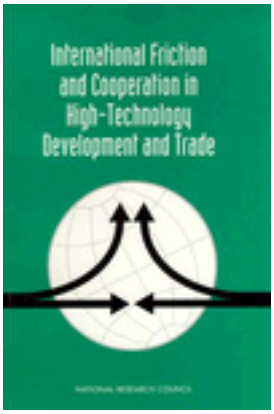

International Friction and Cooperation in High-Technology Development and Trade: Papers and Proceedings

Charles W. Wessner, Editor; National Research Council
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International Friction and Cooperation in High-Technology Development and Trade

PAPERS AND PROCEEDINGS

Charles W. Wessner, *Editor*

Based on a Conference held in Washington, D.C.
on 30-31 May 1995

Board on Science, Technology, and Economic Policy
National Research Council

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PROJECT STEERING COMMITTEE

THE BOARD ON SCIENCE, TECHNOLOGY, AND ECONOMIC POLICY wishes to acknowledge the many fine contributions of the conference speakers and participants from global high-technology corporations, universities and think tanks, and senior policy officials from the United States and other governments. The Board especially wishes to recognize the contributions of the project chairmen, Dr. Erhard Kantzenbach and Ambassador Alan Wm. Wolff, to the success of this complex international endeavor. The Steering Committee deliberations benefitted especially from the experience and expertise of William Spencer of SEMATECH, George Scalise of National Semiconductor, now president of the Semiconductor Industry Association, and Sylvia Ostry of the University of Toronto. The Board also wishes to extend special recognition to Charles Wessner, who was responsible for organizing this exceptionally comprehensive conference, and George Georgountzos, whose assistance was instrumental in assuring its success.

Contents

Preface

This volume is part of an innovative, international project on the *Sources of International Friction and Cooperation in High-Technology Development, Competition, and Trade,* organized under the auspices of three cooperating institutions—the Hamburg Institute for Economic Research, the Kiel Institute for World Economics, and the National Research Council's Board on Science, Technology, and Economic Policy. The three institutions were brought together through a grant by the German-American Academic Council (GAAC).[1] As its first policy project, the GAAC chose to sponsor an examination of the development of new technologies and the industries based on them. These technologies and industries are sources of economic growth and high-wage employment; competition for high technology markets makes them also a source of growing international friction that, over time, could undermine both the multilateral trading system and the tradition of shared scientific and technological information.

Because policy questions related to trade, investment, technology developments and cooperative activities have both national and international dimensions, their analysis can only benefit from a variety of perspectives. Moreover, one of the project's goals was to ensure that the project yield practical policy recommendations for national governments. Consequently, every effort was made to bring a variety of perspectives to bear, not only

[1]Established in March 1993, the purpose of the Council is to support cooperation between Germany and the United States in all fields of science and scholarship by providing a forum for transatlantic dialogue and by collaborating on policy studies on issues confronting decisionmakers in both countries.

scholarly analysis and technical expertise, but also business management and government policymaking experience. Accordingly, an innovative structure was adopted to secure the broadest participation with respect to project guidance, finance, conferences, and related activities.

PRIVATE SECTOR PARTICIPATION

The generous GAAC grant covered the costs of participation for the German institutes and provided a foundation for the fundraising effort required of the National Research Council to meet its different budgetary requirements as a private independent institution. The challenge of securing adequate funding was also seen as an opportunity to secure broad private sector participation in the information-gathering phase of the project.

Validating the project's concept and the GAAC's interest, the National Research Council succeeded in assembling a group of private sponsors very diverse in terms of nationality, sector of activity, and corporate size. These corporate contributors and participants included companies based in the United States, the Netherlands, Japan, Canada, Korea, and Germany, with operations across a broad range of high-technology sectors such as consumer electronics, semiconductors, computers, telecommunications, turbines, and materials. The participating companies include Northern Telecom, Siemens, Hitachi, Samsung, Philips, General Electric, MEMC, Trimble Navigation, Varian Associates, and AT&T.

The substantive and financial contributions of the project sponsors were essential to the success of this undertaking. Without their financial support, the NRC could not have carried out a project of this scope and intensity. Equally important, the active participation of senior industry representatives from these sponsors and a wide range of other companies, as well as of academic experts and senior policymakers, helped ensure that the presentations and discussions of the conferences accurately reflected the genuine opportunities for increased cooperation, the realities of global commercial competition for high-technology markets, the national stakes inherent in this competition, and the resulting policy challenges.

THREE CONFERENCES

Each of the cooperating institutions was responsible for an independently organized conference reflecting its particular analytical strengths, policy interests, and traditions. The first conference, *The Economics of High-Technology Competition and Cooperation in Global Markets,* was held at the Hamburg Insitute for Economic Research (HWWA) in Hamburg, Germany, on 2–3 February 1995. This conference was designed to lay the theoretical and empirical foundations of the study, addressing new growth

theories, strategic trade theory, and issues of industrial organization as well as issues related to different national approaches to technology policy.[2] The second conference, *The Sources of Friction and Cooperation in High Technology Development and Trade,* was hosted by the National Academy of Sciences on 30–31 May 1995 in Washington, D.C. and is the subject of this volume. The third conference, *Toward a New Global Framework for High-Technology Competition and Cooperation,* took place at the Kiel Institute of World Economics on 30–31 August 1995 in Kiel, Germany. This last conference in the series considered policy prescriptions with special emphasis on multilateral or plurilateral rules and mechanisms for conflict avoidance.[3] The respective host institutions are each responsible for the publication of their conference volume.

This volume is the second in this series of three conference volumes. In keeping with the NRC tradition of producing conference proceedings, as well as papers, when merited by the quality of the presentations, this volume includes both the presentations of the large number of distinguished speakers and comments of conference participants as well as commissioned papers prepared to address topics of particular relevance to the issues covered in the course of this conference.

A MULTINATIONAL STEERING COMMITTEE

The final report of this project was produced by the National Research Council in cooperation with the two German institutes under the direction of a multinational Steering Committee. The Steering Committee provided leadership and direction for the project as a whole. It was composed of distinguished academics, leading business executives, trade and technology policy practitioners, and other experts. The Committee included members from Canada, Japan, and other European countries as well as Germany and the United States.[4] The diverse national perspectives and training of this distinguished Committee brought a multidisciplinary and global perspective to the complex issues considered by the project. Different perspectives have a value in their own right but by no means assure consensus. The Steering Committee discussions involved a sustained effort to identify the limits of consensus on a broad range of analytically difficult and often contentious issues of great consequence for international cooperation in science, technology, and trade.

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[2]See Georg Koopman and Hans-Eckart Scharrer (eds.), *The Economics of High-Technology Competition and Cooperation in Global Markets.* HWWA Institute for Economic Research, Hamburg, Germany, 1996.

[3]See *Towards a New Global Framework for High-Technology Competition and Cooperation.* Kiel Institute of World Economics, Kiel, Germany, forthcoming.

[4]The members of the Steering Committee are listed on page iv.

The Steering Committee met on four occasions under the co-chairmanship of Professor Dr. Erhard Kantzenbach, president of the HWWA and Ambassador Alan Wm. Wolff. Three of the meetings were held in conjunction with the conferences, in which Committee members were principal participants. The final deliberative meeting, which took place at the NRC in Washington in December 1995, took into account the conference papers, presentations, and discussions, and the analysis prepared by the three institutions. In the course of this final meeting, the Steering Committee agreed to a comprehensive and significant set of recommendations on a series of interrelated and highly complex issues. These Findings and Recommendations form the basis for the summary report of the project.

A SUMMARY REPORT

That report, entitled *Conflict and Cooperation in National Competition for High-Technology Industry,* includes the Findings and Recommendations of the Steering Committee, and revised versions of the two reports considered by the Committee at its final meeting, the first prepared by the NRC staff, the second jointly prepared by the HWWA and IfW staffs.[5] The Recommendations and Findings underscore the importance of the subject matter and address specific issues of technology and trade policy, government support of research and development, and policies affecting international cooperation. In the rare instances where no agreement was possible, the Steering Committee acknowledged its inability to achieve consensus on a recommendation. The recommendations also highlight the need for additional information and identify specific areas that would benefit from further analysis.

This volume represents a key element in the Steering Committee deliberations. The presentations, discussions, and papers included in this volume illuminate many of the complex issues addressed by this project. Indeed, the questions addressed in this timely and comprehensive conference remain central elements of the international economic dialogue.

Alan Wm. Wolff
Project Co-Chairman

[5]National Research Council, *Conflict and Cooperation in National Competition for High-Technology Industry.* National Academy Press, Washington, D.C., 1996.

I

INTRODUCTION

As described in the preface, this conference was a central element in an international cooperative effort to analyze the *Sources of International Friction and Cooperation in High-Technology Development and Trade.* In the course of this two-day conference a broad range of issues were examined by technologists, trade and technology policy practitioners, academic experts and current senior policymakers. In essence, the conference examined the challenges posed by different national economic strategies to the multilateral trading system and to international technology cooperation.

As a first step, the important differences among national economic strategies and their consequences for the international economic system were reviewed as were the significant differences in the more specific national policies designed to support high-technology industry. One of the hallmarks of the conference was the emphasis on actual cases of both cooperation and friction resulting from governments' efforts to foster high-technology industry within their national economies. Two high profile cases, the Airbus Consortium and the semiconductor industry, were reviewed to illustrate both the potential for successful regional cooperation and the ability of competing trading partners to move from a situation of trade conflict to one of substantial cooperation.

At the same time, the conference devoted considerable attention to asymmetries in national policies in key areas, such as national investment regimes, which are a source of instability for the multilateral system as well as a source of competitive advantage. Because restrictive investment regimes are particularly important for trade and product development in high-technology industry, special attention was given to the consequences of these asymmetries and current international efforts to develop an enforceable international agreement.

The conference also examined the interplay between core national interests, such as national security, and the global development of new technologies. The diffusion of technological capability poses both a challenge and an opportunity for national technology programs. From the American perspective, considerable emphasis was placed on the need to adopt a dual-use approach to the development of new technologies, an approach successfully practiced by Japan and an established policy among other members of the international community. The same interplay between national interest and global opportunity was evident in the three closing panels which took up foreign participation in national technology development programs, international cooperative programs involving both public and private participants, and the growth of strategic alliances among private firms. Each of these topics has significant implications for public support of national programs, in terms of their rationale and perceived distribution of benefits.

Several themes characterized this conference. Many of the Americans present expressed alarm at the prospect of growing cuts in funding for federal research and development programs. European participants shared concerns about national levels of R&D efforts and access to foreign programs against a

background of diverging performance in high-technology trade vis-à-vis both North America and East Asia. Industry participants emphasized the financial and technological imperatives driving enhanced cooperation, while public policymakers recognized the political and policy challenges posed for international cooperation by competing national programs and diffused technological capabilities.

Most participants accepted the premise of the conference, namely the existence of genuine opportunities to cooperate, not only for "traditional" scientific research, but also for the development of new commercially relevant technologies. Participants also accepted the premise that increased friction rather than increased cooperation remains a possible outcome from the growth in national development programs and from the significant asymmetries in national policies in areas such as trade, investment, and cooperative programs.

PROJECT PAPERS

Papers were commissioned from outstanding speakers who contributed significantly at one or more of the conferences to the development of the committee consensus. In other cases, papers were commissioned to provide greater analytical depth on particular topics and to help illuminate alternative views and perspectives.

Differences in economic systems and national economic strategies are the source of considerable friction in the international system. Fairly fundamental differences in the orientations of public policy may be at the root of these policy differences. Noting the evolution of international trade over the last century from a raw material base to trade in knowledge-based products, Bruce Scott's paper, *The Concept of National Economic Strategy,* emphasizes the importance of national economic strategy rather than "inherited" comparative advantage. Scott stresses that government intervention is not always successful (any more than corporate strategies are always successful), yet when these strategies do succeed, as they often have in East Asia, the consequences in terms of economic growth and created national economic advantage are significant.

In what he calls "producer-oriented" countries, national policies favor producers, at the short-term expense of consumers, to permit the exploitation of high-growth opportunities in leading industries—an approach aided further by protected home markets and export incentives. The consumer subsidy to producers permits "learning by doing" scale economies and ultimately is designed to build an improved standard of living around a higher rate of productivity growth and higher salaries rather than low consumer prices.

Scott contrasts this approach with what he sees is the tendency of a number of the older industrial countries to reduce national investments in research and development and in public infrastructure. He argues the older industrial countries are failing to shift resources either towards areas of opportunity or advantage and instead are increasingly transferring resources on the basis of disadvantage. Although transfers of resources to the economically disadvantaged have recently

declined, at least in the United States, Scott observes that transfer payments to low-income groups have substantially increased (tenfold since the mid-1960s) while strategic investments have declined.

As a former head of the Tokyo office of the American Electronic Association, John Stern has spent much of his professional career studying Japanese high-technology industry and the governmental policies that support them. Questioning the current conventional wisdom of American "technological supremacy," Stern notes that notwithstanding the recovery of the U.S. marketshare in leading industries such as semiconductors, the last decade has seen a significant erosion of the U.S. market position. Moreover, Stern observes that even during economic downturns the major Japanese electronics companies have recorded substantial profits in contrast to the tendency of American firms to actually lose money in similar circumstances.

From a longer-term perspective, Stern emphasized that Japan's economic policymakers have accomplished a great deal. In 1960, Japan's per capita gross national product was barely 20 percent of that of the United States but by 1990 it had increased nearly fiftyfold. The Japanese standard of living showed 77 percent real growth between 1973 and 1993, a level of performance not lost on other East Asian countries. Stern emphasizes that this progress has been achieved in part as a result of Japanese government efforts to assist in the acquisition and diffusion of new technologies by promoting standardization, funding targeted research and development including supplying seed funding, blunting foreign competition, and generally reducing risks for business in adopting new technology. Stern also notes that government procurement is one of the most pervasive methods of supporting research and encouraging the development of new products. Stern's fundamental message, however, is that there is a broad national consensus in Japan as to the importance of high-technology manufacturing industries for the national economy. Interestingly, this point is affirmed in the course of Uzuhiko Uwatoko's presentation of the Japanese perspective on the Intelligent Manufacturing Systems program.

One of the most central issues raised in the course of the conference, and indeed the project as a whole, was the crucial importance of restrictions on foreign direct investments and their consequences for trade and technology. Jeffrey Lang, the Deputy United States Trade Representative, emphasized in his presentation the strong linkage between trade and investment. The paper by Simon Reich of the University of Pittsburgh explores the ramifications of restrictive investment regimes for competition in high-technology industries. He suggests that significant advantages accrue to firms able to obtain higher rents from a protected sanctuary market. These include the ability to subsidize exports, thereby gaining market share and economies of scale, and to finance the high capital costs of succeeding generations of technologies. Moreover, the increasingly close coupling of direct investment and (intrafirm) trade suggests that asymmetries in investment regimes have long-term consequences for trade balances.

From a policy perspective, Reich argues that the current U.S. emphasis on the importance of emerging markets simply masks the inability of U.S. policymakers to make significant progress on liberalizing investment regimes in key industrial markets. Reich suggests, however, that competition in these emerging markets will also be conditioned by the advantages enjoyed by firms exporting or investing from a sanctuary market. In light of the linkages between trade and investment in high-technology industry, Reich sees a combination of bilateral and multilateral initiatives necessary to avoid friction and support the continued health of the world trading system.

In a comprehensive overview, Sylvia Ostry of the University of Toronto draws on her vast experience as a national and international civil servant at the upper levels of G-7 policymaking to review the importance of technology issues for the international trading system. She notes that the most fundamental explanation for the increasing prominence of technology issues in the international agenda involves the "convergence" among the major trading powers in terms of technological and managerial capabilities, capital intensity, and education levels—a process greatly facilitated by the reduction of barriers to trade and financial flows promoted by post-war international institutions. Rapid Japanese economic growth, seen in part as a result of successful Japanese industrial policies, has encouraged policymakers in both the United States and Europe to focus on high-technology industries. Ostry sees these fundamental changes in the international environment and the policy tilt towards industrial policies in the 1980s as a source of international friction, often centered on technology-intensive sectors.

Ostry's analysis reviews the major issues related to trade in high-technology products such as subsidies (and the national security exemption), government procurement, product standards, dumping and antidumping, intellectual property rights, asymmetric technology flows, foreign participation in national or regional technology programs, and the growth of strategic alliances. She emphasizes that while existing trade policy rules might be adapted to improve their effectiveness for high-technology sectors, improved international competition policies and a multilateral investment agreement are required in one form or another. Moving beyond the traditional trade agenda, Ostry also suggests the need for improved rules for international cooperation in science and technology, including the need for improved burden-sharing. In sum, the analysis put forward by Ostry underscores, in her words, "the broad range of technology issues that cut across the domains of trade, investment, competition, innovation, and science policies." This perspective of course underlies the concept of the project and this conference.

While emphasizing the long-term importance of improved international competition policy, Ostry's paper also addresses one aspect of dumping, i.e. strategic dumping, that she considers especially relevant to capital- and technology-intensive sectors. She describes strategic dumping as "essentially subsidizing exports

through higher home prices sustained by collusive price behavior and a protected home market" which can deter entry (or encourage exit) in industries with significant dynamic economies of scale and high fixed costs.

The issues associated with dumping and antidumping policies emerged as some of the most contentious issues discussed in the course of the project. In this respect, the Steering Committee membership mirrored the divide which characterizes discussion on this issue in countries with relatively open markets. Interestingly, the divisions of opinion were less apparent on the basis of nationality, and more on the basis of academic training, with many of the economists on the Committee especially skeptical of antidumping policy. Reflecting the strongly held and divergent views on this aspect of high-technology trade, the Steering Committee ultimately could reach no agreement.

As the Chairman noted on several occasions, much of the discussion of this issue paradoxically focuses on the problems associated with *anti*dumping policies, rather than dumping. Relatively little attention is given to the conditions which are conducive to dumping by competitors seeking market share, and in particular to the restrictive trade practices which greatly reduce the commercial risks associated with dumping. Nor is there much awareness or discussion of the experience which led to antidumping legislation in the early part of this century.

The trade policy article by Thomas Howell is designed to address these gaps, including the question of why antidumping policies remain in place in the face of vociferous criticism. Howell provides a historical perspective on dumping in the high-technology industry of 1900—that is, high quality steel—and describes the consequences of the weakened industrial base of the United Kingdom during the trauma of the First World War.

A particularly interesting aspect of Howell's research is that the free trade debates at the turn of the century in Great Britain bear a striking resemblance to the debates on trade policy in the United States and the European Union today. Howell also draws parallels between the powerful economies of scale generated by high levels of capacity utilization in steel production, both in 1900 and today, and the similar economies which can be obtained in the utilization of high fixed-cost semiconductor production facilities. Howell also observes that the debate on antidumping policy is somewhat skewed, in part because the utilization of antidumping legislation is by definition reserved for countries with relatively open markets. Countries that maintain protected domestic markets through restrictions on investment, private or public barriers to competition, discriminatory standards and procurement regimes, and a host of other formal and informal measures do not require an active antidumping policy; government policy already ensures that exports are either blocked or restricted.

Fundamentally, Howell suggests that the controversy surrounding antidumping is a symptom of a larger phenomenon, the divergence which exists between various national markets with respect to competition policy and which has frustrated all attempts at consensus for at least half a century. In this view, antidump-

ing measures have been assigned, more or less by default, the task of addressing specific problems created by this divergence.

Interestingly, some opponents of antidumping believe that the practice is spreading as other nations emulate United States policy. Howell argues that, on the contrary, as countries such as Taiwan begin to liberalize and remove formal and informal barriers to trade, it then becomes necessary for the first time to have an overt mechanism to protect national industry from predatory trade practices. More broadly, Howell suggests that antidumping policies serve as an interface mechanism, a sort of political clutch between dramatically different economic systems. As such, he believes antidumping policy plays a critical role in the maintenance of support for a liberal multilateral trading system.

The greater depth provided by the analysis put forward in these papers is designed to contribute to a better understanding of issues often positioned at the intellectual fault-lines that mark national policymaking on trade and technology policy or most favored nation treatment for investment and foreign participation in publicly funded cooperative research. The importance of these issues, their cross-cutting nature, and their impact on scientific and technological cooperation and international trade are reflected in the observations of the academic experts, industrialists, and senior policymakers brought together by the conference. While no attempt was made to agree on conclusions or recommendations, the conference deliberations did serve to underscore the necessity of a more integrated approach to issues too often treated independently. Recognizing the linkages among these seemingly disparate issues is essential in encouraging cooperation and reducing friction in the development and trade of high-technology products.

II

PROCEEDINGS

Welcome

Robert White, President, National Academy of Engineering

I welcome you on behalf of the National Academy of Sciences, the Institute of Medicine, and the National Academy of Engineering. This conference is sponsored by the National Research Council's Board on Science, Technology, and Economic Policy, and it is part of a series of events in a project called International Friction and Cooperation in High Technology Development and Trade.

This project is a collaborative activity between the National Research Council and two of Germany's leading economic institutes, the Hamburg Institute for Economic Research and the Kiel Institute of World Economics. Both of these German institutes are represented here by their presidents, Erhard Kantzenbach (the project co-chair) and Horst Siebert.

The project cochair for the Board on Science, Technology, and Economic Policy is Alan Wolff, one of Washington D.C.'s foremost trade lawyers. The co-chairs and Horst Siebert serve on the Project Steering Committee along with others, including Sylvia Ostry of the University of Toronto and Bill Spencer, CEO of SEMATECH.

This project was conceived in response to an invitation from the Foundation of the German-American Academic Council, established at the initiative of Chancellor Kohl of Germany and supported by Presidents Bush and Clinton. This project is one of the first undertaken by the Council.

The German-American Academic Council has provided the initial support for this conference, which was conceived as a multinational activity, not merely a bilateral conference between the Americans and the Germans. The Steering Committee is composed of Asian, North American, and European representatives and sponsored by corporations from each of these regions, all of which have global operations.

In January 1995, the Board on Science, Technology, and Economic Policy sponsored a symposium on international access to national technology support programs. It was a worthwhile symposium, with vigorous exchanges and discussions of the complex issues associated with this topic.

In February 1995, the Hamburg Institute sponsored an initial conference that examined the rationale for and the variety of government involvement in support of technology-intensive industries.

For now and in the future, we will build on the record of these conferences, continuing the examination of national economic strategies; reviewing several cases of international friction, for example, Airbus, semiconductors, and telecommunications; and assessing prospects for international cooperation and technology, private alliances, and mixed public and private programs.

In August a conference in Kiel, Germany, is to consider the mechanisms and venues for addressing international conflicts over technology development and trade and the ground rules for cooperative endeavors. The task of the Steering Committee is to produce a set of conclusions and recommendations in a report to be presented in the latter half of 1996 to national governments and international organizations.

We welcome your participation in this larger enterprise and thank you in advance for your contributions to our work on these issues.

Introductions by Project Co-Chairs

Alan Wm. Wolff, Dewey Ballantine

Erhard Kantzenbach, HWWA

ALAN WOLFF: Our inquiry today calls for an examination of the sources of international friction and cooperation in high-technology industries.

We do not have to look very far to find friction in the world today. The current U.S.-Japan automobile dispute is a case in point. It demonstrates that friction of major proportions can still easily occur in the international trading system. The United States contends that the genesis of the friction is to be found in Japanese government policies that promote this key sector through protection of the home market. The U.S. reaction, however, is provoking as strong an adverse reaction from other countries as was Japan's protection.

We are not here today to resolve the problems of the automobile sector, but the dispute does point out that national economies differ as do national approaches to industrial support. These differences raise important questions. What forms of promotion are appropriate? What responses are acceptable? We have managed to channel some international disputes into settlements. Semiconductors and Airbus are two examples, but it is not at all clear that the system will manage itself.

As Korea, Taiwan, and ultimately China, increase their technological capabilities, the sources of friction are likely to become more, rather than less, pronounced. The appropriate responses are less clear. The general sentiment is that it is undesirable to manage trade. This is not the same as a desire to manage relations. A central question to address at this conference is how best to limit the causes of friction and to foster trans-border cooperation?

Several forces can be identified which may be leading toward reduced friction. First, budget constraints are forcing national governments to reduce public sector spending on industrial programs. In the United States, where industrial

promotion is eschewed, the budgetary pressures are reaching into pre-competitive research and development. There is a debate here as to whether to retain either the Department of Energy or the Department of Commerce, as well as whether to continue the National Institute for Standards and Technology (NIST) Advanced Technology Program. Are these institutions to be considered engines of growth and national assets, as many believe, or are they Jurassic Parks, as their critics charge?

Should it be an accepted goal of government to promote the production of public goods, including providing for the development of technologies relevant to the national defense? Or should government go further to promote national economic and commercial interests? Different countries have differing views on this subject.

Is the government's fostering of R&D in the form of a straight subsidy likely to lead to trade friction if these measures are not accompanied by more distorting promotional policies, such as market closure? Is the promotion of technological development, at least at the level of basic science, likely to lead to major trade friction or does it just spur healthy international competition?

Many governments are continuing to implement competitive industrial policies with investment of public funds in the development of new, commercially relevant technologies. However, at the level of individual firms, the enormous increase in the complexity and cost of developing new technologies is driving an explosion of inter-firm cooperation. This is one of the forces governing the movement toward greater globalization taking place in recent years. Whether globalization is all to the good is also subject to debate. The answer depends in part on whether market forces are being allowed to determine the direction and amount of trade and investment flows, as well as competitive outcomes, to the maximum extent possible.

In this connection, the record of individual countries is mixed. There was a very depressing article in the Financial Times not that long ago. It described advice being given by Japan's Official Development Agency to nations in Southeast Asia. The Japanese officials were quoted as saying that the United States was 100% open while Japan was 80% open. The counsel the officials gave was not to open up too much. The giving of advice of this kind, if the story is accurate, must be a cause for concern.

It should be clear that countries do not need external advice to employ protectionist measures. In some corners of the world, it is the rule, rather than the exception, to seek to force technology transfer as the price for permitting investment and market access. This is a subject that should be dealt with in the Multilateral Agreement on Investment that is under discussion in the World Trade Organization.

How best can conflict be replaced with cooperation? Fortunately we have an exceptionally fine roster of panelists and speakers to address this question. The possibility exists that we are on the threshold of a golden age of international

cooperation and healthy competition, all with the desirable side-benefit of spurring technological innovation and realization of widespread benefits through rapid commercialization.

If we are good at pursuing the task we have set for ourselves in this project, we will contribute at least in some small part to understanding the forces that govern technological competition and cooperation. We can then work together to promote shared objectives in harmony without risking friction that could lead to debilitating trade wars.

ERHARD KANTZENBACH: I will first say a few words about the two German institutes that are partners with the National Research Council in this project. The Kiel Institute and the Hamburg Institute are two of the six independent economic research institutes in Germany.

The basic budgets of these institutes are financed jointly by the federal and state governments, but these governments have no influence on the research programs of the institutes. In this respect, they are absolutely independent. But the institutes also do project research, which is financed separately by the federal government, the Commission of the European Union, and private foundations and organizations.

This is the second of three conferences that we, together with the National Research Council, have planned for this project, which is financed by the Foundation of the German-American Academic Council, as part of its program of common German-American research projects.

This conference is also sponsored by European, American, and Asian business firms and organizations, and we are grateful for their support. This project has three stages. During the first conference in Hamburg, Germany, we dealt with the theoretical justification for public promotion of R&D and with the different national approaches of public technology policy. In this conference today we will investigate the sources of international friction that result from these different national technology policies. In the third conference, to take place in Kiel, Germany, in August 1995, we will discuss the possibilities for a new global framework for high technology competition, where it is hoped that we can agree on some basic principles for such new framework conditions so that we can submit these as proposals to our national representatives in the WTO.

Of course, this is a very ambitious goal, and I hope that we will be able to reach it. Therefore, I wish this conference to become a great success.

Opening Address: The End of the Endless Frontier

The Honorable Jeff Bingaman, U.S. Senate

STEPHEN MERRILL: It is my pleasure to introduce the keynote speaker, Senator Jeff Bingaman. Senator Bingaman was elected to the Senate in 1982 after serving as attorney general of the State of New Mexico.

I doubt if anyone would discount the role of Congress in shaping U.S. technology policy, but that was as true in the era of creation as it is true in the era of reassessment, to choose a neutral term. What is indisputable is that no member of Congress has had a more important role in articulating U.S. technology policy and in promoting legislation to implement that vision from several key positions: as a member of the Senate Armed Services Committee and as chair of its Acquisition and Technology Subcommittee, from his position as senior Senate Democrat on the Joint Economic Committee, and from his leadership position in the Democratic Party in the Senate.

Senator Bingaman was an early supporter of SEMATECH, the semiconductor manufacturing consortium and the principal author of legislation creating the Technology Reinvestment Program, including partnerships to create new dual-use technologies. He was the creator of the Critical Technologies Institute, an analytic arm of the White House Science Office, and he has been a strong proponent of partnerships between industry and the national laboratories.

In addition, he has been a leader in national education reform, promoting higher standards for science, math, and other disciplines, and for public school education generally, and he is the author of legislation to make technologies more accessible to public schools.

JEFF BINGAMAN: This is an important time in the Congress and in the country, as far as technology policy is concerned. We have a new majority in Congress. I

am sure you are aware it is a Republican majority and there is an effort under way to fundamentally change the federal government's role in science and technology and in trade.

Last week, the Senate passed a budget that was designed to eliminate our federal deficit over the next seven years. The House had passed its version of that same budget a week earlier. Although there are some major differences between these two budgets, particularly with regard to tax cuts, defense spending, and domestic discretionary spending, one common feature is that both budgets contain a drastic cut in federal support for civilian research and development across the government.

I believe that little attention has been paid to this part of the budget-balancing effort, compared with the substantial attention that has been paid to the issue of cuts in Medicare, Medicaid, and education, and the issue of tax cuts for the wealthy. But in my view, at least, this drastic cut in federal support for civilian research and development may be the place where the Republican budgets will do the most damage to our nation's future well-being and prosperity.

Overall, civilian research and development spending will be cut by 30–40 percent by the year 2002 and will then be at a four-decade low as a percentage of our economy. Some agencies, such as the National Science Foundation and the National Institutes of Health, may be cut only at the inflation rate during the next seven years, but the other agencies that are involved in research and development, such as NASA [National Aeronautics and Space Administration], the U.S. Department of Energy, the U.S. Department of Commerce, the EPA [Environmental Protection Agency] appear slated for much deeper reductions.

For those who are not familiar with the budget process, let me explain why I cannot speak with a little more certainty about the effect of these budgets. The budget resolutions, which were passed last week and the week before, make many assumptions about federal programs, but the only binding assumption that affects civilian applied research is the total that these budget resolutions contain for this large category called domestic discretionary spending.

For fiscal year 1995, the total for domestic discretionary spending is approximately $257 billion. Under the Senate version, in the year 2002, that will drop to $234 billion or a 10 percent reduction, coupled with seven years of no inflation adjustments. Under the House version, the domestic discretionary total in 2002 is even lower, at $229 billion.

If civilian research is treated, on average, like other programs in this domestic discretionary spending category, which I believe is probably the best case considering the strong constituency that some of the other programs have, then it would be cut by 30 percent in real terms.

If some of the other programs in that category, such as highway funding, law enforcement, and veterans' programs, are protected from deep cuts, when funding is finally allocated by the appropriations committees, then the cuts in civilian research could reach 40 percent in real terms.

I am tempted to ask what the research community has done or failed to do in recent decades to deserve this particular treatment. The research community has won the Cold War. It has put men on the moon. It has revolutionized medicine. It has invented computers, pioneered electronic, and semiconductor devices and invented a myriad of new materials that have fundamentally changed our lives.

These accomplishments are just as Vannevar Bush, one of the giants of the post-World War II generation, predicted in his report, *Science: The Endless Frontier*, approximately 50 years ago. Bush had the wisdom to know that new scientific and technological fields would emerge—fields such as semiconductor electronics, molecular biology, and material sciences, just to name three.

Bush had the vision to see that federal investments in science and technology could transform our lives and contribute to the health and standard of living and security of every American.

Federal investments in civilian research and development did not cause the federal deficit; in fact, it was quite the opposite. In 1969 when the federal budget was last in balance, federal civilian research spending was 0.76 percent of the gross domestic product, and, with the sole exception of the Bush administration, it has trended lower for the past 25 years. In 1995 federal civilian research spending was estimated to be at approximately 0.46 percent of the gross domestic product, which is the same as it was in 1992. In 2002, it will be 0.27 percent under the Republican budgets that I have referred to, and that is assuming that research is treated on average the same as other domestic discretionary programs.

It is not just that our federal civilian research investments have not caused the current deficit. On the contrary, there is almost universal recognition that these investments have paid for themselves many times by the growth that they have contributed to the economy. It is not an accident that American industries from aerospace to agriculture to electronics to pharmaceuticals enjoy world leadership in their fields. Federal civilian research investments are truly investments in the nation's future, and it is folly to be cutting them to this extent over the next seven years as we enter the new century.

The cuts in federal support for civilian research will almost surely not be made up in the private sector. *The Wall Street Journal* had an article on May 22, 1995, reporting on deep cuts being made by AT&T, General Electric, IBM, Kodak, Texaco, and Xerox in their research budgets. The reason: The private sector firms have an ever-narrower focus and an ever-greater unwillingness to invest in long-term research projects. The benefits of those projects are seen as uncertain and are usually not capturable by any single firm.

The governments of our major economic rivals, Japan and Germany, recognize the importance of civilian research investments. In data compiled by the National Science Foundation, comparing investments by the United States, Germany, and Japan in 1992, the German government invested 0.9 percent of their gross domestic product in civilian research. The Japanese government invested 0.5 percent directly, and indirect government incentives spur some of the indus-

trially funded research and development as well. Neither Germany or Japan shows any sign that it will join the United States in slashing research spending; in fact, quite the opposite. They and other industrial countries around the world are seeking to emulate the successful American model of the past 50 years, just as we seem bent on abandoning it.

U.S. research universities and federal laboratories and U.S. investments in small business research and innovation are the envy of the world. However, under the budgets that have now been passed through both houses of Congress, we risk losing a generation of research and young researchers as the best students are diverted to other professions by the grim job prospects awaiting them in research centers.

How did we get into this fix, and how can we can get out of it? That is something that I am sure will be the subject of numerous conversations during this conference. What we have seen over the last two years is an almost complete fracturing of a bipartisan consensus that was forged in the 1980s during the Reagan and Bush administrations on the appropriate federal government role in civilian research and development.

The consensus during that time was that the federal role should stop at precompetitive development activity, which should be conducted on a cost-shared basis with industry putting up at least half of the money. One test of the precompetitive nature of the research was whether some of our more intense rivals in industry, such as Intel and Motorola in the case of SEMATECH, could collaborate in the effort. Everyone agreed that the federal role should not include helping individual firms get specific products to the commercial marketplace.

In fact, this very term, "precompetitive development," was first coined by President Bush in a speech he gave to the American Electronics Association in February 1990. He was seeking to distinguish the technology policy that he was pursuing in his administration from the industrial policies of his predecessors in the 1970s. The examples are the Clinch River Breeder Reactor, the Supersonic Transport, and Synfuels Corporation.

President Bush proudly spoke during the 1992 campaign of his efforts to expand civilian applied research through a series of new, high payoff investments in critical technologies. Some examples were the high-performance computing and communications initiative to improve manufacturing and performance of materials, an expanded program in biotechnology research, the establishment of the U.S. Advanced Battery Consortium which was funded jointly by industry and government for a four-year period, a significant increase in the aeronautics research budget, and the establishment of seven regional manufacturing technology centers for the distribution of modern manufacturing tools and know-how.

This notion of what the appropriate role of the federal government in research is and is not was supported in numerous pieces of legislation that we passed since 1980, with bipartisan sponsorship and with the blessing of the Reagan and Bush administrations. The vast majority of the legislation passed unanimously.

Indeed, the American bipartisan consensus of 1992 on the appropriate role of government in civilian research and development was incorporated in late 1993 into the Uruguay Round Subsidies Code. It is now the world norm that governments can fund the full cost of basic research, can fund up to 75 percent of the cost of applied research relevant to industry, and can fund up to 50 percent of the cost of precompetitive development without risking trade sanctions.

Any development subsidies beyond the precompetitive stage are fully sanctionable, as they should be. Unfortunately, by late 1993 the bipartisan consensus on this policy had fractured. As President Clinton and Vice President Gore pursued a science and technology policy almost identical to President Bush's—they did so, in fact, with real commitment—our debate suddenly reverted to the sort of bumper sticker level that we had mistakenly thought was behind us.

Charges of "industrial policy" and "picking winners and losers" were affixed to a broad range of civilian research programs. By early this year, the bumper sticker pejorative had become "corporate welfare," a phrase that was unfortunately popularized by Secretary of Labor Robert Reich to cover a variety of tax incentives and subsidies.

Republican leaders in Congress argued mistakenly that federal support of research in areas from aeronautics to computers to health, energy, agriculture, and the environment was illegitimate either because it was corporate welfare or it represented some variation on industrial policy and was merely a duplication of private sector efforts.

As David Sanger pointed out in an article in the Business Section of *The New York Times* on May 23, 1995: "Such arguments underscore the sharp difference in the way technology and trade policy is dealt with in Washington and in the capitals of its major economic competitors, where trade is considered national security and picking winners and losers is a phrase with no political resonance."

The overall budget prospects facing civilian research in United States in the years ahead demonstrate just how high a political resonance this issue has today within at least part of our political spectrum. Because I do not believe that this is a policy that makes sense for our nation, I led an effort during the Senate debate last week to make spending on research and technology and related trade promotion and trade law enforcement programs a high priority in allocating funds over the next seven years.

The amendment that I proposed would have put the Senate on record in favor of maintaining the overall fiscal year 1995 level for these programs without any inflation adjustment, doing so over the next seven years. It would have put the Senate on record against any net tax cuts unless this goal could be achieved first. The amendment did not seek to allocate the funds that we were trying to maintain in those budgets between the civilian research agencies. That would have been left to the authorizing and appropriating committees, and some agencies might have kept pace with inflation, whereas others undoubtedly would have seen fairly severe cuts.

By the year 2002, even under the amendment's language, federal civilian research and development investments would be at a four-decade low as a percentage of either federal spending or as a percentage of the gross domestic product. My amendment was intended to provoke a debate and to serve as a warning. It would not have fixed the problem of sustaining our investments at the level of our economic competitors.

Even if its prescription had been followed, we would still be spending slightly more than half of what the Japanese government spends and about a third of what the German government spends as a percent of the gross domestic product by the year 2002. Unfortunately, this very modest effort, exemplified in the amendment, was defeated 53 to 47, with all Republicans except Senator Jeffords, voting in opposition and all Democrats voting in favor.

Almost a century ago, the head of the Patent Office is alleged to have proposed to close up shop, believing that everything that could be invented was invented. A half-century later, Vannevar Bush laid out a very different vision for the federal role in science and technology. And now, as we prepare to enter the twenty-first century, we face a choice among those competing visions for the future.

Because I believe the scientific and technological frontier is still endless and because I do not want to risk condemning our children and grandchildren to a less prosperous, less healthy, less secure future, I intend to continue fighting for federal research investments, even as we pursue a balanced federal budget.

I hope that we can restore bipartisan support for these programs before the damage is irreversible, and I fear that this may take years to achieve. Perhaps this very timely conference will begin the process of rebuilding the lost consensus and of pointing out the consequences of the course that we are setting for this nation.

PARTICIPANT: You raised the point about the role of the research community. Do you feel that they have been active in aiding your efforts in Congress?

JEFF BINGAMAN: I believe that the speed with which the two budget resolutions passed the House and Senate was such that there has not been much opportunity for the affected groups to focus on the implications and respond. So I would say that the research community has not, in my view, focused on the implications of what has been passed in both the House and Senate and have not responded, understandably.

PARTICIPANT: What do you think of the prospects for the proposal to consolidate a lot of the science and research agencies? Is that very likely to happen in this legislative session?

JEFF BINGAMAN: I do not see much prospect for a genuine consolidation. I believe that it is much more likely that we will end up with a dismantling of some

programs. Alan Wolff referred to the Advanced Technology Program at NIST. There does not seem to be a majority supporting that in either the House or Senate, and both the House and the Senate proposed to eliminate the Department of Commerce, where the Advanced Technology Program is housed. So that is not a particularly hopeful sign either.

PARTICIPANT: What will happen to defense R&D? Is it the same approach there?

JEFF BINGAMAN: We face the same types of arguments in defense R&D, except I believe that the total dollars allocated to defense, as agreed on by both the House and the Senate, will remain steady essentially over the next seven years, with a slight increase in the last two or three years.

The problem is that we are starting with such a high number of active duty personnel that, unless we can adjust our goals in that regard, we are going to be constantly stealing from those investment accounts, and research and development will inevitably be cut to maintain the level of personnel that both the President and the Congress seem to want.

The same arguments about industrial policy and corporate welfare are being raised in criticism of the Technology Reinvestment Program and several other initiatives.

PARTICIPANT: For years we have had an on-again, off-again research and development tax credit. What are your views of the tax credit as an appropriate incentive for private research and development as opposed to programs that hand out dollars for specific products in research areas?

JEFF BINGAMAN: I favor making the research and development tax credit permanent. The reason we have not done that is because, under the congressional and budgetary scoring process, it costs a lot of money to make it permanent. Accordingly, every year when that question comes up, we end up extending it a year rather than making it permanent.

I do not believe that this is an adequate substitute for some level of direct support by the government for joint government-industry initiatives. Even though R&D tax credit is a good thing to have and should be made permanent, I believe that we would lose a great deal if we back away substantially from some significant level of federal subsidy of R&D activity.

PARTICIPANT: Increasingly there is going to be trans-border cooperation among companies of different nationalities or different ownership nationalities. Given the fact that business by itself will not invest sufficiently for the long term, do you see a possibility for a continuing government role, dealing with other governments and with private companies in consortia that are more broadly based than a single company?

JEFF BINGAMAN: Each of these issues becomes very complicated when you get down to the specifics of whose investment is involved, and where the jobs are created, and where the research is done.

However, I believe that trying to get joint government-to-government cooperation on research projects is a goal that we should definitely pursue. I also believe that there are some opportunities, particularly in environmental and energy conservation areas, where there is a real coincidence of interest between the major industrial powers.

PARTICIPANT: You stated that the reductions in government spending most likely would not be offset by the private sector. Does that apply in the United States or worldwide? And if it is offset worldwide, what would that mean in terms of the infrastructure in the United States?

JEFF BINGAMAN: I was referring to it not being offset by U.S. companies, based on the information I referred to in *The Wall Street Journal* article. I am not sure about worldwide. However, I have seen no evidence that, internationally, there is a backing away from investment in research and development by other global companies.

PARTICIPANT: In historic terms, it is unusual for the Republicans to be so monolithically against this R&D, because historically they have recognized the defense arguments in that direction. Do you think there has been a one-time permanent shift in the Republican mindset or do you think this is rather a temporary ideological flush that has made them all against R&D spending?

JEFF BINGAMAN: I believe that there is a general belief abroad in the land that the federal government can do nothing right. And there is widespread doubt about the efficacy of government activity in all regards.

So this is just a fallout. If you start on the assumption that anything the government is doing, the private sector should be doing instead and can do better, then you naturally arrive at the conclusion that we should not be supporting a major federal investment in research and development.

PARTICIPANT: To follow up on exactly this question, somewhere between an investment tax credit and larger projects, such as SEMATECH, are there programs in the small and medium-sized firm sector that might in turn provide a political constituency that would seem more congenial to the current congressional majority?

JEFF BINGAMAN: I believe that there are some programs that do have some significant participation by small and medium-sized firms. I have not seen the statistics, but my impression is that the Advanced Technology Program has some

substantial participation, as does the Technology Reinvestment Program. Obviously, small business innovative research grants are available to anyone, and I believe that many small firms benefit from that.

Therefore, I do not believe that there is a shortage of opportunity or a shortage of participation by small and medium-sized firms. For some reason it has not coalesced as a political force or taken part in these debates so far.

Thank you.

Session 1

The Multilateral System and National Economic Strategies

Moderator:
Mark Dadd, AT&T

CHARLES WESSNER: To discuss the interaction of national economic strategies and the multilateral trading system, we have a particularly distinguished panel, chaired by Mark Dadd, the chief economist for AT&T. His responsibilities include the analysis of economic developments and their implications for AT&T. Mr. Dadd has also served as the director of international and commodity economics with W.R. Grace in New York, and as an economic advisor to the United Kingdom's Treasury Delegation here in Washington. He has also been an advisor to the Prime Minister's Office of the United Kingdom on their dealings with the European Community, always a challenging task.

MARK DADD: This morning we are going to talk about the different economic strategies for growth around the world, how and why economic strategies vary between nations, and what those differences mean for the world trading system. This session is designed to provide a descriptive and a theoretical framework for our deliberations.

We have three speakers this morning. Bruce Scott will talk about the different national economic strategies around the world and how they impact growth. He will put these strategies into an economic framework for us.

James Fallows will talk about the different ways countries look at economic policy from a societal and an institutional perspective, focusing on East Asia.

And third, Lawrence Chimerine will talk about the role and importance of trade in U.S. policy and the consequences for the international trading system.

I would like you to bear in mind three things as we go through this session. First, it is clear that the global economic and business environment is changing rapidly. We, in the international business community, are acutely aware of this.

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I would like you to bear in mind three things as we go through this session. First, it is clear that the global economic and business environment is changing rapidly. We, in the international business community, are acutely aware of this.

National economies are becoming more interdependent. Competition is intensifying between companies and countries. Technology is becoming more readily transferrable from one country to another. That puts added pressure on us all to work for new cooperation in these technology and trade policy issues.

Second, trade and economic policy does not have to be a zero-sum game in which one country can gain only at another's expense. The challenge for us is to find a combination of policies that leads to higher income and growth for all participants; in other words, "win-win" in terms of the latest business jargon.

Third, countries have a variety of cultural and historical traditions that lead to different views about the role of government and the nature of economic policy. And the fact that many countries do not share a U.S. or even a European view does not mean that they are, in any sense, wrong.

In trying to persuade other nations of the merits of a U.S. view or a European view, we need to bear in mind that we are dealing with sovereign powers who are reasonably and properly trying to manage their affairs in a manner that they think is in their national interest. Let us not fall into the trap of looking at these issues in terms of right and wrong.

Our first speaker is Bruce Scott. He is Paul W. Cherington Professor of Business Administration at Harvard University in the Graduate School of Business Administration. He is currently writing a book on national economic strategies. He is the coauthor of a 1984 book on U.S. competitiveness in the world economy. In 1991 he was appointed to the U.S. Competitiveness Policy Council, which was established by the Trade and Competitiveness Act of 1988.

Our second speaker is James Fallows, who has been the Washington editor of *The Atlantic Monthly* since 1979. Prior to joining *The Atlantic*, he was President Carter's chief speech writer. Among his recent books is *Looking at the Sun: The Rise of the New East Asian Economic and Political System.*

Lawrence Chimerine is our third speaker. He is the managing director and chief economist of the Economic Strategy Institute in Washington, D.C. His previous positions include chairman, chief executive, and chief economist of Chase Econometrics and of the WEFA Group. He has also served as manager of U.S. Economic Research and Forecasting at IBM for 14 years.

Producer versus Consumer-Oriented Economies

Bruce Scott, Harvard University

I approach the issue of economic strategies from a business school and a mix of business administration and economics. Some of our economics faculty in the real economics department would find it curious that I am here in any role as an economist at all, to put it mildly.

First, let me raise a point as to what an economic strategy does not mean. The most familiar form of economic strategy for those of us who have lived in the

United States or Western Europe since World War II has been based on the ideas of Maynard Keynes. These ideas were formulated in the 1930s, a period when there was very little international trade. They were based on the notion that governments could reduce or eliminate recessions on the basis of pumping up aggregate demand.

This became the prevailing idea by the 1960s at the time that the system was opened to international trade. By the time Richard Nixon had decided "we are all Keynesian," these ideas were clearly obsolete. So, what was once the familiar form of economic strategy has now become completely obsolete in an open trading system: pumping up demand simply leads to increased imports and a trade imbalance that is unsustainable.

What is an economic strategy in today's circumstances? I start with the notion that any significant business has to have some vision of where it is going. That allows it to set some goals that are viewed in terms of purposeful intervention.

I believe that there are three broad categories of intervention that are possible:

- mobilization of resources;
- allocation of resources; and,
- promotion of efficiency.

Only one of them, allocation, is really controversial.

Mobilization of resources is familiar to all of you. It means that government could promote additional investments, savings, R&D, the types of programs Senator Bingaman talked about; but above all, education. You could think in terms of the work week.

The fraction of your resources that you try to mobilize for productive purposes is obviously important. At the same time, it is no end by itself. If you are going to invest resources, you do not consume them. Time and again, the familiar reference is, if you invest more, your productivity goes up and your growth rate goes up. There is a direct correlation between the level of investment and the level of productivity growth. But they are over long time periods, and they are almost meaningless when you take them in a shorter time period.

Let me give you the most obvious example. Japan saves and invests today roughly what it has since the 1950s when they had almost a 10 percent growth rate. Since 1973, it dropped to approximately 4 percent. Since 1991, it is 2 percent from roughly the same levels of saving and investment.

In Japan the rate of return on investment has dropped by 80 percent. Mobilization of resources is very important, but it is only a part of the story. For the promotion of efficiency, government can do something there, too, but that is largely a matter of markets and competition. Markets are created by governments. They depend on property rights, the influence of law, and many other factors.

The really controversial part, I believe, and the part that will be germane to your discussions the next two days, has to do with the allocation issue. There are

different ways to think about allocation. The familiar way, if you are an economist, is to think of allocating resources on the basis of *advantage*. A second way is to allocate not on the basis of current advantage but that of future *opportunity*. There is a third way, if you are in a rich country, where resources are often allocated neither by advantage or by opportunity. Increasingly, in countries like the United States, we have been allocating resources on the basis of disadvantage (or need), not advantage and certainly not opportunity.

This is where the real issue is. Comparative advantage is where this discussion needs to start, and it needs to start by recognizing that it has a very long tradition. Paul Samuelson once said that it is the most important proposition in economics that is not simply obvious common sense.

Let me restate the original example. Most of you know that it was David Ricardo who suggested that, if Portugal was a lower-cost producer of both wine and textiles than the British, then the Portuguese should specialize in wine where they had a comparative advantage and leave the textile industry to the British. And, obviously, with British climate and technology, they were not a threat to anyone in the wine business.

What is it that is really the reasoning behind this? This is a static, short-term picture of comparative cost, focused on the short-term advantage that will accrue in both societies. I believe that it still dominates economic thinking, at least in countries such as the United States.

However, it does not have much to tell us about economic development, certainly not nearly what we have thought. Economic development is not a question just of incomes, let alone of short-term comparative costs. Economic development involves the transformation of society.

Take the example just mentioned. Let us suppose that the Portuguese incomes could have kept up with the British. An agricultural society is not the equivalent of an industrial society, even if their incomes are the same. If you want today's example, the oil-based economies in the Middle East are hardly modern economies by any standard.

The second thing to say was that the real issue was not wine and textiles. It was cotton textiles, which at that stage was the first modern industry. The wine business grew approximately 1½ percent a year. Wool and textiles grew approximately 7½ percent a year. At the time of Adam Smith and David Ricardo, cotton textiles became the first industry in history that began at approximately 7½, and it is where we traditionally date the beginning of the industrial revolution.

Are you better off to have an advantage in an industry that grows 1½ than one that grows 7½? For anyone running a business, that is a no-brainer. You have to ask, "Are my advantages comparable to someone who is in a higher growth industry that has better opportunities?" Anyone doing strategic planning in a business recognizes that you have to think of both advantage and opportunity, and if you do not have the advantages, then consider where you want them. You are going to draw resources from one area and try to shift them to another.

You are going to draw resources from your cash cow and shift in the direction of opportunity. You can also do that as a society, but it is taking a business planning idea and trying to move it to the national level.

One obvious question is, if I look at the world economy, where is the opportunity? The answer is that, as we have opened the trading system, world trade has grown much more rapidly than GDP [gross domestic product]. If you are not out there in the world economy, you are missing a higher-growth opportunity. In the trading system, it is not everything that has grown equally; manufacturing has been the key area. And if you go into manufacturing, you are going to find that it is increasingly knowledge-intensive, and, more recently, tradeable knowledge-intensive services. So, it is not GDP. It is trade. And it is increasingly knowledge-intensive exports that have been the premiere opportunity.

The question is, can your allocation system have any effect as you begin to think about that premiere opportunity? I believe that our way of thinking about this and teaching about it in this country is a handicap. If you think back, Adam Smith was writing in 1776, at the dawn of the industrial revolution. The first version of *Wealth of Nations* was published 15 years after the usual dating of the beginning of the industrial revolution. Smith lived for approximately another 15 years. David Ricardo was writing into the 1840s. Neither one of them paid any attention to industry.

Adam Smith's example was a pin factory. That is fairly low technology, but the really interesting thing is his notion that the key is the division of labor. The real changes are division of labor, the creation of machines that create a standardized product, and the application of power to the machinery. An example is the Springfield Rifle with interchangeable parts that can be standardized and mass produced.

Beyond this is the automation of production. All of this was taking place as this debate was being framed in Britain, and it was being ignored. What we think of today as the industrial revolution was not recognized in economic history until approximately 1880. In Ricardo's example, the real difference is not just higher income and vineyards versus woolens or textiles. If you are going to develop textile machinery, somebody is going to have to design it. Somebody else is going to have to have a training system to teach people how to operate machinery and then automate machinery.

You are going to need a much more complex financial system to finance equity debt, short-term working capital, and all the rest of it. Ricardo might say it is in the Portuguese advantage, short-term static advantage, to pick wine, but if they pick wine, they are also picking underdevelopment. Portugal has the advantage in a low-growth, low-opportunity industry, and it represented a way to marginalize themselves as a society. I used to believe that this was something that was an intellectual swindle. In a way it is, but I do not believe that it was done that way. I believe that Ricardo would have had exactly the same idea if he had been in Portugal. He simply did not recognize the importance of industry and

of the fact that an industrial civilization is different from one that is based on agriculture.

Now, that is the opportunity. The countries that have had the most obvious massive advantage in anything identifiable since World War II are the countries that have oil. The countries in Asia that have no oil, no iron ore, no natural resources of any type outperformed the oil producers better than two to one during the oil bonanza in terms of raising their income, and since then, there is no comparison whatever.

A focus on where the opportunities are and mobilizing and shifting your resources in the direction of opportunity beats advantage. Advantage and opportunity are not mutually exclusive, but there is just no question which is more important.

So I believe we end up with some preliminary conclusions: Opportunities can be more important than advantages; manufactured exports have been the number one opportunity.

At the turn of this century, world trade was 80 percent agriculture and raw materials. These sectors now represent less than 20 percent. It is hard to build a nation's future on something that continues to shrink in the world market. Knowledge-intensive exports, whether they are manufacturered goods or services, is where the obvious opportunity is. As you think forward, the question is, what does your society do to move in that direction?

I believe that all the successful strategies have an element of mercantilism involved in them, that the move toward the opportunities requires a society doing much the same thing that a company does, which is that some sectors are going to subsidize others. Here is a way to think about the economic strategies of countries. It is a simple two-by-two matrix, but I believe that there are some things that it helps us see.

The usual way to think about economic strategies is in terms of a trade regime or a resource allocation scheme. According to this resource allocation scheme, economic strategies can be inward oriented, outward oriented, or neutral. An inward orientation means import substitution and a protectionist regime. However, to suggest more possibilities is to have a very different perspective than, for example, the World Bank. The Bank's economists have said, in effect, economic strategies are either based on import substitution and protection or based on neutrality, which they call "outward" oriented.

In the resource allocation scheme, there are three possibilities. The key characteristic that has a bearing on what you are thinking about is the exchange rate. If you look back over the postwar period, outward-oriented countries have all been driven during the high-growth period by an undervalued exchange rate. This was not accidental. One of these outward-oriented nations that one could quibble about is Korea. This has a bearing if you think forward, when you think of what the Chinese are doing at this stage. China's currency is the most obviously undervalued of any major country today, and the magnitude of that undervaluation is enormous.

The other dimension in this approach is the transfer of resources from producers to consumers. In producer-oriented countries, the consumer subsidizes the producers. These countries are building their standard of living around a higher rate of productivity growth and a higher salary rather than cheap consumer prices.

The high-growth countries have not been the neutral consumer-oriented countries. They have been outward-oriented nations with an undervalued exchange rate. They can also be characterized as producer-oriented in the sense of creating a system in which the consumer is overcharged and the producer typically controls the channels of distribution. This is a system in which the consumer subsidizes the producer. You reinforce that system with export growth, which takes you down the manufacturing learning curve faster than someone can on the basis of their domestic market. This has some substantial implications for the trading system.

The other part of this that needs to be thought about is that most of the older industrial countries are, in fact, doing the opposite. Earlier, Senator Bingaman discussed the R&D curve. You can duplicate that with public infrastructure and other investments.

The extent to which resources are being shifted either toward areas of opportunity or advantage is declining, especially in the United States. U.S. allocation of resources is increasingly on the basis of disadvantage, for which no performance is required. Transfer payments to people with low incomes have gone up by ten times in real terms since 1965. They dwarf anything that we do to promote advantage. It is 5 percent of GDP. Senator Bingaman talked about 0.07 percent going into R&D.

As we open the trading system, two things are happening: average incomes are going up, and inequalities in income are going up. The dilemma for the high-income countries is they have a rising share of the population whose incomes are going down. If you live in Europe, you have a minimum wage. Consequently, more people are unemployed or the government employs them, as in Sweden or Denmark. Faced with increased inequality, the rich countries are tempted to allocate, not on the basis of advantage or opportunity, to the disadvantaged.

The Challenge of the East Asian Economic System

James Fallows, The Atlantic Monthly

What I have to say follows directly on what Professor Scott very eloquently and valuably pointed out. He established a point that should be obvious to anyone who has operated in international economic competition. Yet, it is one which has escaped notice in American political discourse and, it seems, in American economics departments. That point, of course, is that there are different strategies with which nations approach the pursuit of economic advantage, and that consumer welfare is not the only idea any society brings to its economic strategy.

I am going to talk about the part of the world in which this difference—between American modern notions of consumer sovereignty and the longer-term producer notions—has the sharpest importance right at the moment. That region is East Asia.

I will argue that most of the opportunity for cooperation that this seminar is designed to discuss, and most of the potential for the disruption that this seminar is supposed to understand and avoid, will lie in East Asia. It will show up in East Asia's interactions with Europe, its interactions with North America, its interactions with the rest of the world.

It seems to me there are four dimensions to this interaction—four ways to think about the impact of East Asia and the consumer-producer tensions around the world.

Let me first say that since I agreed with everything in Professor Scott's presentation except one sentence, I will, with my journalist's mentality, focus on that one sentence. He pointed out that transfers to people in economic need were growing much faster than other efforts to promote advantage. I believe that the only thing growing faster than transfers to people *with* economic need are transfers to people with *no* economic need. This has been the story of American budgeting over the last generation as non-means-tested retirement payments have ballooned.

Back to my main agenda. The four reasons why East Asia will be the arena for the contrast of these systems are as follows.

SCALE

First is the *scale* involved in the East Asian economies, at the moment and prospectively. In talking about scale, I do not mean simply that the Japanese economy is at today's exchange rate something like 85 percent as large as the U.S. economy and that if the yen were to appreciate into the mid-seventies, the Japanese economy would be, in theory, larger than the U.S. economy at that point.

I do not mean simply that China could, by many possible projections, be the largest economy in the world over the next decade or two. I mean instead that there are three subdimensions of this scale issue that make the contrast in economic theories and economic styles particularly important in East Asia.

Sustained growth: One of these subdimensions is *the sustained rapid growth of East Asia,* which means that, whatever happens, there will be a disproportionately large impact on the rest of the world. As all of you are aware, year by year over the last two decades, if you took the ten economies in the world with the fastest growth rate, seven, eight, or nine of them would have been in East Asia. And there has been a compounding effect of growth over the decades.

The growth prospects for East Asia as a whole and for many of its constituent countries are strong over the next ten years. It seems likely that some rate of growth will continue. So the continued growth in East Asia gives it an importance that other regions do not have.

A regional system: The second subdimension of scale that has particular importance is the increasing *systematic nature* of what is happening in East Asia. Despite all the obvious differences of language, history, religion, and ethnic sentiment found in East Asia, as the years go on, East Asia is functioning more and more *as a regional system.*

To me, the most interesting economic story of the last decade is the unintended consequences of doubling the value of the yen in 1985 and 1986. That was the catalyst for creating an integrated East Asian system, as Japanese companies used their newly valuable yen to invest in the rest of the region and integrate a Pan-Asian production base. And with the passage of years, I argue that this systematic integration is increasing and has impacts for the rest of the world.

Influence: A third subdimension of scale is *the influence that Asian economies* now have on every place in the world. Americans should be aware that over the last decade, Japan's trade surplus with the United States has averaged approximately $50 billion a year. So has the surplus from the rest of Asia with the United States. So there has been an average of approximately a $100 billion trade impact from Asia as a whole on the United States. With this producer orientation, the Asian system has an increasing impact on other economic systems as well. In sum, what happens in Asia matters because of the region's scale, its rate of growth, and its influence and spillover effect on the rest of the world.

Political Ideology

The second reason why the Asian system has particular importance and impact involves what I call their "political" ideology. The reasons for calling it that will become obvious later when I discuss dimension four. I have in mind here again three subcategories, three aspects of political ideology that make the Asian growth case particularly significant as a source of both competition and of potential cooperation.

Growth as a national objective: One of these categories is a particular purposefulness about economic growth and about government-directed economic and technology growth that is distinctive in the world. Richard Samuels, who will address you tomorrow, has written the definitive book on this subject, *Rich Nation, Strong Army*, about Japanese technonationalist policy. I believe that you can find milder versions of the same mentality in many other countries, particularly China at the moment.

Mark Dadd pointed out earlier today that, according to Western-style economic theory, we should not view economic commerce as a zero-sum game because, after all, we can all prosper from it. I submit that, in many of the leadership positions of these Asian countries, there is still a zero-sum mentality. That is, to make themselves stronger relative to the rest of the world, it is important to gain technological advantage. And I believe that there is still a purposeful drive in many of these countries.

Confidence: A second subcategory is the increasing confidence within Asia about an Asian route to development, to the steering of technology, and an Asian sense of being on the winning side of the world's technological exchanges.

I will give one illustration here. It is interesting that Japanese foreign aid administrators increasingly say, "Do it our way and you will prosper. Do it the World Bank way, do it the American way, and you will flounder." And the Russians' mistake, they say, was to open up their national market too rapidly, unlike the Chinese.

Barriers: A third aspect of what I call their political ideology is the barriers within many Asian societies to democratic pressures that might make them more consumer oriented in the long term. Americans have a long track record of predicting the imminent collapse of Japan's productive system—because consumers will rise and revolt, salaried men will stop working, the youth will revolt, etc. All these things may happen at some point, but I am impressed by the robustness of many Asian political systems in keeping the lid on these tensions. And, indeed, the most interesting test case here is Korea, which did loosen its belt over the last four or five years and is now trying to tighten it again.

GEOPOLITICAL SPILLOVER

The third reason why we should concentrate on what happens in East Asia is the geo-strategic spillover of economic and technological tensions. What I have in mind here about the geostrategic impact of economic and technological competition also includes three subthemes.

Strategic and military balance: The first one, and the one that has been concentrated on most consciously by American strategists, is the potential—indeed, the inevitability—of overturning what has been a very important strategic and military balance in Asia for the last 40 years. One could argue, and I would, that what has kept the peace in Asia since World War II (with the exceptions of the wars in Vietnam and Korea) have been two conditions that are no longer sustainable:

- One is the U.S. security presence, with the 7th Fleet and its allied forces.
- The other is the U.S. role as the final market for most Asian producers.

This role results in a $100 billion annual trading deficit with Asia. It is hard to see how these two conditions can last in the long run, how the U.S. can both have a $100 billion deficit every year and still send out the 7th Fleet. The question is, what happens to the Asian system if those conditions are no longer present? This is one strategic consequence.

Economic polarization: A second strategic consequence is one Professor Scott mentioned, which is that the trading difficulties that the United States is now having with East Asia have the potential of aggravating the worst political problem inside the United States. That worst political problem is not even racial tension, it is not even gun violence. It is, instead, the continued polarization of

the United States on economic grounds. Economists argue about the many sources of this polarization, but they all agree that trade has something to do with it. So, if the trading differences between the United States and East Asia aggravate this main tension, that has a strategic effect.

The "right way": A third subtheme here is an emerging ideological confrontation between the United States and East Asia about the "right" way to organize society. One sees signs of this in the Singapore caning case last year and in the arguments with China over human rights. What is emerging from these cases is a challenge to the Western idea that the Enlightenment-style, liberal, Western democracy is the supreme way to organize human beings. Increasingly, you will find rich and confident Asians saying "no," saying that perhaps a role for the individual is dangerous to a successful society.

American Ideology

I will now move on to dimension four, which is about why East Asia matters.

This point concerns what I call our political ideology about the economy. Speaking mainly of the United States, but more broadly about Britain and the English-speaking Western world, it is this political ideology that makes it so difficult for us to perceive accurately what is happening outside our borders. Professor Scott mentioned at the beginning of his presentation that he was from the business school and not the economics department. Then he went on to give a very realistic description of what was happening in the world.

I think the juxtaposition of those two things—first that he is realistic and second that he is not in the economics department—is very important. It is not an accident that it is hard to find people with a similar perspective from "real" economics departments. I contend that 50 years from now, people will marvel at the temporary prominence and preeminence of Western-style economics in the mind set of the Western world in the late twentieth century. With today's theoretical economics, we have something that is similar to the problem of Ptolemaic astronomy, earth-centered astronomy, in which you have a theory that is harder and harder to fit to the facts of the real world.

As Professor Scott pointed out, the Ricardo example, which students are still taught, is very hard to fit to a world of aircraft producers and semiconductor producers. It is very, very, very hard to fit anything argued by Western-style economists to what happened in the last ten years in world currency markets. Ten years ago they were predicting that the doubling of the yen from 250 to 120 would cause a complete change in the Japanese export performance. It was, indeed, a change, but not the one they predicted.

To conclude, I have a long argument to make here, which I will boil down to the fact that America has prided itself historically on being a pragmatic, Yankee-ingenuity-type society. I contend that the most ideological aspect of today's world affairs is American economic thinking. There is no clearer case of the conflict between empirical evidence and pure theory than what is happening as

economics departments try to say that the Japanese are doing things wrong. They are just hurting themselves. They are cheating in world trading rules and they are not succeeding. So this dimension, that is, how we can adjust our ideology to square with the facts of the East Asian world will also be significant.

Thank you.

Consequences for the International Economic System

Lawrence Chimerine, Economic Strategy Institute

I agree with the observations that James Fallows made about East Asia and, quite frankly, about economic thinking in the United States and its slowness in adapting to what is happening in the real world on trade issues. That is my subject this morning—to give you some perspective of what is happening with respect to U.S. trade and to put that in the context of overall U.S. economic performance and, in fact, overall global performance.

A record deficit: All of you know the numbers or have read about them. We set a new record last year in the United States for the merchandise trade deficit, and based on data for the first two months of this year, it looks as if 1995 will be another record year for the U.S. merchandise trade deficit. However, there seems to be some complacency about this. Many people, particularly many people in my own profession, are not really overly concerned about it, in part because the economy seems to be doing well anyway, although I believe that is temporary. But more than that, we are told frequently that it is really a sign of strength.

Savings and exchange rates: Some economists claim that the reason our trade deficit is so high is because our economy is growing rapidly and we are drawing in imports, and so that the deficit is a macroeconomic problem. In addition, they argue that we do not save enough, and the Japanese save a lot. We are told that we are always going to have a huge trade deficit until we raise our savings or until everybody else cuts their savings. We have also been told that exchange rates will solve the problem. The dollar will get weaker and weaker until the trade deficit declines. Of course, we only have about 80 yen to go.

We started at 360 yen to the dollar. I am not sure how anyone can keep making that argument, but, nonetheless, you keep reading it. And the final argument of the "not to worry crowd" is, it is okay that we have a $180 or $190 billion merchandise trade deficit, we will make it up in services because we do have competitive advantages in a number of service industries. Services will bail us out.

Structural issues: All of these arguments in my judgment are either completely inaccurate or highly misleading. They focus excessively on the macroeconomic dimension of our trade deficit, in which it has become increasingly apparent that a large fraction of our trade imbalance is what I call structural, unrelated to macroeconomic trends.

Let me give you some of the broad arguments in support of this assertion, and then we will go on to some of the other issues.

First, the argument is that the United States is growing rapidly, thereby pulling in imports. Look at the numbers. In the last five or six years, real imports coming into the United States have risen at a rate more than four times faster than GNP growth. Imports are income elastic, that is, historically, they have grown more rapidly than GNP. Historically the elasticity has been in the range of two. So in the last four years, the rate of import growth relative to the rate of GNP growth has more than doubled from the already high ratio that existed previously. So import growth has dramatically accelerated.

Second, on the export side, while our exports have grown at a healthy rate over the last several years, most studies would suggest that our exports should have been rising even faster than they have been rising, in view of the improvement in U.S. competitiveness, particularly price competitiveness resulting from a significant decline in the dollar.

So although macroeconomics may be a part of the problem, it is clear that it is not the full explanation of why our trade imbalance has been growing so rapidly. And, in fact, look back three or four years ago. The United States was in the middle of a prolonged period of recession and stagnation that lasted four or five years. Western Europe and Japan—this is before the Japanese recession or stagnation developed—were growing rapidly and we still had a $90-$100 billion a year trade deficit.

So, even under ideal, relative economic growth patterns, we still had large deficits. The truth is that we have had a huge and persistent trade deficit in the United States for more than 15 years, regardless of the trends in underlying economic growth.

Third, my favorite argument is the saving and investment argument. I do not know how many of you remember your elementary economics. If you do, you know that there is a well-known identity that the difference between saving and investment equals the trade deficit, or the current account deficit. I will call it the trade deficit for simplicity.

Unfortunately, a lot of economists have naturally assumed that the causality goes completely from savings to trade. Identities tell you nothing about the direction of causality, but if you have a structural trade deficit caused by closed markets overseas or foreign predatory trade practices, or other factors, it is ultimately going to depress savings in your country and probably raise savings in those countries that have adopted such measures.

For example, suppose this were to happen in the United States. Suppose our trade deficit rose because of an increase in import penetration caused by any number of factors—some new foreign products are of better quality, exchange rates change, etc. Obviously this would displace some domestic production that in turn would reduce jobs and income, which is likely to lower savings, and reduce tax receipts, both of which would contribute to a decline in net national savings.

The causality, to some extent, goes in the other direction in Japan as well. Prices in the Japanese market are extremely high. Is it not reasonable that those high prices to some extent discourage consumption, push up savings, particularly for items you must save for if you want to afford them in the future such as housing and autos?

The Japanese are thrift oriented, and they have a number of tax policies and other policies designed to encourage savings. But to some extent, the high saving rate does reflect the high cost of living in Japan, reflecting in my opinion the absence of import competition, which enables prices to remain at those high levels in essentially what is a sanctuary market.

So the saving and investment argument does not impress me. Based on calculations we have done at the Economic Strategy Institute, perhaps a third of the causality goes in the other direction. That is a big number. If you take a third of our overall trade deficit as being structural, rather than a saving or macroeconomic phenomenon, you are at approximately $50 billion a year. And, quite frankly, I believe that a third is a very conservative estimate.

Twenty or 25 years ago, the dollar was trading at 360 yen. Ten years ago, it was 250. It recently hit 80. The weak dollar is not a recent phenomenon. This is a secular trend, and the reasons are obvious. If there is a regular $60 billion trade imbalance between two countries, the one with the trade surplus is likely to experience an appreciation of its currency, and the country with the deficit will find its currency falling in value. And now the Japanese are far less willing to recycle the dollars they are earning from their exports into dollar-based assets because of the huge losses they incurred during the 1980s in U.S. real estate—in fact, in anything they invested in the United States. Some of the losses were asset price losses, but probably the bigger portion was the result of currency losses.

I believe that the Japanese have caught on. As long as their markets are closed and they run this big trade surplus, their currency is going to keep appreciating. Japanese investors have now realized that dollar-based assets are not the best investment under these conditions. This just accelerates the appreciation of the yen, and, in fact, if it had not been for massive Bank of Japan intervention in the last four to five months (buying up a lot of the dollars sold by Japanese exporters, banks, and others), the exchange rate would probably be in the sixties by now.

This is a clear sign of the structural nature of the trade deficit. Do you remember hearing that when the exchange rate was at 200 yen to the dollar, that at 180 we will get rid of this trade imbalance? Of course, when 180 came, it became 160 and then it became 140. We were chasing ourselves down. The ineffectiveness of exchange rates to solve the problem is a clear sign of a structural trade imbalance caused largely by closed markets in Japan.

Anyone who has tried to sell into Japan is familiar with the cultural and structural barriers that essentially keep that market closed, making it very difficult to export into that market. And, closed markets allow the Japanese to charge

high prices in their market, generating huge profits that are frequently used to subsidize their exports. So it shows up on both sides of the equation—lower than warranted exports to Japan and, to some extent, higher imports from Japan because of the subsidies on their exports, which they finance, of course, with the high profits earned in their own market.

Every study that has been done shows that Japan under-imports by a substantial amount relative to other industrial countries—at least $100 billion a year, probably a third which would come from the United States if their markets were truly open. That is the structural element of the trade imbalance between these two countries.

Importantly, it is no longer just Japan. We are now running a $30 billion trade deficit with China. Six years ago, our trade imbalance with China was $3 billion. China has grown at 10 percent a year in real terms during this period. We have grown 2 percent a year. If this was purely a macroeconomic problem, how do you explain our trade deficit going from $3 billion to over $30 billion over this six-year period?

The trade deficit is becoming a structural problem with most of East Asia and, in fact, almost two-thirds of our trade imbalance is now with East Asia, a large fraction of which is structural in nature.

Also, the Japanese run trade surpluses with almost everyone, high-saving countries, low-saving countries, high-budget-deficit countries, low-budget-deficit countries, etc. There are possibly one or two exceptions. Australia is one exception because it exports the raw materials that Japan does not produce.

Not a purely macroeconomic problem: So clearly, the argument that this is purely a macroeconomic problem does not square with the evidence.

To return to the dollar for a moment, not only is its depreciation not correcting the problem, but even if it did, this is not the ideal way to eliminate the trade deficit. A weaker and weaker dollar has undesirable side effects. It creates upward pressure on inflation and interest rates, squeezes purchasing power, makes us poorer, makes our assets cheaper for foreign acquisition, makes it more expensive for us to invest overseas, which in the long run makes it even more difficult to address the trade imbalance. So even if it did work, which, in my judgment it does not, this is not the way you solve what is largely a structural trade imbalance.

One-way free trade? There are some economists who will say "So what? Let them keep their markets closed. It is their consumers that suffer. We should keep our markets open anyway," they claim. I consider myself a free trader, but I know the difference between one-way, unconditional, unilateral free trade and the two-way free trade that represents a win-win for all countries, and consumers in all countries.

One-way free trade of the type that we have had for the last five or ten years can be just as destructive, in my opinion, as widespread protectionism. Look at the performance of the U.S. economy over the last 15 years. Average economic growth has been a percentage point lower than it was earlier. Average unemploy-

ment has been a percentage point higher. Real earnings have stagnated over this period. Productivity growth has slowed. Not all of this is the result of trade, trade may not even be the dominant factor, but it is hard to make the case that our unbalanced trade accounts have not made a contribution to this less-favorable economic performance in the United States.

Consumers vs. producers: Again, you will hear from some that one-way free trade is okay because it maximizes consumer welfare. But, consumers have to have an income to have welfare or to spend. This is another false choice, just like the false choice between free trade and protectionism. In the long run, if you lose jobs and income as a result of predatory trade practices, consumer welfare will be lower. It might be a little better in the short term because consumers benefit from lower prices, but you also have to consider the production side of the economy. And if that is damaged in the process in the long term, it is very likely consumers will be worse off.

It is my judgment that the public in the United States is ahead of the economics profession in many respects because, clearly, the constituency for free trade has diminished. Many of the new people in Congress are also much more nationalistic and isolationist. Most people in this country realize that, under current "free trade" policies, we have suffered to some extent. They want free trade, but they want real free trade, two-way free trade, the type of free trade that we will all benefit from. That is not what we have had in this country, and in my judgment the Clinton administration is correct in trying to force open foreign markets and, until that happens, maintaining effective trade laws in the United States.

Thank you.

DISCUSSION

SYLVIA OSTRY: I am not clear what the combined panel was trying to say. Perhaps it is unfair to put them all together. Is there a feeling on the part of some members of the panel that the problems in the United States are the result of an East Asian model, which is either deliberately or inadvertently predatory and threatens the whole existence of the United States? I am usually quite ingenious about policy proposals, but I must say that I do not know what I would do in this case.

JAMES FALLOWS: It is significant to me that you have used a concept that appeared in neither Professor Scott's or my presentations—that of moral opprobrium, that of "predation," that of some kind of deliberate erosion of someone else's welfare. In my 13-minute presentation, I was trying to compress something I have written about over the last ten years. What I have argued at greater length is that there are simply *different* models of national welfare and *different* models for national strategy. The point is not to shriek in horror about "predatory" impulses, but to recognize that there are systems with different trajectories

and that we need realistically to understand what the trajectory is. My four classifications of where there would be points of conflict, where there would be points of strain, were designed to address this point. The concept of predation is one that we should expunge from our minds. It is rather a matter of where there will be disequilibrium, where there will be conflicts of interest and how we can manage the sources of those conflicts.

LAWRENCE CHIMERINE: I did not mean to suggest that we are being destroyed by the Japanese or anyone else. My point is very simple, that the Japanese system and their approach to trade are different than ours, and our economy has been hurt by that over the last 15 years.

CARLOS PRIMO BRAGA: I found the panel presentation quite interesting, particularly the reference to how you should do policy in developing countries. I was a bit puzzled that no one mentioned the multilateral trade system and its role. What is going to be the role of the multilateral trade system if the world works as per your view of the world? What should the World Trade Organization do? Or should we just get rid of it?

BRUCE SCOTT: Because you are from the World Bank, the obvious place to take the reference is the Japanese request to the World Bank that it recognize reality as it is. It took a Japanese-financed study approximately three years before the Bank was able to recognize that the high-growth countries have had a systematic intervention inconsistent with what they have been recommending. It has been very hard for the Bank to recognize that, and the report that does so makes very awkward reading.

Robert Wade has written a very interesting paper, "The World Bank and the Art of Paradigm Maintenance," in which he discusses the Bank's efforts to maintain a paradigm that simply no longer fits the facts. It is hard to change this, but at this stage there is no one that has had more influence in maintaining obsolete concepts than the World Bank.

The dilemma that we face is that, for most countries, the economic strategies have been overwhelmingly import substitution, what I characterize as inward looking. Pursued too long, they perform badly everywhere. So if you asked for the track record of governments with economic strategies, especially since 1973, numerically the track record is poor.

The unfortunate part is that most of the really outstanding performances are also connected to government intervention. If you are an organization, such as the Bank, making recommendations, this puts you in an awkward position. The Bank would be saying there is another economic strategy, but you simply do not have the competence to do it, which happens to be true.

The Japanese are saying, "Well, there is an additional strategy. Much of the recommendations that you are making to third-world governments are simply

wrong. You are recommending that it is okay to subsidize them when they are subsidizing consumers, but it is wrong to subsidize producers. It is wrong to take a long-term approach. It is wrong to try to accelerate your industrialization."

In essence, that is what they asked. And it takes you back to the same old concepts, with reasoning like Adam Smith and David Ricardo. And some of our institutions, such as *The Wall Street Journal*, act as though they have not learned a thing and that Adam Smith said it all. Quite simply, Adam Smith's economics is preindustrial economics.

LAWRENCE CHIMERINE: I have a quick comment about the current auto and auto parts dispute and the WTO. I am a supporter of the multilateral approach, but it is not clear that the WTO is going to have jurisdiction over the type of trade practices that the Japanese regularly use. If you go back and look at the Uruguay agreement, many of theese practices were not even addressed. I believe that the Clinton administration is correct in filing an Article 23, but it is not clear the WTO has jurisdiction.

JAMES FALLOWS: A correct analogy to keep in mind for the WTO is the role of the United Nations during much of the post-World War II era. Nobody pretended that the United Nations could deal with all great power conflicts. There were certain issues it was not structurally set up to deal with and yet we were better off having it than not having it. In my view, that is how the world trading system will operate. We are better off having it than not having it, but it is not going to contain all of these disputes.

TAKASHI CHIBA: I address my question to Dr. Chimerine. Despite your argument, I hope you share my view that this difference of the savings in both the United States and Japan is that Japan is producing more than it consumes and the United States is consuming more than it produces. This type of difference remains a major portion of the qualities of imbalance of trade between our two countries. It is very important that we address these types of issues and find some positive solution to this type of problem. Otherwise, it is not useful to continue these discussions. I hope we can learn from you what we should do in both countries, both in Japan and in the United States, to rectify this situation.

LAWRENCE CHIMERINE: Good question. Let me make two comments. First, the argument that the United States consumes more than it produces is true, but the question is why, and is production held down by our inability to sell into Japan? Have we lost economies of scale by not being able to sell in some markets, and has that hurt competitiveness in some industries, which in turn hurts our production?

The perception is that we are on a major consumption boom in which consumer spending growth in the United States in the last 15 years has been less than

it was in earlier decades, which is not true. What I am trying to tell you is that, to some extent, our production has been somewhat constrained by predatory trade practices and that is why we are consuming more than we spend. It is not as if we have all of a sudden gone on a big binge in spending.

Second, I agree with you—we need to find a solution to this problem, but I think the history is that, whenever we have had negotiations with Japan in the past, unless there is great pressure exerted by the United States, unless there is an indication that there is some way of monitoring progress, nothing ever seems to happen. I do not like tariffs. I wish we did not have to impose tariffs, but the issue is that we have to force open the Japanese market. We have to get directly at those cultural and structural barriers that make it very difficult to sell into the Japanese market. That is the crux of the issue.

HORST SIEBERT: I thought the role of this session would be to find a common intellectual basis for the discussion of our project and also, of course, for the future meeting in Germany.

I want to give the view of how we see the world economy.

There are firms competing in the product markets and indirectly competing in the labor markets. Governments are competing with the infrastructure, with the institutional setting, and with a taxation system that favors the mobility of capital. Basically, you have a world economy where the immobile factors of production compete for the mobile factors, and it is apparent that this locational competition is at the center of modern international economics, not David Ricardo from 200 years ago. And there are interdependencies among these three levels of competition.

Apparently, the competition in these three areas has long-term implications. Is the market so shortsighted that they would concentrate on the production of a certain product that has a profit only today but not tomorrow? The market should have some long-sightedness. Maybe we do have an American problem here that American firms are shortsighted. But this is not a policy issue, but rather an issue of the internal organization of American firms.

I have heard many things about friction and about cooperation. The word "competition" has not been heard much this morning. Have we forgotten that we believe in competition? Do we not believe in competition anymore? Of course Asia is changing, and this changes the world economy, the locational advantage, and the dynamic interpretation of the United States. We are challenged, but then if we are challenged, we need to look at the competition and stand up to it.

LAWRENCE CHIMERINE: I, for one, believe in competition. I would like to see U.S. companies have the ability to compete on an equal basis in markets that they now cannot enter. That is what this is all about.

KARL-HEINZ PAQUÉ: I wanted to come back to a point that Bruce Scott made

about comparative advantage. And as an economist, you will not be surprised that I stand up a little bit in defense of comparative advantage.

Actually, it is somewhat misleading to look back at the specialization example of David Ricardo regarding Portugal because we know with the benefit of hindsight that wine growing was not a fast-growing industry. Today, if you translate that example into a modern setting with different industries and try to design a technology policy, which really picks the winners and the right sectors, it is much more difficult. I do not know what direct policy conclusions can be drawn.

I will give you an example. If you look at a country such as Holland, which has traditionally had a large agriculture and a large sector introducing technology into agricultural production, it has been quite successful. It is not quite what we mean with high-technology industries, compared to microelectronics, but can we really conclude that the Dutch experience was a disaster?

In other words, the issue of translating the learning effects involved in the change of sectoral specialization is a much more complicated matter than just looking back at an historical example, which can be easy to categorize.

We have to face up to the fact that, currently, the definition of "sectors" as high technology and low technology is becoming more and more difficult. We should, therefore, be much more careful about drawing the right policy conclusions in such cases.

BRUCE SCOTT: I certainly agree with you that, if you look at the track record of most countries trying to intervene, they would have been better off if they had not done anything at all. The dilemma is that you have half a dozen countries that have intervened and have been remarkably successful. The question is, what policy lesson do you want to draw from that? And I think reasonable people can differ.

Difficulties aside, sectoral targeting is a policy to be recognized and dealt with. It is not focused on comparative advantage, but rather on opportunity.

There was a comment that we have not been looking at this relative to the three levels: the strategy of governments, the strategy of firms, and the strategy of units. These three levels should be part of what we are talking about.

I am interested to hear what people say with regard to these strategies. Are they easy? Do we know a lot about them? Are there a lot of successes? I think the answer for these questions is "no." Are you going to apply a test that says if there are mistakes, you do not do it? If you apply that test for a business strategist, you would have to say that we have a lot of people that are grossly overpaid and ought to be fired.

No business runs on the notion that they never make mistakes. The dilemma today is the role of people. We have free movement of goods. We have free movement of money. But we are not going to accept free movement of people.

Japan does not accept immigrants, and the Europeans are rapidly heading in the same direction. We have had a very different experience in the United States.

North Dakota does not need an industrial policy. There is nobody left. They have all gone somewhere else.

You cannot do that when you are crossing national frontiers. Therefore, the question of looking at this in terms of creating opportunities for the people who stay here becomes quite important. We are not going to have mobility of people in any time in the foreseeable future.

MARK DADD: Let us bear in mind one of the comments I made when we first started this session, that people in different countries have very different cultural traditions and simply view policy issues differently. One way of looking at policy issues in one part of the world is not necessarily wrong simply because it differs from ours. To move forward positively over the next couple of days, we need to keep this uppermost in our minds.

Let me give you one quick example. I was working in London at the time when the first discussions took place about the appropriateness of having a fixed exchange rate regime in the European Community. There were intense discussions about whether the United Kingdom should be part of such an arrangement. The United Kingdom would have to give up some of its independence to determine economic policy and particularly monetary policy in favor of a common policy. The question was, would the United Kingdom make the same policy trade-off between growth rates and inflation that, say, Germany would? My conclusion was that Germany, the country potentially with the most influence over a common European monetary system, would have a different trade-off because of their historical experiences with rapid inflation in the 1930s, which would be politically unacceptable in the United Kingdom.

Session 2

Regional Cooperation in Core Technologies: The Case of Airbus

Moderator:
Karl-Heinz Paqué, IfW

CHARLES WESSNER: For this session we have a particularly distinguished panel that will be introduced by Karl-Heinz Paqué of the IfW, the Kiel Institute of World Economics. I want to express on behalf of the National Academy of Sciences our deep appreciation for the members of this panel, who have come a great distance to participate and who are willing to talk in a constructive fashion about an exceedingly complex and disputatious element of high-technology trade, namely the success of the Airbus consortium.

Briefly, Dr. Paqué is head of the Department of Growth and Structural Policy in the International Division of Labor at the Kiel Institute of World Economics in Germany. We are grateful to Dr. Paqué for leading this session, and we are sure that he will be uniquely well qualified to give us an objective assessment.

KARL-HEINZ PAQUÉ: The discussion in the last session concentrated on the American and Japanese trade frictions. In this session we now turn to the European and American dimension of this issue.

And I now will briefly introduce our four distinguished panelists. The stage will be set by David Mowery who will talk on an assessment of project goals, means, and international consequences. David Mowery was associate professor of business and public policy at the University of California at Berkeley from 1987 to 1988. He served as the study director for the Panel on Technology and Employment at the National Academy of Sciences in 1988. He also served in the Office of the U.S. Trade Representative as counsel on foreign relations and international affairs fellow.

Also on the panel is Sally Bath, the director of aerospace at the International Trade Administration of the U.S. Department of Commerce. Her office monitors

the implementation of trade agreements that are specific to the aerospace industry, identifies constraints on the trade performance of the U.S. aerospace industry, and recommends ways to neutralize such constraints. Prior to her appointment with the U.S. government, she spent a year with LTV Aerospace and Defense Corporation in Dallas, Texas, as a senior market analyst. And prior to that, she was with the aerospace industry's national association in Washington, D.C., as chief statistician for nine years.

After these two presentations, we will then hear the views of industry. First will be Raymond Waldmann from Boeing. He is vice president of international business for the Boeing Company. He provides policy direction on key issues in international strategy, trade policy, regulation, technology, and competitiveness. He also represents Boeing's positions with federal agencies, the Congress and the public.

Our final speaker is Jonathan Schofield, who will give the perspective of the Airbus company. He is chairman and chief executive officer of Airbus, North America. Prior to his current position, he had numerous positions with United Technologies.

An Assessment of Project Goals, Means, and International Consequences

David Mowery, University of California at Berkeley

My goal is to lay out the background concerning the development of Airbus and identify some of the issues for transatlantic and, perhaps, global high-technology trade that Airbus symbolizes or illustrates. To do this, I will make some summary comments about the origins and original goals of Airbus; some comments about policy of the respective sponsor governments toward Airbus, comparing that with the U.S. government domestic policy toward its aerospace industry; what Airbus has accomplished; and some observations on some of the factors that have contributed to its accomplishments. I will also discuss some of the responses of the U.S. government and industry to Airbus's accomplishments and talk about some of the implications of those responses for high-technology trade in general.

It is important to recognize several things about the origins of Airbus. First, the structure of the Airbus Consortium represented a new way of organizing and financing a regional aerospace industry that had achieved a fairly high level of technological development. The respective aerospace industries of France, the United Kingdom, Germany, and Holland certainly entered the 1960s with substantial technological assets and substantial involvement in the large commercial aircraft industry.

What triggered the formation of the Airbus Consortium was the recognition of the end of the road for the national champion policy, wherein individual gov-

ernments supported the launch of aircraft by single national firms, combined with a continued commitment to supporting what was viewed as a critical high-wage, dual-use industry, avoiding dependency on foreign suppliers of a critical product, and trying to grow or expand the aerospace supplier and industry within Western Europe. So in many respects Airbus was a regionalization of policies of government support for aerospace industries that had a long history.

The second point about the origins of Airbus, which can be traced to the mid-1960s, is that the early years were characterized by a great deal of upheaval and change in the goals of the program. The original consortium (which included British membership in the development of an all-European large commercial aircraft) that was to include European-developed engines was replaced in the late 1960s by an essentially Franco-German initiative with some Dutch participation to develop a less technologically ambitious airframe for which engines would be sourced elsewhere. This phase was followed in the late 1970s by the reentry of the British into the Airbus Consortium.

There was a lot of instability in the early years, and some clear trade-offs were made between technologically ambitious objectives and what were perceived to be more economically feasible designs and goals.

I will now talk about some of the member governments' policies toward Airbus and U.S. policy toward its domestic aerospace industry. The current estimate of support by the Airbus sponsor governments, in the form of so-called launch aid and subsidies for the production of Airbus aircraft, is approximately $13 to $14 billion. When the cost of capital investments is added, we get a figure in the low $20 billion range. This support has been fairly product specific.

How does this compare with the historic U.S. posture toward its commercial aerospace industry? Aerospace in the United States, particularly in the postwar United States, has been treated rather differently than other industries in the U.S. economy because of its importance for national security.

The United States has had a dedicated civil aeronautics R&D program operated by NACA (the National Advisory Committee on Aeronautics) and NASA. The federal government has made important interventions to sustain major U.S. aerospace corporations, and it has spent substantial sums of defense dollars on procurement and development of airframe, avionics, and engine technologies. But postwar U.S. support of its domestic aerospace industry was motivated largely by national security considerations; such support was much less consciously structured to advance national competitiveness, and it was not directed at specific individual commercial aircraft development projects.

By and large, the focus of U.S. support has been much more diffuse, much more generic, and many of the technological benefits associated with the military R&D and procurement expenditures that were arguably important during the 1950s and 1960s have declined substantially and some even reversed, particularly in airframe and propulsion technologies.

So there are clear differences in the structure of policy in the postwar United States and Western Europe, although one must recognize that aerospace in the postwar United States is not quite the same as steel in the postwar U.S. economy.

What has Airbus accomplished and what are some factors that have contributed to this accomplishment beyond the support of its member governments? The first very significant accomplishment of Airbus over a lengthy history is survival, particularly when one compares the less successful histories of earlier trans-European ventures in nuclear energy, or the very unsuccessful Concorde collaboration. Second, Airbus has managed to expand its global market share, particularly at the expense of McDonnell Douglas in the United States.

What factors have contributed to this success? By comparison with the Concorde, the management structure for Airbus is both stronger and has much greater autonomy from the types of direct, micromanaged government control that characterized that venture.

Another feature of Airbus that distinguishes it from other programs that have followed Airbus and have been directly sponsored by the European Union [EU] is that although there has been a great deal of pulling and hauling within the Consortium over the distribution of benefits and jobs, the distributive politics operating within the Airbus Consortium have been far less pronounced than what we see within other consortia sponsored by the European Union, such as ESPRIT and other programs.

It is far from obvious to me that the EU Commission itself could have sponsored and launched the type of focused program that is represented by Airbus, with very large expenditures devoted to a small number of national champions brought together in a regional consortium.

The distributive politics now operating within many EU programs are far stronger than that. But the other important point to recognize about the government support for Airbus, something that is particularly important for U.S. observers to recognize, is that Airbus has invested a long-term commitment of substantial sums of money. The ability of U.S. federal programs to mount a similar long-term and stable commitment of resources to a civil technology is, I believe, very much in question. So the durability, length, and stability of the financial commitment have been very important.

The Airbus Consortium itself also has been effective in a strategic sense in several areas. The first has been the development of a viable product family, a five-aircraft line of different products that makes the attractiveness of any given Airbus aircraft more attractive to a would-be purchaser.

A second important strategic accomplishment of the Airbus Consortium has been its construction of a viable, global, product-support network. Third, and here we get into a finer line between Airbus's ability to rely on low-cost capital and its ability to manage technology, Airbus certainly has led U.S. firms in the adoption of certain advanced technologies in flight control and composite materials.

The reaction of U.S. industry and the U.S. government to Airbus is also interesting. Airbus had certain opportunities that resulted from slow or perhaps simply inattentive behavior by leading U.S. firms. The first was the decision of McDonnell Douglas to pursue a DC-10 rather than a twin engine, wide-body jet, which created a vacuum in the market, one that to some extent was filled by the Airbus A300 and A310. A second gap in the market that resulted from decisions of U.S. manufacturers was the decision of Boeing to go above the 150-seat class in the development of the 757. In both cases, commercial decisions made by U.S. manufacturers created opportunities for Airbus that Airbus was able to fill, in part because of its government sponsorship.

Another point about the industry response is the consistent ambivalence and a real reluctance on the part of U.S. industry to invoke conventional instruments of trade policy, such as countervailing duties, or the big club of Section 301, against Airbus.

Why is this? U.S. firms have important European markets for other commercial aircraft that are not competing directly with Airbus; therefore, concerned about retaliation, U.S. firms have historically been reluctant, even in the face of encouragement from the U.S. government, to pursue these types of remedies in this particular trade dispute. This reluctance reflects the global nature of the industry and the global characteristics of markets.

The U.S. government response has also been interesting in its focus on sectoral agreements covering the commercial aircraft industry. One characteristic of these agreements is that during a prolonged period of negotiation, the world does not stand still—market shares decay, new products are developed, other events intervene. So the very time constraints associated with negotiations are an important factor and an important limitation.

A second characteristic of these sectoral agreements is that it is very hard to figure out what it is you have negotiated in some cases, and therefore, in many cases it is difficult to enforce the agreement. As I understand the EU-U.S. agreement on Airbus, direct support is capped at 33 percent. Indirect support is capped at approximately 4 percent of any firm's turnover or 3 percent of industry turnover. These provisions raise messy issues of how to define or measure direct and indirect support. These problems are not unique to this agreement, but are likely to occur in any sectoral agreements elsewhere.

What are some implications for high-technology trade and policy generally? The policy of the European governments regarding Airbus in commercial aerospace, I would argue, bears more than a passing resemblance to the budding or emerging U.S. policy in some other high-technology industries—for example, SEMATECH, perhaps, in semiconductors or in flat-panel displays. If the United States is pursuing similar policies in other industries, can the U.S. government successfully oppose foreign government subsidies in commercial aircraft?

How viable is the sectoral agreement approach to the resolution of high-technology trade disputes? Arguably, commercial aerospace is *sui generis*, but it

suggests that sectoral agreements have very complicated features and some serious disadvantages. What are the prospects for collaboration between Boeing and Airbus in the development of the so-called super jumbo aircraft? Should such collaboration emerge, what does that imply for the future of competition and the future of disputes in other segments of their product lines?

Finally, Airbus has discussed at various times moving into the production of military transports. What are the implications of that move, particularly in light of the indirect support question?

Thank you.

The American Reaction

Sally Bath, Department of Commerce

Let me put a few things into historical perspective. Airbus came into being officially in 1968. They laid the keel for the first aircraft in 1970. It rolled out in 1972. It was delivered in 1974. In 1978, the U.S. industry woke up, and I mean that quite literally.

At that point, I was still on the industry side and I can speak a little bit more bluntly about that period of time than I can about my recent career. In May of 1978, five members of the Industry Sector Advisory Committee [ISAC] on Aircraft Trade, advisers to the Tokyo Round of Multilateral Trade Negotiations, met the day after a briefing by the government concerning the results of the apparent direction of the Tokyo Round. They believed that the Tokyo Round Subsidies Code was not going to address subsidy issues adequately, because subsidies to Airbus were going to be adversely affecting U.S. industry.

They felt that the Tokyo Round Subsidies Code would basically have no teeth and that they needed something more direct. In the Trade Act of 1974, Congress authorized the development and negotiation of sector-specific agreements, but none were being negotiated.

So ISAC drafted a two-page document, which it planned on presenting to the special trade representative, as the framework about which an aircraft agreement should be drafted. Their concept was that the agreement should focus on large transport aircraft only. At that time, I was appointed to ISAC-17, and I went to my first meeting in June. They presented this two-page document to the other industry representatives and suggested that the document be presented as advice to government.

It was a document that read as a series of "thou shalt nots." Governments shalt not subsidize. Governments shalt not intervene in aircraft marketing campaigns. Governments shalt not demand offsets. It was a very specific "thou shalt not" document. The committee generally agreed that such an agreement would be a good idea. Then, all of a sudden, some of the subcontractors and the platform manufacturers from other sectors of the industry—the helicopter industry,

the general aviation industry, the business jet industry—stated that they were facing the same kind of competition.

So ISAC-17 went back to the drawing board and wrote a more general agreement on civil aircraft trade, which would address all civil aircraft platforms, all civil aircraft engines, and all parts and components. It was still a two-page document and it was still a series of "thou shalt nots." They took it to the government in July 1978. The initial government response was negative. In fact, I heard a government representative respond to the ISAC-17 suggestion with "Who in the hell do you people think you are?"

He was told exactly who they thought they were. They were representatives of Boeing, Lockheed, McDonnell Douglas, General Electric, Pratt & Whitney, Gulfstream, Cessna, and the rest of them. And the representatives of the U.S. civil aircraft industry felt they had a right to ask for such an agreement because they did not think the Tokyo Round addressed their concerns.

Each of the companies was facing increasingly subsidized foreign competition. Subsidized competition was becoming the rule, and it was becoming apparent that a regional focus for the development of new aircraft programs was coming into play. The strength and the threat of Airbus was regional. You no longer had the British competing against the French competing against the Italians competing against the Germans competing against the Dutch. They were combining their resources to compete against the Americans.

By the middle of the fall of 1978, the industry had been loud enough and vehement enough that a negotiator was appointed, and by the middle of the following year, 1979, a text of the GATT [General Agreement on Tariffs and Trade] Agreement on Trade and Civil Aircraft was concluded. It took less than one year, which may have been part of its problems, but also a source of some of its strengths.

It was a very intense set of negotiations. It was done quickly and in close accord with U.S. industry. Although the initial focus had been Airbus, the negotiations became broader, focusing on subsidies to the aviation industry in general.

The agreement was implemented on January 1, 1980, and almost immediately thereafter the U.S. government entered into negotiations to explain it. The agreement talked about government supports instead of government subsidies. This was quite deliberate. The agreement laid out rules by which governments could continue to involve themselves in what was considered to be a strategic industry.

So the word "subsidy" was avoided. The language referenced the Subsidies Code. There was some additional language that referenced the Standards Code; Article Four discussed how governments should conduct themselves in marketing campaigns; Article Two provided for tariff-free treatment of products covered by the agreement, etc.

In the early 1980s, the Europeans provided additional supports for a new program designated as the A320. That got everyone's attention. We did not know how to address it in government. We did not know how to address it through the industry group. No one wanted a trade war. The European market is

a very good market for the U.S. aerospace industry, and it is and has been a very balanced market. We send them a lot of aerospace "stuff" and they send us a lot of "stuff." While the industry did not want to spoil its market in Europe, at the same time it did not want to face subsidized competition. This issue resulted in a marathon negotiation, and in 1988 we entered strenuously into formal negotiations to develop what became an interpretation of two articles of the GATT Aircraft Agreement: Article Six, which is the subsidies language; and Article Four, which is the so-called inducements language. The interpretation and resultant disciplines apply to large transport aircraft only.

The U.S. government and the European Community entered into serious negotiations to interpret the language of Articles Six and Four and, if necessary, to develop clarifying rules. Again, the focus was only on the large transports, but the hope was that the negotiations would eventually be expanded to everything covered by the GATT Aircraft Agreement. It was a marathon negotiation, finally "concluded" in March 1992. On July 17, 1992, I went to the Office of the U.S. Trade Representative to witness the signing of this marathon bilateral agreement and discovered that the lawyers were talking transatlantically. The European Community lawyers in Strasburg, not in Brussels, had made some changes when they were translating the various languages of the EC, and those changes resulted in changes in interpretation in the English text. The discussions resulted in handwritten corrections being entered into the formal document and initialed by the chief negotiators.

What was the U.S. government responding to when it entered into the bilateral negotiations? First of all, to U.S. industry. U.S. industry and government worked in lockstep to encourage both industry and governments overseas to participate in the negotiations of the GATT Aircraft Agreement and the European agreement affecting the large transport aircraft.

The key was industry and government working together on a common front, and following up on an industry, not a government, initiative.

I will make one final point. Airbus as a regional organization is becoming a pattern for Europe. Since Airbus came into being, Ariana Space EroCopter and UroFighter have been established. Each of them is a work in progress and each of them is organized in a slightly different way from Airbus. Airbus now is looking at reorganizing itself as well. But the use of a regional approach in Europe is certainly taking hold.

Thank you.

Lessons and Prospects: The Boeing Perspective

Raymond Waldmann, The Boeing Company

RAYMOND WALDMANN: Many recognize that Airbus is a historic enterprise. It has been in business for over 27 years. It has achieved a respectable market share. It has customers throughout the world. It has a full product line.

The bottom line for Boeing, of course, is that now that Airbus has reached that state, it ought to be able to stand on its own feet. It ought to be able to operate as an independent company, publish reports, disclose its finances, and operate without further government subsidy. That was the basic thrust of Boeing's support for government activities over the last ten years: to negotiate the subsidy agreement finally concluded in 1992.

There are a couple of things that I want to say about Airbus. First, it is a partnership of the major aerospace and defense contractors of Europe: Aerospatiale, DASA, Daimler-Benz, and British Aerospace, with Dutch, Spanish and Belgian companies, and now an Italian company participating as well. These are not small companies. They are extremely large companies, and if you add them together, they are, of course, much larger than either Boeing or McDonnell Douglas.

Second, the governments have sponsored Airbus since its inception. In fact, you could say that the governments of Europe buried the question of Alsace-Lorraine in Airbus because they decided that the wings would be built in the United Kingdom, the fuselage in Germany, and the cockpit and some of the electronics and control systems in France.

The financial support for Airbus has been extensive. The range in various studies is from $12 billion to $26 billion over its 25-year history, and at various points this made Airbus extremely vulnerable to U.S. trade actions. There could have been antidumping, countervailing duty, Section 301, or GATT actions against Airbus at almost any time in its existence. There was serious thought given to these actions in 1978 when the first sale was made to Eastern Airlines in the United States, in 1984 when Pan Am bought Airbus, and then in various stages throughout the long negotiations. But at every point, the industry counseled the government to stay the course on negotiation to avoid what could have been a major trade dispute between the United States and Europe.

Did the European governments know what they were getting into when they started down this road in 1968? Probably not. I believe that their expectation was that there would be one or perhaps two infusions of subsidies for Airbus and that it would quickly achieve a market position and be able to stand on its own. But, of course, that is not the way these things work.

Once the taste of government support was gained in Toulouse and elsewhere, it became an increasingly attractive way to finance aircraft programs. I do think that it did have a significant effect on Airbus's willingness to take risks. If you know that somewhere between 70 and 90 percent of your development cost is coming from the government and only 10 to 30 percent is coming from the company shareholders, it does alter your perception of risk on such things as launching new aircraft programs, applying new technology, and the types of discounts or concessions that you are able and willing to give to customers. I believe that a major part Boeing's and the U.S. industry's problem with the government subsidy is that it changed the perception of risk in the industry.

We also had another problem with government salesmanship. This is one of those features of the GATT Aircraft Agreement that has not been made effective. We tried again in the 1992 agreement between the United States and the EC, again without much success, and now it seems that the only way to deal with this issue is to fight fire with fire. And, so President Clinton and his colleagues in the Cabinet have become significant salesmen for aircraft, as they have for other products for U.S. external commerce.

A couple of quick points: I do not see Airbus as a technology issue. We are here in the halls of the National Academy of Sciences and Engineering; yet, we are talking about production subsidies, export subsidies, and major development support. There is, to some degree, a small element of transferable research that moves back and forth across this industry that is allowed under the Subsidies Code and under the 1992 agreement. That is the so-called indirect support.

The problem we have is with the highly program-specific, the competitive-specific support, the big dollars. This can range into the billions of dollars of product support, which Airbus has received in the past.

In looking ahead, it is important to say that the industry is cooperating on a wide range of projects—not only the ones that Sally Bath mentioned, but across the oceans. For example, for the subsonic super jumbo aircraft, we have a study group that comprises Boeing and the Airbus partners.

In the small aircraft sector, we have active studies under way with our Japanese colleagues at the Japan Aircraft Development Corporation and with China and Korea. In the supersonic area, we are talking with the Airbus partners, with Japan Aircraft Development, with the Italian company, and even with the Russians through Tupelov.

So there are efforts under way to recognize that this is increasingly a global industry and that any new, big program will be an international program. I want to comment on one statement that was made this morning, that we should all be happy with international competition because, after all, it is not a zero-sum game. Well, in this industry it does look like a zero-sum game when your aircraft program is not launched because your competitor has already launched, or when you do not make a sale because your competitor has already made the sale.

Finally, Boeing's interest in the issues is confined to trying to level the playing field, a phrase that is perhaps hackneyed, but, nevertheless, still true. We want to see the same types of rules operating for everyone in this industry. Currently, there is an extensive fragmentation. We have some countries that are outside the WTO system and, therefore, are not subject to any of the rules that have been patiently negotiated.

Some countries have signed the WTO Subsidies Code and, therefore, are bound by some of the disciplines. There is a smaller number of countries, essentially the United States, Europe, Canada, Japan, that are now signatories of the 1979 Aircraft Code, and, of course, only the United States and the EU are signatories to the 1992 bilateral agreement, which has a much more specific set of disciplines on supports.

It is our view that all these rules, specifically the WTO Subsidies Code, the Aircraft Code, and, perhaps even this special 1992 regime on supports, should apply to all of those countries that have either industries or pretensions to build within this industry.

Thank you.

Lessons and Prospects: The Airbus Perspective

Jonathan Schofield, Airbus Industrie

Raymond Waldmann said that one day Airbus may be aligned with Boeing in terms of a public company. I personally think that will happen. We basically have all of the larger partners privatized except one, which is Aerospatiale. Aerospatiale, I believe, will be privatized probably within the next five years, and that puts the company in a position to go become a public corporation.

In the meantime I have some observations as an Airbus employee who has worked for a large American aircraft corporation. First of all, at Airbus I am one of the few old guys in the company. That is to say, there are a lot of very young, bright people. Comparing that with the U.S. structure, a lot of authority and responsibility is delegated at a very young age. There are risks to that, but I believe that the U.S. corporations are following that trend closely and I applaud that.

Technologically, I believe at this point that the United States is extremely competitive. On the other hand, I invite all of you to walk the factory floors of the various partner facilities and you would be extremely impressed. They are extremely well capitalized. Competition with my colleagues is always very difficult.

There is one thing that is somewhat sane about the aircraft industry that was not sane in the engine industry. Cooler heads prevail, and one is in business to make a profit and, therefore, one sells aircraft at a profit. My old industry is beginning to deal with that. It is a much more difficult business, but be that as it may, competition at the end is keen. If there were no competition, aircraft would not evolve as quickly as they do now. Nevertheless, what is driving the industry are technology and risk. I do believe that the capability exists among the industry to build the VLCT [very large commercial transport], and the timing is quite simply market driven.

No one is going to go forward alone and spend a whole lot of money building a new airplane when there is no market to justify the investment. It just will not happen. The forecasters say that over the next 20 years, a bigger plane will be required and that that plane will be built at a point that is market ready. And you can be sure that this will not happen within the next year.

When Sally Bath mentioned trading "stuff" with the European market, it reminded me of the engine business at United Technologies in the 1970s when

we started to go global. The company was 35 percent international in 1985, it was 55 percent in 1992, and I believe they will be 75 percent international by the year 2000.

In other words, United Technologies, as Boeing, as Mitsubishi, as Daimler-Benz, is a global company. They are searching for the growing markets as they emerge. They build where they have to, and you can see that an airplane today is a multinational entity. The wings, tails, flaps, and engines come from all over the world, and that is not any different whether it be in Seattle, Toulouse, or Long Beach. It is who we are. It is who we are going to continue to be. And it is the right way to move. Each company will make its choice and decisions based on economics and market.

You will find our industry is probably the most multinational of industries. And I think all of us are proud of that. And I believe that globalization will continue as we move forward.

Thank you.

DISCUSSION

HANS-ECKART SCHARRER: I have a question for David Mowery. This session has been confined to the Airbus issue. The Airbus case is a much larger case of competition in aircraft in general, and there are allegations from the European side that the subsidization of the aircraft is just the response to indirect subsidization of Boeing and other U.S. producers by way of the U.S. defense program. Could you perhaps give some sort of an unbiased view on that?

DAVID MOWERY: In contrast to the U.S. steel industry, and in contrast to some other U.S. industries, the commercial aircraft industry has been treated differently as a matter of policy by the U.S. government, at least to the extent of bailing out a couple of firms.

There has been a great deal of federal money in the form of procurement contracts and some defense R&D contracts. Some of those procurement and R&D contracts have generated so-called military-civilian spillovers that have filtered into the commercial product lines of the major producers of engines and airframes.

But spillovers also were created by the military procurement programs of the member nations involved in Airbus, and certainly there was a history of launch aid in all of the member states with respect to airframes and engines before the formation of Airbus. In other words, there is a pre-Airbus history of subsidization in Europe, and there is a pre-Airbus history of indirect spillovers in the United States. In addition, the spillovers from military to civil commercial aircraft in particular have decreased dramatically in the past 25 years and perhaps have reversed direction.

Commercial aircraft is a peculiar industry. There are big first-mover advan-

tages, and it takes a long time to overcome the advantages achieved by early entrance. So some portion of the Airbus support was a regional infant industry program that should have eventually supported the repayment of a significant portion of those original supports to the member governments. By most accounts, we have not yet seen much of that happening.

SALLY BATH: I would like to comment on this. The indirect support issue has always been one that has bothered me a great deal because there are some interesting implications. First, what the Europeans refer to by the phrase "indirect supports" are really government purchases of goods and services, not industry-targeted subsidies.

Second, the issue of whether or not there are government purchases of goods and services in the aerospace sector in Europe is never addressed, and we all know that it should be.

Third, periodically during the negotiations I thought that we were being pushed into a situation in which the Europeans were trying to make us apologize for using the best contractor available on contract awards and then to force us not to use the best contractor available on contract awards for contracts that had a government purpose. No government wants to be put into a position where freedom of choice is curtailed. We object to such efforts and to such arguments.

RAYMOND WALDMANN: Just two quick comments. First, when that issue came to a head in the closing days of the negotiations in 1992, people at Boeing were somewhat amused because we had just had three or four years of major losses on our defense contracting, and this looked to us as if we were subsidizing the government and not the other way around.

Second, it was quite clear that this was a post hoc rationalization to balance the agreement. It had nothing to do with the original sponsorship of Airbus.

SYLVIA OSTRY: The question of the spillover is an important issue. However, a much more important issue than either indirect or direct subsidies is the long time horizon, which came from government procurement, that permitted the planning and the utilization of technology. If the Europeans argued that government procurement in the defense industry was a major source of innovation, then I suppose the rationale for intervention rested on the first-mover advantage that would create a potential monopoly supplier. The reason I am raising this issue is because I think that in high technology, I have never considered Airbus a model of friction for the reasons that have been discussed here today. There is too much at stake on either side and now they are globalizing it.

But I think that the issue of government procurement is the next enormous friction-generating area in high technology, and I do not see any evidence that the WTO is paying attention. The procurement code seems to be more important to high-technology trade than subsidies.

SALLY BATH: Actually, that issue was addressed at some length during the WTO, but we were unable to come to closure on it. I think there will be more discussions on it as we go along.

DAVID MOWERY: As I understand it, you are describing a situation of procurement policy in a classic dual-use industry, but we are talking about procurement for national security or national defense purposes, and that really pushes the envelope on a procurement code that the WTO historically has stayed well away from and GATT has stayed well away from as well.

JONATHAN SCHOFIELD: Procurement of goods and services is ultimately another mechanism. I do not worry about it because I do not think that my colleague is pushing the limits of the agreement. It is as simple as that.

RAYMOND WALDMANN: Just one factual matter. We should not assume that there was a first-mover advantage or any momentum in the United States in the civil aircraft jet business. Remember, the Comet was the first to fly. There were, of course, other national programs, such as the BAC-111, the Caravelle, the Trident, and other types of programs in Europe that predated Airbus. So there was a history in Europe for building jet aircraft, and in the United States we had four jet manufacturers: Convair, Lockheed, McDonnell Douglas, and Boeing.

CHARLES WESSNER: I would like to ask a question to both of our industry representatives: Will your companies bring us a world of global cooperation or will your companies, and perhaps other emergent producers, bring us a world of headaches in a high-wage, high-value-added industry?

RAYMOND WALDMANN: I can see it going both ways. Obviously, we have cooperation now. Boeing has cooperation with a number of suppliers and with major aircraft companies. We are currently discussing with the Airbus partners the potential for cooperation on two very big projects. However, the market is not right for either one of these projects, so we may put them on the shelf for a while. But I think the willingness to cooperate is there, and that, of course, is the key item we are talking about here.

JONATHAN SCHOFIELD: I agree. You will always be competing, so there will always be a natural amount of friction. But on these particular programs you are not competing so you are cooperating. My experience in this industry is that cool heads prevail, technology overcomes, and production moves forward. It is as simple as that.

DON KASH: My question is for Raymond Waldmann. My impression is that the 777 has subsystems that have been developed and that are being purchased

and produced in a number of countries and that the GE90 engine is also physically an international engine.

I would like you to comment about the motives for this network of international production; that is, the extent to which it is driven by capital, technology, and markets. I suspect it is all three, but there has been quite a movement outside the United States. Are there now areas in which the U.S. development production capability with regard to subsystems no longer exists that did exist at one time?

RAYMOND WALDMANN: The triple seven program has approximately 20 percent Japanese content and an additional 4 or 5 percent foreign content beyond the Japanese content. The engine companies have their own programs, and, of course, we are not structuring those programs.

Clearly, all three factors you mentioned are important. The capital availability in certain countries is important to market access. Whether we like it or not, it is an important factor. Technology is probably the least important of those three, only because there is, at this point, no product which cannot be sourced in several different countries, in addition to the United States. So you might find that these are factors that would lead you to cooperate or make an arrangement with a foreign subcontractor, but these arrangements have not weakened the U.S. industry to the point where it is not able to compete extensively and aggressively across the board.

PARTICIPANT: Is this panel discussion relevant to other high-technology industries? Is your industry unique? Is there room for anyone else? Governments dominate the marketplace through their national airlines, and the reason they are unwilling to use these trade sanctions that are available to them is that they make governments mad, which is a bad idea if you want to sell to that government. Is this relevant to the rest of high-technology industry? Is there any other industry that has this type of concentration, dual-use nature and government role, that we need to worry about?

DAVID MOWERY: I think that aerospace is substantially unique, and that your question is an important one. Is the current lack of conflict attributable to the sectoral agreement, and does this suggest that a sectoral agreement model is relevant to other high-technology industries?

I think the sectoral agreement is an effect rather than a cause of the reduced tensions. Perhaps the sectoral agreement has established a better vehicle for consultation, combined with other trends operating within the Airbus Consortium that are pushing for greater transparency and more autonomy from government. If so, these are positive trends.

But it is hard to think of another industry in which governments are major buyers of commercial products and important subsidizers and purchasers of the military products of the industry. Semiconductors do not exhibit a comparable

level of government demand either as a direct purchaser or perhaps as a supporter of R&D. Telecommunications equipment may be one industry in which one could think about an agreement structure of this type. It is an industry, like aerospace, in which governments are heavily involved as buyers, regulators, and investors.

SALLY BATH: There are no tensions apparent at the present time. There has also been no new launch since 1992, so the bilateral agreement has not been tested.

As for whether or not this industry is unique and, therefore, this type of an agreement is unique, I think that the answer is yes for two reasons. First, the time lines in this industry on any project are excruciatingly long. An announcement is made of an aircraft launch. Then it rolls out seven years later. This is an extraordinarily long time to have an extraordinary large amount of money at risk.

The amount of capital required for this industry, the long time lines, and the government involvement in most areas makes this a strategic industry. And that makes it a unique industry.

RAYMOND WALDMANN: I agree that we are a unique industry. Of course, there is always a danger in thinking that you are unique, because then somebody sneaks up and proves to you that you are not. Maybe the U.S. automobile industry at one time thought it was unique. In any case, I would like to just close with a comment. We do not launch our airplanes. Our customers do. The customers are the ones who we have to respond to, and I think that does, in fact, make us a little bit unique.

Luncheon Address

International Competition for High-Technology Industry and the Multilateral Trading System

The Honorable Jeffrey Lang,
Deputy United States Trade Representative

CHARLES WESSNER: For our next session we will hear presentations on some of the outstanding issues on the international trade agenda. We are pleased and honored to have Ambassador Jeffrey Lang, the Deputy Representative of the U.S. Trade Representative's Office, where he oversees the Office of Agricultural Affairs, Europe and the Mediterranean, industry, WTO affairs, investment and intellectual property, as well as the environment and national resources.

AMBASSADOR LANG: Let me say first that I do not know how you have defined high technology, but one of the things I have learned is that it is dangerous to adopt a conventional or narrow definition. For example, a modern dairy farm is a form of high technology. From this example, you can see that we take the concept of technology broadly. Obviously, the basic strategy of the Clinton administration is to favor competition, particularly competition in high-technology industries.

U.S. interests: There are several reasons for this administration's interest in high-technology trade. The first reason is that America is very successful with new technologies. The United States is investing more, and U.S. companies have restructured and are becoming more competitive.

Second, this is where the growth is. We are looking toward the future. Where are the growth markets and where are the growth products? Sixty percent of U.S. workers are knowledge workers, and eight of ten new jobs will move into high-technology sectors in the future. Those jobs will be well-paying jobs, good jobs.

A third reason that the administration is interested in this is because technology tends to be a basic driver. For example, telecommunications is not just something that is profitable for companies engaged in telecommunications goods and

services. The more advanced your telecommunication sector is, the greater the variety of products and services it offers, and the more competition there is, the lower the costs of all the businesses that use those telecommunications services. This is what makes society more competitive and is why the administration focuses on things such as telecommunications and financial services.

The WTO: How does this relate to the World Trade Organization, which came into existence on January 1, 1995? It seemed to me that almost the entire WTO is going to be helpful in providing opportunities for the advancement of high technology, particularly U.S. high-technology exports.

Reciprocity: Part of the reason for this is the way markets are developing. The Uruguay Round and the World Trade Organization represented, in my opinion, the first genuine effort to involve developing countries in the global trading system on a reciprocal basis; that is, instead of just giving advantages for which there was no compensating concession, in this round, developing countries got a lot of advantages, but they also made a lot of concessions, and some of them were very important concessions. Major developing countries that have never bound their tariffs in the past, for example, bound 75, 80, and even 90 percent of their tariff schedules.

If you are talking about installing a cellular telephone system in Tajikistan, these technologies are widely applicable in places where you might not expect them to be applicable. Access to those markets is very important.

Tariffs: I want to mention a couple of specifics. First, we are not exactly looking at these things from a technology perspective. We have to divide them into the types of problems we experience. But in the tariff area, a lot of work, of course, was done in the Uruguay Round, and much of that work will be helpful in high-technology sectors. We continue to push for reductions in barriers in sectors that will benefit us. Almost all of these sectors are high technologies, such as advanced chemicals, electronics, and medical equipment.

So that tells me that the tariff reduction programs of the United States, in terms of exports, will be helpful to high-technology industry. In addition, if you compare the U.S. schedule, for example, with that of the European Union, what you find are relatively few tariff inversions; that is to say, the input tariff is higher than the tariff on the finished product. That will help, because it means that you can buy an inexpensive chip and put it into an expensive computer. That is important for the development of a competitive high-technology sector.

Bilateral market opening: The administration has been successful in opening to global competition some markets in which we have specific barriers that cannot be taken care of in the multilateral system. A good example is medical equipment exports to Japan, for which an agreement was negotiated under the framework system, and, I am told, it has been quite successful.

Standards: Standards are another aspect of the multilateral system that are helpful to high-technology industries in a variety of ways. One example is the Sanitary and Phytosanitary Sanitary Agreement, which is a fairly technical agree-

ment that protects humans, animals, and plants from the risks of pests, diseases, contaminants, and toxins in foods and feeds.

The key assurance that this agreement provides is that restrictions on trade flows have to have a demonstrable, scientifically based relationship to a chosen risk level. The risk level is chosen freely, and there are no restrictions because it is considered to be a social decision. But connecting that chosen risk level to the trade measure or other measures that restrict competition is new and makes it possible for the multilateral system to be used to fight for export opportunities that do not meet these criteria. By setting certain basic requirements on the use of sanitary and phytosanitary measures, the agreement prevents their use for protectionist purposes.

There are other aspects of standards. The new Technical Barriers Agreement will be helpful in getting wider harmonization of standards that will apply in very specific cases. There are a lot of biotechnology products coming on stream. In foreign countries, Europe for example, there are concerns about these products, but we continually stress to our trading partners that these concerns have to be expressed consistent with these multilateral obligations.

We are also seeking to expand the standards consensus, for example through a multilateral agreement on standards, which is a recognition agreement that would deal with recognizing tests made in foreign countries but applied in the importing economy. These may seem like dull negotiations, but they will make an enormous difference in approaching new markets with high-technology products.

Agriculture: One particular sector that I believe is very much a high-technology sector, and that deserves special attention in this regard, is agriculture. Over $40 billion of U.S. exports are agricultural, and many of these industries are competitive without price support programs or subsidies, simply because they are productive and efficient.

The Uruguay Round Agreement, of course, reduces barriers to those products, gives us minimum access to foreign markets, changes quotas into tariffs, and sets up a system that will gradually reduce trade barriers over a period of years. This agreement needs to be phased in because agriculture is sensitive in every country, including the United States.

Intellectual property: Another innovation of the Uruguay Round that is now part of the WTO is its focus on intellectual property, an obvious connection to high technologies, which benefit from intellectual property enforcement regimes. Its expansion sets not only a multilateral standard, but it also creates two important things that I want you to understand from a technological or legal point of view.

The second point about the intellectual property section of the agreement is that it also extends to many developing countries. We are not just trying to build agreements that solve the problems of the 1970s and 1980s. We are trying to build agreements that help us with the problems we will experience the rest of

this decade and into the next century. It will be difficult to do, but this is one way in which the WTO can be helpful with that problem.

Cross retaliation: The first is that the WTO contains a concept known as cross retaliation or integration, meaning that if action is inconsistent with the agreement in one area, retaliation is not confined to the area where the agreement has been violated. Now, retaliation is the last step in the multilateral system, which emphasizes conciliation, compensation, and other ways of rebalancing the concessions that governments have made; but the ultimate threat for violating the intellectual property agreement may well be the limiting of imports of some product rather than simply trying to build a similarly restrictive intellectual property regime. This concept gives us a lot more freedom to maintain the type of competitive environment we need in the United States, while still using the agreement to achieve market opening and to achieve competitive results in our export markets.

Investment: Investment is not treated very ambitiously in the Uruguay Round Agreements, but that has not stopped this administration and previous administrations and the Congress from being ambitious about the subject of investment. There is now a network of bilateral investment agreements around the world that has been negotiated. Last week in Paris we were working on initiating a process that will hopefully lead to a multilateral investment agreement among OECD [Organization of Economic Cooperation and Development] member countries, the 25 most advanced countries in the world, with the ultimate objective of expanding that effort into the World Trade Organization.

This effort would protect foreign investments against seizure. It would provide rights of access. I believe that it is now generally accepted, in both the academic and the business communities as well as in government, that investment and trade are two sides of the same coin. So we need to move as ambitiously on that as we do on other things.

Before concluding, I want to mention two other important areas within the WTO. One is telecommunications and the other is government procurement.

Telecommunications: As you may know, the basic telecommunications services negotiation was not completed at the end of the Uruguay Round but is scheduled to be completed in April of 1996. The United States has ambitious goals for opening markets in foreign telecommunications services. This is both an investment agreement and a services agreement, because you need to be able to install the basic infrastructure to be able to develop telecommunications services, particularly in developing countries.

So we are looking for a very ambitious package by next April. Teams have been negotiating on this subject for some time, and we are working with the Congress to make sure we have the domestic political support to achieve that objective.

Government procurement: In government procurement, many of you know that much of the selling you can do in a foreign country is to that country's

government. For many years the United States has been trying to liberalize government procurement to ensure that foreign bidders have an equal chance to bid on government contracts with domestic bidders. Because we have a large government procurement market in the United States, we have had the leverage to accomplish a great deal on that.

The agreement negotiated in 1979 and expanded in the WTO needs to be expanded both as to its membership and as to its acceptance in those countries that are prepared to move forward with it. In the area of electric power generation, for example, we have very competitive producers. We have a memorandum of understanding with the European Union about market access in that sector, and we continue to push for that agreement to be enforced in the European Union and elsewhere in advanced countries. Expanding that government procurement agreement into developing countries will be a great advantage to U.S. high-technology producers.

Thank you.

GEORGE KOOPMANN: One issue that you did not mention is subsidies, R&D subsidies in particular. In this field, there was a turnaround in the American position. The United States started the Uruguay Round with a position that R&D subsidies should be actionable, as other subsidies are; however, the threshold for nonactionable R&D subsidies was raised substantially at the U.S. insistence to 50 percent for precompetitive development and 75 percent for industrial research.

This is a very vague concept, and apparently this move was to protect growing technology programs in the United States against possible sanctions from U.S. trade partners. How do you explain the turnaround in the U.S. position?

My second question refers to investment. In this case, the American position seems to restrict the multilateral investment agreement in the first round strictly to OECD members and admit third-world countries only after an OECD consensus or agreement has been reached.

In my view, this is not justifiable given the fact, for example, that the bulk of new investment goes into non-OECD countries. In 1993, this was 55 percent. Would it not be wiser to include these countries from the outset in the negotiations?

AMBASSADOR LANG: With respect to the subsidy agreement, I was not present during the negotiations of the Uruguay Round. So, I cannot respond from personal experience. What I do know from my private sector and previous government experience is that many people in the United States have always seemed closely associated with a basic concept in the subsidies area of the generally available subsidy. And the association is that the subsidy was so far removed from the ultimate product itself that it should not be the subject of international action. The short answer to your question is that I do not know why the United States changed its position.

With respect to investment, I agree with your point about the need to involve developing countries in a multilateral investment regime. This subject was discussed at the quadrilateral meeting of the trade ministers of Japan, Canada, the United States, and the European Union in British Columbia, three or four weeks ago, and discussed again last week at the OECD in Paris.

We have some very carefully modulated language about this subject. We are to begin discussions on this subject in the WTO concurrently with beginning the negotiations of the MAI [Multilateral Accord on Investment] in the OECD. However, we all believe that getting the highest possible standards for investment access will be served by moving in the OECD first because that is where we have large investment flows.

Just between the United States and Europe, there is a $450 billion investment. We need to lock in high standards and then approach the developing countries with that agreement. And at the same time, we need to engage the developing countries in discussions at the WTO. We are going to move on parallel tracks and all the ministers have agreed to language to that effect.

CHARLES WESSNER: There have been some trade disputes in the automobile sector recently, notably between the United States and Japan. Do you have any prognosis as to how that might develop?

AMBASSADOR LANG: The statistics suggest that the U.S. producers have invested over $170 billion in Japanese products in the last five years. Exports have increased to the world as a whole by 40 percent in the last three years. The automobile industry is the second largest consumer of semiconductors in the United States. It is a very important sector. Opening this market in Japan is a high priority. The United States has worked very successfully with the government of Japan on a number of agreements under this framework process that was set up by President Clinton. I think it is to Japan's advantage, and to the U.S. advantage, that the market open up as quickly as possible.

HANS SCHARRER: Would you comment on how you relate unilateral action by the United States against Japan to the obligations undertaken by the United States within the WTO?

AMBASSADOR LANG: The United States has not taken any action against the Japanese. The issue is under discussion now. Japan has asked for dispute settlement with respect to the announcement that the United States made of its intention with respect to sanctions. I think this is basically a procedural issue. The substantive question is whether the market is going to open in Japan for automobiles and automobile parts.

To me, this presents a serious question for the system. As far as Japan's request for consultations on the announced sanctions, we responded in a timely

way last week. Japan has come back with some scheduling issues, and I assume we will deal with those in the normal course of the dispute settlement process. It is not appropriate to discuss the tactics of the United States and the litigation here. The important thing to focus on is opening the markets, and this is a sector in an important market that is not yet open to a very important product of the United States.

GEORGE KOOPMANN: I have a short question regarding the Japanese case. Given that, at this time, we do not have international or multilateral competition rules so as to use the dispute settlement procedure by Article 23 of the GATT, do you see any possibilities of creating case law to open the Japanese market to remove this type of competitive distortion?

AMBASSADOR LANG: Yes. But first let me explain some background for those of you who are not familiar with the WTO and the GATT. Dispute resolution involves a phase for consultation and then consideration by panels and ultimately an appellate body under what is known as Article 23. This article allows any country to raise issues that arise under the agreement that involve direct violations of the agreement or practices that undermine the benefit of concessions that a country reasonably expected, or any other situation affecting the operation of the agreement. These are broad provisions, but when it comes to competition, this raises an issue of just how far the agreement covers a complex situation such as the barriers that have been identified with respect to market access for finished vehicles, parts for new vehicles, and replacement parts.

But some of the practices may not be covered by Article 23, and it may not even be a good idea to have them covered by it. For an example, take the situation of access to new car dealerships. This issue has been whether the government in Japan can discourage and avoid intimidation of dealers into carrying only one line of car, the car manufactured by the company with which the dealership has a close financial relationship.

There is a similar situation in Europe, but with a striking difference. The European version of antitrust, Articles 85 and 86 of the Treaty of Rome, is, in effect, a competition law for the European Union. So to have single-brand dealerships, there has had to be a block exemption. That block exemption expires at the end of next month. The terms of its renewal will seriously constrain the block exemption, so that dealers can be allowed under European antitrust law to carry more than one brand.

That may not be the identical situation to the one in the United States with respect to competition law, but the competition law is alive and well in Europe and is being enforced. American vehicles made by U.S. companies in Europe, as well as by American companies in the United States, have free access to the market as a result. Even though the difference may seem small and technical, it is a very important difference in a practical sense.

So we do not need a multilateral agreement with respect to competition law enforcement in Europe or probably elsewhere in the world. That practice may or may not be covered. But, nonetheless, it forms an effective barrier to the export of finished vehicles to Japan, and that is why we are trying to deal with the problem under the framework agreement.

SYLVIA OSTRY: Article 23(1)(b) was designed to bring Section 301 into the WTO. It is discouraging to hear what you have said. As it is very important that there be multilateral transparent rules in the area of competition policy, as part of the new WTO, Article 23(1)(b) would allow, and was designed to allow, a test case. You are correct that vertical agreements are not per se offenses in any country, but it is not clear to me what you are saying. If they are not per se offenses, if it is a rule of reason, and the dispute settlement understanding was also designed to allow expert advisors so that you have a perfect situation in which you can bring in the antitrust, competition policy, and the trade policy people, then the place to debate it is in the WTO.

In regard to after markets and the safety regulations, it is not clear to me how you would deal with Article 23—with the nonviolation. Surely it is important for the United States, which has just signed the Uruguay Round and for whom Article 23(1)(b) was designed, to try and test it, to bring transparency into the system, and to move to a new set of rules, which would be multilaterally determined rather than bilaterally, through a framework agreement.

AMBASSADOR LANG: I guess all I can do is comment on a comment and I am not sure I know enough yet to make a full comment. But anyway, Article 23 has been in the GATT since 1947.

SYLVIA OSTRY: It has been redesigned to allow this to be drawn in.

AMBASSADOR LANG: The timing is different, but the substantive provisions are no different. For one thing, as far as competition law goes, it may be that at some point in the future we may find, through the OECD process and ultimately through the WTO, that there are subjects we do want to cover on the substantive side. So far, all we have been able to cover are procedural matters.

Moreover, there may be aspects of concern regarding the anticompetitive practices that our lawyers feel we can successfully raise in the Article 23 case that we are proposing to bring to the panel process. But, by the same token, there may be practices that are not covered by the multilateral system. So far the framework process has been a successful way of opening, on a MFN [Most Favored Nation] basis, Japan to competition from Europe and America and developing countries in a great variety of sectors.

This basic process has been in existence now through a number of administrations. It is just more intensive in this administration. To the extent that we can

move forward with Japan and agree to open the market on a bilateral basis should not be seen as hostile to the multilateral system. Rather, this approach seems to support the multilateral system by having large markets open and matching people's expectations about what WTO concessions are supposed to deliver.

Session 3

National Policies in Support of High-Technology Industry

Moderator:
Horst Siebert, IfW

CHARLES WESSNER: We are particularly happy to have this distinguished panel here today. We have Horst Siebert, the president of the Kiel Institute of World Economics, who is well known in Germany and throughout the world for his work. We have Dr. Nicholas Ziegler, who is an associate professor at MIT [Massachusetts Institute of Technology] and knowledgeable about European technology policies. Next is Dr. Takeda, who is an expert on successful technology policies of the Hitachi Corporation.

We also are very pleased to have a representative of the Japanese Ministry of International Trade and Industry, Kazuhiko Hombu, who is based here in Washington where he works with the New Energy and Industrial Technology Development Organization. And, last but not least, we have someone who is well known to many of you, Chris Hill, who is to talk about current American technology policy or perhaps the demise of American technology policy, whichever he thinks most appropriate.

HORST SIEBERT: The topic of this session is "National Policies in Support of High-Technology Industry," and the panelists will discuss technology acquisition, diffusion, and development in Europe, France, Germany, Japan, and the United States.

French and German Technology Acquisition, Diffusion, and Development

J. Nicholas Ziegler, Massachusetts Institute of Technology

Much of the debate about technology-intensive industry has focused on the proper links between trade policy and technology policy. Proponents of govern-

ment activism argue that trade and technology are inextricably linked, and that the federal government should therefore take a "coordinated" approach to both. Opponents of activist policies argue that government intervention in either area—trade or technology—is equally undesirable.

In my view, both sides of the debate have seriously oversimplified the issues, especially with regard to technology development. The simple contrast between government intervention and laissez faire is too crude to capture the key mechanisms by which public agencies promote technological change. Indeed, Professor Scott's contrast between consumer-oriented and producer-oriented economies suggests that a wide range of institutions beyond the central government play an important role in public efforts to promote technological change.

By comparing Germany and France—Europe's two largest economies and the world's third and fourth largest economies—I would like to illuminate some of the institutional arrangements that other countries deploy in the service of technological advance.

My argument is twofold. First—and this may surprise some of our German colleagues—I would like to argue that German public policy makers have learned much more in the last 20 years than their French counterparts about how to promote technological advance in industry. Second, I would like to mention some of the important reasons illuminated by the Franco-German comparison for separating rather than linking government activities in technology and government activities in trade.

France and Germany represent two very different cases of technology promotion. The French model of state-led or *deregiste* development, which is drawn primarily from the Gaullist projects of the 1960s and 1970s, has often been likened to Japan's efforts to integrate trade and technology policy in a single developmental strategy. Of course, France's diplomatic strategies consistently made self-sufficiency in military technologies a high priority—an objective that was regularly subordinated to other goals in the case of Japan or, for that matter, Germany.

Let me turn to Germany. In the 1980s and 1990s, Germany took over France's role as the European analog for Japan's successful performance in high-technology competition. At least in the eyes of many French (and some American) observers, Germany appeared to have some of the characteristics of the successful Japanese performance.

The reason I want to emphasize Germany is that Germany does not easily fit the categories that we have been using in our discussions so far today. Germany is clearly a producer-oriented economy, probably Europe's clearest example of a producer-oriented economy. Yet it shares very few of the characteristics of the East Asian growth model. Indeed, it is not clear to me that we can speak of a coherent national "strategy" at all when we are discussing Germany. On the contrary, I would argue that German trade performance rests on a series of indirect policies and institutional features that help German firms to adjust quite effectively to changing technologies and markets.

Some of these policies and institutional features concern macroeconomic aggregates. Not entirely unlike Japan, Germany has several structural restraints on consumer spending. These include legally restricted hours of opening for retail stores; stringently enforced limits on discounting in the retail trade; and a powerful cultural resistance to the use of credit cards, which is only slowly being eroded.

The savings that result from these restrictions on consumer spending tend to be channeled through the well-known German banking system toward industrial development. This pattern is, to be sure, changing, and there is terrific debate among specialists about the way the German banking sector functions. But there is nonetheless a tendency toward high savings and a financial system directing those savings toward industrial development.

In addition to the savings pattern, high wage levels and a strong currency push German producers toward high value-added strategies, which in turn force German firms to adjust rapidly to changing markets and technologies. There is a bundle of public policies and supply-side institutions that assist firms in this adjustment process at the firm or industry level.

Apprenticeship: The famous system of industrial apprenticeships have given German employers a well-qualified and certified work force for industrial production. This system of apprenticeships is idealized regularly in the United States. It is not clear that the model of industrial apprenticeships will work effectively for growing service industries such as banking and insurance, but it has worked well so far for manufacturing firms.

Industrial associations: Strong industrial associations in Germany, much as in Japan, encourage carefully managed competition among producers rather than the cutthroat price competition that is often promoted in the United States under the banner of consumer welfare.

Federal programs: A range of programs are financed by the Federal Technology Ministry in Bonn. These programs include direct research support for many industries, such as aerospace, energy, and electronics. Most of this support is channeled through intermediary institutions, research institutes, or the trade associations just mentioned. Since the late 1970s, such direct support has been balanced with programs to encourage small firms to incorporate generic technologies—including microelectronics, sensors, and some micro machine technologies. These small-firm programs are carefully designed so as to avoid overturning market signals. They are indirectly administered by private agencies—indicating again the importance of intermediary bodies. Rather than targeting particular sectors, they are open to any firm that fulfills formal eligibility criteria. And they provide only partial support for any particular research plan. All of these characteristics help the defenders portray these policies as market-conforming measures.

Länder programs: Beyond the explicit technology policies of the Federal Ministry for Research and Technology—recently merged with the Ministry of

Education—the subnational regions or Länder have extensive technology promotion efforts of their own. Staring in the 1980s, the southern Länder of Baden-Wuerttemberg and Bavaria surrounding the cities of Stuttgart and Munich, respectively, became locked in an energetic competition to build and attract high-technology industry. These regional governments supported educational institutions, helped finance applied research institutes, and used tax incentives to attract new investment. Regional governments in Eastern Germany are now playing a similar role in promoting reindustrialization. In Saxony, for example, the regional government in Dresden has persuaded Siemens and the American producer AMD to build state-of-the-art semiconductor fabrication facilities, which are in turn attracting some of the world's top equipment manufacturers (such as Applied Materials). These regional efforts are crucial because they provide a diversity of experiences. They therefore encourage an institutional competition among the different arrangements that work more or less well in different local economies.

As has Germany, France has undergone very significant changes in the last decade. The earlier Mitterrand governments in the 1980s undertook major efforts at decentralizing the state apparatus, and the Ministry of Industry has actively adopted "diffusion-oriented" technology strategies to supplement France's more traditional strategy of national champions.

These recent efforts toward decentralization and diffusion have, however, been hindered by the absence of the institutions that enable Germany to implement such approaches. In particular, France has no analog to the institutional diversity supported by Germany's federal system of governance. Thus, even the Ministry of Industry develops outreach programs (such as the DRIRE, or *Direction Régionale de l'Industrie, de la Recherche et de L'Environnement*). The regional delegates find themselves bound by uniform and inflexible procedures. In addition, French vocational education is only beginning to recover from decades of neglect; as a result, France is only beginning to build a pool of intermediate-skilled technicians and practically oriented engineers needed for technology-intensive production. Finally, France's industry associations, traditionally weak in their relations with the centralized French state, cannot become strong partners for managing competition and technology diffusion overnight.

In their different ways, both France and Germany attempt to retain technological capabilities within their territorial boundaries. In so doing, neither country has tied itself exclusively to the principles of allocational efficiency or consumer sovereignty. Yet the two countries promote technological development for different reasons and with different policies.

In France, the goal of technology autarky, which has been so important in the country's military policies since the end of World War II, naturally spills over into its policies for technology promotion. France's comparative advantage in public policy rests on those technological capabilities that can be built through highly centralized and coordinated technology programs, such as nuclear power,

ocean exploration, telecommunications, and aerospace. The goal of independence remains paramount in France.

In Germany, the goal of maintaining a balanced domestic economy has taken priority since World War II. By emphasizing technology transfer within the national territory, the German state also achieves important elements of autarky in technology. In contrast to France, however, Germany's comparative advantage in public policy continues to rest on the diffusion of generic capabilities through a broad range of small, medium, and large firms in a variety of sectors.

This contrast also helps to explain the respective behavior of French and German officials in trade policy. The French tend to use trade policy actively to promote the country's most important industries and firms. The German government has its share of nontariff instruments for promoting national firms, but adopts a strong position in favor of openness. By de-linking trade and technology policies, German governments since the early 1970s have been able to promote technology-based capabilities at home while espousing open markets abroad. This contrast between revenue-based and capabilities-based policy strategies underlines the all-too-often overlooked advantages of keeping the state's activities in technology development quite separate from its activities in trade negotiations.

Thank you.

DR. SIEBERT: We will now hear from Mr. Takeda. He is senior executive managing director and a member of the board of Hitachi, where he is responsible for Hitachi's R&D, intellectual property, and instrument business divisions.

Japanese Technology Acquisition, Diffusion, and Development

Y. Takeda, Hitachi

Different phases: Since World War II, Japanese electronics firms have made great progress by acquiring, developing, and transferring technologies. This process has had several distinct phases. Until 1960, Japanese electronics firms followed successful examples of U.S. businesses and imported both patents and technologies.

In the 1960s, however, these firms watched the trend of development in other countries and began to participate in this trend. During that decade it was not always necessary for Japanese companies to import technologies.

In the 1970s, Japanese electronics firms were still acquiring basic concepts of technologies worldwide, but were developing new ways to apply the concept to industries. Thus, they were vigorously obtaining their own patents and were exporting or transferring many of those technologies.

Finally, from 1980 to the 1990s, these firms were actively carrying out their own basic research, while remaining in the forefront of applications. Japanese electronics firms started to recognize that it is essential to create core technologies by expanding R&D activities.

Hitachi's growth during these 50 years is just one example of the growth of Japanese electronics firms. During the 1980s and 1990s, Hitachi continued to invest 10 percent of its sales in R&D activities, including basic research.

In the 1990s, however, the recession that was triggered by the crash of the bubble economy in Japan led to a saturation of domestic markets. To continue operating production facilities, Japanese industries had to rely heavily on exports. One result of this was the tremendous trade imbalance and the marked appreciation of the Japanese yen, which drove many industries to shift their manufacturing and sales centers to other countries.

For example, more than 10 percent of the production of the Hitachi group now occurs outside of Japan, approximately 15 percent of the equipment and materials used by the group are imported, and approximately 20 percent of Hitachi's domestic production is exported. Hitachi will continue to increase overseas production and international procurement.

Alliances: Now another step of technology management appears in electronics firms. Instead of each individual corporation developing all the technologies it needs, they now establish intercorporate alliances or cross-licensing, which constitutes a technology matrix among the necessary elements that have become more important and advantageous.

This matrix involves core technologies, which are the hallmarks of each company. Each core technology should be developed through intensive R&D efforts within the individual companies, whereas other elements of the technology matrix can be acquired through alliances.

"Strategy," "marketing," and "core technology": these three factors constitute the so-called "core competence" for high-technology industries today.

Globalization: Now to touch the second topic, many Japanese manufacturing companies are trying to change their business structure in the following ways. The first challenge is a "new business globalization."

Many Japanese manufacturing firms have already shifted their manufacturing and sales centers outside of Japan and now their globalization efforts are approaching the next stage: global sharing of intellectual resources and global cooperation. Two typical examples of this are globalization of R&D activities and intercorporate alliances.

Hitachi has already established various collaborations and has exchanged researchers with several well-respected research institutes outside of Japan. In 1989 Hitachi established overseas R&D laboratories in Hitachi America and Hitachi Europe, Ltd.

Hitach & TI: An example of a global intercorporate alliance is the cooperation between Texas Instruments [TI] and Hitachi in developing new generations of semiconductor memories. TI and Hitachi started to develop jointly a 16-megabyte DRAM [dynamic random access memory] in 1988. We have continued to cooperate in developing a 64-megabyte DRAM and are conducting a feasibility study on a 256-megabyte DRAM. As a result of these cooperative efforts,

TwinStar Semiconductor, Incorporated was established in Texas in January 1995 for manufacturing advanced semiconductor memories.

New frontier: The second challenge is pioneering new business frontiers. It is essential for R&D personnel in private companies to sow the seeds for new industrial concepts. Although revolutionary innovation is a high-risk activity, it also offers high returns. The flat-panel display business is an example of innovative areas in which Japanese companies have made major contributions.

In 1992 Hitachi's major display business was a cutout display tube [CDT] and a cutout picture tube [CPT]. They have been shifted to overseas production, and LCD [liquid crystal display] has created a new market so as to contribute to reducing the hollowing of domestic industries.

This type of dedicated company activity is especially valuable, not only because it benefits the company itself, but also because it creates new industries and job opportunities, both domestically and worldwide.

In Japan, most R&D investment is done by industries. Government R&D investment is less than one-fifth of total R&D spending. To become an effective source of advanced information, the Japanese government will have to increase its R&D investment in academic circles and public research institutes to the same level as that of governments in other advanced countries. When industries, universities, and the government cooperate in R&D, each needs to clearly understand its own mission and responsibility.

The 1990s have been and will continue to be a crucial period for Japanese electronics firms to change their business structure. The challenges will include further steps toward globalization, creative marketing, and developing core competence. I conclude my presentation by emphasizing that advanced countries have a mission to conduct R&D not only in low-risk but also in high-risk fields that promise significant human benefits.

Such areas include health and welfare, disaster and crime prevention, and energy conservation and environmental protection. In the past, technology has been developed from a perspective overwhelmingly oriented toward the natural sciences. From now on, however, technology cannot be handled without a deep understanding of its impact on global society. R&D activities combining technology, science, and sociology need to be based on the well-being of our global human society.

Thank you.

Evolution in National Policy Support

Kazuhiko Hombu, MITI

NEDO: I am the chief representative of the New Energy and Industrial Technology Development Organization (NEDO], a quasi-governmental organization and an affiliate of the Ministry of International Trade and Industry [MITI]. NEDO is a managing organization of MITI R&D activities.

My presentation is divided into three parts. The first part is how the R&D activities in Japan have changed recently. Second, I will talk about past MITI policies on industry and science technology R&D. And third, I will discuss the direction of these policies.

Small government role: Compared with the European countries and the United States, the role of government in the R&D expenditure in Japan has been very low, especially in the 1970s and 1980s. During this time private industry R&D expenditures rose rapidly.

Recently, there have been some big changes. Private industry R&D decreased dramatically the past two years after the crash of the bubble economy. Since 1992 and 1993, the annual gross rate of the private industrial expenditure on R&D has decreased. This had a shocking result for our economy.

Compared with other developed countries, Japanese governmental expenditure is approximately 20 percent of total expenditure. On the other hand, in the United States, Germany, France, and the United Kingdom, the level of expenditure is approximately 35, to 45, or 46 percent.

In the United States, the expenditure for defense activities plays a key role in governmental R&D funding. The U.S. governmental R&D is defense-related, which is possibly a driving force. Most private companies do not want to spend such large amounts of money by themselves.

You need to understand the recent shift of the R&D levels that have been sent overseas by Japanese enterprises. Before the 1970s, or within the first half of the 1980s, there were not many Japanese companies that had R&D levels overseas. However, in the late 1980s and early 1990s, the number of Japanese companies with R&D facilities overseas, especially in Europe and the United States, increased dramatically. The number of researchers overseas also increased. On the other hand, the number of foreign visitors or foreign researchers who come to Japan is very low. We are very anxious about a deficit of the R&D resources, both in facilities and in human resources for the future.

Lagging government expenditure: My final issue here today is the difference in the government expenditure in leading-edge technology areas. I have selected two different areas: information technology and life sciences. There is a big difference between Japan and the United States regarding governmental expenditure in these two areas. For information technology, Japanese expenditures are approximately one-third of U.S. expenditures; for life sciences, our expenditures are approximately one-fifth of the U.S. expenditures.

In conclusion, recent R&D activity in Japan can be outlined by five points:

- industry's R&D effort is stagnating;
- there is insufficient government effort in some specific areas;
- there is a loss of Japanese R&D businesses to other countries;
- there is a lack of leading-edge technologies; and,
- we hope to learn some strategic efforts for national competitiveness from the United States.

MITI S&T activities: What are the MITI's industrial science and technology activities? The very basic technology is science. Science moves up from basic generic technologies for welding, heating, etc., to applied technologies and then commercial technologies with R&D efforts.

MITI covers some parts of applied technology and science. Of course, the Science and Technology Agency and the Ministry of Education of the Japanese government cover the basic technologies and science areas. Japanese industry, of course, covers the goods, market, and commercial technology.

Consensus on technology's importance: In Japan, there is a consensus that science and technology are the biggest driving forces supporting our society, but unfortunately the status of the R&D policy is very low, very quiet, because the outcome is not clear. And the facilities of the universities are tremendously bad. So we need to use private industries' R&D abilities to promote R&D research. At MITI I have an interest in the science and technology policy, but this policy is heavily affected by other policies that have been affected by industrial policy, which later were affected by energy and the environmental policy.

In the 1980s other issues arose. We are now thinking about other policies. We cannot focus only on industrial science technology policy.

Finally, I want to say something about the future directions of the MITI's policies. Our R&D budget is covered mainly by a special account on energy. This account is funded by the tax on energy, oil, and electricity. We can keep spending some amount of money on R&D. For future R&D policies, we are considering three major points. The first point is the need for continuing support. MITI has to support industry R&D activities continuously. The main area is leading-edge technologies or infrastructure of R&D or the R&D activities of medium and small-size enterprises.

The second point is that the MITI should lay emphasis not on applied technology, but on basic or generic technology areas. The last point is that we have to contribute to the economy and society through the outcome of R&D activities that we are conducting.

Of course there is criticism that Japan profits from the science conducted by European countries and the United States, but we are thinking of how to contribute with our R&D efforts from applied to basic technologies.

Thank you.

U.S. Technology Acquisition, Diffusion, and Development: Assessment of Current Trends

Chris Hill, George Mason University

I focus on aspects of the U.S. technology policy that encourage and support the development and use of new technology in the commercial marketplace. I will not address such equally important aspects of technology policy as those that

are focused on military or environmental markets. Nor will I address the aspects of technology policy reflected in the regulation of technological applications.

Government Roles

I intend to identify some important trends in the area of commercial technology policy and—despite the current strong opposition to technology policy in the Congress—I intend to suggest some future directions and opportunities in the field. Because the present congressional leadership seems determined to terminate much of the nation's explicit technology policy, regardless of the consequences, I am not going to attempt a grand synthesis of what is going on today in terms of broad economic, political, or constitutional principles.

Expenditure: To keep in mind the domain of interest, it is useful to remember that the federal government has recently directly financed approximately $70 billion worth of R&D activity annually. It indirectly finances billions more through tax preferences for industrial R&D and for charitable contributions to institutions of higher education and other nonprofit organizations, through reimbursements on government procurement contracts for portions of contractors' "independent R&D" costs, and through grants-in-aid to graduate students and postdoctoral fellows.

Infrastructure and procurement: In addition to providing funds for R&D directly and indirectly, the government plays other important roles in encouraging commercial technology development and use. It pays for important complementary assets such as parts of the nation's communications and transportation systems. It subsidizes the markets for new technologies in such key areas as medicine, aviation, agriculture, and construction. The federal government also encourages collection, interpretation, and dissemination of technologically relevant information.

IPR and standards: It is not widely appreciated on Capitol Hill today, but the federal government helps to strengthen the market for new technologies by setting and enforcing the standards of safety, quality, and environmental impact that give consumers confidence that untried new technologies can be considered reasonably safe and effective for their ostensible purposes. Other federal government incentives and contributions to technology development and use include, for example, maintenance of a system of intellectual property (patents, trademarks, copyrights, and their specialized derivatives), opening new markets by way of trade policies, and encouraging private investments to commercialize new technologies by way of direct and indirect support for industrial consortia, new commercial ventures, and plant expansion.

Developmental states: In other words, the modern developmental state—and I include the United States within this rubric—is awash in technology policy. Such states have no choice but to adopt and implement such policies if they are to thrive. Today, no modern state attempts to evade responsibility for a technology policy.

The visible technology policy programs that are the focus of current policy debates are important, but they represent only a small portion of the total public sector support for technology development and use in the United States. More important than such programs is the growing and widespread recognition that technology is important and an integral component of both corporate strategy and national policy. This recognition will persist, I believe, regardless of current political developments.

The Central Role of Technology

I refer here not only to the pervasive and ever-growing role of technology in shaping individual lives and society in general. More important is the adoption, development, and adaptation of a new understanding of the place of technology in all of life's activities. We now understand that wise management of technology and technology development can be manipulated to the advantage of individuals, firms, or nations. In other words, technology development has taken its place alongside more traditional concerns of societies such as the development and exploitation of land, natural resources, people, and capital as a key factor in national well-being. To deny a national responsibility for technology policy is to deny the essence of modern society.

Evidence for this new understanding of technology's role abounds. "High-tech" is in the news every day. Countries that seek to advance to the front rank of nations now try desperately to adopt technology policies, adapting a mix of policies and practices typical of those of Europe and the United States as well as those typical of Japan and the "Tigers" of south Asia. Every modern business makes development and deployment of technology a key element of both strategy and operations. It is now recognized that effective management of technology is integral to a firm's future and that, as such, it is too important to be relegated to the R&D department. Every American state has a technology program of some type. Even the Speaker of the House of Representatives articulates vague futurist visions of a technological society.

Yet another piece of evidence is that the traditional MBA [master of business administration], concerned with managing finances and people, is giving way to advanced education in the management of technology that is concerned with managing the means for generating and using "the new." Some people even recognize the pervasive role of technology in public affairs, and they study, teach, and do research on science and technology in schools of public policy.

American Policies for Innovation

During the past three decades, the United States has led the world in experimenting with new elements in technology policy. Although the Stevenson-Wydler Technology Innovation Act of 1980 got the contemporary ball rolling, during the mid-1960s several efforts had already been made to install technology policy at the national level, and several of these efforts were emulated success-

fully in other countries before they were finally adopted on a permanent basis in the United States. The approaches we have used include encouragement of technology transfer and spin-off from federal mission R&D programs; incentives for private R&D spending and for the formation of research and development consortia involving firms, universities, and federal laboratories; and new approaches to protecting the unique intellectual property typical of modern technological economies.

The importance of teaming: One of the aspects of the current debate over science and technology policy that I find most unsettling and counterproductive is the view that each R&D institution in the country—especially each federal laboratory—should determine its mission and stick with it. A decade ago this view was widely held, and concerted efforts were made to break down the barriers among institutions implicit in this model of how the world should work. And yet, one of the characteristics of the modern technological society is that it is often difficult to tell who is working on what, for whom at any given time. Teams, coalitions, joint ventures, partnerships, and many other forms of mission-blurring organizations are now widely understood to be more effective at rapid technological change than the "stove-piped" structures in which each cog in the wheel has its role and sticks with it. To the extent that policymakers in the Congress and elsewhere try to roll back the clock and rebuild the barriers that separated the various R&D institutions from one another from the 1960s through the mid-1980s, they are making an unfortunate mistake.

New Victorians?

At present time, the new Victorians who have taken charge of the Congress would like to get the United States out of the technology policy business—or, at least like good Victorians, they would like to repress the visible parts of this policy and put a heavy curtain around the rest. In view of the history of the idea of technology and its place in national strategies and policies, I believe that the congressional attacks on programs, such as the Advanced Technology Program, the Technology Reinvestment Program, and Cooperative Research and Development Agreements (CRADAs) are thoughtless at best, probably destructive, and certainly ill-considered.

I do not mean to imply that the existing U.S. technology policies and programs are faultless. I have my own list of reservations about these programs and activities, and I have spoken and written about a number of my reservations in the past.

Current U.S. Technology Policy

The Clinton administration's approach to technology policy has suffered from a number of ills. The administration has been excessively timid and has lacked resolve on technology matters from almost the beginning. It has focused too heavily on support of research and development rather than on a broader range of initiatives and actions.

A focus on R&D only: To illustrate, it was a major error to structure the interagency committees of the new National Science and Technology Council [NSTC] around R&D funding rather than around major national goals and problems for which R&D funding is but one policy option among many. Structuring the Council committee around traditional domains of R&D funding also effectively precluded consideration by the Council of significant shifts of resources across national goals and across scientific and engineering disciplines, as had been promised in the Clinton-Gore campaign.

Poor coordination with Congress: In addition, the administration was insufficiently responsive to congressional initiative on technology policy during its first two years in office when it faced a Congress of its own party. For example, disagreements over treatment of foreign company participation in U.S. technology support programs precluded passage of the congressional leadership's flagship National Competitiveness Technology Act (S. 4 and H.R. 820 in the previous Congress). The bill should have been clarified, passed into law, and implemented aggressively early in the new Clinton administration. Instead, it languished and died at the end of 1994, in part, due to a lack of administration leadership and resolve.

Process vs. initiative: Finally, the NSTC process seems to have substituted an accretion of unwieldy and resource-consuming bureaucratic procedures for straightforward policy initiatives that might have been undertaken successfully when the administration's party controlled Congress. Now such action is essentially impossible, even if there were to be vigorous articulation of the need for policy changes of a type not typical of the first two Clinton years.

A Look to the Future

In view of the powerful congressional opposition to technology policy as it has taken shape in recent years and in view of the nature of the Clinton administration's technology policy, how might we begin to think about new approaches for the future?

Temporary opposition: I believe that the present climate of vigorous opposition to federal funding of government-industry partnerships and to other forms of technology policy is only temporary. Such opposition was not articulated as part of the congressional campaigns of 1994, and the next election in 1996 is unlikely to ratify this opposition.

Need for a new agenda: We need to begin thinking now about a new agenda for an American technology policy that

- reflects the vast opportunities inherent in the continuing unfolding of new possibilities;
- incorporates the fact that technology is no longer peripheral to modern governance but is absolutely central to it;
- recognizes explicitly the importance of establishing and empowering an

institution—a government agency or department—to be responsible for the detailed design and implementation of the next generation of technology policy.

Contrary to a widely held view, to get an important job done by government it is necessary to give an agency the power to do that job. Important tasks cannot be accomplished by interdepartmental coordinating bodies or by agencies that are asked to work on them as marginal additions to their core assignments. We need to begin to think about the form, powers, duties, and resources appropriate to a truly effective federal institution that can be at the center of a new round of federal/ state/ industrial/ academic technology development and application partnership.

Careful studies should be done of experiences over the past six years with experimental programs such as the NIST [National Institute for Standards and Technology] Advanced Technology Program and the multiagency Technology Reinvestment Program so as to extract lessons useful for building more successful and efficient programs in the future. We also need more thoughtful studies of the successes, problems, and pitfalls of the technology policies used by other nations and regions of the world.

This is a difficult time for supporters and implementers of technology policy in the United States. Hard-won gains of the last two decades seem likely to be swept aside. Yet the need to justify such policies has stimulated fresh thought about what they can and should become. The current climate will change, and the community should be ready with a coherent and well-developed action agenda when it does.

DISCUSSION

KARL-HEINZ PAQUÉ: My question is directed to Nicholas Ziegler in regard to the performance of the German economy in general. Germany has a relatively high research R&D intensity, despite its traditional concentration on medium-technology industries that are the backbone of the German chemical industry, mechanical engineering, car industry and so on. Despite this and Germany's relative weakness in microelectronics, it has a very high R&D intensity.

The reason for this is that Germany basically—within these medium-technology industries—specializes in the high-technology segments. Therefore, we should be very careful not to attribute too much to a technology policy because in this case, Germany has a very long-run pattern of specialization, which has not changed dramatically in the past 20 years. We need to be careful about the idea of reasonable competition because most of these firms are medium-sized. They compete in very narrow world markets, and there is no way they can control the type of competition they are in.

ERHARD KANTZENBACH: I have two short comments, specifically to Mr. Ziegler and to Mr. Hill. First to Mr. Ziegler. I am not sure whether your evalua-

tion of the Germany R&D policy performance is too optimistic, because if you look at the export structure of the German economy, you will find that the export of medium technology is rather strong, whereas on the high technology level, we actually have some weaknesses. This raises much concern in the German economy and for German economic policy. We now have a debate about the competitiveness of the German economy that is at least as strong as the debate in the United States.

To Mr. Hill. You talked about the necessity of R&D policy, and in this respect, we should separate two different aspects. One aspect might be the necessity from a national point of view. If you see different nations competing in world markets, it may seem that, for one nation, it is necessary to have R&D policy. But we are trying to look for common framework conditions for the world economy, and for that we need different criteria for the necessity of technology policy.

We should find out whether technology policy gives a welfare gain for the world economy as a whole. From that point of view, we have different criteria. We have to look for external effects, which might or might not exist, but I believe that any technology policy has less convincing arguments if you look straight from the perspective of the world economy than from the national economy.

CLAUDE WOLFE: I have two corrections to Dr. Ziegler's assessment concerning France. The first one concerns the education system. In the past 30 years we have developed a system of what we call higher technicians, which are formed with the agreement of the industry and fairly fit the needs of the industry. We have also developed a permanent educational system.

I also want to say something about the centralization of the public support for industrial R&D and for the diffusion of generic technologies. This is no longer true. Our national agency for the validation of research and the Ministry of Research have no regional offices—local offices with financial autonomy and decisional autonomy. They can allow support for up to approximately $100,000 under their own responsibility.

NICHOLAS ZIEGLER: I want to respond first to Mr. Wolfe. Your observations are pertinent, but I do not quite agree with the full thrust of them. The system of engineering education in France through their national schools, nonetheless, continues to create a political elite, which does, I would argue, dominate public technology policy in France very, very strongly.

The other educational initiatives that you have mentioned are very important, but they have not yet made a real switch in the hierarchical structure of enterprises in manufacturing, though they may very well in the service industries.

Regarding centralization, your point is an important one; however, for the Ministry of Industry, at least, the regional agencies are still forced to use uniform procedures so that there is nothing like the regional experimentation possible in

France that one sees in Germany. Even though the implementation of policies occurs in the periphery, you do not get the kind of variability that is necessary to comparing experiences across geographic locations.

So I agree that all of these things are happening, but they have not yet caused a fundamental change.

On performance issues and how much we can attribute to technology policy, of course, I think that Dr. Paqué is correct in pointing out the very persistent pattern of specialization of German firms in medium-technology sectors, but that persistence itself is quite remarkable when you think of all the technological changes that have occurred in the metal bashing industries or in machine tools, for example. By comparison, certainly with France, the policies of the German research ministry have to be viewed at worst as neutral, which is good compared with what the French Ministry of Industry did to the French machine tool industry.

I am not an economist. I compare these policy histories, and if you look at them closely, you can see how the French Ministry of Industry systematically undermined this industry while, at the same time, these indirect specific programs in Germany did help small-firm sectors to modernize.

As to the degree of competition, whether it is determined by domestic institutions, such as trade associations or world market conditions, this is a very complicated question. I am not sure there is a short answer, but I would argue that the very intricate structure of the trade associations does impose certain types of governance restrictions on markets that German firms can and cannot enter easily.

To answer Professor Kantzenbach, your question was very similar. It is the emphasis in Germany on medium-technology sectors and, in fact, one of the reasons I emphasized in my remarks the indirect specific programs, these small-firm programs run by Bonn, is that they are designed precisely to help the so-called German mittlestaundt, which often are in medium-technology rather than high-technology sectors.

I certainly agree that there is a vigorous debate in Germany about the role of technology policy and about the performance of firms in what we usually think of as high-technology sectors. That is precisely why I put such emphasis on these institutions and policies that do support small and medium-sized firms in medium-technology sectors, such as mechanical engineering.

DICK SAMUELS: I direct three questions to our Japanese participants. The first question is by way of clarification. There was a contradiction in the numbers about where R&D is headed in Japan. Dr. Takeda described a Hitachi case in which there was an increase or investment of 10 percent, a fairly constant and rather high continued reinvestment in R&D. However, Mr. Hombu described in the aggregate a post-bubble decline—I presume it was real and not nominal terms of investment—in R&D.

I would like some clarifications as to how to explain this discrepancy. Is it large firms versus small firms that are going in opposite directions or is there something else, multinational versus domestic oriented?

DR. TAKEDA: My numbers are in a very wide range. Since 1950 to 1980 to 1990, we grew very rapidly and steadily. But when we rose up in that rather small range, particularly after the 1990s, there were some costs. Also, 10 percent of our annual revenue is spent in R&D, but the revenue itself is now decreasing.

DICK SAMUELS: That is very helpful. Also in your presentation you stated that 15 percent of Hitachi's equipment and materials were now imported. There is a great deal made of the difference between intraindustry trade between the United States and Europe, which is very robust. We sell cars to Europe. They sell cars to the United States. We sell them steel. They sell us steel. There is a very different pattern between the United States and Japan, in which there is far less intraindustry trade. The question I have is, what portion of that 15 percent of Hitachi's comes from related firms?

DR. TAKEDA: I do not have that number at this moment.

DICK SAMUELS: The problem is that, in general trade discussions, that number never appears, and it would be very useful as a general matter to have those numbers. Actually it is a request from all of us for better data.

Next, you talked about the 10 percent of Hitachi's production being located overseas. That is slightly higher than the 8 percent aggregate that is reported for Japanese firms overall, and it is approximately half of the 20 percent of U.S. manufacturing production that is reported for U.S. firms overall. You expressed a concern about hollowing in the Japanese economy, and you gave a wonderful example of LCD technology, which you increased at home as you migrated other display technologies overseas.

My question is, what criteria do you use as a research director and as a director of Hitachi overall? What types of criteria do you invoke when you think about what to move overseas and what to keep at home? How important is this concern for hollowing? How does it weigh against other types of criteria, such as the desire to acquire technology abroad, supplier relations, access to foreign markets, and dealing with foreign trade barriers?

DR. TAKEDA: I would like to give my answer to the third question.

PARTICIPANT: Before Dr. Takeda answers, I have a question along the same line. In the opening session it was suggested that the East Asian model is drastically different from the Western model. But in this session I am hearing just the opposite. I find this confusing.

So I would like an answer from the two Japanese participants whether they disagree with the presentations during the first session this morning, or whether they are operating very differently from American firms.

There is something that is not right in this picture. Both views cannot be right. So if you could either tell us if you disagree with this morning's discussion or give us a little bit more in terms of how you differ from American firms?

DR. TAKEDA: I would like to answer Professor Samuels third question. As to which businesses are conducted overseas or in domestic markets, this should be decided by the managers of the business groups, not by the technology manager.

In addition, this selection is based on marketing more than technology. For example, we are now distributing semiconductors and automobile components into the United States. Of course, when we create new businesses, we are forced to create new businesses for the company, not only, for example, Hitachi but also for General Electric. When we create new business, our resources are intensive. For example, at this moment, Hitachi has strong research resources near Tokyo.

CHRIS HILL: In response to Dr. Kantzenbach's observations on my comments, two quick points. First, it is important to realize that we are not talking about R&D policy. You may have been using that as shorthand, but that is simply grossly inadequate to characterize the subject of technology in modern economic development.

The second point is that it seems to me so clearly self-evident that the development application and integration of technology and culture are at the root of economic development. To suggest that there are no positive benefits from this activity is to ignore the last 5,000 years of history. Now, what does lie before us is a need to find constructive ways to cooperate internationally and not to use this as a substitute for shooting each other in the future.

Session 4

From Conflict to Cooperation: Trade in Semiconductors

Moderator:
Michael Borrus, University of California, Berkeley

CHARLES WESSNER: In this session we will be discussing another one of the case studies: the trade in semiconductors. For our first presentation I am especially pleased to introduce Michael Borrus, who is codirector of the Berkeley Round Table on International Economy.

MICHAEL BORRUS: In this session we will focus on the semiconductor industry. To most people the silicon chip is the unique symbol of the information age. The silicon chip is and will remain the most potent symbol, not just of the marvelous technologies that are transforming both industrial production and leisure time in our societies, but also of enduring trade and technology conflicts—and the potential for cooperation.

The semiconductor industry has been the subject of dramatic trade confrontations between the United States and Japan since the mid-1980s, the last time the United States threatened and actually went forward with imposing trade sanctions. It has been the subject of less well-known but equally significant trade disputes between Europe and Japan, between the United States and Europe, and increasingly between the many new entrants in Asia who have suddenly become such significant forces in the industry—Korea, Taiwan, and Singapore.

It is an industry in which startling reversals of competitive fortune have been experienced over the past 15 years in which the Americans were on top, then the Japanese were on top, and now the Americans are back on top, but the Koreans and the Taiwanese are coming on fast. One expects that, with China and other players, perhaps Russia and India coming on line in the next decade or so, these startling reversals of competitive fortune will continue to play themselves out in the market.

It is also a sector in which governments have played, from the industry's very inception, an extraordinarily significant and interventionist role in helping to create launch markets for the technology, funding research and development, and in helping to resolve some of the disputes that have arisen in the industry.

The governments of Korea, Taiwan, and Singapore have played a very effective role in helping those producers to emerge as major players in the industry, as the government of Japan did before them, as the U.S. and European governments did before the Japanese government. And, indeed, from the mid-1980s on, to some extent the competitive success of the U.S. industry owes a debt to both aggressive intervention on the trade front, through the semiconductor trade agreement and the market-opening negotiations with Japan, and the domestic support to technology in the form of such enterprises as SEMATECH.

Indeed, this sector would seem to be the embodiment of the central tension that we have been talking about here that exists in our system of technology and trade: that is, the coexistence of very different national, perhaps regional, political economies in the same economic space, each of which wants a piece (preferably a large piece) of the same set of high-technology industries that we all assume are the guarantors of future high-wage jobs, high-value-added activities and, therefore, which none of us can do without if we are going to have a rising standard of living.

Fortunately, this is a sector that, having been the source of trade-technology tensions, has also moved very far in the last decade to resolving some of those tensions. It has moved from being highly confrontational to being much more cooperative. We have seen the emergence of a broad range of cross-national alliances between companies, of direct investment, and interpenetration of industries that originate in one nation or one region into markets and industries that originate in other parts of the world.

These alliances and direct investments have spanned the gamut from R&D to production, product development, and distribution. Therefore, perhaps it is also an industry that can provide us with some useful lessons and ways of thinking about the future. As we move forward, we should consider such issues as:

- whether the move from conflict to cooperation in this industry is permanent, driven by the horrendous economics of technology development associated with getting ever smaller and smaller line widths on silicon, with improved price and performance;
- whether the industry will be able through private negotiation to resolve foreseeable tensions that will arise as other aggressively government-supported entities, Chinese firms, for example, enter the arena;
- what the impact will be as other regions, notably Asia, become the primary arena not just for producing semiconductors, but also for defining new products as a launch market, a role the U.S. and Japanese markets have exclusively played in the industry's past;

- is there still a role for government outside of this aggressive sort of infant industry development support? Is there a role in resolving disputes that may arise? and
- is there a role in cooperating either with other governments or with firms to continue to support the development of technology in this industry?

To discuss these issues we have a wonderful panel. Let me briefly introduce them. First is Claudine Simson from Northern Telecom, who is both a major user and producer of the technology. Dr. Simson is assistant vice president of Bell Northern Research. Her responsibilities are, in essence, to direct Northern's global research and development investments, especially in strategic technologies such as semiconductors. Perhaps we can coax her to give the user perspective as well as the producer perspective.

Next we have Y. S. Kim who has the unique distinction of having built what is today at the so-called "bleeding" edge of production, the leading producer of memory chips, the lowest-cost producer in the world, Samsung Microelectronics. Perhaps we can coax him to give us the perspective of one of the aggressive new entrants in this business.

Following Dr. Kim will be Owen Williams from Motorola, one of the few U.S. companies that actually runs counter to the "small and entrepreneurial is beautiful" movement of the last few years, proving that a large, vertically integrated enterprise can, in fact, be nimble and flexible while also bringing the advantages of size and scale to its market competition.

Current Trends in the Semiconductor Industry

Claudine Simson, Nortel

I would like to share with you my views on the evolution of trade in semiconductors, along the following lines: First, I would like to address the semiconductor market trends and evolution, then look at some of the trade issues, the technology trends in this industry, the challenges that each faces, and, finally, I will try to describe some of the new factors that I believe are going to influence the evolution of the market, the future of the chip market, the impact of the yen's trends, and finally the issues of dependency and cost.

The growth of the semiconductor industry ultimately depends on the growth of the electronic equipment market. This relationship has been and will continue to be inseparable. The semiconductor compound annual growth rate [CAGR] is approximately 16 percent and is twice the rate of the electronic systems, which is due to the increases of semiconductors in electronic products, notably with the boon of the personal computer market.

The percentage of semiconductors that use electronic equipment gradually increased from 11 percent in 1991 to 16 percent last year and will increase to

almost 20 percent by the end of this century. In 1994 North America was the largest producer in the 690 billion dollar worldwide electrical equipment market, producing 39 percent of the total equipment sales, followed by Korea and Asia Pacific with 23 percent and Japan at 18 percent.

The forecast for 1999 is about the same, with North America increasing slightly and Korea increasing also by two points, which will be to the detriment of Japan, whose share will go down to 15 percent.

The Japanese market is expected to decline in share from 28 percent in 1994 to 25 percent in 1999, whereas the rest of the world, mainly Korea and Asia Pacific, will increase its share from 20 to 22 percent and North America from 23 to 24 percent.

Because 90 percent of the semiconductor market is really integrated circuits [ICs], we have to focus on ICs. There are five major categories in products in the ICs. In order of importance, we have memories and for microcomponents there are microprocessor units, microcontrollers, peripherals, and analogs. The largest IC market segment is represented by memories. It jumped from 31 percent in 1993 to 35 percent last year, mainly due to the strong demand in DRAM. The market share will remain steady at 35 percent until the end of the century.

The fastest growing segment of the market is represented by the microcomponents, the MPUs [microprocessing units] and MCUs [microcontrolling units]. This market will grow from 26 percent in 1994 to 31 percent by the end of this century. This growth will mainly be due to the growth in the personal computer market, fueled by the success of Intel's Pentium chips and the power of the personal computer.

It is interesting to note that 36 percent of the worldwide production of microcomponents is actually done in North America, whereas 29 percent is done in Japan, 5 percent in Europe, Korea, and Asia Pacific. It comes as no surprise that Intel was by far the leading microcomponent supplier in 1994.

Intel sales represent 39 percent of the worldwide microcomponent sales, four times larger than its nearest competitor, Motorola. This is due to the boom of Intel's 486 and the Pentium chips, showing a 30 percent increase from 1993 to 1994.

The memory market has a very different geographical outlook. Fifty-three percent of the worldwide memory production is done in Japan, 23 percent in Korea and Asia Pacific, 20 percent in North America, and 4 percent in Europe. However, no market share lead is safe in the IC industry, even in a market that seems solidly in the grasp of Japan.

From 1992 to 1994, Japan's share of DRAM production decreased 8 percent, whereas Korea and the Pacific increased 5 percent. This is exemplified by the five top memory market leaders from 1993 to 1994. In 1993, Samsung went from the fifth position to the first position, ahead of Toshiba and NEC. Samsung is expected to retain the lead, taking advantage of the wavering Japanese economy.

However, the dominance of the worldwide memory market by Japan, Inc.,

which is expected to remain at approximately 50 percent until the end of this century, is one of the main contributors to the large IC trade surplus that Japan has enjoyed over the United States for the last several years.

In 1994, the trade gap widened even further, mostly due to the increasing prices of the DRAMs. However, U.S. export market share in Japan increased in 1994, reaching 14 percent of the $25 billion IC market. Japan exports reached 18 percent of the $32 billion U.S. IC market. However, the sales of the Japanese-owned companies outside the country or the U.S.-owned companies outside Japan were not accounted for in these numbers.

If you put these shares inside the numbers that I just gave you, you reach about an equal share of the penetration into the Japanese market and the U.S. market of approximately 24 percent. So there is little doubt now that there are more companies that will be established outside their home base. The export market share and the trade figures are going to be essentially meaningless.

With respect to tariff structures, there was a new GATT proposal in 1994, which is being reviewed by the United States. In that document, the European duties on selected semiconductors are to remain at 14 percent until 1999 and then drop to 7 percent. For South Korea, the duties on semiconductors will remain at 9 percent until the end of the century and then disappear.

The industry response to these new proposals is mixed. The United States does not like it too much. The Europeans like it better. We see a very positive response from the semiconductor industry. For example, the protection of intellectual property was strengthened, and the new treaty will continue to strictly reinforce existing antidotes.

I want to now turn to the semiconductor technology trends. Complementary metal oxide semiconductor [CMOS] technology is expected to continue to be the technology of choice for the VLSI [Very Large-Scale Integrated Circuits] of the future. Speed and power of CMOS are the magic contributors to this increasing market share as the techniques improve and smaller feature sizes become manufacturable.

There are two scenarios that will likely be developed in parallel: the high-speed scenario and the low-speed scenario. For future sizes, I expect it to be at 0.35 micron this year, down to below 14 microns by the year 2007 so as to meet the needs of the 16 DRAMs.

A definite trend is in the area of lower operating voltages, with VCC dropping from 3.3 volts this year to 2.2 volts in the year 2007 for the high-speed scenario, and to 1.5 volts for the lowest power scenario. Reducing operating voltages is significantly important to reduce the power consumption, which is a key limiting factor in VLSI.

The push toward higher density is equally predominant. By the year 2000, the DRAMs will have approximately one billion transistors, whereas the microprocessors led by the Pentium generation are expected to have above 50 million transistors.

We project an even more impressive strength in the increase in the die size, steadily growing at 13 percent per year. If you extrapolate that up to the year 2000, we will see die sizes up to 1,000-square mls or 2.5 inches per side.

These die sizes approach what we now call the wafer scale integration. The key challenges are the following: What changes will be needed to accommodate such huge die sizes so as to be practical? Ten inches? Twelve inches? Larger wafer sizes? Similarly, what level will be needed to keep the yields above zero? What type of densities will be required? Third, and most important, what capital investments are going to be required to keep up with these large die sizes?

Although it is difficult to imagine a 6-inch-square die size, it is even more difficult to imagine the economical practicality of producing such a die, in particular with respect to the capital investments required. The capital investments of semiconductor companies are quite significant. Capital spending grew by 44 percent in 1994, to reach almost $22 billion, which represents approximately 20 percent of the worldwide semiconductor sales.

So it is expected that in 1995 we are not going to see any major shortages of capacity in the semiconductor industry, except in the DRAM area.

Japan and North America are each responsible for one-third of this heavy capital spending, whereas the rest of the world is split on the remaining one-third. Continuing growth in capital investment is expected, and it will impact major decisions as to the future of the semiconductor companies. The most affected will be the captive semiconductor companies. As captive producers, when they are forced to justify their funds, they have two directions to go.

The first direction is to scale back production to cope with the capital requirements and eventually close down or sell off their firms. The second avenue is to open the firms to the merchant business by selling ICs or by offering foundry services. Many of those captive companies that are moving toward opening the firms to the merchant market have chosen to smooth the transition by teaming up with other merchant companies. This will create a flurry of alliances and cooperation between the captive suppliers and the merchant suppliers in the same countries or in different countries. The future of captives is, therefore, a major influencing factor in increasing the cooperation and the alliances across companies and across countries.

Another influencing factor is the continuous trends in the yen over the years. Since 1993, the Japanese yen has gained significant strength. It is estimated that each time the dollar falls by one yen, the Japanese auto and electronics industry lose $500 million a year in revenue.

Several Japanese companies have already responded by expanding the so-called reverse exports of the 4-megabyte and 16-megabyte DRAMs, such as, for example, NEC. NEC is expanding their production in their California plant. Others, such as Fujitsu, plan to double their overseas semiconductor assembly in 1995.

Others, such as Toshiba, have tried to negotiate a price increase for the pro-

duction of the 4-megabyte DRAMs. We have not seen any of these price increases yet. But DRAM dependency and cost are some of the most important factors influencing the future of trends in semiconductor trade.

The DRAM market is booming and showed a growth of 69 percent in 1994. In the same year there was a worldwide growth of $25 billion. The DRAM concentrations continue to be greatest in North America, accounting for 38 percent of the market, whereas Japan and the rest of the world account for 22 percent each. In contrast, DRAM production remains firmly in the hands of the Japanese firms, which account for 54 percent of worldwide production, whereas the rest of the world, mainly Korea and Asia Pacific, are at a sizable market share of 28 percent, with the United States at only 18 percent.

If this trend in very high growth and monopolistic production of DRAM products between Japan and Korea is to continue, we could be entering the twenty-first century with DRAM shortages and price control issues similar to those of the oil energy crisis of the 1970s. However, DRAM dependency may be reduced significantly in the future as more foreign-owned facilities are established outside the home base and products are consumed from local production sources, as is the current trend in Europe.

For the 4-megabyte DRAMs, Europe is actually now achieving 50 percent self-sufficiency, and the trend is up. There are four foreign companies in Europe currently producing 4-megabyte DRAMs in addition to Siemens. In fact, there is renewed interest in establishing local-based DRAM fabrication facilities in Europe. There are three reasons for this: the 14 percent EU tariff on semiconductors, European-based companies want to have local production, and European costs are close to the Japanese costs.

This will change the geographical split of DRAM production in the world in the future. However, there are also pragmatic limitations to the DRAM market evolution in the future. In fact, some of the forecasts have already predicted that DRAM shipments are expected to decline at the close of this century. This is because the current downward price trends for DRAM cannot necessarily be maintained for the DRAMs products at very high densities such as the 256.

Over the past ten years, the DRAM price decreases followed a 68 percent slope, except in the 1985 and 1986 time frame in which prices were lower due to an overcapacity. There was a reverse trend in 1993 and 1994 due to a strong demand versus a weak supply. This should be corrected in 1995 because heavy capital investment should prevent it. However, this level of capital investment may become prohibitive.

For example, Mitsubishi expects to produce a 1-gigabyte DRAM. The cost is going to reach $15 billion for a future size of 15 microns by the end of this century. One can only speculate on the incredible cost of the 256 gigabyte that will produce 0.035-micron devices in the year 2010.

To cope with the large DRAM cost and technological complexity, there are more alliances and more cooperation among companies worldwide. I will give

you a few examples. For the 16-megabyte DRAM, Toshiba and Motorola created a joint venture. Texas Instruments [TI] and Kobe Steel created the KTI semiconductor joint venture for the 16-megabyte production. For the 64 megabyte, TI and Hitachi joined forces and developed 3.3-volt, 64-megabyte DRAMs.

However, the future growth of semiconductors may slow down, not because of the failure of technological advances, which are achieved by increased cooperation in alliances, but simply because of the questionable economic viability. The ultimate question is not about the physical limitations or the higher complexity of the future integrated circuits, but whether the industry can afford to produce them.

Thank you.

Capital Costs, Standards, and the Need for Cooperation

Y. S. Kim, Samsung Electronics

Because I represent the Samsung Electronics Company, it would be appropriate to introduce Samsung very briefly and then I will go over the semiconductor business, especially focusing on Samsung's business. At the end of my discussion I will present some of the challenges we all face and then suggest some solutions.

The Samsung group is a conglomerate that is made up of approximately 24 companies. The total group revenue was $60 billion in U.S. dollars in 1994. It has approximately 190,000 employees throughout the world.

Samsung Electronics Company is a flagship company of the Samsung group, and it is the largest electronics company in Korea. It is also the largest manufacturing company in Korea. It is the world's leading supplier of semiconductor memory chips. Revenue was over $14 billion in U.S. dollars last year, and it has approximately 6,000 employees throughout the world.

The revenue breakdown is as follows: The semiconductor represents 35 percent of the total revenue and 32 percent of consumer electronics; 18 percent information products, such as personal computers, monitors, printers, etc.; and 15 percent telecommunications, such as telephones, cellular phones, and printing systems.

We are also doing well in a few product areas. For the semiconductor and color monitor, we maintain the largest market share. These two products are currently in short supply; that is, demand far exceeds supply today. We have practically all the components or ingredients that are needed for the multimedia business: personal computers, CD ROMs, flat panels, memories, etc.

Now I turn to the semiconductor industries. In 1994 the world semiconductor business reached over $100 billion in U.S. dollars. North America had 33 percent of the total, Europe had 19 percent, and Japan had 26 percent. For the

next five years, it is forecast that these numbers will almost triple to $272 billion in U.S. dollars.

Korea currently has a little over 10 percent of the world market. It reached $11.8 billion in U.S. dollars last year. Of this $11.8 billion, 73 percent was attributable to silicon wafer processing and 27 percent to assembly. We expect this to maintain this ratio for 1995. However, the total semiconductor consumption for Korea in the industrial market this year is expected to be approximately $3.7 billion in U.S. dollars.

Only 31 percent, one-third, comes from Korean domestic manufacturers and approximately 70 percent comes from outside. The majority of consumption comes from the United States and some from Japan.

Let me give you a brief history of Samsung's current status in the semiconductor business. Samsung started its memory production in 1983 with a 64K DRAM. We were at least four to five years behind the industry. In 1991, we finally caught up somewhat and were slightly ahead of the industry. With the 64-megabyte DRAM, we were able to make fully functional devices. In 1992 we became the largest DRAM supplier and we have maintained this position ever since.

Overall, we rank seventh in the semiconductor business as of 1994. We expect to maintain that position this year. In 1994 we successfully developed completely functional 256-megabyte DRAMs. Of course, Japanese companies produced their device before we did, but we were the first to produce a fully functional device.

Also in 1995, Samsung started a volume production of the LCD, which was made by semiconductor people because it is a similar fabrication.

Currently, our wafer fabrications are done in Korea, though some packaging is done outside of Korea. In Portugal, for example, we have a joint venture with Texas Instruments. In the United States we also have R&D and manufacturing in San Jose, California. And it has been announced that we will build a $1.5 billion R&D fabrication firm in the United States. Hyundai, which is another competitor with Samsung, just announced last week they are building a $1.2 billion firm in Oregon.

Despite the larger production and the position of the DRAM market, the trade balance between the United States and Korea is negative for Korea.

The main reason for the significant growth in the memory chip is the demand. Currently, there is tremendous demand in DRAMs. Today, we cannot supply all the demand, and, even though we are increasing our capacity in Korea and elsewhere, we just cannot meet the demand from our customers. Personal computers regularly demand more memory. Microsoft is developing new generations of software every few years. Every time they do that, it requires more memory.

Samsung benefited from a little vision, and maybe some luck. We anticipated that the demand would increase rapidly and we decided to invest in the

memory business. It turned out to be the right business. Every year for the last few years, we have spent over $1 billion on our facility for DRAMs. This year we expect to spend approximately $30 billion.

Despite this acceleration, the world market is becoming a single market. This is one of the biggest challenges we face today. The semiconductor business must also face major barriers, such as the protection of industries through tariff barriers, price undercutting, and dumping charges. The European tariff on DRAM is still 14 percent.

The capital investment requirements remain enormous. It currently takes at least $1.5 billion U.S. dollars to build a 64-megabyte unit. So we developed the 256 DRAMs, but will this be cost effective with the current technology? I am not quite sure.

The next generation of DRAMs will be 1 gigabyte. We will need a breakthrough in technology, and we cannot do it alone. No one can do it alone.

The issue is not to solve frictions or conflicts, but rather it is an issue of how to create fair competition. The question is whether there can be cooperation in competition. If the answer is "no," then we are wasting our time here today. For the semiconductor producers, we have no choice but to cooperate.

Thank you.

Strategic Partnerships: Challenges and Opportunities

Owen Williams, Motorola

I want to give you a different perspective from the semiconductor industry's viewpoint in looking back over 30 years of cooperation between Motorola and other companies. To give you a little background on myself and my perspective on these issues, you should know I have been involved in technology alliances for Motorola semiconductor products for almost 20 years. Starting in the early 1970s, when we second-sourced our 6,800 family to six companies around the world. Later, we made technology transfers to customers such as Delco; companies in Europe, such as Siemens, Johnson CSF, Ericson; and companies in Japan, such as Hitachi, Toshiba, Mitsubishi, Matsushita, and others.

First, I am going to tell you about some of the problems that have caused some conflicts during those years, and then describe to you our most successful cooperation with our partner Toshiba in a joint manufacturing line.

First, let me review briefly the earlier agreements. In the 1970s and early 1980s, we were very naive. Motorola tried to generate partnerships, going through a series of primarily product-oriented or process-oriented arrangements in which we got into some difficulties, one of which started with a disregard for intellectual property rights. Quite frequently we found people building products that infringed Motorola's intellectual property. We found these products already in the marketplace or they came to us and asked for a license at the same time that

they were in mass production with these parts. They had customers, the same customers that we supplied. We could not cut off their supply to that customer.

We ended up being forced to license products that we had not intended to license, products that actually hurt our product strategy. We also found a lack of enforcement of intellectual property rights throughout the world; the laws were there to protect us, but we could not get them enforced.

The second issue that we found was a disregard for commitments made in contracts. Almost every product contract we put out specified what products could be built and what could not be built. And quite frequently with a partner in the later years of a contract, we would find that they were producing other products derived from the products that they were allowed to produce, but were not legally licensed to produce.

In other cases in which we had joint development agreements with some companies, we found that sometimes the other company did not have the same urgency to develop the products that they were supposed to develop according to our agreement. These were the type of joint development activities in which we developed so many parts, they developed so many parts, all to produce a bigger portfolio. Quite frequently, however, they did not produce the number of parts that they were supposed to develop.

Finally, we also found some unfair practices. We found preferential treatment by governments and agencies that favored their domestic companies. We found that we were sensitive to direct subsidies from government. One of our rules was that you cannot license technology to a company who is being subsidized by the government because, when you compare your cost of sales to their cost of sales, their cost is smaller and they can then underprice you in the marketplace. We found that happening.

Dumping to gain a share of the market was another issue. Misappropriation of technologies and stolen technology gave alliances partnerships a bad name.

In general, to have good cooperation, the message is not only that everyone must understand the rules, but that everyone must abide by the rules.

Cooperation is possible, however. I want to turn now to an excellent cooperative venture that we have and spell out some of the reasons why it is good. We have a company called Tahoku Semiconductor, Inc., in Sendai, Japan. It is a seven-year-old joint venture operation between Toshiba and Motorola. What has made this particular joint venture work is that we have buy-in at all levels of management within the corporation.

First, management has to treat a joint venture or a cooperative effort as if it were part of the company. Too frequently managers treat these joint ventures as extracurricular activities for their company.

Communications have to be intense. You have to identify the issues regularly. You have to work the issues regularly. You have to be willing to change. Too often people write a contract in 1994 and want to live by that contract for the rest of the ten years of the agreement. You cannot do that. You do not do that in

your own business. You have to be able to change and make adjustments to the relationship.

You need to seek a balance over a long period of time. You may get more out of it than your partner in the first part of it and your partner may get more out of it in the latter part of it. And that is acceptable, as long as you have an agreement that you will reach a balance over the long term. In fact, it is very difficult to have a day-to-day balance as you go through the agreement.

Finally, you need to understand the entire agreement. Too frequently the lawyers are the only ones who understand the entire agreement. You have to understand what value you are getting and what obligations you have to make for the agreement to work. And you also have to manage the interfaces.

Interfaces will change from time to time, and as we all know, people make agreements work, companies do not. So if the people change, you are in jeopardy of losing the spirit of the agreement. You want to keep a number of people involved with the agreement so if one person changes, it does not kill the spirit of the agreement.

Finally, I would like to say a few words about the need for cooperation. In the past, we did it as a convenience. We did not absolutely have to have these agreements. But now, as we enter into the latter half of the 1990s, the ability to continue to improve our productivity is essential. The cost of improving the technology is very high. The cost of building manufacturing lines is very high, and we have lost one of the biggest leverages that we had in improving productivity simply because we already get such high yields today; incremental improvement is costly.

We have to find new and better ways to cooperate. I believe that it will start by cooperating in standards: standard requirements for equipment, standard requirements for wafers, standard requirements for gases and chemicals. But it will go much further than that. We will have to share in the cost of developing products. We will have to share in the cost of developing the equipment for the manufacturing line.

It is almost imperative that we have cooperation if we are to continue the growth of the semiconductor industry. Yet, cooperation is not for the weak-hearted. You have to know what you are doing when you enter into these cooperative deals or you will lose your company.

Too often we have inexperienced people trying to start or enter into cooperation without knowing the pitfalls. When you enter into cooperation, you give up something. It is not all roses. I will give you one example. Two major companies enter into a joint development agreement for a process technology. They bind themselves not to disclose that technology to anyone else. If that partnership dies or goes away, they cannot jointly develop that process with anyone else for the period of confidentiality of that agreement.

You have to share in the cost of development, because if you join into an agreement and it does not work, then you have lost your ability to share in the

cost of developing the product. It is serious. Yet, we have to have interfirm cooperation. And, we have to have cooperation with our government. If the government does not invest in the semiconductor technology, we will lose one of the biggest export businesses we have.

Thank you.

DISCUSSION

MICHAEL BORRUS: We have a description from all three panelists of an industry that is continuing to progress at a remarkable rate technologically, in which the associated costs of doing so are forcing more and more cooperation. Another element, not much mentioned, but implied in the remarks of all of the speakers, is the degree to which cooperation that takes the form of foreign direct investment is partly motivated and encouraged by government policies in those other locations. This is clearest today, perhaps, in a place such as China, where if you want to do business in this industry, as in most other high-technology industries, you have to invest and eventually set up a production facility.

Does the pattern of political decisionmaking that is shaping investment in this industry overwhelm the prospects for cooperation? Will most investment end up in the places where the governments are most politically aggressive?

I was encouraged, for example, by Dr. Kim's comments that several Korean companies are going to invest in the United States—at least in part this is a response to political pressures such as the thrust of trade action against dumping.

Are we inevitably in a market where, despite the economic push toward and the necessity of cooperation in technology development, governments are going to continue to be setting the agenda for where production actually takes place?

DR. KIM: The government is not involved in setting the locations where we can make the production. They are not involved at all, and it is our own decision where to go. Why are we producing in the United States? There is obviously a trade issue in our mind. No question about that. We go where the technical resources are, where the market is, and where the people are. We are also preventing a potential disaster in Korea.

HORST SIEBERT: What went wrong in European firms that they are not represented in this market? What is your response to that question?

OWEN WILLIAMS: European firms have chosen to go after a different segment of the semiconductor industry. Phillips is doing very well in the consumer products sector of the analog circuit marketplace. Siemens is doing well in the memory sector. They have approximately 5 percent of the DRAM marketplace and are very successful.

My own personal view is that the European companies tended to put more emphasis on specialization and customization of circuits than the rest of the world did, which was not as successful as the standard product in the marketplace.

ERHARD KANTZENBACH: Do you think it is possible for an industrialized nation in this field to hold the position of a free rider, just to import subsidized products and transform them into final products?

MICHAEL BORRUS: Let me rephrase your question. Is it possible to stay at the leading edge and maintain dominant positions in industries that use semiconductors if you are not a producer of semiconductors?

DR. KIM: Of course, if you start any business and you do not start it with a 64K DRAM, you are going to get the technology from outside. Eventually, you have to put your own money in it to keep up with the technologies. In the long-term, there is no free ride.

SYLVIA OSTRY: I am not sure that I understand the answer. This is a new definition of "strategic," that word that we all use. To compete, firms produce systems products that include one strategic component that you cannot import. Therefore, everybody has to have a full supply base.

The global implications of this are serious. I do not know what evidence there would be beyond the fact that you can arbitrarily define strategic. As we have seen, the steel industry was considered strategic. The auto industry was strategic, and so is the aerospace industry. So for a systems product, you have to replicate the supply base in every part of the world. Is that what is being said, as far as strategic import?

OWEN WILLIAMS: There are interdependencies existing today, even within the semiconductor companies. We buy wafers from Japan and from Germany. We do not have a supply in the United States. We buy ceramic packages from Japan.

On the other hand, Japan buys inspection equipment from the United States. Applied materials is a very large market in Japan and in Germany as well. So there is an interdependency among the semiconductor industries that tends to prevent you from being able to get that one component from wherever it is made.

We had a silicon plant destroyed in Japan, and everyone was worried about the availability of resin. I was on a team that researched that. Our back-up plan was to go into production in the United States if we needed to. It was an expensive back-up, but we could have done that in time to not cease production of encapsulated chips.

So there is going to be interdependency. Certainly there is risk with that, but not to the degree that we have to replicate the industry everywhere.

BYOUNG-JOO KIM: My questions are for Dr. Kim. My focus is about an article that I read a month ago in *The New York Times*. On the first page of the business section, there was an article about the Korean semiconductor industry. There were three main points. The first point was that, for the U.S. semiconductor industries, Japan is no longer the main competitor. Korea is now the main competitor, and is rising quickly in a way that threatens the U.S. lead.

The second point was that Korea is waging this rising challenge based on government support and subsidies with a lot of money coming directly from the government. And the third point was that Korea is, again, waging this challenge based on cheap labor. I wonder whether the writer of this article was confused between the footwear industry and the semiconductor industry, but that was the main point.

So I ask this question because I am not familiar with the semiconductor industry. I work for the Korea Foreign Trade Association. We wanted to respond to this type of misinformation, but we could not at the time because we did not have the correct information.

My first question is, is the Korean challenge a real threat for the U.S. industry? Is there something within the U.S. industry that Korea can challenge? In my understanding, Korea has been strong in the memory chip sector, but I am not sure what is happening with logic chips. So, in that sense, I question whether the challenge itself is real or not.

My second question is in regard to the business-government relationship between the Korean government and, for example, some semiconductor industries. I thought there was a lot of friction between the government and the Samsung semiconductor industry from the very beginning.

The third question is in regard to cheap labor. Are the general level of wages in the Samsung semiconductor industry low compared to other companies in Japan and the United States, and even within Korea? Could you also briefly discuss the portion of labor as a production factor in semiconductor production?

DR. KIM: I believe that the article might have misrepresented the real facts. Korea is not challenging the U.S. semiconductor industry. It does not happen that way. In Korea we produce only the memory chips. Samsung and the other semiconductor producers in Korea are second in this industry to Japan. Japan dominates this industry more than 50 percent. Korea has only 20 percent of the market. The United States is the main user. The United States has an alternative to Japan, and also the U.S. government supports the semiconductor industry. The total Korean government budget, which pays for the third or fourth largest army in the world, cannot afford to do anything for the semiconductor industry.

So the total government budget is more than Samsung. How could they support an industry like this? Because investors supported the industry and they invested some money. However, that money has to be paid back with interest. There are no free dollars coming from the Korean government.

In regard to labor, in the last few years labor costs in Korea quadrupled. However, semiconductor labor is only a small portion of the total cost of chip production. It represents 6 to 7 percent of the total cost.

I have one more point. SEMATECH has done an excellent job the last few years with balancing the semiconductor equipment business. In Korea we used to import most of the major equipment from Japan. Because of SEMATECH's contribution in this industry, the United States now has an equipment industry. However, no equipment company can stand, that is, make money by depending solely on selling their product with their own country. They have to sell equipment outside to countries like Korea.

Because the competition is generally against a Japanese equipment company, this helped us at first. So, right now, it is all intertwined. The question is how to cooperate and still compete. That is the only issue we have.

ALAN TONELSON: In this session we have heard about the semiconductor industry and how it is running into a structural problem because its products are becoming literally too expensive to make. But there is still the question of whether it really does matter which company succeeds in this business and which does not.

We have not heard anything here today about what the success of the various companies and the various countries means for our national security, for our living standards. What we have heard is that you have a bunch of companies. They make this product. They trade with each other. They form strategic alliances with each other. They invest with each other. There are a few trade barriers around the world. The Europeans have a 14 percent tariff, but still there is a lot of investment in the product that would have gone to Europe anyway.

One Japanese company dominates the packaging, but when their factory burned down, it really did not matter because Motorola had a wonderful plan to compensate for it. I have not heard any good answer to the question of why any citizen of any of the countries that your companies are headquartered in really should care which of your companies are winning and which are not. In other words, I have not heard that there is any significant public policy dimension to all of this.

OWEN WILLIAMS: If you want an electronics industry in the United States and you want that industry to be competitive globally, you have to have a semiconductor operation that supports it. You have to foster research in the new systems and the new applications of electronics. The multimedia systems that are being developed today are virtually developed in a 1-square-mile area in the Bay Area of San Francisco.

It implies a lot of software. The electronics industry in the United States is a $900 billion industry. This is a major economic factor in the economy of the

United States, and, if you want to keep that, you want to keep the semiconductor operation in the United States.

There are two other areas. One is national defense. If you look at the smart weapons that we used in the Gulf War and you want to continue to have that type of a position, you would want to keep the semiconductor industry in the United States.

Third, and probably the most significant, if you want environmental safety and health improvements in the United States, you are going to get most of it through electronics. For those three reasons, you want that industry in the United States.

MICHAEL BORRUS: Several people have touched on this question of whether this industry is strategic in the sense that you must have domestic production and producers. Look at Korea or Taiwan, where 10 to 20 leading-edge semiconductor fabrication facilities are being built, or at Singapore with Chartered Semiconductor, a new partly government-controlled or government-owned producer. Look at China, which will be a producer of semiconductors. Look at plans being formulated in Malaysia or Indonesia. It almost does not matter whether you or I believe there are strategic industries. Governments believe it. Companies believe it. And governments will support companies within their backyard so as to pursue a position in this industry, whether or not the economic model suggests that strategic industries exist.

And, in fact, support is the prudent thing to do. If strategic industries do not exist, but you devote some government resources to nurturing production in your own backyard, maybe you misallocate resources. But if they do exist and you do not devote the resources to maintain a position, then you have done far more than simply misallocate resources.

To borrow Bruce Scott's terms from this morning, you have missed out on significant opportunities for growing your long-term standard of living, your ability to pay high wages over time. So the prudent thing to do, fortunately or not, is to try and maintain a significant position.

Europe certainly has come to this conclusion. Siemen's dramatic reappearance as a major player in memory chips in this industry is partly the result of European cooperative technology programs, partly the result of indirect government subsidies through low-cost capital, and other political agreements.

Foreign production in Europe is completely the result of the common external tariff on semiconductors. That is not protection for protection's sake. It is protection explicitly to get new production investment in the European market behind the tariff walls. It is an old-fashioned tactic. It turns out that it works extremely well.

I want to suggest that debating the strategic industry issues is, therefore, the wrong question, and not just because governments are going to continue to act as if strategic industries exist.

It is the wrong question because it focuses on producers rather than users of the technology, where the real economic being lies. What do users of the technology, by which I mean producers of computer, telecommunications, or consumer electronics products, such as TVs, need from producers of the chips? They need timely access to the appropriate technology (and by "appropriate," I mean the right quality and functionality) at a reasonable cost.

We go through patterns, both because of the cycles in this industry of government intervention and patterns of private investment. We go through times in which it looks like there will be just a few dominant producers of a set of relevant technologies and, therefore, that some set of users somewhere in the world will not be guaranteed timely access to the appropriate technology at a reasonable cost.

So we counterbalance that with government policies and industry initiatives aimed at recreating some capacity within the location, in Europe behind protective walls, in the United States through the semiconductor trade agreement and investment in SEMATECH, in Asia these days through a variety of concerted government and business relationships. The aim is to keep everyone honest in the market, to ensure that your users of the technology have timely access at a reasonable cost.

That type of government intervention is going to continue. It will continue if only to support the ability of firms to do the types of cooperative deals that these panelists have been talking about. It is much easier to negotiate the benefits from those cooperative relationships from a position of strength with a government standing behind you than it is from a position of weakness.

Again, the danger, given the fact that we are going to have intervention, is that the pattern of intervention concentrates production in some part of the world to the detriment of users and producers in another part of the world. It is going to get much more expensive to recreate a capacity once lost in this industry. Therefore, the prudent position—and I think even Europe has taken it—is to maintain at least a modest ability on which you can continue to build and keep everyone else in the market honest over time.

Session 5

Foreign Direct Investment Restrictions: Consequences for Trade and Technology

Moderator:
Sylvia Ostry, University of Toronto

CHARLES WESSNER: It is my pleasure to introduce Sylvia Ostry. Dr. Ostry's work has originated some of the topics that we are considering in this conference. She would no doubt not want to take responsibility for every part of the program, but our project does owe her an intellectual debt.

SYLVIA OSTRY: First I want to say that the OECD work on investment is an important issue. One reason why investment has gone to the top of the agenda is because of the disappointing results in the Uruguay Round. The Uruguay Round introduced radical new issues. I say "radical" in a very fundamental sense: services, trade-related intellectual property, and trade-related investment.

They got two out of three. Investment really dropped off the table for a variety of complicated reasons, but while the Uruguay Round was going on in Geneva, the world was being transformed in the mid-1980s largely by the enormous wave of FDI [foreign direct investment]. There was a slowdown in 1991 and in 1992. We are now experiencing the beginning of a new wave, but it will not be as big as it was in the 1980s. The end result of the slowdown in the 1980s was that the degree of global interdependence became much tighter.

The Brookings project that I was involved in called this interdependence "deeper integration." This term essentially involves the far greater ubiquitousness of the multinational corporation. Since that transformation has taken place, and since the multinational enterprises are the main agents for trade, investment, and technology flows, the investment issues are now at the top of the post-Uruguay agenda. This issue is also associated with new definitions of market access that involve effective access by exports and effective presence by investment. This issue has pushed the policy template of deeper integration inside the border.

Deeper integration resembles the paradigm of the U.S.-Japanese structural impediments initiative. It involves trade flows, the interrelationship between trade and investment flows, technology flows, and it involves structural impediments.

Compared with the surge in the 1980s and the slowdown due to the recession, the new surge looks very different. For the first time in history the main outflows are into non-OECD countries, such as East Asia, particularly China. So if this is the beginning of a new phase of deeper integration, one could argue that any investment policy should involve the non-OECD countries.

On 24 May 1995 we received a major announcement that OECD ministers had requested that the negotiations begin immediately on a multilateral agreement on investments (MAI) and that they should be finished by 1997. As a former drafter of communiques, I consider the ambiguity in this announcement to be very well done. The words are very careful. The announcement describes "a freestanding international treaty open to all OECD members and the European Community and to accession by non-OECD-member countries, which will be consulted as the negotiations proceed." I do not understand what that means. It also states that ministers "should prepare for discussions on investment in the WTO, which it would be appropriate to envisage in the future and encourage the OECD to cooperate with the WTO to this end."

The OECD has played a major role on other issues. It did all the basic work on services. It did all the basic work on trips. It did all the work on agriculture, but it never did anything that was not done with full linkage with the GATT. This is a very different project. This is moving to rules and dispute settlement. But the OECD has never had rules. It has had voluntary codes.

It is significant that the growing resentment, which I have seen at meetings and heard of from the excluded countries, unfortunately threatens a new North-South dispute. And unless we take firmly into account the importance of the Uruguay Round, the friction will be very serious.

Thank you.

Investment, Trade, and Corporate Strategies

Bruce Duncombe, Department of State

I am here to make a few remarks on the relationship between trade and investment and to say a few additional words about the exercise that we have launched in the OECD.

We hear more and more today about market access and that the increasing emphasis on market access will push investment issues to the fore of future trade negotiations. This is particularly true of trade in services, in which delivery often depends on having a physical presence in the market where the services are sold. But the need for a presence in the market is also crucial for many manufactured goods in which design must be tailored to market requirements, in which service and reputation are important and in which a fast response is frequently key.

Thus, although foreign direct investment was once seen as a substitute for international trade, it is viewed increasingly as a complement to trade or even a necessary component of trade. In fact, foreign direct investment is growing much more rapidly than trade. Since the early 1980s, foreign direct investment has nearly quadrupled. Companies increasingly need an investment or presence abroad to increase their exports.

For example, U.S. subsidiaries abroad are the best customers for U.S. exports. Over one-fourth of the U.S. merchandise exports go to subsidiaries and affiliates of U.S. companies overseas. This means that exports to affiliates of U.S. companies overseas account for more than two million of the eight million U.S. jobs supported by our overall merchandise exports.

Removing foreign barriers to U.S. investment is thus a key element in promoting U.S. exports and enhancing the international competitiveness of U.S. companies and the U.S. economy. It is vitally important to ensure that U.S. companies investing abroad have access to markets—that is, the right of establishment—and are treated fairly and are otherwise able to compete on the same basis as other companies, both foreign-owned companies as well as domestic firms.

The agenda in which the United States is promoting this market access includes a bilateral investment treaty program in which the United States signed bilateral investment treaties with 35 countries. One of the important features of the U.S. prototype of the bilateral investment treaty is that U.S. companies do have the right to either national treatment or most favored nation treatment, whichever is more favorable, both in the establishment phase as well as the post-establishment phase.

This is very, very important from the point of view of market access as viewed by the United States, and it is one of the issues that we will be particularly concerned with in the multilateral agreement on investment in the OECD. Other countries generally do not have this as a cornerstone of their investment policy, in that they would have access to markets in the establishment phase. It provides a scope for screening, for example, foreign investments. It means that in some countries you would not necessarily have access to the initial sale of shares of stock in privatizations.

As we know, privatizations are taking place around the world. Within the OECD itself, another $200 billion or so of privatizations is envisaged probably by the turn of this century. So, market access is very important.

Dr. Ostry referred to the fact that we have had discussions with the Japanese. We have also had discussions with the Koreans that were aimed at the particular problems that American investors have encountered in a number of these countries.

The United States supported the services negotiations in the Uruguay Round and is particularly concerned, and is watching very closely our market access on financial services.

We are also very supportive of the initiative in the OECD that was launched at the OECD ministerial meeting last week. Dr. Ostry mentioned how the multilateral

agreement on investment refers to nonmembers, but let us look at the other part of what the ministers approved, that is, the structure of the investment agreement itself.

For the OECD initiative, the ministers provided for a multilateral agreement on investment that will provide a broad multilateral framework for international investment, with high standards for liberalization of investment regimes and investment protection and with effective dispute settlement procedures. We in the United States deem this as very important.

First of all, on the liberalization front, we will certainly be looking at the outcome of the GATT negotiations on services and then telecommunications. We will be looking to see, once those outcomes are determined, whether or not in the OECD context it might be possible to go beyond those sectoral liberalizations just as, for example, we expect in the OECD, and if it will be possible to go beyond the rather limited trade-related investment measures [TRIMS] results that we had in the Uruguay Round. We do believe that the OECD countries will be able to do better on TRIMS than they did in the Uruguay Round.

We will also be looking at liberalization in a more generic, nonsectoral sense by way of having rights to establishment rather than rights to most favored nation or national treatment only in the postestablishment phase. In the OECD context there are still some countries that have screening mechanisms and limit access of foreign investors to the initial sales of shares in privatizations. High on the MAI agenda for the United States will be significant accomplishments on the market access front.

We are also concerned about investment protection, and we will seek the free right of transfer of funds, absence of performance requirements, and expropriation that is taking place only for a public purpose in a nondiscriminatory manner, and on the payment of prompt, adequate, and effective compensation, as set out in the international law standards.

We are also looking at dispute settlement. The exact form of dispute settlement, both for investor-to-state and for state-to-state dispute settlement, will be worked out as the negotiations unfold, but we are concerned that investors will have the right to take governments to dispute settlement, and that, in some cases, governments will want to take other governments to dispute settlement.

For the investor-to-state dispute settlement mechanism, of the 25 OECD countries, 22 are members of ICSID [International Center for Settlement of Investment Disputes]. I would not be surprised that, if the parties to a dispute cannot agree to another forum as a default mechanism, the ICSID mechanism would be available under the multilateral agreement on investment as at least a forum that would be offered for binding international arbitration.

There are models in the NAFTA [North American Free Trade Agreement] and the WTO for how to handle government-to-government dispute settlement. Precisely what forums will be adopted for the multilateral agreement on investment will be worked out during the negotiations.

Now I would like to comment on one point that Dr. Ostry made and that is in

regard to the OECD as opposed to the WTO. Although it is true that in recent years there has been a lot of investment flowing to the Pacific Rim, it remains the case even today that approximately 80 percent of the foreign direct investment flows on an annual basis between OECD countries. There is an enormous amount of flow between OECD countries, often in the form of mergers and acquisitions as part of the overall corporate structures and strategy of the investors rather than in the form of greenfield investments. Greenfield investments are important, but mergers and acquisitions are certainly the dominant type of foreign direct investment flow today, and the lion's share of that remains between the OECD countries. So we believe that, in that sense alone, the OECD is a suitable forum in which these negotiations can be carried out.

We recognize, however, that nonmembers are interested in what is happening and are concerned. We have had consultations with nonmembers about the program of work that is taking place in the OECD. For example, there are five countries that are on membership track for the OECD (four countries in Central Europe and Korea). We have consulted all five of them.

The OECD has an established forum for dealing with the so-called dynamic nonmembers. These are basically countries on the Pacific Rim, plus Chile, Argentina, and Brazil. The dynamic nonmembers met recently in New Zealand with representatives from the OECD Secretariat and a number of the OECD countries as part of an ongoing dialog.

They were joined by India, China, and Indonesia, and there were consultations on the investment initiative in the OECD. We recognize that there are concerns on the part of some nonmembers about not being parties to the negotiations. We have an outreach program to hear their views and keep them informed as to the work that we are doing, but we believe that if a country is going to have a high standard agreement, it needs to be done with the OECD.

In APEC [Asian Pacific Economic Council], we did agree on some nonbinding investment principles. They are at a rather low standard. We are aiming for a high standard agreement. Just as nonmembers found added value over the postwar period to becoming members of the GATT and the International Monetary Fund (because they were not there at the time of the establishment and the setting up of the initial disciplines), we believe that nonmember countries will find it in their interest to accede to an investment agreement that is negotiated in the OECD.

Thank you.

Asymmetries in National Patterns of Foreign Direct Investment: Consequences for Trade and Technology Development

Simon Reich, University of Pittsburgh

Recent extensive empirical work by the Office of Technology Assessment has done much to add validity to the claim that there are at least two distinct

patterns of behavior among the world's leading multinational corporations in regard to how they link their trade and overseas investment policies. Traditional patterns of behavior have often meant policies that are designed to substitute foreign trade for foreign direct investment. The export of finished products has therefore been replaced by the formation of overseas affiliates and building of fully integrated overseas plants. The manufacturing process has subsequently been shipped abroad by firms—first, the final assembly process but eventually the entire process—as they seek to take advantage of lower overseas labor costs and avoid protectionist trade barriers. Economists, studying this pattern of corporate behavior, claim to have identified a routine pattern that they label "product cycle theory."

But the OTA's work supports the notion that a second, alternative corporate strategy exists. Instead of replacing domestic production with production at the manufacturing plants of their foreign affiliates, some multinational corporations focus their direct investment policy on efforts to increase domestic exports. This trade-promoting corporate strategy places a premium on intrafirm trade or, more broadly, trade within traditional parent-supplier networks as a conduit for increased exports. To achieve this goal, foreign direct investment focuses on the development of wholesale and manufacturing assembly facilities rather than fully integrated plants.

The optimal goal of such an investment strategy is to increase domestic exports, not to substitute domestic production for foreign production. Minimally, although the overall volume of exports might nevertheless fall as a result of overseas investment, it will not fall as precipitously as would normally be expected. Crucially, the high-value-added end of the production process will be retained at home. This "trade-promoting" approach to investment by corporations challenges the traditional foreign direct investment pattern of behavior because it is designed to sustain the firm's domestic manufacturing base and shift as little of the production process offshore as possible.

Evidence suggests that such a pattern of "trade-promoting" behavior by multinational corporations is systematic, widespread, and, where appropriate, effective in sustaining a vibrant domestic manufacturing base while increasing foreign sales. The capacity to pursue this strategy is, however, curtailed by three factors: the limits of host government regulation, the exogenous effects of macroeconomic forces, and requisites of sectoral constraints. Nevertheless, a major bifurcation in the preferred patterns of direct investment behavior among the world's leading firms is readily evident.

The preference in behavior appears strongly correlated with the country of origin of the foreign direct investor. Japanese firms appear to be the leading exponents of this alternative, trade-promoting strategy, as measured by the concentration of their investments and consistently high levels of IFT [intrafirm trade]. This observation is evident in data concerning both their global patterns of investment as well as their investments within the United States, where they

enjoy sustained free market access within a market characterized by minimally intrusive regulations. Other new investments by some German and Korean firms show preliminary evidence that they are engaging in similar patterns of behavior.

The capacity of these firms to invest in ways that maximize exports to the United States is, in part, a product of the American policy of national treatment that minimizes government regulation in the hope of maximizing the volume and gains of foreign direct investment. This approach seems to be justified, in view of the record aggregate growth in foreign investment in the last 15 years.

Anglo-American firms have often encountered a different pattern of regulation when investing abroad. They have often been forced by host governments to invest in fully integrated production facilities and in exchange market access for patents and have often been denied any investment access at all. Recent evidence suggests, for example, that a series of "structural barriers" continue to deny U.S. firms the type of access to the Japanese market that their Japanese partners enjoy in the United States. Indeed, the denial of such access has become so routine that some U.S. government and corporate officials have concurred confidentially that it may be better to avoid entering such markets at all and to move on to other less-regulated or "structurally impeded" investment markets. This approach has become an implicit part of U.S. government policy, with the decision to focus on "emergent markets" for both trade and investment, and to turn away from some mature markets.

I argue that such an approach bears a heavy cost. The consequences of this unreciprocated access and the "avoidance strategy" it has spawned are important for at least three reasons. These apply directly, although not exclusively, to Japan, traditionally the most elusive market among OECD members for U.S. investment.

If the analysis suggesting that foreign direct investment has taken on increased importance in enhancing the significance of intrafirm trade is indeed correct, then the persistent inability of U.S. firms to invest in Japan naturally curtails the capacity of U.S. firms to export to Japan. With the majority of U.S.-Japanese trade accounted for by intrafirm trade, and with and overwhelming proportion of that trade being among and within Japanese firms, the inability of U.S. firms to invest in Japan and thus sell goods there has major implications for the recent, present, and future size of the bilateral trade deficit. It may indeed go a long way toward explaining the durability of the trade deficit in the face of significant currency fluctuation.

Furthermore, constraints on the ability of foreign firms to invest in another country affords that country a sanctuary home market. Although competition between domestic firms may exist, the collective effect is the creation of a sanctuary market, and in some cases, this generates cartelistic arrangements. Here, artificial profits are often generated as domestic consumers are forced to pay artificially high prices. This is undoubtedly the case in many sectors in Japan, where a variety of goods—from agricultural to consumer products—cost more

than identical goods sold overseas by those same Japanese firms. Thus, the inability to invest thwarts competition and awards domestic firms artificial profits to subsidize exports.

Finally, preliminary evidence suggests that these same artificial profits serve domestic firms in a new, irreplaceable manner. As the cost of successive rounds of development of new high technology grows at exponential rates, firms are increasingly pressed as to how to finance successfully the research, development, engineering, marketing, and distribution of innovative products. Even the largest computer companies, for example, have had to enter into strategic alliances so as to raise the necessary capital to develop the next round of semiconductor chips. Sanctuary markets therefore provide firms with artificial profits that prove to be an effective source of capital in financing these efforts.

The policy implications of this issue are not without major significance. Faced with this problem in the case of Japan, administration officials have tended to pursue economic possibilities in large, untapped potential markets such as China, Brazil, Southeast Asia, and Eastern Europe. The potential flaw in this approach is that U.S. firms often face competition in these third markets from the very firms that benefit from the privileges of sanctuary markets. Because Japanese firms are armed with artificial profits that subsidize sales and finance new technology development, U.S. firms face the short- and long-term prospect of being outcompeted in their efforts to attract new customers.

Second, the investment-access problem may not be confined to Japan. It may prove to be a growing problem, even in the age of apparently growing liberalization, globalization, and deregulation. A variety of regional requisites and agreements, nontariff (e.g., technical) barriers, and the consolidation of private sector access barriers have compounded a tendency by some countries to use Japan's traditional public sector regulatory behavior as a model for development. Although this tendency has been most avidly discussed in the behavior of newly industrializing economies, recent evidence points to the use of discriminatory trade barriers in the Vizegrad countries of Eastern Europe against U.S. products, as well as the denial of trade and investment access in select cases in other OECD countries—such as Westinghouse's recent experience in Germany.

Finally, it appears increasingly likely that such issues as the linkages between trade, investment, and high technology will have to be managed in the context of multilateral, regional, and bilateral cooperative frameworks if policy friction is to be avoided. Anecdotal evidence suggests that the onus is increasingly on those critics of negotiated agreements to justify their claim that a laissez-faire approach yields an optimal outcome for all parties. Left alone, the international economic system appears under too much stress to hope for satisfactory, nonnegotiated outcomes.

In sum, foreign direct investment access appears to be the key to the realization of global and regional liberalization, to mutually beneficial and balanced trade, and to the capacity to fund the next generation of technological develop-

ment. In turn, the failure to secure satisfactory access among the home of the world's largest multinational corporations does not augur well for global free trade, for the future competitiveness of America's largest and most prosperous firms, or for the vitality of the U.S. economy.

Thank you.

Sanctuary Markets and the Development of New Industries

Michael Gadbaw, General Electric

I am going to talk about General Electric, the role of technology and technology policy, the impact of the global framework of trade and investment, and, finally, I will make an observation about the role of multinational corporations in shaping the global environment.

First of all, GE prides itself on being a technology-based company, whether it is aircraft engines, engineered plastics, or advanced imaging equipment, built around technological discoveries, or whether it is in our more traditional lines of business, such as advanced turbines for power generation, energy-efficient lighting products, or locomotives and other transportation equipment. The harnessing of technology is key to our competitiveness and essential to our globalization strategy.

This means that we have very strong views about the role of governments in promoting technology, and, at the same time, we are very realistic about the environment in which we must operate. Our basic strategy has been to build strong technology-based partnerships that enable us to penetrate markets and harness the capabilities of local partners. To cite a few examples, in aircraft engines we have what I believe is the most successful joint venture in the world with a French company, SNECMA, which is now the second largest manufacturer of aircraft engines in the world. And, in power generation, technology-sharing arrangements allow us to capture a large share of the global power generation equipment base.

Part of my responsibilities are to spend my life traveling around the world, counseling GE businesses on the relevance of the global framework for trade and investment—relevance, that is, to our business problems as we encounter them, particularly in emerging markets.

There is a consensus globally as never before about the direction in which the system should go and the policy orientation that individual countries must choose. This orientation, more than anything, is driving the globalization strategies of companies such as General Electric. In Russia we struggle with the absence of basic legal and tax regimes. We are in China and India because we see these countries as the megamarkets of the next century, based on policies that are essentially liberal and market oriented.

The departures from this free market model are blatant. In emerging markets it is amazing how local content requirements and nontariff barriers make a mock-

ery of newly negotiated trade concessions, with forced technology transfer arrangements accepted as the order of business.

In developed markets, restricted procurement regimes, anticompetitive market structures, and laws and business practices that do nothing to combat the institutionalization of corruption in global markets are prevalent as we look at the international system.

What is interesting is the extent to which these departures from the ideal policies that we would all embrace are justified implicitly or explicitly by the desire to capture some technological edge. In emerging markets, it is the desire to capture a piece of the technology pie. In developed markets, it is to capture some monopoly rents to feed the insatiable appetite for funds to develop new technologies.

This leads me to an observation that is a response to the question, "So what?" More than at any time in history, multinationals play a critical role in shaping the policies of the new global marketplace. Multinationals are the beneficiaries of both the liberalization initiatives and most of the remaining restrictions.

We are entering a period in which you cannot have it both ways. The world is too small. There will be less and less tolerance for inconsistent policies. Failure to get ahead of the liberalization process will come to haunt companies more quickly than ever before, increasing the risk that a company or a policy will choose the self-serving, short-term choice.

This is true whether the multinational is a U.S. company, a German company, a Japanese company, or a Singapore, Malaysian, or Indonesian multinational.

Thank you.

DISCUSSION

SYLVIA OSTRY: We heard one message here that there are different systems, and the need to invest and the linkage with trade and technology means that domestic impediments, including corruption, bribery, lack of law, lack of transparency, are affecting the freedom of the multinationals. Is that your message? There are system differences, and deeper integration means that there is a latent pressure for harmonization of regimes?

TAKASHI CHIBA: I believe that international investment is one of the very effective means of rectifying the trade imbalance among the nations. Mr. Duncombe mentioned that national treatment must be guaranteed for international investors. In this respect, I am concerned that in the United States, Congress and government officials are arguing that the so-called conditional national treatment must be applied to the investors.

BRUCE DUNCOMBE: It is true that recent Congresses have enacted legislation that has conditional national treatment provisions. The record also shows that

there were many bills that were introduced into the previous Congress that also contained these provisions but were not enacted into law. We recognize that there is a concern on this matter. However, the record shows that, where there are conditional national treatment provisions as part of the legislation, foreign firms have had access to these programs, and I am aware of only one case in which a foreign firm was denied access to a program. I believe what we are talking about is a small blemish on an investment climate that is really very hospitable to foreign investment.

SIMON REICH: In regard to Dr. Ostry's comment suggesting that there was a latent process of convergence, I suggest that we qualify that because, despite the exogenous economic factors that should be pushing us toward convergence, if you actually examine the contrasting behavior of different firms, it is by no means clear that the convergence is toward an Anglo-American variant. In examining the behavior of new entrants into the American market in the case of German firms, for example, it does not appear at all clear that there is convergence toward this Anglo-American variant.

SYLVIA OSTRY: Let me correct that. I did not mean to say that there is convergence. I said that there are pressures that create system friction.

CHARLES WESSNER: I have a question for Michael Gadbaw. First, why do you think we can get an agreement on investment? How could we enforce it? Would you also comment on Professor Reich's last point that the models that we discussed today that seemed to work most effectively are the East Asian models? There were also a lot of compliments concerning effectiveness of the European model, in semiconductors, for example, which is one that has high performance requirements, is slow to accept acquisitions, and encourages greenfield investments.

MICHAEL GADBAW: First of all, I am not optimistic in the short run about the prospects for negotiating an investment treaty. An investment treaty at the multilateral level is less likely to lead policy than to follow policy. What can make one optimistic is what is happening at the national level within countries, what is driving them toward liberalization of trade and investment.

I am acutely aware of the problems alluded to in even the German market. Here is a country that is at the forefront, or should be at the forefront, of both regional and multilateral liberalization, and, yet, it is way behind many European countries in implementing the European Community laws, particularly with respect to procurement practices.

However, I am optimistic that those companies that are the biggest beneficiaries of that regime are also very cognizant of the impact that this will have on their ability to penetrate the U.S. market and to work with U.S. companies in

penetrating global markets. As that awareness becomes more and more acute, these companies will influence their country's policy toward greater openness.

The fact that German utilities are now taking some of the money they made in the power generation sector and are putting it into telecommunications is a further sign that they will realize that you cannot have it both ways. You cannot play in a global game and have an exclusive national game at the same time.

It is difficult to generalize about the Asian model. Because companies pursue different parts of a strategy depending on the business and the product line, it is difficult to characterize an entire company as embracing one or another strategy.

But my conviction is that, as the world becomes smaller as a result of this liberalization process, we are at the dawn of an era in which the prominent model will be rationalizing on a global basis, wherein it is no longer possible for a company to go into even a protected market and think that that protection is going to be secure.

I see this constantly in GE businesses. GE accepts a partner based on the notion that a certain regime or environment will survive. Within three or four years, that environment is changed. That commercial relationship does not work because the problem it was designed to solve, the barrier it was designed to get over, no longer exists and GE is stuck with a commercial relationship that does not work because it is not realizing real commercial value.

As companies realize the implications of this, they will move to force the process. In Europe, this happened with the Single Market Agreement. Companies came forward and said we have to accelerate the integration process. In Asia, as the Koreas of the world reach out to try to change their policies, there is more pressure toward a convergence. Yes, there will be different approaches. There will be a lot of bumps along the way, but it is not a question of whether; it is really a question of when.

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Close of the First Day's Proceedings

Second Day's Welcome

Charles Wessner, National Research Council

It is my pleasure to welcome you to the second day of our conference on Sources of International Friction and Cooperation in High Technology Development and Trade. Permit me to make one small observation. The topics that you are working on today are of great importance to the future of this country and to the continued success of the multilateral trading system which has contributed so much to global growth. As was noted repeatedly, these topics are of great interest to the Clinton administration; they are also of great interest to the majority party. We have had extensive consultations on the science committee in the House as well as in the Senate. Indeed, both Senator Bob Dole and House Speaker Newt Gingrich have personally expressed their interest in the subject of this conference and our deliberations. This bipartisan interest underscores the policy relevance of today's discussions.

So, to return to today's agenda, let's welcome William Colglazier, the executive officer of the National Academy of Sciences.

Introduction

E. William Colglazier, Executive Officer,
National Research Council

It is my pleasure this morning to introduce Daniel Goldin, who has been the administrator of NASA since April 1992.

We all recognize that he has truly been an agent of change in bringing revitalization and reform to NASA, especially during this period of budget stringency. Mr. Goldin has promoted significant new collaborations between the United States and Russia in space, particularly on the international space station. Before he joined NASA, he was vice president and general manager of TRW Space and Technology Group. He has vast experience in international cooperation and an exceptional grasp of the challenges and potential of new technologies. It is a great pleasure to have him address the conference this morning.

Opening Address

The Honorable Daniel Goldin, Administrator, NASA

Good morning. I had a speech all prepared, but I changed it this morning because I thought about an experience I had recently and I want to share it with you.

For the first time since I have been in Washington, my parents came to visit me during this past Memorial Day weekend. On Saturday morning I took my mother on an errand to Old Town, Virginia, to buy some bagels.

So we drove into Old Town, and we went to Chesapeake Bagel where there was a line of 25 people waiting to buy bagels. My mother notices that there are garlic bagels and blueberry bagels and salt bagels. She, however, just wanted to buy a bagel.

There was a grandfather in front of us in line with his two grandchildren of about 10 and 12. So while waiting in line, my mother engaged these two kids in conversation and found out all about their lives—she has a way of doing that. When it was their turn to order, one of the kids stepped up to the counter and said, "I will have a salt bagel, split in the middle, put some butter on it, give me bacon on the side." My mother was dying, because the only way to eat a bagel is plain with cream cheese and maybe a little smoked salmon.

When we got back in the car with the bagels, my mother had tears in her eyes. When I asked her what was wrong, she said, "I can't handle the change in the world. Ethnicity is disappearing. It is moving so fast, and we don't have history, we have boutiques. Where are we going? I feel so lost."

We then had a long discussion about how wonderful things are now, and I reminded her that when I was a child and we went swimming, they would not allow us in swimming pools for fear of polio. But through technology, we had the Salk vaccine and the Sabin vaccine.

It became clear to me at that point that my mother was reflecting the frustration of people not just in America but in the world, that things are moving at an unbelievable pace.

And she is right; everything is changing. The Cold War has ended and there are international realignments. National priorities are changing.

The focus just ten years ago was on defeating the evil empire, and now people are worried about building bridges and tunnels in Shanghai; in Japan they are worried about how they can win the digital revolution. They have already beat the United States in the analog revolution.

We now have the emergence of the Pacific Rim. For some people, it is scary. For other people, it represents opportunity. The former Soviet states—specifically the Ukraine, are moving at the speed of light. They are really changing fast. But in the United States we are focusing on what to do about this deficit that we built up during the Cold War.

On top of this, we are going from a manufacturing to an information-based society overnight. Just a few years ago only 3 percent of Americans earned their living in information-based technologies. In 20 or 30 years from now it will be 50 percent.

The sophistication and the information content in goods is skyrocketing. In 1984, 80 percent of the computer market was in hardware, 20 percent was in software. In 1990, the respective percentages were 20/80. Today, 10 percent of the market is in hardware and 90 percent is information, R&D, and services that go with that computer. But the really interesting point is that opportunity still exists. Only 50 percent of the people in the world have telephones.

The globalization of the marketplace is another change. You could have inflation and recession, you could put off the future, you could sell, and then you could come back. But you could sell to the same market and you would be protected. But now, because of the internalization in the marketplace, you cannot put off the future. If you do not keep up, you are wiped out. We cannot get away with cutting back on investments in the future anymore.

Budget pressures are driving dramatic changes in industry and government. Industry faced this first. The investment community demanded shareholder value.

Now if I had asked my mother in 1950 what shareholder value meant, she would have told me, "I would be able to clip coupons for the next 20 years from AT&T." But if you read *The Washington Post* or *The New York Times* business section today, you will find that some corporation got a new CEO because last year's stock price did not go up, even though the CEO was trying to position the company for the future. So stockholders were demanding his head.

Who is accountable for the future? Today, shareholder value means where the stock is at today. And if it is low, then the CEO has three months to fix the company. No one wants to hear about the future value of the corporation. The top players are shifting their research goals for fast payoffs. Who is accountable? Who is accountable in America or any other country for the next genera-

tion? Wall Street is driving us because this is what the investment community is demanding.

So the corporations have to pay down this enormous debt that they have from the pac-man activities in the 1980s when they all bought each other out. They also are facing the reality that in this era of global competition, they can no longer pad the books and keep people on. They have to keep up their productivity, and the productivity has to match the expectations of the marketplace.

The corporations are not just cutting back on corporate R&D, they are cutting back on the percentage of corporate R&D that goes for long-term basic research. We juxtapose that with this passion in America to pay down the debt, which we must do. In order to win the Cold War, we built up a $5 trillion debt. We have got to pay it down.

We are so unidimensionally focused in America on paying down that debt. This is not just in America. Go to Russia. Over the weekend I met with some friends who are familiar with Russia. They were telling me that R&D in Russia is being decimated.

The issue here is, in a society with all these things going on, you cannot be unidimensional. You cannot talk about the children and then cut the budget. To me, this is the issue that we have got to deal with nationally and internationally.

Now, what is the output? There is an unbelievable displacement of people around the world who have lost their jobs as a result of improving productivity. Jobs are being shifted. Education is a mess. And again, I am focusing here on America, but these same problems exist all over the world.

There is anger. There is uncertainty. There is a call for change. There is a lot of frustration in America. In my view, the major reason for the frustration is that productivity has not been keeping pace with the expectation on the standard of living.

Consider the expectation for the standard of living in the developing nations. Half of the people in the world do not have telephones. Think about how critical phones and high-speed digital communications systems are, and think of what it means to be in the part of the world without it.

So here in America we have built up this anger and frustration. We have an incredible R&D machine and we are now on the verge of destroying it, not out of maliciousness, but out of this desire to solve our budget problem. As we engage in a national debate, the rest of the world is watching.

What is going to happen to the expectations of a world whose population will double in the next 40 years, a world that has expectations for a higher quality of life, if everybody walks away from R&D and technology for the next ten years until things are straightened out?

To me this is the heart and soul of the issue that the R&D community had better deal with. I have never heard such silence in my life. I do not see any passion in the R&D community. R&D investment basically serves as a pool for investments. It is like aquifers. It takes tens of thousands of years for an aquifer

to fill up with water, but we can drain it in only a few decades. We cannot all sit silently by and satisfy the desire for shareholder value for today. It will be a disaster for the competitiveness of America and our citizens' expectations.

So what are we going to do? Clearly, a first step is to increase productivity.

America is 19 in the world in the rate of growth in our R&D account. Other countries are growing at 5 or 6 percent. The United States is going negative at 2 percent. This is a recipe for absolute disaster.

What about the downsizing of corporate America? It is now clear that the U.S. government has to do something. There is this enormous pressure to downsize and restructure the federal government, and I agree with it. The President agrees with it. You can eliminate tasks, but you cannot eliminate people.

Those U.S. corporations that have been successful in restructuring have completely disrupted their corporations. For example, as Ford Motor Company started downsizing, they found an increase in defective products.

If we in the government and in this administration do not work with Congress and if we move too fast, we will do dumb things. It takes time, focus, and energy. But the R&D community has been silent.

Academia in America is in even worse shape because the cost of an education at a private university is far outstripping the inflation rate. I believe that there is a real need for improved productivity in American universities or they will price themselves out of existence. For 1994, approximately half of the Ph.D.'s awarded in physical sciences were to noncitizens of the United States. They are filling the seats, but is that accomplishing any of the goals for higher education?

We have got to get R&D more productive. At NASA we cut our budget by 36 percent. We took billions out. We downsized from 215,000 people to roughly 160,000 people.

The number of government employees will go from 25,000 to about 17,000, and we are about a third of the way there already. The amazing thing is, at NASA we have started 21 new programs and we are getting higher output. So our productivity is going up by leaps and bounds. And yet, three years ago, we were saying that we did not know how to cut.

We now recognize we can do it, but we are planning to make the cuts over a five-year period. You cannot do it in one or two years. No corporation could downsize that drastically in one or two years without losing key capability. Government must downsize; the R&D community and universities must do it. This is the challenge for Congress and the administration to work on. You cannot tell people to do things. You have got to help them understand on both sides. And you have got to get out ahead of the power curve and not wait or hold off.

Government interests need partnerships. Because of the financial necessities, U.S. industry is doing 3- and 5-year investments, not the 10- to 20-year investments. The government looks to 10- and 20-year basic research. But with-

out that basic research, you will not have the products by the year 2015. Other countries are doing a great job.

The U.S. needs a clear national vision. A decade or two ago, the Europeans said that they were going to own 50 percent of the long-haul jet transport market. America laughed. In the Airbus factories there are pictures of cartoons of the Airbus 320 eating up the American aircraft industry. This is the image in the heads of the people in Toulouse.

It is dog-eat-dog global competition, and America is giving away marketshare. Now you may have to give away some marketshare, but you also have to compete. You have to have the best technology, the best financing, and the best management. That is how you hold world leadership.

An example: Boeing just put its 777 into operation. Fifteen years ago, in the late 1970s, NASA did basic research on jet engines. We had no idea that the 777 was going to come out. But we did fundamental research on engines and for efficiencies, noise, and durability. The GE-90 engine is loaded with that technology. What if no one had come up with a plan to do this research?

Yet, to cut the budget, there have been numerous people on both sides that have said that we should cancel the aeronautics program in this country. We started this program back in 1917. Cancelling it is unacceptable.

We need a national commitment to R&D investments. President Clinton has proposed 3 percent of gross domestic product. I would say that that is the minimum necessary. The 3 percent is a combination of government and industry. America better start the dialogue today. You cannot put off the future.

Some countries in the world are committed to major R&D efforts; others are not. Unless we face this challenge, the future will be very bleak. The clash between expectations for increasing standards of living and the ability to produce will become a major problem. This is not just a national issue. This is an international issue because when the expectations do not get met and people get frustrated and angry, the weapons business booms again.

I am for a strong America. But a strong America has to be a competitive America; it has to be economically competitive and superior technically before we can have productive international cooperation.

At NASA, the programs under way are doing unbelievable things. An example: In the early 1970s, NASA developed some ultraviolet astrophysical platforms. The astrophysicists looked out at the cosmos and found absorption lines. They looked at the stars and saw these funny carbon molecules and were puzzled.

Then in the mid-1980s, at the University of Arizona, they had a process fluke. They had an op jet running with a laser, and they produced these strange carbon atoms in small quantities. Later, in 1990 in Germany, they were doing some experiments with benzines. They found these funny things called bucky balls, the carbon-60. It has a lot of interstitial nodes so that if you put teflon in it, you can have designer lubricants, if you can make it in quantity.

It is a semiconductor. It is wideband gap. It is like gallium arsenide. But it

is not expensive like gallium arsenide. It looks more like amorphous silicon. You can make it by the roll. It has a very high molecular weight, and they are making incredible plasma engines for space propulsion. There is a problem with the convection currents on the ground that could possibly prevent us from controlling the process dynamic. So now MIT is looking at zero gravity and space. Which brings us around to the space station. I knew I would get you here.

One of the possibilities is in the zero gravity of space you do not have convection. You can do controlled combustion experiments to understand the physics of it on the ground. The possibilities for society are enormous. You could make an entire wall of a house as a semiconductor. It is the ultimate in flat pounds of space. You can roll it out and roll it up. You could build a house out of it, and because it appears not to degrade with radiation, you could generate electricity.

Why do we look at the cosmos? Because we have to be intellectually stimulated. You never know where basic research is going to lead, and sometimes these discoveries take decades.

Now that we have finally figured out what a fullerine is and what it might be, it might take another decade to even get to the point where it can be produced.

My point is, you cannot give away the future because you are so worried about what is going on in the present. We have got to be assured and confident not cut the budget, throw away the future, and define shareholder values as the stockmarket value at this minute. And you do not go after the federal budget.

I believe that everyone is very well meaning in this debate. I do not criticize the politicians. I criticize the R&D community. We are the enemy because we understand, and we are so busy protecting what we have got that we are not taking the time to explain it to America or to the countries that we live in. Stop being so silent and speak out.

Thank you.

SYLVIA OSTRY: This climate that you discussed, both in government and R&D applications, is absolutely true. The implications are quite frightening for the longer term. What do you see as possibilities for intergovernmental cooperation? Do you see an opportunity for an international cooperation that would help governments pool some of their resources?

DANIEL GOLDIN: That is a very insightful question. We have an expression at NASA, "cooperation, not just competition." And I put "not just" in the middle, because each nation has to decide what is fundamental to its survival, its enrichment, and its set of priorities.

These are the things that we must do for national defense, and that is sacred. These are the things that we must do. In Europe they said, "we must beat the pants off the United States and take away 50 percent of the market share in the long-haul jet transports."

That was a national and regional decision, and that is good and that is accept-

able and that is fine. In the United States we said, "we are going to be leaders in the world and launch; this is in our domain." We will have international participation, perhaps not at the prime level, but certainly at the subtier level.

In basic research we could do the same thing. If you could sort out where your priorities are and know where you are going, I think there are tremendous possibilities. I believe the international space station is a litmus test. If we cannot succeed with the international space station, then we will set international cooperation back into the dark ages.

It may not be everybody's favorite choice. But the R&D community and the international scientific community had better learn how to love the space station. Its failure would devastate the spirit of international collaboration, which is essential to the future, and leave an environment of mistrust.

Also, international commitment is very important for another critical aspect. We need, together in the world, to understand the impact of the human species and natural forces on our environment, because we need to put into effect international rules on the environment, not based on passion, but based on scientific fact. If just the developing countries do this, or one country does it by itself, then mistrust could develop about what their data means. They might feel that collaboration or commitment was not to provide a sustainable environment, but for economic leverage.

International commitment is crucial for the aircraft industry. When we talk about the 50 percent marketshare for Europe for the Airbus, there are American companies working for Airbus. We would like to have the American companies prime. We need to have international collaboration in aeronautics.

Now, these activities will be market-driven. But I want to tell you, if we start pulling in our tents and we do not do basic research where it is in our national interest to do it, then it will be a disaster. No one has the resources to do all the research alone.

The infrastructure costs will be monumental. Not everyone can build a super collider. Not everyone can build launch facilities. And not everyone can build wind tunnels. Simply put, you have to decide where you want to collaborate and where you are going to compete.

PARTICIPANT: In the great competition for funding in Congress, how do you think the scientific community as a whole should approach lobbying on the Hill this year and in the coming years? You seem to be saying that the community needs to take a different approach in its lobbying to get the funding that they need. How should that approach change? What is the approach now? How has it been effective and ineffective, and how should it change in the next few months and years?

DANIEL GOLDIN: In America the R&D community should stop the scientific cannibalism. People think that canceling the space station will make wonderful

science for other areas. But remember, that did not happen with the super conductor and the super collider.

First, the scientific community should lose its self-interest. As I have said, we are at a crisis point. We are cutting back our long-term R&D investments. The members of Congress are not at fault, the American public is not at fault. The scientific community has not taken the time to explain its importance to the American people.

Let me will give you an example. At a recent meeting of the AAAS [American Association for the Advancement of Science], the main message of my speech was that the American scientific community needed to communicate with America. They are not communicating. They are too busy. Why is it so hard for the scientific and technical community to understand that their customer is the American public and not the U.S. government? The American public does not understand the correlation between astrophysics and mammography. They do not understand the need to spend $40 billion a year on federally funded research.

I do not think it is an issue of lobbying. The issue should be what is in the national interest. The scientific community also has to be more productive in their research.

PARTICIPANT: NASA had a TV show, "NASA Selects," that I thought went a long way in helping the American people understand and get excited about space and space exploration. But it was canceled. Isn't this the type of program that could reach out to excite the American people?

DANIEL GOLDIN: The government should not be in the business of promoting itself so that it can get funding. I feel very strongly about that. We can educate, but we should not promote. "NASA Select" is no longer. We have "NASA TV," and it is becoming much more focused on providing educational materials. But there is a very narrow line.

However, those in the research community are spending inadequate time in communicating with children. Everyone is too busy with their focused research that they are not taking the time to communicate with children. People are so focused on their work that they have lost sight of what we are trying to accomplish as a nation.

There is no wonder that our kids are 13th in math and science. We will lose the digital revolution. There is a $1 billion market in long-haul jet transports. There is a quarter of a trillion dollars in the high speed civil transport market. There is a robotics market. We have lost the stationary robotic wars. Now the field robotic wars are starting. It is all up to us.

PARTICIPANT: With respect to international cooperation on basic research but with the Airbus case in mind, would you comment on whether or not NASA would be willing to allow Aerospatiale to participate in the X33 and X34 programs?

DANIEL GOLDIN: My gut reaction is no. But I really do not know for sure. Aerospatiale and Airiane want to wipe out the U.S. launch market. We should call it what it is. What do we want? We want to win that marketshare back.

We have to talk straight. There is nothing wrong with competition. But we could certainly work together on the space station. Maybe we could choose to compete on launch vehicles. But we cannot be squeamish about competition.

Competition is wonderful. It builds moral integrity and strength. And it is okay for us to want to beat the Europeans with a new revolutionary launch vehicle instead of having a 5 percent improvement. But I am not sure that Aerospatiale should be involved.

PARTICIPANT: Within the environment of advocacy, how do you make successful decisions about which R&D is the most productive for the long term, and how is NASA participating in that process?

DANIEL GOLDIN: We have to be very careful here. If you are talking about scientifically productive, NASA is qualified to do it. If you are talking about economically productive, NASA has to be told what to do.

We will do fundamental things. We will do ultraviolet scanning of the heavens to understand the matter between the stars and Earth. When we develop a process defect and come up with a fullerine, we will work hard to see how to make fullerines.

But under no condition is NASA going to develop products and get them to industry so that we can get more money from the government. Basic research is essential. I contend that we do not have enough peer review inside NASA. Many of the NASA scientists do not have to compete. They do not feel the heat of competition; this is not good.

At NASA we are starting to transition NASA science into an institute where we have a partnership with industry and academia, and get them on the board of trustees of this particular outfit.

At NASA we are making unilateral decisions about how to balance our budgets between human space flight and robotic space flight and aeronautics technology. It would be nice to get some objective holistic input.

It cannot be done overnight. The problem we have in America is that everyone wants the quick fix. And if you get the quick fix, it is a disaster. Therefore, we have designed our budget to ensure some stability.

Session 6

Dual-Use Technologies and National Security

Moderator:
W. Clark McFadden, Dewey Ballantine

CHARLES WESSNER: I would like to first introduce the moderator for this session, Clark McFadden, who is one of the leading authorities on U.S. technology policy. He works with the well-known law firm of Dewey Ballantine and serves many of the leading high-technology companies. He has also worked very closely with SEMATECH over the years, and has been instrumental in developing a number of creative solutions to partnerships between the U.S. government and private industry.

CLARK MC FADDEN: As we continue the examination of friction and opportunities for international cooperation in technology development, I will focus this morning on dual-use technology, which is a curious and often elusive term. Inherently, all technologies tend to be susceptible to more than one application. The dual-use distinction is reserved for technology that has a significant government application and a private sector application, especially as the government application pertains to national security. Technology has become a more pervasive differentiator of military performance. Governments must compete in developing and securing technological advantage for national defense.

The Clinton administration has made a significant change in technology policy. Historically, the U.S. Defense Department [DoD] has had the latitude and resources to enlist industry to respond to its technology needs. It could regularly dismiss the commercial effects of its actions, impose unilateral terms and conditions on R&D activities, and rely largely on a defense-unique industrial base. All of this has begun to change under the new dual-use technology policy. The DoD will take greater account of commercial considerations, enter into more flexible contractual arrangements such as partnerships and place greater reliance on a

commercial, as opposed to a defense, industrial and technological base. In short, the Defense Department will become more attuned to and hence more involved in the commercial considerations surrounding technology development.

This emphasis on dual-use technology could have a profound effect on research and development in the United States. Although the dual-use policy has been evolutionary and responds to the circumstances of a post-Cold War environment, it has still provoked controversy, skepticism, and questions such as:

- Can the dual-use policy be effective in meeting military needs?
- Does the DoD have the skill and muscle to pull it off?
- Can the DoD develop a consensus that will sustain it for the long term?

The ramifications of the dual-use policy will be felt by U.S. trade partners as well as the U.S. industrial base which responds to DoD needs.

The Japanese reaction is worth special attention. The Japanese government has its own approach to technology development. Japan is also in a position to be most affected by the U.S. dual-use policy both for opportunities to cooperate in the implementation of the policy and to feel the commercial impact of the policy.

Finally, the U.S. industrial base will surely be affected. Is it efficient for government to engage in this kind of activity—attending to the commercial dimensions of technology policy—or could industry better adjust by responding to the DoD as a customer with changing requirements?

We have on the panel today Paul Kaminski, the Undersecretary of Defense, who has been a major architect and proponent of the dual-use technology that the DoD has begun to implement.

We also have, from the House National Security Committee, Bill Andahazy, who has been grappling with technology issues in the national security area and dual-use policy.

Next we have a well-known expert on Japanese technology policy, MIT's Professor Richard Samuels, who can give us some insight on the foreign international reaction to dual-use technology policy.

And our final panelist is Jacques Gansler, a prolific writer, commentator, and activist in the area of defense base and military conversion.

A New Model for Defense Acquisition

Paul Kaminski, Department of Defense

Today I will share with you some of my views about where the DoD is headed in dual-use technologies and international cooperation and some of my thoughts about a new model for defense acquisition.

Currently, the DoD's technology strategy is shaped by three dramatic changes that are occurring in the national security environment. The first change has to do with the post-Cold War needs transition, or why we need weapons systems. Al-

though the United States will be operating much more in an allied and coalition environment, we will need to retain or maintain a leadership position. I will talk about this some more as a principal motivation for our international cooperative efforts.

In the environment that we are operating in today, I will describe the types of threats we face in terms of first- and second-order statistics. The first-order statistic, the mean level of the single greatest threat that we are facing today is, of course, down considerably relative to what it had been during the Cold War.

But the irony in the situation is that the second-order statistic, the variance, is not down. In fact, it is up. It is a more difficult environment in which we need to develop coherent plans for the medium- and long-term future. And this is a key underlying change that I will come back to in a minute.

The second change that we are dealing with is how America fights, and that affects what weapons systems we will buy in the future. This change is captured in the thoughts associated with studies of the "revolution in military affairs."

This revolution is driven by a number of factors, but a principal factor is the decision to ensure that a wide range of new technologies are available to improve our battlefield situation awareness and to shorten our battlefield action cycle time, the time it takes the U.S. and allied commanders to bring effective force to bear on an objective.

The third change that we are dealing with is a change in the way America develops and fields its weapons systems. This is a "resources transition" and one that I am promulgating at the DoD to change how we buy our various systems. My objective is to make the procurement system more efficient and to reduce the cycle time associated with the acquisition process. The DoD is placing far greater reliance on commercial sources to field technologically superior weapons systems at a more affordable cost.

Over the past 30 years, the evolutionary change in the industrial base that supports the DoD has been no less dramatic than the changes in the world order since the end of the Cold War. Although DoD purchases have declined, America's commercial markets have continued to expand. In aggregate terms, commercial industry surpassed the DoD in research and development spending way back in 1965. And the disparity between DoD and commercial sector investment in R&D has been growing wider ever since.

This difference means that the technological momentum of the United States is being driven to a greater extent by commercial market forces rather than the defense market. In this environment, we in the DoD have no choice but to move from separate industrial sectors for defense and commercial products to an integrated national industrial base. We must leverage commercial technological advances to create military advantage and ensure that our equipment remains affordable and the most advanced in the world.

Here is where the DoD's dual-use strategy and the Technology Reinvestment Project of the Advanced Research Projects Agency play a key role. Lever-

aging commercial technological advances to create military advantage is critical to ensure that our equipment remains at the leading edge. Our objective is to marry the momentum of a vigorous, productive, and competitive commercial industrial infrastructure with the unique technologies and system integration capabilities provided by our defense industrial base.

A tighter linkage with commercial markets can shorten the cycle time for weapons system development and reduce the cost of inserting technological improvements into DoD weapons systems.

The DoD can no longer afford a 15-year acquisition cycle time for our major systems when the comparable commercial turnover is every three to four years. The issue is not only cost. The lives of our soldiers, sailors, marines, and airmen may depend on shortened acquisition cycle times as well. In a global market, everyone, including our potential adversaries, will gain increasing access to the same commercial technology base. The military advantage will go to the nation that has the best cycle time to be able to capture those technologies that are commercially available, apply them to its defense mission needs, and get them fielded with people who are trained to effectively exploit them in the field.

The DoD's dual-use investment strategy has been documented in our 1995 report entitled *Dual-Use Technology: A Defense Strategy for Affordable, Leading-Edge Technology*. I will give a very brief summary of the highlights of this document, and I recommend it for your reading.

The DoD's dual-use strategy is based on three pillars. The first pillar involves leveraging the commercial sector's technology-based investment. As I said earlier, commercial industry is now the technological agent of change in a variety of leading-edge technology areas that are critical to the DoD.

Examples of where the department is no longer the leader include information systems, telecommunications systems, microelectronics, and a whole variety of fields associated with computer-aided design and manufacturing tools. The issue here is to capture what is being done commercially, perhaps to influence it slightly, and apply it to our needs.

The second pillar is the idea of "dual produce." The DoD is putting a great deal of emphasis on taking advantage of commercial production to manufacture defense equipment. Producing major weapons systems on a commercial line, in my opinion, will certainly be the exception rather than the rule. However, we have not given enough attention to commercial production of major subsystems or critical components for our defense systems. We have the design tools available to us today to design around components being produced commercially. We need to apply, and will be applying, a far greater effort to this dual-produce concept: to be able to produce our key subsystems and components off of high-volume commercial lines and then to apply our systems engineering and our software applications capabilities to fuse those components into usable defense systems.

The third piece of the strategy calls for the DoD to make those investments

that are needed to facilitate the use of commercial components into defense systems. The objective is to design components for dual-use applications. This pillar recognizes that acquisition reform and dual-use technology investments are not sufficient by themselves to ensure use of commercial components.

Program managers and contractors still face up-front costs and risks in adopting commercial products and technologies—for example, the cost of determining that a commercial integrated circuit will withstand the necessary extremes of temperature and humidity. In the past, the onus was on the program manager who did not use a military specification for a defense system.

We have removed the burden of proof from the program manager and, in essence, put the shoe on the other foot with respect to the use of commercial specifications. A waiver is, in essence, required to use a military specification. It can be used only when there is not a suitable commercial or international specification available for our products.

In addition to executing an overall dual-use strategy, the DoD must take steps to strengthen international armaments cooperation. It is clear to me that we will have to leverage the industrial base of all of our nations to modernize the equipment of our defense forces at an affordable cost.

To us that means increased emphasis on cooperation with our allies in a variety of endeavors to include increased cooperation in acquisition of defense equipment.

The United States seeks cooperation with its allies here for three reasons. The first is political: These programs help strengthen the connective tissue, the military and industrial relationships, that bind our nations in a strong security relationship.

The second reason is military: There is an increased likelihood of operating in a coalition environment where we need to deploy forces with interoperable equipment and rationalized logistics.

And the third reason is economic: Our defense budgets and those of our allies are shrinking—what we cannot afford to do individually may be affordable through economies of scale and a common effort. For the first time, the United States finds itself in a role in which there are programs we would not be willing to undertake of our own volition without a cooperative effort in which we can share some of the development costs.

The history of international cooperation on armaments has not been good. As I look at the record, I see that many programs were started but few have been completed or continued for very long.

In general, most of the problems in armaments collaboration revolve around conflicts between narrow national interests that are at odds with broader cooperative interests. To quote a good friend: "We have converging needs but diverging interests."

As I look at some of the key problems associated with our past cooperative programs, there are many that I believe are worth highlighting. One is the long

decision times associated with these programs, in which complex national decision processes have to be combined to produce an international decision.

The second problem is the relative lack of competitive forces once international teams are put together. Here we need to build on our commercial models so as to bring competitive forces to bear in international cooperative programs. If we do not maintain competition, the combination of long cycle times and a fixed team generally lead to inefficient performance.

I see additional problems developing in the area of increasing European-only defense cooperation. This construct is not objectionable. In fact, it is welcomed, so long as it does not come at the expense of the transatlantic link.

Taken to an extreme, this could have drastic results. Some of the possible negative outcomes could include closing out U.S. technologies and expertise from the European developments and related markets, the development of noninteroperable systems, and greater cost to our allies with less security to show for it in the end.

The Clinton administration is prepared to be an equal partner in armaments cooperation. Our objectives include:

- increased emphasis on cooperative solutions;
- the use of the best technologies, wherever developed, in our weapons systems; and,
- systems-level cooperation versus cooperation only on parts and individual technologies.

A "triad" of key initiatives is under way today under the aegis of NATO's Conference of National Armament Directors [CNAD]. These programs are examples of large cooperative efforts that are breaking new ground on innovative management approaches in alliance ground surveillance/theatre missile defense, and combat identification.

In summary, given DoD's new budget realities and the amount of research being conducted by commercial firms, we have no choice but to take an innovative approach to technology development and utilization.

If we are to have assured and affordable access to the technologies needed for future technologies systems, then we must reach out and exploit technological advances being made in the commercial world here at home and abroad. I believe that the strategy outlined in rough terms here today is a prudent way for us to accomplish that goal.

Thank you.

PETER SCHARFMAN: Do you foresee a modification of the structure by which the DoD establishes requirements so as to be able to purchase commercial items in the way that commercial items are normally purchased? That is to say, some emphasize one thing and some another. You try to look for the best value.

For example, if you are going to buy a car, you do not make a list of 170

items that a car has to have and then reject a car because it has only 169 of these items. How will we create new links from the war fighters who know what they need through the purchasing process?

PAUL KAMINSKI: My response has two components. For smaller-scale purchases, certainly those under $25,000 and in most cases under $100,000, there is a lot more freedom in our system to buy commercially. I believe that it will have a significant impact. It represents well over 90 percent of the purchases made, but in dollar volume it is still a small percentage.

The bigger issue has to do with our major systems in which we are making some fundamental modifications to our approach early on in the acquisition process.

We have introduced the concept of integrated product teams that are working across all pieces of the system, and working to do a much better job of making affordability trades earlier in the process, so that the consequence of the trade looks at the numbers to be bought versus performance requirements.

During the Cold War, the paradigm that we operated under was one in which I would describe cost as a dependent variable. That is, the paradigm went as follows: We saw a threat system being developed, we often had exquisite intelligence of what the characteristics of the threat system were, or what they were going to be, and we had a good estimate as to when the system was going to be fielded.

So, in a sense, we could design a system to counter those capabilities. And the performance of the system dictated what was needed to counter the threat system. The cost was whatever it had to be. The cost was a dependent variable that came out of that process.

We are no longer in that environment. We are in the process of introducing these affordability trades up front so that we can make some reasoned assessment of cost and performance.

We have introduced some means to avoid a wholesale commitment to what I would call a platform-by-platform recapitalization, because we cannot afford to be replacing every platform in our inventory or successor platforms.

There are some places where we need to take some different approaches and to introduce some new concepts. That is a subject of an entirely different discussion on advanced concept technology demonstrations, which gets some things fielded, so our users can make some informed decisions about alternatives.

There is one other aspect to this equation that also needs very careful attention, and that is not simply the cost of development and procurement, but the life-cycle costs of our systems, looking at total cost in a systematic way. Sixty to seventy percent of the life-cycle costs of the major systems that the DoD fields occur after the system is fielded.

So we need to be giving much more attention to the affordability of those systems over the long term, especially as we keep them in the inventory longer. There is a big gain to be won there.

The big problem is there are not sufficient incentives in our system to produce savings in the future by making expenditures today.

CLARK MC FADDEN: You have described the new dual-use technology policy that moves away from a defense-unique industrial base and seeks to provide more flexibility from the take-it-or-leave-it contract terms that have been typically imposed, and it contemplates, by virtue of relying on a commercial base, international participation.

What are the guidelines that you would see as appropriate in determining when the DoD should move to international sourcing and international participation in their R&D program?

PAUL KAMINSKI: With respect to looking at major subsystems and components, we have really opened things up in a major way to international acquisition. The inhibitions are much reduced. We are seeing, in several of our new systems being developed, the insertion of a commercial-like international component. For example, the U.S. Army's new mobile artillery piece, the Crusader, is a system that will have a diesel engine produced by Perkins in the United Kingdom. So we are seeing a lot more work by looking at international sourcing of the best product for the key subsystems and the components.

At my level, we will review new developments over $50 million so that we can have a conscious look at whether some other more formalized international arrangement seems appropriate rather than just turning the crank the old way.

OZZIE SILVERMAN: Do you find that there are any areas of technology or components where you feel that the security supply is not there, perhaps because U.S. companies are obtaining part of their technology from elsewhere, where you feel you have to develop a base, say a manufacturing base, in the United States?

PAUL KAMINSKI: Yes, there are arenas where we feel we have to have a base in the United States. However, in almost all cases, it occurs at a very high level, at an integration or assembly level, as opposed to going down into a component or a piece-part basis.

The places where we have made a conscious decision to sustain an industrial base, for example, have been in areas such as the nuclear-capable yards for submarine and carrier production. In most other situations where we are not faced with current legislative restrictions, the policy has been a far more open policy, and I would say that the exceptions are notable and countable.

Policy and Budgetary Drivers

Bill Andahazy, U.S. House of Representatives Staff

We had a hearing in early March, where Lt. General Wilhelm from the Marine Corps Combat Development Command made a comment that is worth re-

peating here. He had been asked by a student what the next war would be like. His response was, "Let me put it to you this way. It is going to be about four 'Bs.' And those four Bs are: brief, bright, bloodless, and a bargain." I bring this up because our investments in science and technology are also somewhat focused around this principle of the four Bs.

(1) Brief: We all depend on the overwhelming power within the United States military, typically the joint forces in air, sea, and land, to overwhelm an enemy.

(2) Bright: We will have knowledge of the battlefield and battle space through satellites, Unmanned Aerial Vehicles [UAVs], and intelligence, with a digital connectivity to all the battlefield components, so that there is a degree of knowledge that will carry from the theatre commander down to the lower echelons.

(3) Bloodless: We are looking at removing the war fighter from the battle scene. We are making investments in precision-guided munitions. We are looking at stand-off capability in an effort to distance the war fighter from the enemy.

(4) A bargain: We have to understand the fiscal environment in which we are working. For example, when you go to buy a house, the realtor knows that there are three things that are important in selling a house: location, location, and location. Similarly, when Congress looks at new weapons systems, the three things that it looks for are affordability, affordability, and affordability.

This new description of future battlefields and future wars gets to the point that technology will be a major player in our strategy. Technological superiority, which is one of our major tenets, will continue to be a factor that the DoD will view as a keystone in the way it builds future forces.

However, we must have access to that technology, and we will rely on both in-house and out-of-house sources. We must also have industries to produce those systems in ways that rely on technology so as to ensure performance and to control manufacturing costs.

Clearly we need the tools to get there. We have had robust programs in science and technology within the Defense Department for some time. Even when I came to the Congress back in 1988, we saw that the technology base needed support, and we put it on a reasonable growth curve.

We are in a situation right now in which the technology base is strong, even though the DoD budget has decreased. However, even though we have defense technology on the plate and we are continuing to develop new technology, we understand that we have to rely more and more on the national technology base and our access to it for the future.

If you look at the budget facts and figures for the National Science Foundation, the National Institutes of Health, and the Commerce Department, they are investigating technologies that are often common to the needs of DoD. Each department must have access to it all. Therefore, we are trying to shape and reformulate our defense technology base and the investments that we make in science and technology to ensure access and crosswalks for DoD and others.

Also, we need to move technology to the field more rapidly. For years the DoD has had a rather traditional model of moving along a continuum from its basic research to its exploratory development, advanced development, and final phases that allow us to take defense S&T and make meaningful products for the war fighter. We will continue to do that with new programs within the DoD. Advanced concept technology demonstrations, for example, are a way to synergistically bring in different types of systems based on new technology so we can look at what the system provides the war fighter before we move into the acquisition process.

We also must have early involvement with industry. It is senseless for us to have all the technology we develop under wraps and then all of a sudden reveal it to industry when we specify new systems. Bringing industry in early through a number of programs—particularly dual-use developments as a means of early industry entry—is important. This is one of the themes that we in this Congress are talking about. We have great support for dual-use technologies.

So we have a number of ways in which we can and will consistently work for industrial cooperation in technology development. But we also have some impediments to accomplishing this rapid transition of technology to product for the miliary. These impediments must be solved if we are to be successful.

Currently, we are infrastructure poor. We have over 100 laboratories and test facilities that were perhaps essential in the Cold War, but now that the Cold War is over, we probably no longer need that much capacity. We have a tough time taking these facilities down in the current political and economic climate.

We are fundamentally infrastructure poor, or infrastructure rich, however you want to look at it. It is certainly costing the DoD a lot of money to keep people on the job and to keep the lights on. We have to find ways to pare that down.

I want to assure everyone here that the Republicans are not the Dr. Kevorkians of technology. We are trying to interact with industry and other players. We are trying to foster, and will support, continued work in dual-use technologies as a major mechanism. For example, ARPA and, to a high degree, the service programs in S&T are producing not only new knowledge and new understandings of future systems for the DoD, but they are producing new technologies for the nation at large.

ARPA programs are a good example because they provide fundamental building blocks in electronics that are essential to the nation at large, not just the DoD. These programs are funded solely by the DoD in partnership with industry.

Currently we are trying to rationalize just what should be the future role of the DoD to continue to fund these types of developmental technologies. But at the present time, there is no change in what we have done in the past to what we are doing in the FY 1996 program.

I will, however, comment on the Technology Reinvestment Project. We have taken a new look at that program, and we have removed it from the current 1996 budget. We have also encouraged more dual-use partnerships that are tan-

tamount to the Technology Reinvestment Project, but over which we have appropriate oversight and control.

So, in summary, we are trying to refocus our technology primarily toward military purposes. We are still encouraging and emphasizing dual-use technologies for the purposes of civil and military integration, and we are relying more and more on the national technology base to support our military systems.

Thank you.

RICHARD THAYER: It seems that the concept of dual-use technology is straightforward, but it strikes me that there seems to be a lack of understanding, or a misunderstanding of this concept, and confusion of terms such as spin-off, spin-on, and technology transfer. Why is this?

BILL ANDAHAZY: Technology is worldwide. We are no longer the technological gatekeeper within the DoD or within the nation. Spin-off or spin-on technologies are terms that we utilize to arrive at an understanding among ourselves in terms of what does or does not make sense for public investment.

We have to rationalize the dollars that we are putting on the table. For example, for the basic research that we must conduct, we have to find a way to make the process more efficient. As we move across the continuum from basic research to exploratory development, we have roughly $4 billion in investment in the Army, Navy, Air Force, and DoD agencies, including ARPA, in which we are advancing technology. Whether or not that has spin-off or spin-on potential must be determined on a case-by-case basis. I believe it is applications dependent.

In most cases, particularly in electronics, we have a major stake in public investments. When electronic performance has to increase, the companies themselves provide research products that can be spin-on to defense. We use both approaches because we want technological superiority. Information sciences or information technologies are a good example of what we need to have so as to satisfy the four Bs.

Whether it is in the nose cone of a guided missile or whether it is in the radio used by a soldier, that electronics system or individual component has to be developed. It may have been through the public investment within the military or it may have come from private investment. But clearly when that chip or that component appears and we need it, we do not care if it is spin-on or spin-off.

It is far too difficult to separate technology out and put it into little boxes. So we have an emerging policy in that we will support a technology to the point where it tends to break or show feasibility and promise to move us forward for a future system that is, indeed, totally military. We know full well that there may be other nonmilitary applications.

Clearly the researchers who are in our industries, our laboratories, or whoever shares in the technology development that is supported by the DoD should have an opportunity to spin off to other sectors for the national good. It is an absolute certainty that this Congress and everyone else wants this to happen.

The form, fit, and function that will force this spin-off to happen is something that probably does not fully exist. We have enough councils within the DoD and the administration to motivate the functions for technology transfer. Most of these councils have a lot of responsibility but little or no authority to really get done what needs to be done programmatically.

On a similar note, part of our observation and criticism of NSF and NIH is that these agencies are too steeped in basic research to advance to the point where American companies, who are living by a different set of rules than public entities (that is, the companies focus on short-term payoff and short-term product), can connect to proven *technology*, not just proven *theory*. How does that technology bridge? What makes it bridge to a potential system? What forces it? What is the business environment that makes a company want to draw on the technology that has been advanced in a university? What is it that makes good national business sense, or why does industry not establish a more personal relationship with universities in an effort to move university technology into their R&D facilities for the next generation of whatever they manufacture? These are the real questions that must be answered by administration-appointed councils, and they should be followed by a plan of action.

So when we look at technology development, the DoD is clearly an important part of it with its public investment. But technology is an international woven fabric in terms of the way it functions by various investments. The DoD and the commercial sector need technology to stay profitable and competitive.

Where are the national leaders, and who has the game plan that will guide all of us who work within the public sector to make our investments? They do not exist.

CLARK MC FADDEN: The dual-use technology strategy implies a much greater sensitivity to and involvement with the commercial technology base by the DoD. It is going to take a much greater understanding of what is happening there, how to exploit it, how to come to grips with it effectively. What is your assessment of the will and commitment of the military services to embrace a dual-use technology and to move away from the approach of defense priorities first and doing it in a way that is a very simple take-it-or-leave it approach in dealing with industry? And how do you see the DoD obtaining the skills to manage this? How are the military services going to be able to manage technology development when they are forced to go into partnerships with commercial entities, forced to anticipate and exploit commercial developments in R&D?

BILL ANDAHAZY: ARPA is attempting to see where technology is going in various sectors and trying to institute new acquisition methods to allow ways for the DoD to get a hold of it. ARPA is a leader in trying to move into new dimensions within the DoD.

The military services are slow to react to that same mind set. It is not that

they do not understand it, it is just that the military departments are more internally structured. Before they can do the same things that ARPA does, for example, partnerships, there is typically a regulation that needs to be established within the DoD. People need to be willing to change both their attitudes and their ways of doing business.

Clearly the Office of Naval Research [ONR] is an activity that everyone knows and appreciates for what it has done and what it is attempting to do. But the Navy, in this particular case, has the authority, as does the Army and the Air Force, to take any of their technology-based programs and, where it makes sense, exercise a partnership, a joint venture, or any other agreement for the advancement of dual-use technologies. But it is just slow to happen.

At this point, ARPA has been in the business for several years. They have established a track record for getting these things done. But we should and do have the responsibility to take the entire $4 billion technology base and leverage all to some extent. Not that it has to be a 50%-50% shared cost, but perhaps an 80%-20% shared cost or whatever makes sense for a partnership. Part of what we are trying to do is to ensure that there is a military focus for that dual-use partnership.

LANCE GLASSER: ARPA has been in the dual-use business since it was created in 1958 in response to the launch of the Soviet Sputnik. The ARPA mission is to create and prevent technology surprise.

Our first mission was space. We were in space before NASA. So, in retrospect, our first mission was a dual-use mission. Since then we have done ARPANET that has turned into Internet. We have done parallel computing since the ILIAC-4. This is a 35-year-old record of success.

But let me also point out that dual-use is a dependent variable. The first issue for ARPA is, is there a military need? Is there a compelling military reason to invest in a technology?

The second issue is, will investment make a difference? There are a lot of things that we would like to have, but we cannot figure out how investment will make a difference.

The next question is, what is the most affordable way to do things? When a dual-use strategy can work, then it is usually the most bang for the buck for the military.

So it follows from the military need. It follows from the ability of investment to make a difference. It is a way of investing that is the best value for the U.S. taxpayer.

If you look at our various programs, from flat-panel displays to electronic packaging and many other areas, what do we need for the future revolution of military affairs?

This is all based on a revolution in information technology. If there is a revolution in information technology, there has to be a machinery of information technology. And it has to connect to people, to soldiers.

The highest bandwidth connection between the machinery of information technology and people, of course, is displays. That is why building armories for flat-panel displays is not a good idea. The only possible way to make that investment is a dual-use investment in which you build an integrated technology base that will serve the DoD's needs.

BILL ANDAHAZY: With respect to your last question, in terms of developing the management skills within a department, people have to be exposed to both the technology and the military system vis-à-vis the way the military system works. We have to recognize people early, groom them, put them in different assignments, make demands of them so that leaders can be grown. Whether it be in industry, whether it be in government, leaders have to be grown.

Dual Use: Implicit Japanese Policy

Richard Samuels, Massachusetts Institute of Technology

Today I want to outline some of the elements of Japanese dual-use policy, some of the differences, and their consequences for economic growth, innovation, and bilateral relations.

In 1936, Hermann Goering stated that, "guns will make us powerful; butter will only make us fat." That is one succinct vision of national security. Japan has now proved him wrong all together. Japan teaches us that butter is as likely as guns to make a nation strong.

The Japanese lesson is simple: Japan has subordinated defense production, yet has emerged as one of the most technologically sophisticated nations in the world. At a time when a nation's defense skills will more than ever depend on the strength of its commercial economy, the Japanese are well positioned to have butter and guns—should they make the requisite political decision.

We know that the Japanese defense industry is very small. Japanese defense production comprises barely one-half of 1 percent of total Japanese industrial production. Barred from export markets since 1976 by cabinet policy, Japanese arms sales are no larger than those of the nation's sushi shops.

But despite limited production of final systems and large-scale weapons platforms, Japanese firms have emerged as world leaders in the design and manufacture of materials, components, and subsystems essential for defense systems at home and abroad.

Indeed, the most rapid growth in postwar Japan was in sectors closely linked to the materials and technologies that enhanced the battlefield capabilities of modern weapons: data processing, telecommunications, optoelectronics, and lightweight materials.

By making integrated circuits in large volumes for consumer electronics and graphite fiber in large volumes for tennis rackets and golf clubs, Japanese manu-

facturers were able to accumulate experience and "spin on" their knowledge to military aerospace applications. Having responded to the escalating demands of rapidly changing civilian markets for these and other products, they found themselves able to meet military specifications of performance, reliability, and quality—often at lower cost.

Notwithstanding the U.S. security guarantee that made this possible, Japanese firms and the Japanese government have embraced technology and the economy as matters of national security. In particular, three values are maximized: autonomy, diffusion, and nurturance. This fusion of industrial, technological, and security priorities was driven by military needs in the first half of Japan's industrialization and by commercial needs in the second half.

(1) Autonomy: Autonomy has been Japan's strategic constant over the course of its industrialization. Since the mid-nineteenth century, Japanese security planners have had to navigate between the Scylla of technological backwardness and the Charybdis of foreign dependence.

Consistent with this desire for autonomy is the belief that national security is enhanced by the design and production of weapons as well as by their deployment. There is rarely an industrial policy document that fails to justify its goals with reference to the development of "autonomous technology" *(jishu gijutsu)* or "indigenization" *(kokusanka).*

In accordance with this principle, in both military and civilian cases, it is not uncommon for each subsequent generation of Japanese products—whether aircraft, machine tools, eyeglasses, or chemicals—to depend less than its predecessor on foreign technology, as one MITI official put it, *"ichingo yunyu, nigo kokusanka."*

Thus the paradox: Licensing has been the middle road toward the higher ground of pure *(jun)* technological autonomy. Japanese firms have purchased enormous stores of knowledge, mostly from the United States, as a way to achieve technological independence.

The contrast to the United States could not be more stark. During the Cold War, American firms were not only willing, but eager to sell technology. U.S. firms operated under a perverse set of incentives comprising the U.S. financial structure, Japanese demands for technology, and the Soviet enemy. Note how "offsets"—the allocation of production among allied nations as a way to entice them to allow deployment of U.S. troops and military systems—provided extensive foreign access to U.S. military and aerospace design and production technologies.

The United States transferred more weapons to Japan than to any other ally except Germany, mostly in the form of licenses at every level of production—from the final, integrated platform to the production machinery that formed the components. Japanese defense contractors licensed and co-produced 29 major U.S. weapons systems, more than any nation in the world. Benefits have not been insignificant.

(2) Diffusion: A commitment to autonomy is not uniquely Japanese, of course. However, layered on this is a corresponding commitment to diffuse technologies as broadly as possible throughout the economy.

The history of technology is a history of interdiffusion between commercial and military applications (the wheel was not invented for the Roman chariot, but the spoked wheel was), but in Japanese practice, technology is often a quasi-public good developed and distributed through elaborate networks of producers and bureaucracies.

Participants in the process believe that proprietary technology can be distinguished from generic information, and that each contributes significantly to Japanese national security. As a consequence, Japan has built an extensive network of "technology highways"—an infrastructure comprising at least as many lanes, but perhaps fewer roadblocks than its U.S. counterpart.

Institutions such as research consortia enable competitors to achieve common technical goals before they compete with each other in the market. Japanese firms cooperate in consortia at every level of development and—especially in aircraft—device manufacturing. Although the form and function of these consortia vary—and although competition among the participating firms never disappears and is often extremely vigorous—collaboration persists as a highly valued norm in Japan, while it is denigrated as "collusion" in U.S. thinking.

A second difference with the United States is derived from the way the Japanese system facilitates extensive inbound (but much less outbound) technology traffic from abroad. It is able to exploit the opportunities other countries have created to promote technology exchanges as well. Partly as a result, Japanese technology highways much more effectively acquire and diffuse global and domestic technologies than similar systems in other countries, certainly greater than in the United States.

In the United States, the technology highway came close to resembling a "toll road," with restricted access lanes, while Japan's technology highways are "freeways" that can accommodate automobiles, trucks, or tanks with equal facility. The interdiffusion of civilian military technology is just another lane on a very busy highway. Any vehicle can travel on any lane at any time.

(3) Nurturance: In Japanese thinking, autonomy and diffusion are incomplete without a parallel effort to support and sustain the producers that benefit from these processes. There are many threats to the sustenance of long-term manufacturing capabilities, including market shifts and technological revolutions. Firms and the government vigilantly monitor the economy to mitigate the worst effects of each.

There is also the threat of "excessive competition"—the fratricidal competition among firms that results in bankruptcies and unemployment, but which is oxymoronic in Western terms. In the Japanese view, the social dislocations of "excessive competition" are as great or greater than the eco-

nomic costs of excessive concentration in the neoclassical model. Thus, firms and sectors are nurtured.

Japanese military manufacturing has been limited by comparatively low military expenditures. But the country's defense base—indistinguishable from the larger industrial base—has been sustained by regional producers who retained their skill and manufacturing networks.

In sum, then, the protocols of the Japanese economy differentiate Japan from U.S. practice in at least four ways:

(1) In terms of industrial structure, Japan's leading defense contractors are also Japan's most innovative commercial firms. As elsewhere, the top defense contractors are among the largest firms in the economy, but unlike in the United States or much of Western Europe, these firms are highly diversified and depend little on sales to the military. Only two of the largest defense contractors in Japan are dependent on defense procurement for more than 20 percent of their total sales. Ten of the twenty have less than a 5 percent dependency.

(2) In terms of technological diffusion, Japan's prime contractors—unlike U.S. prime contractors which virtually isolate defense from commercial production—make much less distinction between military and civilian products, except at final assembly.

(3) In terms of collaboration, there are rarely clear-cut winners and losers in Japanese defense procurement. Firms that fail to be designated prime contractors often are assigned a significant subcontracting role and are rewarded the next time around with the more lucrative prime contract. In the meantime, each firm participates in each project and in the commercial economy. Technology is more widely diffused to the benefit of the entire economy. We know how important the ability to "team" has become for U.S. defense contractors. But in the United States, balancing competition and cooperation is a brave new and unchartered world. In Japan it is a well-practiced, fine art.

(4) In terms of using foreign partners, Japan brings more than a century of experience in foreign technology licensing and "international cooperation" to a global market that is only slowly learning that single firms in single countries can no longer build complex military systems (or even all the necessary components) on their own.

The Japanese lesson is that, under propitious circumstances, a nation need not sacrifice national interests to foreign dependence. A corollary is that propitious circumstances, like comparative advantage, can be created.

In Japanese parlance, technological autonomy and "international cooperation" are not incompatible. Indeed, to the contrary, a central purpose of "international cooperation" is to enhance the Japanese technology base which, in turn, strengthens the Japanese position in international projects and enhances Japan's ability to demand more offsets and a higher value added.

The crucial task for the United States and Japan is to restructure bilateral

technology diffusion while maintaining grounds for collaboration rather than conflict. This involves far more than simply—and naively—promoting "joint development." "Co-development" in the context of different ideas about national security and without developing an accompanying capacity in the United States to acquire, diffuse, and nurture foreign technology is doomed to failure. Worse, it is likely to escalate the friction it is designed to ameliorate.

We need to restructure the "perverse incentives" affecting U.S. firms. The United States can and ought to develop its own version of the subtle blend of strategic cooperation and domestic technological nurturing the Japanese have practiced for years. Again, the ideas are neither alien nor "unfair." It is just that American and European strategists have been distracted and have allowed our institutions to evolve without regard for these concerns.

The threat that this will be interpreted as the need for crude protectionism is especially troublesome and misses the point entirely. Fortunately, it is too late for protectionism in any vulgar form. Nor should we want to be isolated from overseas technologies. This outcome would only ensure the United States' eventual obsolescence and generate even more negative commercial and defense consequences.

If global power increasingly depends on industrial capabilities, then all nations will lose their capacity to bargain in the world if they fail to link themselves more effectively with foreign economies in ways that assure that state-of-the-art technologies flow reciprocally into their domestic economies and are effectively exploited.

Nurturing without becoming predatory and indigenizing without protectionism is a delicate and difficult task, one made more challenging by the need to insist on reciprocal treatment and access to technology networks, manufacturing associations, consortia, and regional networks.

Military, Commercial, and International Realities

Jacques Gansler, TASC, Inc.

Three broad trends are affecting all developed nations' views of national security in the twenty-first century:

- the globalization of markets and industrial structures,
- the dramatically changing nature of warfare, and
- the development of an integrated civil and military industrial capability.

These three highly interrelated broad trends increase the risks of friction, yet enhance the desirability of international competition in weapons development and trade.

Consider first the globalization of markets and industrial structures. Not only are commercial markets becoming global, but there is a growing and rapidly spreading proliferation in military technology and worldwide arms sales. This

had been led by the United States, which last year captured 73 percent of this shrinking market. Recently, the defense industry and the DoD have received added presidential and congressional encouragement to increase the worldwide arms sales efforts, based on the rationale that this is necessary to "preserve the defense industrial base." Because most nations' domestic military budgets are plummeting, and because they all have an excess of modern military equipment, as well as huge excesses of defense industrial capability, this is clearly a buyers' market! Thus, there is fierce competition between the numerous selling firms, as well as the many producer nations. In fact, even Japan has been recently threatening to enter the market. As a result, sellers are making "giveaway" offers on equipment and technology transfers, offering local development and production, and offering "offset" purchases that greatly exceed the basic sale prices of weapons.

The overall result is that the United States and its military allies are developing frictions over domestic economic and trade issues in the national security arena. This problem is compounded by the very real need to reduce worldwide arms proliferation—for obvious long-term security reasons. Such action will require multinational cooperation, and it is certainly not aided by the fierce, politically supported, economic competition simultaneously taking place.

Ironically, this international weapons competition is occurring at a time when shrinking defense budgets and rising weapons costs require far greater cooperation in the development and production of future complex weapons systems (for example, for space and antiballistic missile systems). In fact, with significant defense industry consolidations taking place in both Europe and the United States, the need for weapons collaboration is being countered by the growing political drive for defense industry "self-sufficiency"—to assure "invulnerability," without recognition that the benefits of international cooperation can be achieved while maintaining competition, and without contributing to domestic vulnerability.

Finally, this friction is compounded by both the rapid changes in the nature of warfare and by the increasing overlap between civil and military technologies—which leads to consideration of the second broad national security trend, the dramatically changing nature of warfare (often referred to as the "revolution in military affairs"). With the end of the Cold War and the removal of the clear differentiation provided by the bipolar world, the evolving new geopolitical structures—which are far more liquid and multifaceted—introduce greater uncertainty into international relations. Therefore, they considerably blur the line between friction and cooperation. (One need only note the current U.S. relations with Russia and Syria, as examples, to see this fuzziness.) In addition, as was clearly shown in the Persian Gulf War, future military operations (from peacekeeping to war) will be done on a coalition basis; so increased military cooperation is absolutely required—but often with nations that, for political, economic, or human-rights reasons, do not make "natural bedfellows." So increased friction and cooperation will coexist in this new geopolitical environment.

The other major shift in the nature of warfare is from the historic model of

"attrition warfare," in which large masses of heavy forces wore each other down, to modern battlefield concepts of "information-based warfare," which utilizes real-time satellite and aircraft reconnaissance data to command and target smart weapons to a precision strike—as was demonstrated so effectively in the Persian Gulf War. Thus, for future weapon systems, nations must focus their defense resources on advanced information technology.

Here, of critical importance, is the fact that the information age explosion in the commercial world has caused large investments (in both engineering and manufacturing technologies) that have actually put the commercial world well ahead of the defense world in many technologies that are critical to defense. Thus, to obtain state-of-the-art capability, the military have no choice but to extensively draw on the commercial industrial base (in areas as wide ranging as electronics, software, and new materials) if they want to maintain military technological superiority—especially at an affordable price.

This, then, leads to the third of the broad trends in the national security arena, namely, the integration of civil and military industrial capability. Three factors are driving this trend:

- commercial information technology increasingly represents the state of the art;
- modern, "flexible" manufacturing allows efficient production of small quantities of military items on the same line with large quantities of related (but very different) civilian items; and
- greatly reduced defense budgets.

Faced with these trends, nations have essentially no option but to move to a "dual-use" industrial structure to achieve affordable, state-of-the-art military capability. This not only means making maximum use of ruggedized commercial components, materials, and subsystems, but also achieving integrated R&D and, particularly, integrated production. Essentially, this means having the military as simply another customer of high-quality, high-performance, affordable goods and services from a large, integrated, and global industrial base.

For the United States to move in this direction it must remove the barriers that currently exist to integration of the commercial and military industrial bases and create incentives for firms that are in the commercial world to want to do defense business, as well as for firms that are currently in the defense business to diversify into related commercial areas. Essentially, this means removing the government-created barriers and disincentives to the operation of free-market forces.

Specifically, unique government oversight requirements, unique procurement practices, and unique military specifications are the answers given by world-class corporations (such as Motorola, Boeing, IBM, etc.) when asked why they have historically separated their commercial and military businesses. These barriers are now being addressed by the DoD and Congress—for example, with the initial

acquisition reform legislation of 1994. However, much more needs to be done in this area.

The issue here is not whether integration will be achieved, but when and how efficiently and effectively. Although inevitable, this civil and military integration trend—especially when combined with the equally inevitable industrial globalization trend and the changing nature of warfare—is accompanied by inherent increased internal and international friction, both in the economic and security spheres.

Given these inevitable trends, the challenge for the leaders of the developed world is to recognize and accept them; expect the increased friction; yet overcome the obstacles to achieve increased cooperation. There really is no viable alternative. What is needed is the evolution of a coherent, forward-looking public policy and the leadership to assure its implementation.

CLARK MC FADDEN: As you look into the twenty-first century, what do you see as the utility and the feasibility of a national technology base to support military activities?

JACQUES GANSLER: It seems to me there is no choice and understanding this point is critical. In an effort to stimulate the economy with defense dollars, the Clinton administration proposed spending $1 billion, which raised a lot of questions about certain so-called industrial policy issues. In contrast, the DoD cannot buy a new weapons system unless they can buy it at a low price, and yet it must be state of the art. This can only be done with civil and military integration. In most cases (e.g., materials, software, electronics, manufacturing technology), low cost and state of the art are represented by the commercial area.

In many cases, the commercial area has no interest in defense work. World-class companies, such as Hewlett-Packard, refuse to do defense R&D. So the DoD has to change the way it does business so as to interest those suppliers. It also has to encourage world-class commercial firms to want to do things that are different for defense. It is important to recognize that defense products will be different. The way to take advantage of these commercial capabilities, especially flexible manufacturing, is to imagine, for example, electronic warfare equipment (built with commercial components) and commercial electronics all on the same production line.

Another example could be a cannon (for which there is certainly not a large commercial demand) being built on the same rotary forge as a railroad freight car axle, again in the same plant. This simply requires that you recognize that defense items can be designed with commercial parts and be built in commercial facilities. The need for this change has to be understood by Congress.

RICHARD SAMUELS: I am reminded of an experience I had two years ago when I visited a factory in Japan where armored vehicles were being manufac-

tured. There I saw precisely what Jacques Gansler is describing. Gear boxes, transmissions, and other common goods were flowing down assembly lines, but as final assembly drew nearer, the lines were separating for snow mobiles here and bulldozers there. Final assembly for the armored vehicles was taking place behind a thin green curtain, unguarded in any way. When I asked about the curtain and remarked about what, by U.S. standards, was a lack of security, I was told that the curtain was there only because the "Americans like to segregate military from commercial products"! True or not, the image stays fixed of the difference between an integrated and a segregated defense industrial base. The United States must be the only industrialized country that even takes this question seriously. Everywhere else, integration is taken for granted.

U.S. firms even talk about becoming "virtual corporations." They say that they care little about whether they actually manufacture anything, just so long as they capture added value through design, assembly, or even simply sales. But a nation cannot fight wars with virtual weapons, and a nation should not build an economy with virtual companies.

HORST SIEBERT: I have a question for Dr. Samuels. The intent of this conference was to look at frictions in technology policy within countries and then to possibly see to what extent we can establish an international order that will prevent these frictions.

After listening to your talk, I have the impression that, apparently, countries can take quite different approaches to technology policy. You talked about Japan and they have done it in a specific way. Other countries could follow a different role. Should we allow a variety of approaches to technology policy in the world economy?

RICHARD SAMUELS: First we must acknowledge that differences exist. There are many academics and policymakers who are in deep denial about this point. They cannot imagine that the Japanese can possibly be different than the Americans or the Europeans. The Japanese have no problem imagining this, however. The second step is to be very clear about what we each need and want in the global economy. I have never heard the United States state clearly and convincingly what sort of economy and technology base we must have. We pay lip service to the relationship between the technological and economic dimensions of national security, but until we are clear about our goals, we will forever be very unclear about the appropriate means to achieve them. We must decide what we want, and above all, we must decide what we want from our partners.

JACQUES GANSLER: I would argue that we also have two sets of technology policies within the United States: national security and commercial. We are now trying to see if we can merge these two at the same time. Historically, they have been dramatically different, and they have been moving further apart.

CLARK MC FADDEN: With respect to the objectives of this conference, it may be slightly more modest to come up with a set of guidelines or rules of operation that can accommodate these differences and that can lead to growth and prosperity without diminishing the differences in national interest.

SYLVIA OSTRY: It seems almost inevitable that as you move towards the blurring line between civilian and military, friction is bound to increase. I have been in meetings in Europe where it is believed that the Americans are going to pull out of NATO, that the Republican Congress is such and such, and that therefore the Europeans will have to be autonomous.

The Japanese stance is perfectly logical. They have done extremely well. But as they approach the frontier, as the catch-up phase diminishes, they will be less willing to cooperate.

But there was a point that was made here today that I find even more interesting. In the weapons competition, which is very fierce, I was trying to imagine a high-technology enemy, and I thought of Bosnia. It is clear that it would be possible for the United States to produce some high-technology enemies by weapons competition, which in turn could develop into a vicious cycle.

JACQUES GANSLER: In fact, the most likely high-technology enemies are equipped with U.S. equipment. What many countries are doing—France, Russia, China, and Israel are probably taking the lead in this area—is taking good, first-line equipment and upgrading it. They are making it actually a lot better and for very small incremental costs.

It is this rapid worldwide spread of technology and weapons that is the concern that many people now have. You do not have to be a fully developed nation with the capability to develop these weapons. You can simply buy them at bargain basement prices.

Session 7

Research, Economic Growth, and Competitiveness

Moderator:
Ozzie Silverman, Government of Canada

CHARLES WESSNER: I am pleased to introduce Ozzie Silverman, who will moderate this session on the role of research in the economy. Dr. Silverman has had a distinguished career in both the private sector and with the Canadian federal government. He is currently the Director General for Science Strategy in Industry Canada. He is also very active in the OECD, which has the task of working through a number of these issues.

OZZIE SILVERMAN: The title of this session is an amalgam of ideas that are central to the policy agenda of every country—a grouping now commonly addressed under the broad rubric of innovation policy. It is a particularly active area of government policy interest and one with the potential to give rise to serious friction among national economic systems.

In almost every country, government policies for the support of innovation are in a state of transition. They are evolving and being refined to respond to powerful forces as well as to new ideas about the sources of economic growth, particularly of the so-called knowledge-based economy. By way of introduction, I would submit that there are four major factors driving changes and innovation policies. They are both domestic and international.

First, the dynamics of technological change has itself changed. Among other things, technological change is now driven by science to an extent not seen or previously experienced.

The second factor is trade liberalization and the internationalization of production systems that are forcing governments to develop policies that take account of the fact that R&D and production can be shifted from one country to another.

A third factor is the recognition that there are limitations in the carrying capacity of global ecosystems. And this is giving rise, a bit slowly, to the need to reshape production, energy, transportation, and other systems to achieve sustainability.

And the fourth factor is the end of the Cold War and the implications for the defense industry, as well as the traditional sources of research funding for the university system.

Adding to these driving forces is the continuing view of governments that they have a role to play in engineering new comparative advantages for their economies. This view has given rise to a variety of public policies that may be the basis of frictions between countries.

Friction is not a new phenomenon. It has been going on since the early 1980s. A number of years ago, Sylvia Ostry wrote a paper on the policy-induced recession in the early 1980s. That was the time when a number of governments came to the view that all new emerging science and technology could be the basis of economic growth in the future, and that they should be positioning their countries to capture future markets for high-technology products. This is how technology came to be viewed as a strategic asset in global trade competition. Of course, that brings with it a cascading effect—when one country takes action to mobilize national resources, other countries follow. For example, when Japan launched the fifth-generation project, the United States came out with the Strategic Computing Initiative, and Britain launched the Alvey Program.

This session will deal with three aspects of this new paradigm, and we have a very distinguished panel which balances public and private sectors. The defense research area will be addressed by Anita Jones, Director of Defense Research and Engineering at the U.S. Department of Defense. The subject of public funding of research will be addressed by Charles Curtis, Undersecretary of the U.S. Department of Energy [DoE]. The role of other countries in sustaining the U.S. domestic research base will be addressed by Knut Merten, president and CEO of Siemens Corporate Research.

Defense Research and Technological Superiority

Anita K. Jones, Department of Defense

I would like to tackle the subject of research, economic growth, and competitiveness by discussing the two ends of it: defense research and military competitiveness.

Most of the discussions at this conference have revolved around economic competitiveness in which the metric is the bottom line in corporate and national strength. At Defense Research and Engineering we are the national security mission agency for the United States, and our report card for competitiveness success is written on the battlefield or the site where a security mission is executed.

We had a great deal of technological success in Operation Desert Storm. Technology was not the sole enabler, but it was a necessary enabler for the type of success in that operation. If we look at the technologies that made the most difference—stealth, precision strike, night vision, and an increased battlefield information awareness—the majority of these technologies today are military technologies for which there is not a very large commercial market. Possibly there will be a commercial market for them in the future. Affordability is a large issue, and some challenges have to be met before affordability is achieved.

These technologies started life as military-dominated technologies. So when we talk about defense leveraging commercial industry, we have to look at that quite carefully: when and where we do it and what it means to leverage commercial industry. It is not merely buying components off the shelf; that is the least of the challenges in this arena.

To a first approximation, there are five agencies in the federal government that are concerned with long-term technological research. Health and Human Services has a third of the long-term budget. There are four other agencies that have, at the back of the envelope level, about the same amount of budget: NASA, the DoE, the DoD, and the National Science Foundation. All of these agencies have different missions, and their investment differs dramatically.

The DoD receives 16 percent of the $28 billion U.S. government investment in long-term technology activity. The objective of the DoD science and technology program is to enable military superiority based on technology. So the DoD invests where the greatest promise is for enabling that type of military superiority. Today that investment is in electronics, in information technology, and in materials. These are some of the high-priority areas, but certainly not all.

If you look at the U.S. federal investment in these areas for the long term—not at the entire $70 billion R&D budget, but the $28 billion that is in the long-term investment—the DoD dominates the electronics investment, particularly the electrical engineering investment.

Defense also invests heavily in mechanical engineering and materials. Collectively, the DoD is a major, if not the major, investor in information technologies. Again, this is just the federal investment, not the industries investment, which for all R&D is certainly larger.

Defense is also a very heavy investor in engineering. The DoD builds a lot of systems, and they have to operate under very severe environments, and they have to operate over the long term. So the DoD invests approximately 40 percent of what the federal government invests in long-term engineering technologies.

Government investment has been made over the decades to enable technological breakthroughs, such as time sharing, networks that have given us the Internet today, and the National Information Infrastructure for tomorrow. Government investment in decade-long investments is crucial. The interplay of government and industry investment is very complex. Many people today believe that we should let industry do all the R&D. I certainly hear this from some of the

four-star generals at the DoD because the DoD has a budget that is down 40 percent over the past decade.

However, for defense purposes, industry cannot do it all. Their dominant investments are for the short-term, measured in three to five years. Global competition is forcing down the industrial investment dramatically. There are good reasons to recognize in this financial climate, in this global competition, why it is prudent that industry cannot and will not make that long-term investment.

In this changing world, we are breaking some of the paradigms of the past and are asking how to best invest to ensure access to the technology that will enable technological superiority for the military.

First of all, the DoD seeks unique military advantage. And quite bluntly and frankly, where we can keep it solely to ourselves, we are going to invest to do so. Where there are really new breakthrough technologies, we need to invest, particularly in military-unique areas, where no one else will. This is the investment that the DoD will protect in the science and technology area as budgets go down.

Second, DoD needs to leverage wherever it can find good ideas. In the DoD there is a more outward-looking policy in the science and technology community. There are a number of very early collaborative science and mid-stage technology projects with nations all across the globe. For example, the Russians have a very good ejection seat, suitable for use in fighter aircraft. And so we have a collaborative project with the Russians to do an evaluation of that technology.

So leveraging whoever is smart and whoever has a good idea is an appropriate strategy for defense. And in the very early science arena, one wants to work with the best on the globe. And that is a strategy that the DoD is executing.

The third approach is to leverage commercial assets, where there is commercial advantage to be had and where it can be leveraged in a way that we are assured we will be able to use it for defense systems. We are talking with our long-time international partners to look creatively for opportunities in which we can collectively afford to pursue something that the United States cannot afford to do alone.

There is another force that has come to bear on what defense does, and that is that there is a strong voice among the war fighters who will fight in partnership with our allies, with our coalition partners, and we want these partners to be well equipped. So it is in our own self-interest that we work cooperatively with our allies and that we go into a mission with all partners well equipped. That is a major change from the past.

In the past decade the DoD has been looking actively for cooperative ways to work. As a result, a number of consortia have been formed. Many of you may think of these consortia as U.S. companies but, in fact, in many cases these are companies that have very strong international markets. Some of these are cooperative cost-share consortia. They have grown over time because working through consortia was believed by the DoD and NASA to be a smart way to do more with scarce dollars. The objectives are jointly arrived at by the industrial partners and the government.

DoD deliberately enters into codevelopment, coexploration, coproduction projects internationally. Let me give you as one example, an experimental craft called the X31, which we jointly developed through ARPA in the United States and Germany. Daimler Vince Aerospace was the German corporation, and Rockwell was the American corporation.

The challenge was to have a tailless aircraft that used thrust veins to vector the gases as the means for controlling the aircraft. This project showed that you can fly supersonic and do this. This was indeed a joint project. The pilots were both German and American. This has been a successful project and is a good example of an early-stage technology exploration that was executed in a joint way with one of our allies.

I have gone through a set of four different ways that we cooperate. There is no one solution. The United States and all the countries that I have had direct interaction with are looking for creative ways to leverage their funds, to gain access to technology in one way or another, and there are many ways to cast a mutually beneficial international cooperation. One size does not fit all.

I will highlight a point that Daniel Goldin made this morning. This country must continue to invest in a stable way in long-term science and technology. We must nurture the infrastructure, both in universities, which are the long-term corporate memory for science, and in industry, which is the long-term memory for technology and production.

We must invest for technology breakthroughs. It is scary to hear people talk about dramatic reductions in the R&D budget, because you cannot achieve breakthroughs without decades of stable investments.

We are aggressively looking to cooperate, but it is with an eye to the United States getting the advantage. We are being more open, and we see a tremendous advantage in cooperating with our allies to exploit technology as rapidly as possible.

ERHARD KANTZENBACH: You mentioned that American investor firms do the bulk of their investment in short-term investments. Is this the result of some financial institutions on the American capital market, that these firms feel that they have to defend themselves against the threat of takeovers? In other industrial countries we do not have this phenomenon, especially in Japan and in continental Europe.

ANITA JONES: There are a number of reasons, but the financial community structure in this country is a major one. For publicly held corporations, the equivalent of 100 percent of their stock turns over between 12 and 24 months. That is why boards of directors have a strong fiduciary responsibility to pay attention to the short term. That is not the only reason, but that is a major reason.

Another reason is that global competition has heated up. There are less funds available to be directed to long-term research. We are impatient in America and often look for short-term return. We want an answer now.

Culturally, we are less patient than other countries across the globe. Research is difficult to predict, so it is high risk. You might get a product that others are in a better position to exploit. Your sales force may not be educated in this area, they might not have the right contacts.

You may produce technology or products that are entirely outside of your corporation's expertise and not be able to get the benefit of the corporate long-term investment. And since our corporations operate solo, there is no leverage if you develop a technology that your corporation cannot use. You can sell it but probably not at good return on investment.

Public Funding of Research: A Strategic Imperative?

Charles Curtis, Department of Energy

At no time since World War II has the threat to this nation's R&D base been so apparent or serious. My talk here today speaks to this threat as it is embodied in the proposed budget cuts; why the direction of cuts within the R&D budget is particularly harmful for economic growth and for our mission accomplishment. I will offer comments about what we are doing at the Department of Energy [DoE] to manage our piece of the nation's R&D enterprise more effectively, and will make a few comments on the implications of these budgetary changes for our capacity to engage in international ventures.

Cuts in the R&D Budget

First, let me focus on the budget cuts. In its attempt to balance the budget, Congress so far has failed to distinguish between spending that is truly discretionary and might safely be curtailed or postponed, and spending that represents good investments with real future payoffs to government's essential functions—its missions—and payoffs to society and industry in the form of enhanced capacity for innovation.

Much of this nation's R&D expenditure claims to provide high rates of return of this type. To retrench on this investment is a false economy.

Despite this, the House Budget Resolution appears to reduce civilian federal R&D spending by more than 11 percent by the year 2002; assuming a modest inflation rate, this would represent a real dollar cut in seven years of one-third against the base.

As great a concern is where these cuts are targeted. The new Congress appears to be using a dated "linear" model of innovation in deciding where to target their R&D cuts.

For much of the postwar period, it was widely held that the government had two appropriate roles in supporting R&D. Government should support basic research and it should support R&D for the government's own missions, of which defense was foremost. Why should government support basic research? Because the payoffs are real, but diffuse and long enough into the future that only

government—acting as our representative—can recapture its benefits for our society.

A linear model: The conceptual model for innovation involved a "linear" process. Government would support basic research, and the private sector's role was to take that knowledge generated from government-supported basic research and do the additional work needed to develop commercial products.

In recent decades, of course, it has become clear that this "linear" innovation model is overly simplistic. Although basic research sometimes does lead to the creation of new industries, such as biotechnology, there are many other innovation mechanisms.

Sometimes it is new technology that leads to new science, either by showing where new knowledge is needed or by providing the tools to create new knowledge. For example, some believe that thermodynamics owes more to the invention of the steam engine than the other way around. Another example concerns one of our main functions at the DoE: that of developing new scientific instruments—such as accelerators, light sources, electron microscopes, and gene sequencers—which in time make new scientific discoveries possible.

New technologies also can be created by the fusion of other technologies. Some examples include optoelectronics from the marriage of optics and electronics and robotics from the marriage of electronics and mechanical engineering.

Another way innovation occurs has been suggested by Ralph Gomory, the president of the Sloan Foundation. He has pointed out that much innovation occurs as rapid incremental improvements to existing products, drawing on both science and other technologies.

In other cases it is the technology moving from one field to another that creates the new opportunity. The Lawrence Livermore National Laboratory recently invented a radar that can be put on a chip. This technology came out of the laser program at Livermore, but with refinements it can be applied to finding construction studs in houses or to providing collision warning systems in cars.

Furthermore, it is clear that the private sector often cannot fund all the long-term applied R&D needed to bring a breakthrough to the market. A current example is high-temperature superconductivity. Since the breakthrough work by IBM in 1986, a large amount of applied research has been under way to make it practical. Many companies that were interested initially backed out because they could not justify the long-term investment.

A few weeks ago the Los Alamos National Laboratory made a major breakthrough by figuring out how to make high-temperature superconducting materials into a bendable wire that can carry high currents. The research expenditure required to bring this about had fallen to government; the individual companies would not, and perhaps could not, support it.

Perhaps a better model for envisioning how research leads to economic growth is to see the science and technology enterprise as a complex network rather than a linear process. The Internet serves as a good analogy for the connec-

tions between universities, federal laboratories, and companies. Just as it is hard to trace the path of an e-mail message across the country, it is hard to trace or predict how new knowledge and technologies come together to create new technologies. What is clear is that if you take out the key linkages, the network will generate less value.

Over the past decade, a consensus had built up in industry, government, and academic circles that key parts of this network—in particular the linkages between industry and government—were weak in the United States relative to other countries, a consensus that is breaking down in the political environment of today. It was, and is, though, a cardinal principle of this administration that strengthening these linkages was crucial to generating more economic value in the United States from research. And a companion view of this administration is to see the innovation process as more complex and interactive—requiring nurturing of all of its parts—a policy that honors and seeks to expand on the government's traditional investment role in basic research, but does not attempt to draw bright line distinctions in the continuum between fundamental and applied research.

The new Congress, however, has a different view. The House Science Committee, in its "views and estimates" states:

> In many cases, we have neither the luxury nor is it a wise use of resources, to continue steering taxpayer dollars in the direction of applied research, which can, and should, be market-driven and conducted by the private sector.

This statement and the priorities now reflected in the budget clearly reflect the old linear R&D model. They assume that if government simply puts money into basic research, the market will automatically provide the economic benefits.

Not surprisingly, the House has focused its budget cuts, with the precision and subtlety of a hand grenade, on what the Committee sees as applied research of the "corporate welfare" character. They would continue to support what they see as worthy fundamental research, but take out programs that build linkages between companies, universities, and national laboratories. As Xerox CEO Paul Allaire and Cornell University President Frank Rhodes recently wrote:

> Creative new R&D partnerships across the sectors need to be embraced even if they challenge prevailing assumptions about the nature of research or government activity.

Unfortunately, the House budget cuts go against this prudent advice.

DOE's Role in Research

To understand the import of this mistaken action in the case of the DoE, I will say a few words about the DoE's role within the U.S. science and technology network. The DoE funds a major part of the nation's basic research. In FY 1995, DoE will support $2.8 billion of basic research—nearly 20 percent of the total federal support, second only to the National Institutes of Health. For example, we support major physics facilities, such as the international team at Fermi Lab

that recently found experimental evidence for the existence of the elusive "top quark," as well as extensive work in materials and in the life sciences.

In FY 1995, the DoE will provide 9 percent of the total federal support for R&D, or 20 percent of federal nondefense R&D. In fact, almost 40 percent of DoE's FY 95 budget is considered federal R&D.

We operate many scientific user facilities—used by some 15,000 industry, university, and government scientists each year. We receive requests for twice the amount of time that is available. Each request goes through a peer review process, which ensures scientific merit and that the use requires the DoE's unique capabilities.

We support nearly $850 million of university research. The loss of any significant part of this will be hard to make up from other sources. For example, the funds spent with MIT alone total nearly $70 million. That represents a lot of tuitions.

The proposals to eliminate the DoE, and the budget cuts proposed by the House Budget Resolution, are a clear threat to this science and technology network. Let me explain what is at stake in ascending order of threat.

Our High Energy and Nuclear Physics Research Program, totaling nearly $1 billion in FY 1995, would fare relatively well because it would be cut by only 9 percent by FY 1998. But the resolution would totally prohibit the restoration of funding called for in the Drell report, reflecting the community's expert judgment of what is required to maintain world leadership in this field.

Our Energy Supply R&D programs, totaling $3.3 billion in FY 1995—which include basic research in materials and in the life sciences, as well as research on renewable energy resources and fusion, among others—would be cut by 35 percent by FY 2000.

Our Energy Conservation R&D programs, totaling nearly $450 million in FY 1995, which fund some of our important successes—such as superconductivity work and advances in energy-efficient lighting that have paid for themselves many times over—would be cut 79 percent by FY 2000.

Our natural gas, oil, and coal R&D programs, totaling nearly $450 million in FY 1995, would be cut 77 percent by FY 2000. This appears especially shortsighted in view of recent forecasts that world dependence on Persian Gulf oil exports will double over the next 15 years.

These cuts, of course, are greater in real terms because they do not reflect the effect of inflation, which we now estimate will reduce a dollar's purchasing power by approximately 25 percent in the next seven years.

Scalpels, not Blunt Instruments

Of course some cuts can be made, and the innovation system can always be improved. But changes need to be made in a way that carefully preserves the core research and strengthens the linkages through which the research provides value to the nation. Blunt instruments will not do a job requiring scalpels. At the DoE over the last few years we have been doing a more careful pruning of the R&D bush.

We are engaged in a major new effort, begun at the outset of this administration to:

- focus our efforts where we can contribute the most,
- cut overhead costs out of our laboratory system,
- make the DoE and its laboratories work together better as a system, and
- improve the integration of the DoE with the rest of the R&D system.

We began by developing a strategic plan to determine the areas in which the DoE provides the most value to the nation. We have started reforming our contracts with the organizations that manage our laboratories, to give them greater incentives to cut costs and improve their efficiency. We recently released our Strategic Alignment Plan, which will ultimately result in a reduction of 27 percent of our federal employees.

We also asked Bob Galvin, former chairman of Motorola, to head a task force to examine the missions of our national laboratories. We asked Dan Yergin, the energy industry expert and author of *The Prize*, to head a task force that will help evaluate and set priorities for our applied energy R&D programs. And we are now implementing the changes in response to the recommendations made by the Galvin Task Force. Let me highlight a few of the changes:

- We are committed to cutting overhead cost out of the laboratory system. Al MacLachlan, the former Dupont chief technical officer who helped cut cost out of Dupont's R&D system and is now my deputy, is leading an effort to help accomplish the same for the DoE.
- We are reducing the DoE's audits and are allowing the laboratories to follow commercial practices in the procurements. Over the years, our laboratories have had to follow more and more federally imposed rules. We are reversing years of regulatory creep and freeing them up.
- We have formed a Laboratory Operating Board, with both DoE and external members, to help our laboratories work together better as a system, with defined centers of excellence, operating under processes that draw on talents throughout the system.

Out of this effort will come a leaner, more cost-effective DoE and one that works together in a more tightly integrated way.

We also are working to improve the way DoE works with the rest of the U.S. R&D enterprise. For example, we are working with other agencies through the National Science and Technology Council, and we are working much more closely with industry. We have Memoranda of Understanding with the Departments of Defense, Commerce, Agriculture, and with NIH. We have more than 1,200 Cooperative R&D Agreements with industry, involving more than $1 billion in industrial contributions, essentially triple the number of two years ago. This work not only benefits industry, but benefits the various DoE missions. Our labs can accomplish their goals more effectively working with industry than working alone.

This would be an ambitious set of activities for a private company. They are even more challenging for a government agency. But we are making progress, and we will accomplish these tasks.

Implications for International Cooperation

Let me conclude with a few comments on the implications of these budgetary changes on the larger theme of international friction and collaboration.

The first point is that there is a very large degree of uncertainty about both the future of our organization and the funding for individual activities. It is difficult to predict how this will affect international collaboration. It is possible that budget cuts will force us to collaborate more; we certainly would like to improve our collaboration. Unfortunately, it is more likely that budget cuts will prevent us from collaborating.

Take for example our fusion program. Under an ideal budget, we would like to support our own fusion machine, the TPX, and participate in the international thermonuclear experimental reactor [ITER]. Our capacity to engage in activities that require long-term commitment is put into question by this budgetary turmoil. To sustain these activities will require a high-level presidential commitment and political consensus in the Congress that is able to sustain the required investment over a 25-year period. Toward that end, the President's Council of Advisers for Science and Technology [PCAST] is reviewing options for the fusion program. Our capacity to make this investment is now very much in question.

In general, we are approaching international collaboration in the same way we approach other partnerships. We are looking for win-win solutions. First and foremost, we are looking for benefits for the U.S. taxpayer, but we recognize that any successful collaboration must make sense to our partners as well.

In some cases we will want to share the cost of major science facilities or welcome foreign scientists to our facilities. In other cases we will want to ensure that the technology we develop with an industrial partner will provide substantial benefits to the U.S. taxpayer. And in still others, we will directly support scientists and engineers from other countries, such as scientists from the former Soviet Union, if it would support our nuclear nonproliferation goals.

It is difficult to define precise rules concerning these activities. The best we can do is to use our judgment about what makes sense for the American taxpayer and for our specific missions while acting within a framework of congressionally directed preferences, and, in some cases, restrictions.

I have focussed my discussion on the DoE because it provides a compelling illustration of the dilemmas before us. Other agencies, however, are facing similar challenges in trying to maintain the integrity of their research programs and their linkages to economic growth and competitiveness. Other agencies also are facing similar challenges in maintaining their international collaborations in this budget climate.

But the fundamental and first-order challenge is to inform the congressional

judgment, to teach it to discriminate, to take a broader view of the innovation process, and to learn what is at stake. In this, you have as much of a role as I. It is a considerable challenge, and we will need your help and support.

WILLIAM SPENCER: Would you comment about your view on how basic research will be funded in our national labs versus universities, and perhaps the changes you are taking in an approach to international collaboration that will save us from digging another $8 billion hole in Wachsahatchee, Texas, and then offering to sell part of it to our foreign participants.

CHARLES CURTIS: Dr. Spencer is referring to the superconducting supercollider investment that envisioned an international contribution, and obviously represents a failed enterprise on the part of government because the super-collider lost its capacity to sustain the necessary political consensus to fund that project over time. You can talk about cost overruns and the redesign of the program, which basically changed the economic parameters, but at least in my judgment the fundamental problem was the inability to sustain a political consensus to support that investment over time.

What we are doing about that is illustrated in my reference to the PCAST related to the fusion program. The fusion program involves a major international collaboration in the ITER that, incidentally, is expected to cost $10 billion to construct and $10 billion to operate over its expected operating period. The reason that we examined the PCAST was to determine if we could develop a high-level presidential commitment to that program, which is necessary for sustainable financial support, as well as to engage Congress in something more than an annual appropriations act.

I suggest that this is very much in jeopardy. International collaboration requires a presidential commitment and a way of engaging Congress in making an investment over time and committing to it on an eyes-open, fully evaluated, analyzed basis. This is what we will try to evolve out of the PCAST process. It may be the only answer to getting international projects properly funded, and I am very skeptical whether it is possible in our current political environment.

With respect to questions about the locus of basic research dollars—that is, the tradeoff between investments in our national laboratories and in the university system—the answer is that the DoE does both. There is always the parochial first-preference claim of our national laboratories, or at least the suspicion that there was a first-preference claim. This is a fair criticism of the DoE's practice in the past, because it sees the maintenance of the national laboratories' core competencies as essential to its mission accomplishment. In the future, however, the DoE will be more disciplined as to where it puts that investment dollar, and it will present better opportunities for university basic research.

The DoE is now establishing a Laboratory Operating Board. One of its first missions will be to develop a strategic plan for the laboratories as a system, out of which the DoE will identify centers of excellence and also will lead laboratories for

various work. By default, this will also define areas in which centers of excellence do not exist in DoE laboratories, but where they do exist in universities.

RICHARD BRADSHAW: I have heard a great deal of speculation on the part of the Republican leadership that the DoE laboratories could be sold or privatized. Even if one were to assume that that would be true, there are some implications, specifically the national research capability, that have to do with preferential treatment of customers, partnerships, or alliances. Could you address and speculate what the implications might be to the U.S. R&D base if so much of our capabilities were, indeed, privatized?

CHARLES CURTIS: I am not aware of any analytic basis on which such an assumption could be grounded. There is a great variety of capacity and character to the DoE laboratories, but quite obviously to the extent that they house facilities that are important to materials science research, for example, acquiring control over the use of those facilities against competitors would be a valuable competitive tool.

To that extent, there are certainly some facilities that could be privatized or that would be very attractive to private industry. But then there are all sorts of questions concerning the conditions upon which privatization might occur that are designed to assure, in essence, a fair field of access to the facilities in industry.

If I might use an analogy to the electric utility industry, it has not worked out very well when you have, in essence, one competitor maintaining ownership of an essential means of competition, even under rules that were designed to provide fair and full access to those facilities.

Foreign Contributions to the U.S. Research Base

Knut Merten, Siemens Corporate Research

I am from the Princeton Research Laboratories, but today I represent Siemen's Corporate Research as a whole. We have three locations worldwide for corporate research: Erlangen and Munich, Germany, and Princeton, New Jersey. I offer to you today what I know best: how Siemens is organized in the United States in terms of R&D and what it does here.

An Overview of Siemens

Siemens is an electronics company and has been in the business for many years. Currently, it has 380,000 employees worldwide, which is a drop of over 5 percent since 1993–1994. It is Europe's largest private employer and the second largest employer worldwide. Sales are now a little over $60 billion annually.

Regionally, in terms of sales, Siemens is quite strong in Germany. If you include Europe and Germany together, three-fourths of our sales are European-based. Thirteen percent of our sales are in the United States, 9 percent are in

Asia. Siemens's strategic mission is to grow further in the United States and in East Asia.

Siemens came to the United States in 1970. At that time, the company had already been in business for 135 years. Before World War II, there was an agreement between Westinghouse and Siemens that they would not go into each other's territory, so Siemens did not begin business in the United States until after World War II. Currently, Siemens has over 46,000 employees and 75 manufacturing assembly locations in the United States. Geographically, Siemens is quite diversified.

The apprenticeship program: Siemens has also implemented an apprenticeship program in the United States that is quite successful and has been widely recognized and discussed. For example, Siemens has apprentice programs located in Raleigh, North Carolina; Lake Marion, Florida; at Potter & Brumfield in Princeton, Indiana; Franklin, Kentucky; and Newport News, Virginia.

If you compare Siemens with other foreign-owned companies in the United States, it ranks third. Siemens is the biggest foreign-owned manufacturing company in terms of U.S. employees.

U.S. content: The domestic content of Siemens's U.S. sales is approximately $6 billion. Imports are $1.4 billion. Most important, however, worldwide exports out of the United States are now more than $1 billion, a figure that is above average compared with other U.S. companies.

Siemens's overall U.S. R&D is somewhere between $600 million and $700 million, which is equal to the share we have in Germany. The bigger portion is in the operating divisions, not in central R&D.

The biggest spender in R&D in the United States is Siemens Public Network Switching, headquartered in Boca Raton, Florida. They are the third biggest supplier after AT&T and Northern Telecom in the United States. Siemens's corporate R&D budget this year was $21 million.

University funding: Cooperation with American universities is always viewed positively in the company. Approximately 60–70 million German marks have funded university research here and in Europe. Ten percent of this is spent in the United States. Princeton University is given the biggest share of these research dollars because we are geographically close to the university. Siemens Corporate research in Princeton has approximately 150 employees. The budget is $21 million to $22 million.

Siemens's R&D mission: Siemens has a worldwide responsibility for selected R&D topics; it does research in the United States for our operating companies throughout the world. We have approximately 40 people working in imaging and visualization. Our artificial intelligence activities employ 20 people. We are also growing in multimedia, and at the end of the year we will probably have 20 to 25 people in that area. These are our core technologies at Princeton. If someone in a lab in Germany had a problem in software testing, they would be directed to Princeton. This is exactly how Siemens has changed. Before 1991, we did research for our operating companies.

Funding level: In regard to funding, we have roughly the same funding scheme as our German departments. Fifty percent is funded by the divisions, 35 percent is funded out of a central budget, and 15 percent is public funding. The funding scheme for Princeton is 50/50, because I do not receive any funding from federal agencies. We are writing some proposals and hope to win some federal contracts.

Siemens Corporate Research is handled like a department, but from a legal point of view, it is a company. It has worldwide responsibility for certain Siemens core technologies.

Siemens is also integrated in our innovation activities. For example, Siemens Corporate Research is responsible for the innovation field of health care. This is just looking for new opportunities in terms of market and in terms of technology over the long term.

From the headquarters' point of view we are totally integrated. The overall Siemens budget for corporate R&D is 400 million German marks. This is roughly 5 percent of the overall R&D spending.

Again, 10 percent of sales is devoted to R&D. Out of this 10 percent, 5 percent is corporate, so that brings it down to 400 million. Ten percent of this is here in the United States.

To summarize, I am responsible for an R&D organization, and I must say we should not forget that R&D also has to do with fun, with excitement, with good people. That is the reason why I would like to tell you about a specific project, an example, of a project that we are currently working on.

We have taken an inexpensive induction motor, and have tried to make some failure predictions—to indicate in advance when the motor is breaking down. This has been a successful experiment. We have implemented a very complex neural network that can only predict approximately 90–95 percent of all the cases of breakdown and separate between good motors and bad motors. It takes into account such factors as weight and how the motor is mounted.

This is one of the technologies that I believe are important for the future. So we are happy to have such projects at Princeton.

Thank you.

Session 8

International Cooperation and Market Access in Telecommunications

Moderator:
W. Bowman Cutter, National Economic Council[1]

CHARLES WESSNER: For this session I would like to introduce Carlos Primo Braga, who is the senior economist for the telecommunications and information division of The World Bank. He will bring us a unique overview of both the opportunities and the challenges in the revolution in informatics to the developing world.

Next is Don Abelson who is an advisor to Ambassador Michael Kantor on issues such as investments, trading services, and intellectual property rights protection. A number of these issues, as you will recall, were raised in earlier discussions. Mr. Abelson has taken the lead in the administration in resolving U.S.-European Union audiovisual trade issues. He has a unique grasp of some of the complexities that are involved in services trade.

Our final speaker of this session is Randy Lumb who brings a valuable perspective on the basic issues faced by the industry, but he also has a firm and broad grasp of the Washington political and policy environment.

The themes that we will be trying to capture in this session are the opportunities of global cooperation, the opportunities presented by global information infrastructure, and at the same time, some of the difficulties that are associated with access to national markets.

Global Opportunities

Carlos Primo Braga, The World Bank

Today I will focus on global opportunities. I am not going to talk much about cooperation, although the topic of this panel is an interesting one.

[1]Mr. Cutter was unexpectedly detained.

Instead of seeing technological progress as something in which a country or company will have nothing to gain unless it controls the process, cooperation today is very much at the core of the discussion. In the past we had the "lead dog" approach: the scenery only changes for the lead dog in the sled of technological progress. You had to believe in that to be the top dog or you were lost. More and more we believe that cooperation has an important role in this process.

Where do developing countries fit in this scheme of things? My talk today will focus on answering this question.

I suggest here that, from the point of view of the world economy and from the point of view of science and technology, what happens in many developing countries will be vital, not only for their own development, but also for the future of the world economy. So I begin my talk with a vision of the future qualified by the obvious caveat: "He who predicts the future is bound to be wrong even when he happens to be right."

I present three issues. First, globalization is here to stay, but globalization not only in the sense of an increasing interdependence in terms of trade and investment, but also interdependence in terms of knowledge flows.

What is really new in the world economy today are the possibilities that we have to exchange knowledge and information in amounts that were impossible just a few years ago. In this context, there is a kind of discontinuity in the way the world economy can operate.

Second, the world economy is becoming more and more knowledge intensive. And knowledge has become a major determinant of how to explore comparative advantage in an effective way.

The concept of comparative advantage is probably the only economic concept that is both true and nontrivial. There is no doubt that we have to discuss dynamic comparative advantage, and this is not an easy subject. What I will do is focus on the opportunities generated by international knowledge flows.

Consider international trade flows. If we focus on R&D intensity, by 1965, most products that we would characterize as R&D-intensive products were responsible for approximately 11 percent of world trade flows; now they account for roughly 25 percent. So there are a lot of opportunities.

The third point that I would like to make is that we are moving into an economic system that is increasingly disciplinarian. Countries that make mistakes pay dearly for those mistakes. The recent experience of Mexico is a good example in this context. So interdependency and its consequences will continue to increase. Countries will have less freedom with respect to policy choice in this global economy.

At the core of this global economy are service links. And the services trade is growing very fast. (However, there are many problems with the statistics. I recommend the recent World Bank report called *Global Economic Prospects,* in which the growth of trade in services is reviewed.) We find significant growth, particularly in the so-called "private services" category which consists of typically knowledge-intensive activities.

So information technology is making a difference, and it is changing the way that companies and the world economy operates. And a global information infrastructure is emerging.

A major policy issue is how to enhance the penetration of networks and how to provide better communications. These are major issues for developing countries.

More and more, the developing countries will be divided among the slow and the fast. Actually, I submit that this will probably be true for all countries. The slow will not be able to connect to the global information infrastructure. The fast will succeed, and they will be able to converge with the industrialized economies. The slow, by not connecting, will face even greater divergence in terms of economic growth and, of course, welfare.

A major policy question for an institution such as The World Bank is: What policies promote connectivity to the global information infrastructure and enhance productivity?

We believe that the private sector should lead in this process. We believe that competition should be fostered. But we also recognize that the regulatory environment of these economies plays a major role in shaping this process.

Accordingly, regulatory reform is high on our agenda. It can be pursued through several avenues. The World Bank, for example, has supported unilateral reforms. Actually, we are initiating a new fund (InfoDev) with the cooperation of governments and the private sector to try to discuss these issues in the capitals of the developing world—about how to connect and how to have a proper regulatory environment.

But this may not be enough. You have to explore other avenues. We have, of course, the multilateral avenue, and the General Agreement on Trade and Services [GATS] offers important opportunities, although much remains to be done.

The negotiations on basic telecommunications are still in progress, but if you look at the commitments on value-added services made in the context of the GATS negotiations, it is clear that most developing countries have not yet convinced themselves of the importance of being connected in a competitive environment.

In Latin America, for example, if we take the "universe" of possible service activities in value-added services that could be offered, only 5.7 percent of these activities were offered by Latin American countries. In South Asia it is 3.3 percent, in East Asia it is 12 percent, and in Eastern Europe, it is 20 percent.

What about the highly industrialized countries? They did not fare much better either; they are in the 20–25 percent range. Yet what is clear is that, although the GATS has the potential to bring partners to the table and foster the win-win proposition that we have been talking about, much effort is still required.

So I believe that markets will play a much bigger role in shaping the connections of developing countries to the global information infrastructure. The possibilities in terms of social impact are dramatic.

For example, in the area of education productivity, growth has been quite slow over time. But now things are changing. We can now explain economies of

scale and scope (for example, interactive CDs [compact disks] or the use of the Internet to access resources in the developed economies).

The same applies to the health sector. There is an experiment called the Global Health Network run on the Internet; the University of Pittsburgh is very active in this initiative. It is creating databases in epidemiology to allow not only countries to monitor possible outbreaks (like the ebola case), but also to initiate proactive actions in areas such as diabetes. Telecommunications as an enabling technology and computer-mediated networks create possibilities for major changes in social areas.

One other point: If we are going to promote market solutions, however, we need to protect intellectual property rights. This is a very tricky issue.

In the digital era, you can either be among copyright optimists (those who believe that copyright will take care of everything) or you can be among copyright pessimists (those who assert that copyright is okay, but that there are many problems that require a *sui generis* approach for protection). Or you can be a radical and say that there is no way that we can use a legal instrument that has evolved in response to eighteenth century technologies in the digital age. And you could suggest, that we have to work with encryption and create new mechanisms to assert property rights.

No matter where you stand, the problems are very real, particularly in developing countries. For example, I recently prepared a paper on the impacts of the TRIPS Agreement—the Trade-Related Intellectual Property Rights Agreement—on developing countries. I evaluated it sector by sector. In the area of software and copyright protection, I found that 63 percent of 98 countries would have to change their laws significantly just to cope with the new requirements in the TRIPS Agreement. Can you imagine the many challenges in adopting proper laws and enforcement to promote the information age in the developing world?

To sum up, the challenges are great, but the opportunities are also significant. The main issue is how to make the transition feasible and how to help the developing countries benefit from this technological revolution.

Thank you.

The Need for Market Access

Don Abelson, Office of the United States Trade Representative

My discussion focuses on how to proceed to cooperate so as to open overseas markets. To understand how one uses GATS, which is an agreement under the World Trade Organization, one has to understand the nature of it; that is, the way the agreement itself is fashioned.

Principles and commitments: GATS builds upon the way we constructed the GATT in the late 1940s; that is, an agreement that has principles in it and then an attachment to that agreement of specific commitments. The GATT has a core set

of principles as well as tariff commitments (bound tariffs that a country is willing to keep).

The way the GATS works is very similar. It has a set of core principles, and each country has made commitments with regard to two aspects of delivering services: market access and national treatment. These two elements are not built into the core text of GATS. The concept is that, with regard to specific service sectors, each country can decide whether or not it will permit foreigners access; and, once a foreigner—a company of a foreign country—is inside their market, whether they will treat it like they treat any other national company.

We have heard reference to "value-added networks" or "value-added services," and we have heard commitments taken by some countries when the Uruguay Round was concluded. Indeed, inside the GATS and the commitments by a number of countries, there are some commitments in the area of value-added service. Not enough, but certainly it is a starting point.

Basic telephony not covered: The GATS does not cover basic telecommunications services. Only one country, by mistake, made a commitment in basic services, and it is asking if it can get out of it. Other than this one case, there are no commitments taken as a part of the Uruguay Round in the area of basic telecommunications.

In fact, when the trade ministers met in Marakesh in April 1994, it was agreed to extend the negotiations on basic telecommunications for two years. That extension will expire in April 1996. This two-year extension is to allow time for the countries to negotiate in the area of basic telecommunications. We have the possibility of cooperation or the potential for friction.

The first point I want to make with regard to these negotiations on basic telecommunications is that we do not know exactly which country is the "demandeur" and which countries are the ones that will go along for the ride. Is the United States the "demandeur"? If you look into the history of these negotiations, it can be seen that four years ago the United States was the "demandeur." At the end of the negotiations in December 1993, however, it was not.

If you listen to the presentations of developing countries and the need they have for infrastructure development, and the fact that if they want to be on the fast road in this environment, and that they need this kind of development, then they should be the "demandeurs."

Some would have the United States be the demandeur to ensure that overseas markets are open. That is the point on which I would like to focus the remainder of my comments.

Closed Markets

Markets overseas are not open, not as open as are U.S. markets. There are only two markets that perhaps match ours: the country to our north and the country in Europe that speaks our mother tongue.

There are no other truly open markets in basic telecommunications around the world. We find markets that have traditions of 100-year-old monopolies that have not yet been demonopolized significantly, that have not been privatized to any great extent, and, in which there is only a limited environment to create a competitive framework for that demonopolization and privatization.

If a country does not have a framework for a regulatory environment that promotes competition, how are U.S. companies supposed to compete? Clearly the type of deal that we need is one that gives us the same type of opportunities that others find here in the United States.

A regulatory mirror? So we use ourselves, once again, as a mirror for what we are looking for overseas. If I could describe that mirror image, this is what I would see in it. I would see a country that has an independent regulator that is not subject to the whims of any particular administration, a regulator that is not inside the industry ministry, and that is not part of a government that has a share of the major telecommunications provider.

I have just described Germany for you. I have, to some degree, just described France for you. I have perhaps, to some degree, described Japan for you. I could have described Brazil, I could have described South Africa, India, on down the list. What more important markets could I describe?

We need an environment in which there are competitive safeguards. Countries that have had monopoly suppliers for the last 100 years—that is, either demonopolized or not, privatized or not—must make sure that that supplier cannot use that 100-year-long history as a way of preventing new entrants from competing.

We have heard every reason and every excuse for not allowing competition in the United States during the past 15-20 years of our process of demonopolization. Just remember the "hush-a-phone" case, which is a classic. That case shows you how creative monopolies can be.

The hush-a-phone had to do with a device sold in the 1950s that you put on the end of your phone to keep the conversation quiet. It had nothing to do with unscrewing the mouthpiece and screwing in another piece. It was just a piece of foam rubber.

Our own monopoly argued that, in fact, that product had to be safety tested, had to be technically tested, etc. Every argument from monopolies stems from that. They are trying to protect their market position. We need competitive safeguards.

Transparency: We need transparency. We need a process by which the foreigners will, in fact, make open the terms of competition to all who need to know the information.

Who needs to know? New entrants, new competitors, companies that are entering the market for the first time and need to know exactly what it is, either on the technical side to be connected, or in fact on the accounting-rate side, so that they can figure out what deals are being cut by overseas monopolies to their own favored suppliers.

Without these conditions, you will find that there is very little possibility for cooperation on a final agreement, and in fact there will be much friction.

I close my comments by talking about the possibilities. I believe that there are tremendous possibilities. I believe that the United States will be very successful with the agreements next year and achieve the types of conditions that I have just outlined. I say this because we are all "demandeurs" in this negotiation. The United States is, key developing countries are, certainly the Europeans are, and, our friends in Japan are. We all want access to this very fast moving high-technology sector. And therefore it makes us all the more eager to figure out how to conclude an agreement.

Another reason that I believe that we will be successful is because the terms that I have just described are not new. Each and every country coming to this debate, each and every regulator and company coming to this debate is increasingly aware of the need for just the types of guarantees and disciplines that I have outlined.

The problem, of course, is how quickly we can politically put them into place.

Thank you.

GEORGE KOOPMANN: In the context of the European position on open markets in telecommunications, your remarks are very interesting. But you did not make any comment about the direction of liberalization to date and the fact that there is a commitment to liberalize competition by 1998.

I have two concerns that derive from that. The first one is, this seems to be an awful lot to be fighting for over just a three-year period. If the Europeans had no commitments for liberalization I could understand it. But they are already partially liberalized and moving to full liberalization by 1998. If England can get along in the kind of market that is evolving there, it seems to me that there ought to be a basis for a U.S.-European deal.

My second point is that my interpretation of the directives is that there is no way that a basic service provider can provide its own equipment uncompetitively. Because AT&T both provides equipment and wants to provide basic services to Europe, how would it handle the directives in Europe if AT&T is able to get into the market under those directives?

DON ABELSON: My reference was to commitment on the part of the European Union and its 15-member states to complete a liberalization process by January 1, 1998.

The deadline in these negotiations is April of 1996. So there is a gap between one date and the next. That kind of gap is manageable, so that is not an issue.

The issue is, what is the liberalization that will take place in Europe? This is an open-ended question. If all that is done in Europe is to make it easier for large companies to compete within the framework of Europe, because of the political need, then in fact you do not have true liberalization.

I am saying that if you are going to allow Deutsch Telecom and France Telecom to continue as the behemoths that they are, then there will be less than full competition. In the end, these companies will segment the market in Europe and continue to dominate that market.

That would not be the result if there was real competition based on a set of competitive safeguards, transparency, rules on interconnection, and an independent regulator, in which case you would have great competition, and we would not be able to predict the result.

One thing we could predict, of course, is that there would be tremendous upheaval, the types of social, political and labor upheaval that we have gone through. So if Europe does not truly liberalize in 1998 but liberalizes on the margins and it looks good on the surface, but underneath it is really not liberalized, how are the United States and/or non-European suppliers going to get into that market?

ERHARD KANTZENBACH: I would like to add something to the last comment. You say that we in Europe are limited because of the monopoly and that we are not finalizing liberalization. It is a two-way street. At least under a monopoly we would have public procurement, which we do not have.

If we compare the facts, it is not easy for the European telecommunication companies to sell systems and equipment to the United States, because the United States does not have this public procurement, which makes it very difficult to get access to the U.S. market.

For the time being, both sides have to learn their lessons. It is too early for the United States to suggest that it is open and that the others are not. My point is only that we have to learn on both sides and not to say the others are making the mistakes.

RANDOLPH LUMB: For those of you who are following the debates on Capitol Hill right now in terms of the domestic structure of the U.S. telecommunications industry, the entire issue around the ability to manufacture or the ability to offer competitive long distance services is certainly a reciprocal benefit accruing to the regional Bell operating companies, for allowing those who were offering competitive services today into the local exchange business.

So the theory here, at least in the United States, is that you can be vertically integrated anywhere you so choose as long as the marketplace is the regulator of that competition.

To address the fact that the German market is open to procurement: One of the things that did not happen in the GATT agreement was that the European Union would not accede to the agreement on government procurement for infrastructure procurement of telecommunications.

The United States was willing to open the state, local, and federal government markets and to bind open the monopoly regional Bell operating companies to open in transparent procurement. But it was the Europeans at that particular

point who would not bind open their monopoly markets to a fair and equitable GATT-related procurement.

If the GATS is successful, and there is a core nucleus of key countries that agree on competition and basic telecommunication services, frankly once those markets for basic telecommunications services become open and competitive, the procurement issue is moot. It follows along as a natural pull through of a competitive marketplace.

CARLOS PRIMA BRAGA: Just as a footnote, in the GATS Agreement, there is a commitment to begin negotiations in the procurement area for services in two years' time. It is a different ball game with respect to services vis-à-vis the government procurement plurilateral agreement.

SYLVIA OSTRY: Given the definition, the services sector is really not a traditional trade sector. It is domestic deregulation. And the Americans are saying that the Europeans had better deregulate the way we do or you are unfair, and that is perfectly legitimate to say that.

But say that to the rest of the world. You can reach an agreement with Europe because they are too big to fight with. But say many of the other countries do not go along. Presumably you will not do national treatment and you will not do MFN. So your alternative is to use 301 and do it bilaterally. I am just trying to find out whether the GATS Agreement on this would collapse because the other countries do not agree. What is your alternative?

DON ABELSON: You are right to assume that, should we not get a deal that is deemed by U.S. interests as good enough, we would not reach a successful conclusion to the talks. I do not know what other governments would do. We would make this assessment based on consultations with Congress and with the private sector. We would not make a commitment to others to provide national treatment and access to the U.S. market.

In addition, we would not provide MFN treatment in this sector. We would be free to do what we wanted to do bilaterally. So that would be the first step. However, we are guessing what would happen. It is only based on an assumption that there is failure, even though I do not believe that we will fail. This is a very hypothetical framework at this point in this discussion. I hesitate to go into such a hypothetical framework, because without the appropriate conditionals in each and every sentence, it could be misquoted. But, nevertheless, in such a situation we would probably use the type of mechanisms we have at our disposal today, some of which have been mentioned here.

GEORGE KOOPMANN: Between these two extremes—301 and the multilateral agreement—there might be scope for the plurally lateral or many-lateral agreements between like-minded countries, which should be open to other coun-

tries that could accede to the agreement at a later stage. Do you see any scope for this option, and who would be a possible participating country?

DON ABELSON: You describe an option that is somewhere in between doing it one-on-one and doing it with 120 countries, which is what our negotiating framework in Geneva is.

To be honest, we need approximately 40 or more key countries in the negotiating room in Geneva, not 120. We need less than the entire universe of the WTO to get the deal.

I am convinced that we will eventually have a deal. A deal must include the countries that we have heard about; that is, the developing world as well. Because in the area of infrastructure of telecommunications that we are creating, we are talking about the pipes of the information highway.

It is not sufficient to have pipes that go across the Atlantic and the Pacific but then do not go beyond. We need the Asian countries, we need Korea, and we certainly need Australia and New Zealand. We need the subcontinent, key countries in Africa, the Middle East, certainly the emerging countries in East Europe, the former Soviet Union states, and then, of course, Latin America. Without these key emerging markets, we have only codified yesterday's markets and we have not really dealt with tomorrow's markets.

I did not mention China and Taiwan, or Chinese Taipei, because they are not members of the WTO and do not participate in the negotiations. But certainly we could meet them too, and the former Soviet Union.

Is such a deal possible? Yes, because it is largely in the interests of the countries that are around the table. We all want to be in the fast lane, and this is the negotiation that will create the rules of getting into the fast lane, and that is where the commonality of interest is.

An Industry View

Randolph Lumb, AT&T

At the 1964 World's Fair in New York, the Bell System introduced the first video phone. It was in 1993 that AT&T put it on the market as a commercial product. From 1964 to 1993, the commercialization of that product was somewhat dampened by the fact that there was a regulatory policy within the United States that was very customer-user focused. And the regulation of the Bell System was in place to ensure affordable and universal basic telephone service. The inventions of the Bell Laboratories during that period of time accrued more benefits to companies outside of the Bell System than they did inside of the Bell System.

Why was that? It was because of the regulatory framework created to put 20-year depreciation schedules in place for switching technology, in which the tech-

nology itself was starting to turn over every decade, then every five years, then every two-and-a-half years, and then every year. But the entire rate structure, the entire cost structure, and the entire capital structure of the Bell System was regulated. And it was regulated for the U.S. user and consumer of telecommunications.

Basically what happened a decade ago was that competition was substituted for regulation, because that is basically what happened with the modified final judgment in the divestiture of the Bell System. What were called natural monopolies, or what we know as local exchange companies, were put in a position in which they could only offer basic telephone service and others could offer other types of service.

The fascinating thing is that the rates have dropped by 40 percent over that decade. So rate-of-return regulation was substituted by competition. There was disruption of employment, but today there are more companies in the telecommunications business.

Currently, there are 650 long distance telephone companies in the United States. You can access them by dialing their access code. Some of them are very highly oriented, some are very general. But there are more companies in the business, and the business is growing at a tremendous rate. When you look at the information technology sector, it is probably the leading sector in terms of employment, invention, and leadership in the United States today. And the telecommunication sector is certainly a prominent part of that.

In Europe, they have a different approach. Instead of the consumer, the worker seems to be the most important person. Many of the policies that are associated around the activities of liberalization in Europe are labor-based policies rather than consumer-based policies. This changes the thinking of the government and the regulator when they start to make decisions.

In Japan it is producer-based policies. It is very important for NEC, Oki, and Hitachi to be linked with NTT in a very close, almost vertically oriented way. But the policy is different, and therefore the motivation of government and the motivation of liberalization is different.

We certainly would like to see a system in which competition is the norm, not the exception, and that comparable or effective market access becomes the test.

A government has a sovereign right to develop any market model that it so chooses. If one chooses to have a monopoly government-owned telecommunications system, they have the right to do so. But they should not have the right to have a monopoly in their home market, have access to my competitive market, and be able to use monopoly profits to compete against my stockholders' equity. This is not effective market access and effective competition.

So that is why we are concerned about things that are occurring in the marketplace today that are dysfunctional. For example, the German- and the French-owned telecommunication firms are trying to buy into Sprint. We think they

ought to have every right in the world to invest their capital in that company. But when it is a government-owned monopoly doing so and U.S. companies do not have an effective opportunity to compete in the investor's markets, then that creates an asymmetry. Congress is trying to get away from exactly this type of asymmetry in terms of what the Bell operating companies, AT&T, MCI, and Sprint are involved in. So why would we, on the one hand, try to dismantle that type of asymmetry, and on the other hand, perpetuate it in the domestic market and the international market?

We believe that the GATS Agreement offers an opportunity to bring the most players to the table at one time so as to achieve effective competition in basic telecommunications services. If it requires some sort of a transition period, so be it. But we believe that this is a much more preferred solution to bilateralism or the ad hoc system that exists today.

Thank you.

ERHARD KANTZENBACH: I just want to assure you that in Germany there will be an open market in 1998. The plans of the Minister of Postal Service are published already, and I am sure we will have a system, too, that is consumer oriented.

But let me say one thing. If, in general, we have a monopolized postal service, and in America you have a consumer-oriented market, in that case you would deny the access of the European firm to the American market. This, of course, is a producer-oriented viewpoint, too, because the firms would not do any harm to the American consumer.

RANDOLPH LUMB: I have seen European firms be very successful in this market, selling telecommunications equipment, even switching equipment. Let me tell you what disturbs me about the two markets.

If you are in Paris and you make a telephone call back to Washington and then if you are in Washington and make a call to Paris, and then you compare the two bills, you will find that the same call costs almost three times as much to originate in Paris as it does to originate in Washington.

Why is this? Is the French telephone system so inefficient that they have to pay so much, or is there a huge subsidy in there that is going into the pockets of some sort of a program that is keeping some social program alive, or is it subsidizing some producer who may be in the United States selling against the competitive market?

But the fact of the matter is that there is a huge disparity in the prices. I believe that the competition in both markets—and we know that the competition in this market is causing those prices to be what they are—will take the subsidy out and will make everyone probably more fleet of foot in the long run.

HANS SCHARRER: To follow up to what Dr. Kantzenbach said, I believe that

there is an inadequate recognition in the United States of the changes that are taking place in Europe. It is true that deregulation is still not concluded. You mentioned the United Kingdom, but you could have mentioned other countries in Europe.

If you take the German example, there is access to wireless networks, and American companies are part of this process. I do not know of any German company that would be part of an American wireless market. There is a change coming up in cable networks that will be demonopolized within the next years, and a number of countries will compete in this market as well, besides German Telecom.

German Telecom is going to be demonopolized; it is going to be privatized. But it is a worker-oriented approach. People who worked for German Telecom went into this company for lifetime employment. Now the company has to cut employment by 80,000 people within a short time, so it is quite natural that they have to take some account of how to manage this.

So to that extent there is some social component in it. But this does not rule out that, in the end, this will be a consumer-oriented process that will be different from the American market. But it will be highly competitive and quite in line with what is going on in other countries of Europe.

One final thing regarding access in the components market. Mirroring the U.S. market in Europe may very well mean that, instead of public procurement, you will have nonpublic consumption by the private telephone companies. And what will you do if AT&T or some other company does not get into this network? Would you then apply 301 according to the Japanese automobile example?

This is the other side of the mirror of course. There is no public procurement in the United States. It is all private buying. And without any transparency.

RANDOLPH LUMB: To briefly respond, I believe that Europe is on the right road to liberalization, and 1998 seems to be the date that they say that it will occur. But competition and liberalization are distinctly different. It takes time for competition to become whole.

I hope that this move will allow the Europeans to make a commitment to open their markets to competition not only among themselves, but among others, the United States included.

In that regard, that would be a foundation of private, commercial companies competing with each other in a global market, not unlike private commercial companies competing with each other between Europe and the United States today.

That then says that procurement becomes private and commercial. And if you make a mistake and you buy something incorrectly, then you suffer the consequences of that capital acquisition in the marketplace, not under the protection of a regulator.

Session 9

Participation in National Technology Development Programs

Moderator:
Charles Wessner, National Research Council

CHARLES WESSNER: Before we begin this session, I would like to mention a symposium held earlier this year as part of this project. The symposium focussed on *International Access to National Technology Programs* and was organized under the auspices of the National Research Council's Board on Science, Technology, and Economic Policy. It allocated a full day to reviewing issues associated with foreign participation in national technology development programs—a subject not dissimilar to the topic of this session.

Every effort was made to make that symposium as inclusive as possible. As with the other subjects that we have covered in the course of the today's discussion, such as Airbus and telecommunications policy, the question of participation in national technology programs elicits strong opinions but not always careful analysis.

Although the STEP Board did not issue any formal findings from that symposium—and I stress that there were no formal findings—there were perhaps four points that are relevant to today's discussion.

Program complexity: The first point is that there is a great deal of complexity and many administrative differences in the programs of the participants in the international system. However, these programs share a common orientation; they are *national* technology programs designed to promote *national* industries.

Practices differ: Second, the actual practices and procedures of these national programs differ a great deal. For example, they often differ in terms of administrative procedures and the judgments that result. One of the most interesting observations was made about a Finnish program, to the effect that if the Finnish administrators decided that they needed a company in the program to achieve its objectives, the company would be invited to join the program, regard-

less of its national origin. That is the national criteria standard they adopted, and it appears to be a very compelling standard and one which relies on good judgment of program administrators. Of course, here in the United States, some would have us codify a set of legal principles to address these issues, which may take on the dimensions of Hammurabi's Code.

Linkages: A third point is the issue of linkages. Issues that are seemingly separate, such as public procurement, investment regimes, and trade practices, are in fact intimately linked. For example, some private sector speakers objected to the idea that they could cooperate on developing a technology together but then would not be allowed to sell that product in the home markets of the partners.

Legislative complexity: Fourth, not only do the practices in each of the countries discussed differ, even the programs of the federal government in the United States differ quite substantially. Moreover, to "realign" all of the U.S. technology programs to ensure that same condition of access would not only be conceptually difficult (given their different objectives and origins), but as Tom Kalil, who works with the White House National Economic Council, pointed out, opening up the legislation for all these programs would be impractical. Indeed, he jested that the policy solution for access to U.S. programs that the Congress might adopt is to abolish them all.

The underlying point is, of course, that the topic of international access, like many others addressed in the course of this conference, could be the subject of a full day of presentations and discussion.

We have three outstanding participants for this session: William Spencer, who is both a respected leader and a survivor of cooperation among American companies, will be our first speaker.

We are also very pleased to have with us today the head of the Office of Naval Research, Rear Admiral Marc Pelaez. The Admiral has very kindly agreed to bring a perspective that was touched on earlier today with the DoD program and the dual-use program. Admiral Pelaez is responsible for a vast array of Navy and Marine Corps programs designed to provide a competitive edge in that most critical and unforgiving of environments, the battlefield.

Our last speaker is William Keller, who works for the Office of Technology Assessment [OTA] which provides an invaluable service through its objective and thorough analyses of the technically complex questions that are raised by public policy issues today.

Opportunities and Challenges in International Collaboration: A Civilian Perspective

William Spencer, SEMATECH

I am here to give you some idea of what we have done at SEMATECH, some of the lessons we have learned, and then some thoughts that might translate into ways we could cooperate internationally.

I want to talk about SEMATECH, about what it is and what it is not. The SEMATECH consortium of semiconductor manufacturers has been around for almost a decade, and I have been at SEMATECH for almost 5 years. It is still an experiment; all of its participants are still learning new methods, processes, and techniques.

This year we have a budget of $180 million, half of which comes from the federal government; the other half comes from our member companies. We have approximately 750 people. Over 200 of them are assignees from our member companies. Our members send very good people to our organization for periods as short as a few months to as long as five years. Our assignees are a major asset.

We run approximately 100 projects a year. Even though SEMATECH has been accused of subsidizing only the big companies in the United States, most of the money flows through to very small companies doing equipment development. Two-thirds of the companies in the United States who provide manufacturing equipment are under $12 million in sales, and the bulk of our money goes to these companies.

We have even more meetings than the National Academy of Engineering. We run 600 meetings a year, and these are only the ones that we keep track of. Participating in these meetings are approximately 25,000 visitors each year. Communication is a major part of what we do.

In addition, the semiconductor industry provides approximately $35 million a year for university research, and SEMATECH accounts for $10 million a year of that $35 million. This is administered through the Semiconductor Research Corporation located in North Carolina.

About 15 months ago, the board of directors at SEMATECH asked us for a plan in which we would no longer use federal funding. Their thought was that, since the semiconductor industry in the United States was now fairly healthy, it was appropriate to have private industry assume full responsibility for funding SEMATECH in the future. Our board and SEMATECH's management extended what was a very gracious thank you to the federal government for the help they had given us, pointing out that we could not have accomplished what we had over the past few years without their support. The board determined that, in 1997 and beyond, SEMATECH would no longer seek direct federal funds.

If you look at what happened in the November 1994 elections, our board was prescient. It was an extremely good move for us, though we certainly hope that the interactions that we have had with the government in the past will continue in the future. We believe that there are a great number of advantages, both for private industry and for government, in working together.

The area in which we found that the semiconductor industry could best work together is in manufacturing technology not related to products. Specific products are certainly part of the competitive business that our member companies are in, so we stay out of it; we do not get involved in memories, microprocessors, logic, or any other products.

We also stay away from specific manufacturing processes. The way that, for example, Samsung manufactures memory and Hitachi manufactures integrated circuits is a competitive advantage to them. They have a process that is better than others, and that is one of the reasons why they have a strong position in the market. So we stay out of specific products and specific processes and instead focus on precompetitive areas for cooperation.

Our biggest effort is in information exchange. We ask our members constantly: What do you get out of SEMATECH? And the biggest return they get is a place for their manufacturing people to come together with other manufacturing people and exchange information. That has never existed in the United States before. I am aware of many professional societies—the IEEE [Institute of Electrical and Electronics Engineers], the American Physical Society, and others—where R&D people can get together and share information, but manufacturing people have not had such a forum.

As part of the effort at SEMATECH, over the last few years we have developed a roadmap for our industry, looking out 15 years into the future. That roadmap is admittedly fuzzy when you get 15 years out, but we think that for the next 6 or 7 years we know what the industry requirements will be.

You heard yesterday from Northern Telecom that one of the key issues for the semiconductor industry is whether we can afford to build fabrication facilities in the future, facilities that are going to cost billions of dollars but that will nonetheless return a profit to the builder.

The reason that the semiconductor industry has grown so rapidly for the past 30 years is that every year we have had a 30 percent reduction in the cost per function that is provided in silicon. That translates into over a million times improvement in productivity over that time frame. To look at it another way, in 1965, an individual transistor in a plastic package cost approximately $5. In 1985, just 20 years later, a 1-megabyte DRAM with over a million transistors in a plastic package cost approximately $5. There is a saying in Silicon Valley that every integrated circuit will ultimately cost $5 except for those that cost less. And it seems to be true; a lot of them cost less than $5 today. This is a tremendous improvement in productivity.

And the real question is, when you are now paying $1 billion, $2 billion, or $3 billion for a manufacturing facility, can you continue to get that 30 percent per year improvement in productivity? We think we know the answer to that for quarter-micron technology—the technology that is required for megabyte DRAM manufacturing and the associated logic and microprocessors required in the 1998-1999 time frame—because our industry has gotten together, both the suppliers and the manufacturers, and worked out what equipment has to do to stay on a 30 percent per year productivity curve to the year 2000. And this year the U.S. semiconductor and equipment industries will start on 1-gigabyte technology, and in a year or two we believe that we will have the questions answered for that technology as well.

A very important question came up in the sessions this morning: Where is the research for this industry going to come from in the future? I happen to agree that industrial research is in terrible trouble and that the U.S. government is likely to reduce the funding for basic science and certainly for development programs. Universities are in a time of stress, and the national laboratories are searching for a mission. So where will our new inventions based on fundamental science come from?

My choice for the source of future breakthroughs in semiconductor devices and technologies is the world's research universities. Research centers, similar to the National Science Foundation engineering research centers, could be established at selected universities. These centers, jointly funded by NSF and the semiconductor industry, would focus on the technologies required 10-15 years in the future, as identified by the National Technology Roadmap for Semiconductors. The first of these centers will soon be established by the NSF and the Semiconductor Research Corporation.

Approximately three years ago, SEMATECH started to determine a return on the dues investment of its member companies. Our members, not SEMATECH, calculate this return; SEMATECH provides them any information they need and assists in the algorithms, but they make their own calculations. We had a goal of a factor of 4 in 1994; it had a nice ring to it. We did not know if we could make it; we did make 3.8—that is, for every dollar invested in SEMATECH, our members calculated they received a return on investment of $3.80—which we and our members thought was very good.

Sharing information: One of the most interesting aspects of early information sharing in our consortium—particularly information on current manufacturing processes, things that we thought we could share about equipment reliability or other areas that did not affect competitive capability—was the question of who goes first. Fourteen member companies got in a room, sat around a table, and said, "Well, who's going first?" Fortunately one company, a very small company, spoke up and provided information that was of use to the others. And as we broke the log jam, a tremendous peer pressure arose that said, if you don't participate in this meeting, if you don't share in this meeting, you aren't welcome here any more. And that pressure was applied to the large companies just as it was to the small companies.

What we learned is that there are very few secrets in this business. If you have been manufacturing integrated circuits for a number of years, the problems that you solve and the problems that you wrestle with are the same problems that are occurring down the street in the other person's factory. I suspect that they are the same problems that are occurring in Korea, in Japan, in Europe, and everywhere else. So a big secret we have discovered is that there are very few secrets.

Specific objectives are very important to the success of consortia. I was pleased that Dr. Jones from the Department of Defense described such objectives for consortia in DoD. In the cooperation on jet engines, for example, there were

specific goals: a 30 percent improvement in performance, a 20 percent reduction in cost. A consortium needs clear, measurable goals if it is going to succeed.

We believe that it is important for SEMATECH to be led by industry, and we appreciate that we have had an extremely good working relationship with our colleagues in the DoD. Long-term support is also essential. SEMATECH's results would have been meager indeed if the consortium had not survived more than two or three years, because it takes that long to establish a clear direction and mission and begin working toward them. And, as I mentioned earlier, the involvement of member-company personnel has been essential to SEMATECH; we have over 200 assignees each year at our Austin, Texas, site.

International Cooperation

Let me move now to international cooperation, and the possibility of things that we as nations and members of the global community might do together. Concerning environmental safety and health, we all recognize that the release of pollutants in Japan or Europe affects the United States and vice versa. There is no reason why everyone should look for a replacement for silicon; we ought to be able to do that together.

300-mm wafers: Another area for cooperation is in the conversion to 300-mm wafers. One reason the semiconductor industry has been productive is that we have consistently gone to larger wafers. We know that the cost of conversion from the current 200-mm wafers to 300-mm wafers will be between $10 billion and $20 billion. That is the same amount of money that it will take to build reactors for fusion energy 20 years from now. Our wafer conversion has to be done over the next two years, and the cost will be borne entirely by the semiconductor industry; I hope it will be an international effort, with the cost shared equitably by a large number of companies.

X-ray lithography: X-ray lithography (or nonoptical lithography) may also be a great opportunity for international collaboration. Today, if you buy a laser for an exposure tool, it costs approximately $500,000. But today, a light bulb for x-ray lithography, just the light bulb alone, costs approximately $25 million. That is a 50-time increase. Now the rest of the exposure system does not go up by a factor of 50, but it is still significant. You can see why a future factory will cost $2 billion or $3 billion if you have an exposure tool whose light source alone costs $25 million or so. And you can understand why it may be a viable area for international cooperation.

Roadmaps: Let me turn to roadmaps. I believe that the basic science activities around the world owe the rest of us a roadmap for what they want to do. Why, for example, is it important to put $10 billion in fusion energy? What are the milestones you expect to meet, when do you expect to break even, what are the things that you expect to deliver to the world to better our lives in exchange for the $10 billion it will cost you to perform that experiment?

I think of myself as a scientist and sometimes as an engineer, and I believe

that as a group we have made a huge mistake in not communicating better to the general public, and particularly to our politicians, just why these programs are important.

I believe that the U.S. academies might take a leadership role in developing roadmaps for biology, physics, chemistry, and computer science—and in those areas in which we will make large multibillion dollar investments, make clear why they are important and what the payoffs to the world will be for those investments.

Industry, on the other hand, has a responsibility to set roadmaps within various technologies. Certainly our industry has found the National Technology Roadmap for Semiconductors very useful, and it has set an example for the development of roadmaps in photonics, batteries, jet engines, and other technologies as well.

I believe that it is important that all of these interactions that I have described, whether local, national, or international, be treated as experiments. We found that our problems in the semiconductor industry are not primarily technology problems. They are management problems, business problems, financial problems—generally, technology problems are way down on the list. And when you start talking about international cooperation, the complications of trade policy, international financing, and intellectual property rights are going to be more daunting than the technology issues. These complex interactions will demand innovative experiments.

National and Regional Consortia

In addition to SEMATECH, a number of national or regional organizations have been formed to foster sharing in the electronics industry—EUREKA, ESPRIT, and JESSI in Europe; the Semiconductor Industry Research Institute Japan (SIRIJ); the Industrial Technology Research Institute (ITRI) in Taiwan, etc. Through such organizations, information can be provided to an entire industry. Adequate capital to follow up on international cooperative experiments is essential. If you are going to embark on international collaboration and do not have the capital to fund the results of that collaboration, you had best stay out of it; all you are going to do is frustrate yourself and the people who support the cooperation. Moreover, one country having more capital than another also complicates cooperation, because most high-technology industries today are very capital intensive.

Each participant must have something to give. The U.S. semiconductor industry could not have entered into an international cooperation ten years ago; we were down. At that time, everyone believed that the U.S. semiconductor industry was going the way of the U.S. consumer electronics industry.

Is an organization such as JESSI or SIRIJ or SEMATECH necessary? In my view such organizations may be necessary for international cooperation to succeed. Each nation must have a strong local organization and a strong national capability so as to share information.

Today no single country, and certainly no single corporation, and generally no single economic region, will be able to do most of these high-technology activities itself, whether it is in pharmaceuticals, semiconductors, or software.

Finally, it is important to point out that, not only does technology flow immediately over the worldwide web, so does everything else. Capital investments around the world are very fluid; they go to places where they will get the biggest return. People move very easily. People, capital, and technology are all on the move, and in such a fluid environment, international cooperation makes a lot of sense.

Thank you.

Opportunities and Challenges in International Collaboration: A Military Perspective

Marc Pelaez, U.S. Navy

Today there has been much talk about the DoD. I am going to give you some perspectives and put some issues on the table that may help with discussions for the remainder of this conference and beyond that. I will take issue with something that William Spencer said and take a potshot or two at a couple of the other speakers.

Daniel Goldin said he was looking to the future. And in dealing with the future in the United States, I believe that the long-term view rests with the government. The investment for the government is in the basic research area.

Government's Role in Research

I am talking about the next generation of markets, not today's tools. I have talked with Bob Galvin, the Chief Executive Officer of Motorola, and his basic view is that industry uses technology, whereas the government implements technology. Industry does not invest in basic research. The government is the instrument in this country that has done it for the last 50 years.

The brain trust that exists in the United States is in the university system. The way we use it is somewhat unique.

There has been some reference here today to places such as AT&T and Bell Labs. Certainly some great corporate labs have existed in the United States—IBM and Westinghouse in Pittsburgh are good examples. For the most part, if you look at the history of those laboratories, they really existed as great scientific laboratories at the time when those companies enjoyed monopoly positions in the market. That gave them the flexibility to invest in the long-term view.

Because we no longer have that monopoly, for better or for worse, we have seen a real decline in basic research as it existed in those types of institutions. So, again, it comes back to the government to invest.

In taking issue with William Spencer because he said that basic science owes

us a roadmap, I do not believe that this is true in science. We tend to mix science and technology. As soon as you make roadmaps, you are out of the science business and thinking too close to the present. I like to think of the next generation of markets.

I also take issue with Daniel Goldin's comment that researchers should sell the public on what research is all about and convince the public that it is a good investment.

I manage an enterprise that takes $1.5 billion a year directly out of the Navy for science and technology. I was introduced at a conference recently as somebody to whom every man, woman, and child in this country gives $6 a year to invest wisely in science and technology.

That hit pretty close to home. I decided that if I were to go out and personally ask people to give me $6 this year to invest in science and technology, I would not get much money. So there has to be some view that is beyond the general public. There is a governmental function, I believe, to sustain a long-term investment in the types of enterprises that are important to our economic health, as well as our military superiority. I do not want to lose sight of that.

My situation is that I have a customer and I understand the customer, and many of you are in the same position. In terms of the military, I understand the customer very well.

Technological Superiority

Now we are moving to such things as dual use and drawing more on the private sector, and I believe that this is excellent. But we have to recognize that if we equip our forces, which are getting smaller, with whatever any country can buy off the shelf, then it becomes a numbers game beyond the training, and soon we are a second-rate institution. So our investment in science and technology is to give us that edge to cover those gaps that are not possible within the framework of industry.

A good example are all the radars that are available in the private sector. There is plenty of antenna technology in the private sector. But frankly, the antenna technology is driven toward very specialized and unique components. For the military, we are looking for a much broader and more robust environment to operate in when we conduct electronic warfare. So there is a convergence between the commercial interests and the military interests, but there is also a point in which the military investment will be critical to giving us a winning edge.

Basic Research is International

Now I will take some potshots at a few things that may generate some discussion. I mentioned basic research. I really do believe that it is transnational. I do not believe that it is possible to capture the market in basic research. Science tends to move across borders very easily. Even during the Cold War, there was

considerable exchange with the Soviet Union, because scientists, to survive in most of the world, publish or perish. So what you find is that no one has a real monopoly on science. I do think some countries invest quite differently in it.

Challenges to International Cooperation

When you move beyond science, you begin looking at international cooperation. What you are really talking about for the most part is the difficult and sticky points that center around technology, because technology gets much closer to application. I operate an office in London and an office in Tokyo as well, so we have a lot of interaction globally.

There are a number of unique problems, one of which is the U.S. perspective. First, I do not believe that we are driven by a national strategy. That is a broad statement. The problem when we try to deal with technologies is that we tend to think in terms of critical technologies; Congress likes to do that. It is a very convenient way to discuss technology. Critical technologies, in my opinion, are the worst way to discuss your products.

You need to look at what capabilities you want to achieve. If you are in the private sector, if you are in a business unit, such as the gentleman from AT&T who was here today, then you talk in terms of what capability are you trying to get to the market. And yet when we talk in terms of science and technology on a national scale, we tend to talk in terms of critical technologies, because that is easy to deal with and you do not have to be very specific.

That causes us, in my opinion, a number of problems when we deal with other countries. I will mention a few of the countries and a few of the issues. I would hate to think that anyone would misplace my words as attempting to attack a particular country's interests, because I am not.

The French. When I deal on a technology level with the French, I face a real dilemma. When I deal with the French government, I find I am also dealing directly with the French private sector, almost across the board.

And yet, on my side, we tend to treat our industry somewhat as orphan children; we do not want to pick winners and losers. So we do not pick anyone. I end up with a government lab on my side and industry on their side. What technology am I going to transfer and where does it go? Where is the level playing field that you would like to have? It is a dilemma. I am not saying this has impeded us from entering into cooperative arrangements, and I am encouraged by some interesting opportunities. But it does pose a problem for us, and it is something that we have to think through.

There was some discussion yesterday and today about producer-, worker-, consumer-based structures. Japan is very much a producer-oriented structure. Basically the Japanese have paid for the Americans to be there to support their defense structure for a long, long time. It has been a very good relationship for both sides. I am not sure of the actual numbers, but the Japanese nationals are paid billions of dollars to work and pay for land and utilities and such things for

us to operate there. This is a two-way street because our military presence actually gives us access to markets in a very diverse sector of the world that has the greatest trade with the United States and represents one of the greatest market potentials for the United States, even though we tend to be Eurocentric because it is convenient geographically.

So this is a two-way street that has enabled the Japanese to concentrate on the producer side without investing heavily, although it has changed somewhat in the defense structure.

The Need for Persistence

Maybe it would be worth undertaking a case study about long-term strategy for the United States. One of the things to consider is that we do not have persistence. We have wonderful long-term investment in science and technology, but we do not always have a long-term view in terms of policy, and it tends to change at least every four years, if not every two years.

For another example, there is a program that was the first cooperative development of a weapons system between the United States and Japan. It was a derivative of the F-16 aircraft, the FSX. It is managed and funded by the Japanese Defense Agency.

The commercial contracts between the U.S. and Japanese industry result in the U.S. gain of 40 percent of the work share. The aircraft quantities are two flight tests, two ground tests, and approximately 100–130 aircraft in production. The history of this started in 1985, and in 1990 a memorandum of understanding (MOU) was finally consummated.

The U.S. program goals were to assist in the development of an interoperable fighter for the defense of Japan, enhance two-way technology flow, and share a meaningful work plan for U.S. industry.

The MOU outlined the process whereby the JDA or the Japanese FSX contractors provided all derived technology to the DoD or U.S. FSX contractors. This includes the ability to examine and evaluate without charge to the U.S. government or to U.S. industry Japanese indigenous technologies. Access also includes the opportunity to pursue special testing and full transfer of technology through separate contractual agreements.

This memorandum has been fully supported by the Japanese. The problem is that we never took advantage of it.

We could go down to the assembly line and sit right next to the U.S. F-16s that are being put together with all sorts of rivets and examine polymer co-cured composites on an adjacent line that is being used on Japanese aircraft.

Other technologies in use include gallium-arsenide-based radars, as well as some others in terms of surface-mount technology for direct chip attachments in electronics, optical interconnects, advanced displays, and thermal management technologies, etc.

When we enter into these agreements we have an opportunity for real tech-

nology transfer, but we do not take advantage of the opportunity. So there is an issue not only with having a strategy, but also a policy and a strategy that waivers with time, which does not serve our national interests.

Criteria for Foreign Participation in National Programs

William Keller, Office of Technology Assessment

Today I am going to address the subject of criteria for participation in national technology programs. There is a lot of interest in this because, in the end, it comes down to who gets the money and according to what principles. So my talk today will center on money and principles. These are two ingredients that get rather mixed up in Washington at times.

Taxpayers' Money

The money is taxpayers' money. It is given to corporations, usually in matching grants, under technology development programs such as the Advanced Technology Program (ATP) and programs under the Energy Policy Act of 1992.

These technology programs for the Department of Energy and the Department of Commerce are not insignificant. In FY 1995, the appropriation for the ATP was approximately $431 million, and the appropriation for the DoE technology programs was on the order of $2.3 billion. Some of the money is getting taken back by way of recision, but even after the recision, it is still a very significant investment in the nation's technology base.

and Industry's

The money is also industry's money. Government is not in the business of giving a handout to corporations. Usually industry must come up with half the money. And the money that industry antes up is a very special kind of money: It gets invested in technologies that may or may not pay off.

This is why industry does not go it alone for many of these projects that are contemplated under these programs. The risks are simply too high. It is the government's money that brings the risk to an acceptable level. And it is the fact that government and industry are willing to take the risk with the money that enables the exploration of technologies that might otherwise not have been developed.

There is not much agreement on the money these days. Some want to reduce it. Some would like to build it up. Some want to reserve it, I believe mistakenly, for U.S.-based companies under certain circumstances. And some think that foreign companies should have the same opportunity to compete for U.S. technology funding as U.S. companies do.

So much for the money, now for the principles.

Principles

It turns out there are two principles. The first is easy. To be eligible, firms must act in the economic interest of the United States, broadly defined. The

second is more elusive, which is the principle of national treatment. Nations should treat foreign countries as they treat their own indigenous firms.

Let me take these one at a time, and the way to do this is to focus exactly on the ATP and the Energy Policy Act programs that I mentioned earlier.

The legislative language that governs participation in these programs is virtually identical. There are two parts to it. The first is an economic interest test that applies to all firms that would like to participate.

Economic interest: The legislation gives an illustrative list of what might constitute the national economic interest; this list includes investments in R&D and manufacturing in the United States; significant employment in the United States; and an agreement to promote manufacturing and resulting products in the United States. A fourth item on the list is oddly worded. It is an agreement to procure parts and materials from competitive suppliers.

And we say they do not all have to be met, there could be other ones. It is an illustrative list, and it is very important to keep this in mind. These are broad criteria and presumably others would do as well.

To my knowledge, no firm to date has been excluded from participation on the grounds that it did not contribute to the economic interests of the United States. So we may have a bit of a tempest in a teapot here. There has been so much argument against this. There have been entire coalitions of companies and large-scale business organizations that have fought it. Maybe they are fighting against a straw man.

When you get down to it, there is a strong presumption that any firm, foreign or domestic, that conducts a lot of business in the United States, employees a lot of people, and conducts R&D is simply acting in the United States's interest. It is a net plus for the national economy. So much for the principle of economic interest. There are very few, if any, situations under which it would disqualify a foreign firm.

National treatment: The second principle, the principle of national treatment, is really far more troublesome. It has several synonyms or elements, if you will: level playing field, equality of competitive opportunity, comparable treatment, basic fairness.

If anything, there is less agreement here than there is about the money. This stems from the fact that there is a giant misunderstanding about what national treatment is, how it should be applied, whether and how it should be enforced, and whether it extends past investment to government procurement and/or beyond that to government funding of basic research, applied research, and technology development.

Let me illustrate the dimension of this misunderstanding about national treatment as it applies to the ATP and the DoE technology program.

The congressional staff who drafted the national treatment provisions of the legislation crafted it explicitly, or so they thought, as an instrument of national treatment. The basic intent of the comparable treatment provisions of this legis-

lation was to say that federal funds should not be provided to firms from countries that choose not to treat U.S. firms as they treat indigenous firms. And this extends past technology funding to intellectual property protection and also to investment at large, or investment generally.

The proponents of this legislation believe that it is a legitimate application, indeed a ringing confirmation of the principle of national treatment. It simply says that we will provide funding to foreign firms on a competitive basis from countries that provide funding to U.S. firms on a competitive basis. And so far it includes every country except one. It is the golden rule.

Furthermore, they contend, national treatment is a principle that is primarily applicable to private sector investment and trade. In this view, our legislation affirms national treatment by extending the ATP-EPEC rule into the public sector, indeed into the inner sanctum of national technology development, a place that it has not often been applied in the past.

Opponents of this eligibility rule say that it is unilateral in character, it is something that national treatment was never intended to be. Indeed, far from affirming the principle of national treatment, it sets up conditions for foreign firms that U.S. firms do not have to meet. It is therefore conditional national treatment and a negation of national treatment itself. Moreover, it extends past reciprocity in national technology funding to reach intellectual property rights and direct investment more generally. To opponents it is a dangerous precedent, a slippery slope that threatens to erode progress toward a more free and open global trade and investment regime.

Clearly, there are two distinct sides to this debate and this is one of the hallmarks of OTA. We learned to do this in an evenhanded way.

Simple logic would suggest that both sides, being polar opposites, cannot be right. And if this is correct, then they probably cannot both be entirely wrong either. The problem is that each side has become a caricature of the other.

Friction and Cooperation

I would like to turn just briefly to the theme of the conference, which is the sources of friction and cooperation in high-technology development and trade.

It is quite clear that some aspects of the national technology programs have the potential to become sources of considerable friction. They already have.

Not long ago, for example, the European Commission found it necessary to notify the OECD that the foreign eligibility provisions that we have been talking about in the Energy Policy Act constitute a violation of the principle of national treatment. So we are already beginning to develop a prelegal infrastructure to deal with this.

I would like to suggest in conclusion that the comparable treatment aspects of the national technology programs could also become a source of broad-based international cooperation. This might be accomplished by elevating the debate to the level of multinational negotiations. It would be possible, for example, to

include eligibility of foreign affiliates as a provision of the multilateral agreement on investment that is just now getting under way.

I will end here with the further comment that one of the last OTA papers that we are likely to publish will be on this subject and it will be available soon.

Thank you.

CHRIS HILL: I am an avowed declared partisan in favor of the ATP program. History would be very helpful in understanding where this came from. The provision that you quoted or paraphrased was a substitute, very carefully put together by staff rather than, for example, the members who were in favor of establishing an ATP and wanted a very tough, U.S. firms type of provision in that bill. This was crafted as a way to sneak past the proponents—not the opponents but the proponents. It is a good provision, given where it came from. That does not mean that it could not be improved, but it seems to me that one should not take Congress to task for having done a bad thing in this provision. In fact, it is remarkably open to international participation, given its origins.

WILLIAM KELLER: What you say is correct. But it has allowed the international foreign economic policy of the United States to devolve upon individual agencies, so that the Commerce Department is now in a position where it can decide that Japanese firms are not eligible—which it has done in the last round of awards—for the ATP program. So it does actually provide a legislative vehicle that was not in place before.

HORST SEIBERT: A question for Mr. Spencer. Assume we take SEMATECH international, as you alluded to in some parts of your presentation. I can see that creating common standards would be a possibility there. But how do you solve the "who goes first" problem?

In a way, this is an issue of our conference. We can see attempts internationally to reduce transaction costs, if people can agree to rules, standards, and procedures. But again, if today we review, starting with the first talk, apparently competition must be the driving force so as to create new technology to open new vistas.

So where is the dividing line between the role of competition on the one hand and possibly some type of rules that do reduce transaction costs?

WILLIAM SPENCER: You have put your finger on a very important part of any collaboration. Let me give you our experience in that area, and I will try to elaborate on the story about 14 companies sitting around the table, all asking that question, who is going to go first.

However, before I do that, if in my talk I alluded to an international SEMATECH, I take it back. This is something I have been asked about many times before, and I it is something that will occur sometime in the future. It has to be done through a series of experiments, and I offered four or five areas where we can experiment. And I think we should try those first.

When we started SEMATECH, many of the original people coming from the member companies were given very strict guidelines on what they could and could not say. They were also given safes in each of their cubicles in which they kept private information.

We do not allow private information any longer at SEMATECH. If it comes to us—if, for example, someone wants us to contract with them to develop a new widget for manufacturing and they send us confidential information—we return it immediately. We will not accept private information. We share only things that we have been able to determine are totally precompetitive. That is why we stay away from any product or specific process.

The noncompetitive things are common to all of us. The semiconductor manufacturers in other regions have been working to solve problems the same way we have, and if we sat down and talked with the people in Korea, Japan, Europe, or elsewhere, we would find that they are working on the same problems. The technology is similar—everyone is making CMOS [complementary metal oxide semiconductor] devices—and the precompetitive areas for cooperation are similar as well.

As I said earlier, if we had stopped SEMATECH after two years, we would have accomplished very little. It took us at least that amount of time to begin to break down the barriers of secrecy and the question of who is going to go first.

When you start an international cooperation, whether it be roadmaps or 300-mm wafers, or x-ray lithography, it will probably take a couple of years before the barriers break down and people are willing to open up.

But in a business such as semiconductors, where the main thrust has to be increasing the size of the pie, it is possible. When you grow 15 to 20 percent a year, and when you see that, for the next two decades, the need for your products will grow in areas such as communications, computing, intelligent highways, and wideband entertainment into the home, you will see that the opportunity for reducing the costs on a global basis are there. And if we do not cooperate, we will end up spending more on this technology to keep the world moving into the information age.

STEPHEN COONEY: I just want to make a statement to correct a possible misimpression made by Dr. Merten, which is that he is correct in that Siemens Corporate Research does not have any public funding yet. They have made one or two applications that have yet to be disposed. Siemens has participated in a number of programs from their operating units, however. We are involved in the intelligent transportation system, we are involved heavily in some DoE projects.

My question is for William Keller. Is it possible that we, particularly Europe and the United States, will move to some type of a general reciprocity community in the same way that, for example, the GATT created MFN reciprocity agreements, which in turn created a basis for a community?

The second question is to Admiral Pelaez. Did you say that U.S. industry has

not followed up on some of the technology transfer agreements signed with Japan and the FSX after five years of that negotiation?

ADMIRAL PELAEZ: That would be my impression.

WILLIAM KELLER: I will tell you what I would do. If you want to get a general agreement on science and technology between the United States and Europe, I would not use the word "reciprocity." I would use something very different.

It is possible to move toward that, but it is clearly against the drift. If you mean by that excluding other countries, either developing nations, or developed nations in other parts of the world, then it is against the drift toward a more multilateral framework in trade and investment models and, by extension, into technology development programs.

But it might be a way to start where there is a good deal of commonality and understanding and a lot of projects already in play and already going on. So it might be a good place to start and then to open up from there. The problem is that it does not work, particularly in this area of national technology funding, if one country is more open than another. There are just too many interests that would come in to play. We have to start with as multilateral a framework as possible.

ADMIRAL PELAEZ: I would like to add something. Nothing is absolute. Obviously there is technology transfer; individual companies do it in performing their job on their factory floor. The government has access to all that information, and I am not so sure we have taken advantage of the agreements to the extent that we could. That is my real comment. There has obviously been some technology transfer both ways.

PARTICIPANT: Is this in an area of composites?

ADMIRAL PELAEZ: There was some composite work, particularly in the electronics areas and in radionics.

CHARLES WESSNER: There may be grounds for some debate here. There are two broader points. First there is the necessity of constancy of effort over a long period of time, which not all political systems seem equally well adapted to provide.

You have also identified weaknesses in the U.S. acquisition system. Some of those weaknesses for commercial acquisitions seem to be aggravated by the fact that the military programs are the initial acquirers. So the transfer of these technologies is harder.

There is also some debate as to whether or not the technology has been made freely available under the FSX program. Sometimes it is available in principle, but not in fact. During a stint as a diplomat in Europe, I came to understand that when a diplomat says he agrees with me in principle, you know you have a long hard road ahead to reach an agreement.

Last, I would like to point out that some of these principles of cooperation, some of the difficulties of organizing broad international groups, are exactly the issues that we will be discussing in the next session.

Session 10

Public and Private Programs and International Cooperation

Moderator:
Anne Solomon, Department of State

CHARLES WESSNER: We are very pleased to have as our moderator for this session Deputy Assistant Secretary Anne Solomon of the U.S. Department of State, who has line responsibility for a broad range of international cooperative issues on technology and the environment and, therefore, the future structure of our economies as well.

ANNE SOLOMON: In 1980 I directed a study here at the Academy that was very close to the topic of this conference, concerning policies that industrialized countries institute to generate and use new knowledge throughout society for economic and national security benefit. These topics are, if anything, even more important than they were then.

This panel has been preceded by a number of excellent presentations dealing with the relationship of technology to economic growth and security. Speakers have examined national policies that support technology development and diffusion and have provided examples of the return on that investment to industry.

In this panel we will explore the extension of public-private partnerships into international cooperation. Our first speaker, Robert Cattoi, is a senior vice president and technical advisor to the chairman of Rockwell International. In 1991 he served as the chair of the U.S. delegation to the international steering committee for the Intelligent Manufacturing Systems [IMS] program.

Next is Dr. Uwatoko, Chairman of the Board of Toyo Engineering, who will describe Japan's views of the IMS program. That program, as you all may know, was conceived and initiated by Professor Yoshikawa, a member of the Steering Committee and president of the University of Tokyo.

Our last speaker is Reinhard Loosch, who is head of the EUREKA Secretariat in Brussels. He will discuss EUREKA and the European Union Framework programs.

In recent years, the focus of international cooperation in science and technology has moved from cooperation in the basic sciences to cooperation in areas of more strategic research and even technology development.

Strategic alliances among corporate competitors are challenging, but they are important and desirable to pool research strength for efficiency, to reduce the associated costs and risks of development, to facilitate market access, and to establish mutually beneficial protection of intellectual property. Strategic alliances will be discussed in some detail in Session 11, chaired by Stephen Merrill.

Our panel will focus on ways that governments assist the private sector by promoting bilateral, regional, and multinational science and technology cooperation. Through this cooperation, governments help secure for industry a wider range of technologies than may be available domestically, thus raising the level of science and technology that industry can rely on for future growth. At the same time, these government-to-government ties can position private firms for greater opportunities for market access.

To help achieve the balance between the goals of technology cooperation and corporate desires to seek competitive advantage, the international community is exploring some basic principles of international technology cooperation in a number of different contexts, including the OECD and the Asian-Pacific Economic Council.

We are fortunate to have Ozzie Silverman here, the Canadian representative to the OECD in science and technology policy. I will call on him later to talk a little bit about what the OECD is doing in this area.

Governments may undertake joint projects in support of industry or simply facilitate cooperation led by the firms themselves. The primary goal is to ensure the broadest possible transfer and diffusion of technology throughout the private sector.

Our speakers today will review technology programs that are conceived jointly by the public and private sector and are international in scope. The International Intelligent Manufacturing Systems Program was conceived as an international effort to improve productivity through manufacturing techniques. The EU framework initiative and EUREKA are multidisciplinary R&D programs that are concrete expressions of the European intent to strengthen industry to be more competitive at the international level.

Thank you.

The Intelligent Manufacturing Systems Program: Two Perspectives

Robert Cattoi, Rockwell International

Program origins and objectives: As many of you know, IMS is a global, industry-led activity of international cooperation for the development of manufacturing technologies and systems.

This program was first proposed by the Japanese in 1989. After subsequent meetings of MITI, the U.S. Department of Commerce, and the Commission of the European Communities, a feasibility study for IMS was inaugurated in 1991. The geographic-political regions that agreed to participate in this study were the United States, Canada, the European Union, the European Free Trade Association, Japan, and Australia.

The goal was to use shared investment for developing precompetitive or noncompetitive manufacturing technologies and systems, with the objective of improving the effectiveness—and the seamlessness—of global manufacturing operations.

Corollary objectives included the development of manufacturing processes that would be environmentally friendly and the establishment of an international management structure that would motivate and facilitate international research collaboration.

Manufacturing consortia: This collaboration was to be achieved by establishing various consortia to address relevant manufacturing research projects. Each consortium was to be composed of industrial companies from at least three of the participating geopolitical regions, along with university and/or government lab participation, as deemed necessary or desirable.

This IMS feasibility study, which included the establishment and monitoring of six international consortia called "test cases," concluded in early 1994. These six test cases involved 21 countries and 140 project partners of all sizes. After a review of the study, the International Steering Committee, which governed this activity, declared that the objectives of IMS were valid; that international consortia involving large companies, small companies, universities, and government laboratories could be effectively established and managed both equitably and beneficially; and that the IMS concept was, in fact, feasible.

A recommendation for a full-scale ten-year IMS initiative was passed on to the six participating governments. The terms of reference for such a full-scale activity were subsequently ratified by the United States, Japan, Australia, and Canada, with the ratification by Europe expected soon. By agreement, Canada will chair the International Steering Committee for the first two years.

The technical themes that are proposed for the full-scale IMS activity are the following:

- total product life-cycle issues;
- clean, energy-efficient manufacturing processes;
- virtual and extended enterprises;
- strategy, planning, and design tools; and
- human, organization, and social issues.

Obviously, this short list is not intended to limit the scope of projects. Further detail on the proposed themes can be gained from the IMS Secretariat at the Department of Commerce.

Noting that summary background, we are ready to launch our full-scale IMS activity here in the United States. Let me briefly outline the management structure for this initiative.

The IMS Management Structure

At the top of the management structure is an International Steering Committee, followed by the U.S. organizational structure. We intend to have a high-level policy and strategy board to provide guidance to the U.S. Steering Committee, with top people from organizations such as the Council on Competitiveness, NSF, NAM [National Association of Manufacturing], NIST, NCMS [National Center for Manufacturing Sciences], and CIMS [Coalition for Intelligent Manufacturing Systems], which I will discuss later, as members. We will also have a set of standing committees to deal with topics such as manufacturing technologies, intellectual property rights [IPR], and communications. All of these slots, top to bottom, are filled with volunteers from industry, government, and academia. Secretariat support will come from the Department of Commerce.

CIMS: Those familiar with the IMS feasibility study know that CIMS provided the real industrial support for the IMS. Membership of CIMS includes a reasonable cross section of U.S. companies, along with industry associations such as NAM and centers such as NCMS.

ACIMS: There is currently in formation an organization called ACIMS, or the Academic Coalition for IMS. Membership will consist of universities and colleges throughout the United States. This is obviously patterned after, and is a sister organization, to CIMS. Academic outreach to associations such as the Engineering Deans' Institute, ASEE [American Society for Engineering Education], and state university or college extension programs will be coordinated by this activity.

CIMS will have standing committees that mirror those of the Steering Committee. These CIMS committees will be staffed with industry experts who will conduct necessary studies, perform analyses, bring industry views to the surface, and provide evaluations of the research projects.

CIMS and ACIMS will also provide the links to trade associations, academic associations, and interagency groups to help keep IMS on the proper track.

A steering committee: A three-person U.S. Steering Committee has been appointed by the Secretary of Commerce. The members are Dr. John White of Georgia Tech, representing the university community; Dr. Graham Mitchell from the Department of Commerce, representing government; and I will represent industry and be the chair of this delegation. The government members of the national committee are observers on the international committee.

The unique aspect of this initiative, from the U.S. viewpoint, is that it is intended to be a government-sanctioned, but an industry-managed and, for the most part, industry-funded, activity. Industry representatives set the objectives, goals, and priorities, and of course are intended to be the primary beneficiaries of the research output.

Let me emphasize that point another way. IMS is *not* a government program in the typical sense of the word. There is no line item in some government agency budget that will support the collection of research projects carried out in the IMS consortia. Therefore, there will be no competitive bidding for IMS projects. There will be no "customer-specified" requirements for government R&D content, and there will be no contractual requirements or related government oversight.

There *will,* however, be government support through the Department of Commerce to handle government-to-government negotiations regarding the legal and regulatory issues, such as intellectual property rights agreements, technology export control, and so forth. And the DoC will provide a small secretariat—two or three people—to handle international meeting logistics and information dissemination.

A Global Dimension

Quite often we hear the argument that there are a number of national-level manufacturing activities—such as NIST's MEP [Manufacturing Extension Partnership] or NSF's manufacturing research programs. So why do we need IMS? The answer is quite simple and straightforward: We in the United States must add a *global* dimension to this network of ongoing activities.

We can all agree that U.S. manufacturing must become increasingly global if, in fact, we want to become globally competitive. I believe that all of the other participating countries feel the same way. The objectives of the IMS initiative, from a U.S. perspective, are closely aligned with this mandate.

Global standards: For example, one objective at IMS is to establish—not react to—global manufacturing standards. These include standards for industrial automation systems, CAD [computer assisted design] and CAM [computer assisted manufacturing] tools, control architectures, manufacturing processes, electronic commerce, etc. I note that this segment of the activity is fully complementary with CALS and product data exchange initiatives.

Another objective is to develop the most effective processes for global concurrent engineering. Global manufacturing is not a mutually exclusive function—designing for manufacturability in conjunction with designing manufacturing processes is an imperative.

Global IPR: We have an objective to establish a framework for intellectual property rights protection that transcends national borders for companies large and small, as well as for academic institutions large and small. Major headway was made here in the feasibility study, but more needs to be done.

Benchmarking: There is an objective to provide for a cadre of properly trained engineers for U.S. companies in all of the geographies of interest to them—all of these engineers working in an environment that respects their professionalism. There is an objective to provide an environment for efficient, effective benchmarking of global manufacturing operations. This contributes to increasing knowledge of, or even awareness of, the state of global competition.

U.S. universities and colleges will participate with industry and the research

consortia. This participation has an objective, from an IMS viewpoint, to strengthen industrial ties and to allow academic partners to further improve and modernize manufacturing engineering education curricula required to make U.S. manufacturing engineers the best in the world. And I add, to raise the professional status of manufacturing engineers in this country.

SMEs: Most important, there is an objective of involving U.S. second- and third-tier companies, the SMEs [small- and medium-sized enterprises] in activities that can raise the level of their manufacturing competencies and increase their ability to be globally competitive, directly or indirectly. It is our intent, and it is an IMS imperative, to involve significant SME participation in all the consortia we are a part of.

Management Issues

Allow me to give you some thoughts on management issues related to the IMS initiative. The future success of a full-scale IMS activity will depend heavily on the effectiveness of the industrial infrastructure that will

- determine national and international priorities;
- facilitate the formation of meaningful research consortia;
- monitor technical and business-related progress; and most importantly,
- provide the information network that disseminates useful output to those who can use it.

Japan has a well-organized IMS center to accomplish this. The European Union has a structure headquartered in Brussels to serve this purpose. Australia and Canada have similar networks.

In the United States, the backbone of such an infrastructure is provided by CIMS. The success of CIMS will depend heavily on the level of support it will get from its industrial members—support in terms of dollars and volunteer resources. This, in turn, requires solid backing from the CEO level and active participation from the vice presidents of engineering and manufacturing. A priority task of the IMS management team is to help ensure that support.

Traps: Another issue relates to the formation of international consortia and the dynamic environment of global competition. This obviously includes company-to-company competition, industry-to-industry competition, as well as government-to-government competition. The pitfalls or traps embedded here are many. One relates to the protection of IPR with a maze of sometimes contradictory national IPR laws. Another trap relates to ensuring balance and equity and the equation of resource inputs versus direct project benefit for each partner large or small. And, of course, there is the concern about hidden national agendas—often stated in such terms as, "What does Japan really have up its sleeve?" or "Whose side is the EU on?" The IMS feasibility study and related test cases indicate that there is a more than reasonable chance of success in facing these issues.

Let me touch on the management issue related to the involvement of, or more importantly, to the upgrading of SMEs. Obviously, only a relatively small percentage of thousands of SMEs will be involved directly in the manufacturing research consortia established as part of the IMS initiative. We can assume that these relatively few will benefit from their participation, but the standing question is, "How about all the others? How restrictive is the IMS structure?"

I now want to make two points. First, a significant portion of the IMS process and system research output will be available to industry at large. Of course, there will be some that is proprietary, protected output, but that which is not can still give great leverage to those who accept and use it. Also, the increased awareness of global manufacturing technologies and processes and the related global benchmarking provided by IMS projects will be available to U.S. industry. The issue will be the effective dissemination of this knowledge, especially to the U.S. SMEs.

My second point. I indicated earlier that IMS must be a complementary, integral part of our total set of national manufacturing activities—adding a global dimension to this network. If, for IMS outreach and knowledge dissemination purposes, we can use the existing infrastructures of NIST's manufacturing extension centers, NSF's engineering research centers, NCMS, and the many state university extension programs, we have a high probability of reaching out successfully to a high percentage of SMEs.

Thus, another priority of the IMS management team is to develop the coupling to these infrastructures and to provide an effective, workable network.

Funding: My last topic is one that always gets the most questions and discussions—funding.

If we can first establish that there is an important reason for IMS to exist as part of the national framework to improve global competitiveness—and then establish an effective process to manage IMS—can we really get the necessary funding from the larger industrial partners to support the participation of SMEs and universities, the smaller guys who cannot afford to proceed without resource help? This works in the IMS test cases—but how about a *full-scale* initiative?

I remind you that in all the other participating countries—except possibly Canada—the governments will fund approximately 50 percent of the consortia costs for the companies and universities within their boundaries. A government-industry sharing concept has been implemented. This is not so in the United States.

So can the United States, in these budget-slicing times, get any seed money from U.S. government sources that small companies or universities could tap to support their collaborative efforts? I refer to direct grant monies, as well as resources embedded in approved programs that support national manufacturing efforts—resources that can be competed for by individual project teams and are not funneled through an IMS superstructure.

Are there funds in major foundations or trusts or in industry associations that

could help? Obviously, the jury is out on the answers to these questions. So the third major challenge or priority of the IMS management team is to get a workable solution to the funding issue.

My personal belief is that those larger companies who are truthfully progressive, who are, or are emerging, as leaders, will step up and provide reasonable support. They will recognize the future leverage to themselves and to their supplier base when operating in a global marketplace. There are, on the other hand, those who feel we cannot win—that the U.S. industrial partners always lose when collaborating with those from offshore. In my opinion, those who think that way are inherently not winners, and fit best in a follower role. Not much funding support will come from this segment.

As to government sources or foundations sources, time will tell. I think there are opportunities, but they must be worked aggressively. As is true with most challenges, nobody said it would be easy.

Thank you.

The Intelligent Manufacturing Systems Program

U. Uwatoko, Toyo Engineering

I am chairman of the Toyo Engineering Corporation, and it is a great honor to make this presentation on the IMS program at the American National Academy of Sciences. Since 1989 when IMS activities were started, I have committed myself to the promotion of this program. During the international feasibility study from 1992 to 1993, I represented the Japan region as the chair of the International Technical Committee.

Before beginning my presentation on the IMS activities, I will briefly introduce my company, Toyo Engineering. Toyo Engineering Corporation was founded in 1961 to provide engineering and construction services. The corporation now has approximately 1,600 employees, with annual net sales of approximately $2 billion.

Our businesses cover plant engineering, industrial systems engineering, and nuclear and electric power engineering. Through our main business, which is plant engineering and system integration, we supply products such as fertilizer plants, petrochemical plants, oil and gas processing plants, and computer-integrated manufacturing systems to clients worldwide. The successful results of our company reach out to 40 countries on 5 continents.

In this presentation I will focus on the strategic and political aspect, rather than the technical aspect, of the IMS program on the basis of our five-year experience of the feasibility study in Japan and the international test cases.

IMS Feasibility Studies

Manufacturing industries are developed based on the following basic understandings:

- manufacturing is the basis for all economic activities;
- efforts to develop manufacturing technologies are essential to realize a sound and richer world; and,
- free competition stimulates intellectual activity and promotes the development of manufacturing technologies.

These efforts, however, have caused unevenly distributed technical knowledge and wealth, which results in various conflicts among countries under the globalization of economic activities.

In Japan, the sharp increase of the value of the yen is having serious impacts on Japanese enterprises, forcing the deployment of manufacturing facilities overseas. This overseas deployment is causing the hollowing out of Japanese industries. It is also causing problems in standardization of technologies that are transferred to foreign countries and problems in global business management. Toyo Engineering is also experiencing these problems through its deployment in Asian countries.

Two other issues that are important: We have long been facing the problem that young people prefer working for service industries rather than working for manufacturing industries. And we must try to realize human-centered manufacturing and recycling of products to resolve global environmental issues.

These issues cannot be resolved by individual organizations, countries, or regions. All the developed industrial countries must cooperate in tackling these issues. The IMS program is a concerted international effort to tackle these issues with vigor, foresight, and intelligence through research and development embracing industry, academia, and government.

In 1990, the IMS Promotion Center was founded to form the IMS management infrastructure. The center was designed to function as a regional secretariat in cooperation with MITI, to promote a domestic feasibility study, and to finance research projects.

To promote the IMS activities, the Domestic Steering Committee, the Technical Committee, and the IPR Committee were organized.

In 1991, the Domestic Preliminary Study was begun to identify the image of the IMS and also to extract and classify R&D topics for an IMS feasibility study.

The Domestic Feasibility Study was carried out from 1991 to 1994 to establish study items for international test cases. As a result, 21 study items were selected and conducted.

Along with the domestic activities, Japan approached the United States and the European Community to spread out the IMS activities. As a result of talks between governments, it was agreed that the nations of Australia, Canada, Europe—consisting of the European Community and the European Free Trade Agreement—Japan, and the United States should participate in the International Feasibility Study. This study was to assess the technical and management process and the feasibilities of a full-scale IMS program. The International Steering

Committee, the International Technical Committee, and the International IPR Committee were organized at the end of 1991.

During 1992, six international meetings were held for preliminary work and to select study topics and schedules. After this preparation, the international test cases were begun in February 1993. Six test cases were implemented:

- TC-2: Clean Manufacturing in the Process Industry,
- TC-3: Global Concurrent Engineering,
- TC-4: Globeman 21: Enterprise Integration for Global Manufacturing toward the 21st Century,
- TC-5: Holonic Manufacturing System,
- TC-6: Rapid Product Development, and
- TC-7: Gnosis: Systematization of Knowledge.

Japan participated in four of the six text cases: TC-2, TC-4, TC-5, and TC-7. Toyo Engineering participated in TC-2 and TC-4.

First, I want to discuss our experience in Globeman 21, one of the six test cases. Globeman 21 was named after Enterprise Integration for Global Manufacturing toward the 21st Century. There were two missions in Globeman 21. One mission was to identify whether the international collaborative research would be feasible or not—that is, if participants from different regions and cultures could perform research as a team and to determine a framework for carrying out such research.

The second mission was to clarify the technology issues of variable-kind and variable-lot manufacturing that should meet customers' needs and to study the mechanism for global manufacturing to be deployed over the world.

The participants in Globeman were 19 enterprises, 13 universities, and research institutes from Australia, Canada, Europe, the United States, and Japan. As a result, the project was well balanced across the academic, industrial, and public sectors.

A task for Globeman 21 was to determine which organizations should be employed for collaborative research. It was concluded that research activities should be carried out by individual subgroups and that these activities should be integrated by a Technical Management Committee. Furthermore, an Academic Support Committee could provide technical support to research activities, and a Management Board should manage all activities.

Globeman 21 has concluded that global-scale collaborative research will be feasible, although various difficulties are anticipated, and the research goals of this project will be essential for future manufacturing industries. Globeman 21 was our first experience with such an international collaborative project.

We have clarified various tasks and problems such as intellectual property rights. It is extremely important that we solve some of these problems and verify the effective management architecture.

The IMS is a very unique program, and therefore it seems that there are many

difficulties with its features. The following points have been assessed through the international test cases:

- Multiregional and multinational. What difficulties are anticipated in communication among different countries, regions, or different time zones and cultures?
- Various industrial sectors. The consortium will be formed from various sectors, such as aircraft, automobile, construction, electronics, and shipbuilding. It can be difficult for these different sectors to find common issues.
- Various-sized companies. Will companies of different sizes be able to perform collaborative research under a common framework?
- Diversified interests of companies and researchers. People from different enterprises and universities will be from different backgrounds. Some people may be interested in product design, whereas other people may be interested in quality issues or production management.
- Different funding systems. Funding is accomplished differently in each region, and these differences will affect research activities.
- Distributed R&D system. Almost all the work is done by each region, spread style. How should we efficiently perform research activities in a distributed manner?
- Intellectual property rights. IPR rules are different among regions and partners.

At the end of January 1994, the International Steering Committee declared that the full-scale IMS program would be feasible and recommended that it should be started as soon as possible.

The key factors that made the test cases successful are summarized as the following two points:

- The members of the International Committee exerted a spirit of give-and-take collaboration and settlement by compromise.
- Although the project was carried out under close collaboration among academic, industrial, and public sectors, the Steering Committee industrial and public representatives took leadership for management matters, and in the Technical Committee the academic members took leadership for technical matters.

Benefits of IMS

Finally, I would like to touch on the expected benefits of the IMS program. Specific objectives of the IMS program are described in the following five points. These points are common issues that the manufacturing industry in the world is facing today. Without any actions and responses to these problems, it will be very difficult for manufacturers to grow and improve. The IMS program is aiming to achieve various objectives and, at the same time, will be able to provide the following benefits and opportunities:

- **Sharing R&D risks and eliminating redundant investment.** As many manufacturers face harsh competition, investment for improving competitiveness such as development of new products, improvement of productivity, and development of new technologies is becoming a heavy burden.

  Advancement and complexity of technologies require integration of various technology areas. Also, technological and financial risks of research and development are increasing and even a large corporation cannot absorb such risks by itself.

  To maximize such constrained resources, research and development through international cooperation will be a driving force for all manufacturers in the world, and it seems that this is the natural direction in today's world.
- **Facilitating the development of new technologies through the integration of international technologies.** There is a Japanese proverb that says "Three people can create precious knowledge." This means that when individuals with different ideas get together, a new idea will be born. The IMS program will make this proverb real through international collaborative research activities, and each region and partner will bring excellent and unique technological ideas to the program. Such ideas will be organized and integrated to become better technologies than a single company or a single region can develop by itself.
- **Acceleration of global standardization.** Through international cooperative research activities, it is possible to accelerate global standardization related to manufacturing. Currently, there are any number of proposals for international standards yet to be developed. But it requires long periods of time and much research and development for the establishment of new standards. The IMS program will support and can respond quickly to the establishment of such international standards.
- **Matching new partners.** Through international consortium activities, partners or researchers will be able to understand each other. As a result, the matching of interdisciplinary partners will be much easier, and they will be able to exchange products and technologies. It also will lead to creating new business opportunities.
- **Understanding of cultures and global markets.** Cultural gaps will be filled through the IMS program, and it will also help the understanding of global markets, which could also provide a good opportunity to expand into the business. Today, such opportunities are open for very limited numbers of companies in the world.

The new International Steering Committee recently issued a call for a proposal for a full-scale IMS program. In line with this call, the full-scale program will soon begin. The Japan region has been preparing infrastructure for this full-scale project. Toyo Engineering will participate in the program as a member of

Globeman 21, and I myself would like to contribute to the promotion of the IMS program. In closing my presentation, may I ask you to cooperate with and support this ambitious and attractive program.

Thank you.

European Programs: EUREKA and the European Framework

Reinhard Loosch, EUREKA Secretariat

Today I will describe to you two large initiatives in Europe on international cooperation in research and development: the European Union framework program and its associated activities, and the EUREKA initiative. I will concentrate on the similarities and the differences between the EUREKA initiative and the European Union's framework program on research, technology development, and demonstration.

But first I want to make two preliminary remarks. First of all, when we are talking about research and development in Europe, we are talking automatically about trans-boundary cooperation. This is all-pervasive, because we not only have the European Union with its big program, we not only have EUREKA, but we have in addition many other specialized European organizations that are concerned with cooperation in research and technology, such as the European Space Agency, the institute in Grenoble with the high-flux reactor, the European Synchrotron one cyclotron radiation facility, the European Southern Observatory, and many others.

If you take all of these initiatives together, they account, however, for only approximately 12–15 percent of the expenditures on RD&D [research, demonstration, and development] in the area of the European Community, and a smaller percentage if you include the other European countries.

But then you have to add the many, so to speak, unofficial international cooperations going on in Europe, partly because of the internal European market, where it is difficult to distinguish whether a particular R&D job is done by a French company or a German company or a French institute or a German institute or any other country you might mention, because it is all interlinked and all interrelated.

Why is it that when we talk about R&D in Europe we are talking about international cooperation in Europe? First, of course, it is because of the European desire to unite and to become competitive on a global scale.

Second, there are external factors. Some are direct, such as, for example, the U.S. influence on Europe to cooperate, basically motivated by Cold War considerations to have a strong, united Europe. Some are internal influences. To be competitive, we have to unite in Europe so as to compete.

The Framework Program and EUREKA: Similarities

Now I turn to the similarities of the European framework program and the EUREKA initiative.

Identity of purpose: First, there is an identity of purpose. I will read to you the statement of the objective of the Hannover Declaration, which is the basic charter of the EUREKA initiative. It says: "The objective of EUREKA is to raise, through closer cooperation among enterprises and research institutes in the fields of advanced technologies, the productivity and competitiveness of Europe's industries and national economies in the world market. And hence, strengthen the basis for lasting prosperity and employment. EUREKA should enable Europe to master and exploit new technologies that are appropriate for its future and to build up its capability in crucial areas."

When you read the relevant article in the Maastricht Treaty, and preceding that in the Single European Act, you will find practically the same words, with one additional objective of the European Union which is to enhance cohesion among the member states of the European Union, to have a comparable state of development throughout the Union. The main purpose is identical both for the European framework program and for the EUREKA initiative.

Membership: The membership is also similar. Of course, the European Union has only 15 member states. But if you add to that all the bilateral or plurilateral agreements concluded by the European Union and other European countries, then it covers more or less all of Western Europe and, increasingly, central and eastern Europe.

EUREKA now has 22 member countries, which are the 19 European-member countries of the OECD plus, since the fall of the Iron Curtain, Hungary, Russia and Slovenia. And in one month's time, I am sure we will be adding two more countries to that list: Poland and the Czech Republic. They have requested membership and everything is processed, but only the Ministerial Conference of EUREKA can accept this request when it meets in June.

There is one more member of EUREKA, and that is the European Union itself, which only proves the point again, that there must be an identity of purpose.

Scope of activity: The scope of R&D activities to be undertaken in the two frameworks also shows a high degree of similarity. The European Union acts on the basis of specific programs defined in the framework programs that are passed from time to time, every four or five years, and these framework programs and the specific programs describe particular fields in which the European Union is willing to promote R&D in cooperation across the borders in Europe. But if you look at all these programs, they cover practically all the fields that are not covered by the more specialized agencies and international organizations that I mentioned before.

EUREKA, on the other hand, is completely agnostic as to subject areas. We only say that we would like to foster cooperation across the borders in any R&D project no matter in what field. The only thing we say is, it has got to be R&D oriented toward civilian markets, toward civilian applications.

International cooperation: There is one more similarity, which is the inter-

national positioning of the two frameworks. Despite all talks about Fortress Europe, both systems are open to the outside world. In the case of the European Union, it is open through agreements with other countries. One of the oldest agreements between a European community and another country has been the nuclear energy agreement between EURATOM and the United States back in 1958.

In the case of EUREKA, members are European countries and the European Union. Whenever project participants think it is useful to include someone from somewhere else, they can do it, and it has been done; not to a vast degree, but nevertheless it has been done quite often, including a few American companies that have joined EUREKA projects.

Why two organizations? If the similarities are so numerous, why do we have two different organizations to achieve the same purpose, namely to increase competitiveness through international cooperation in Europe?

Different approaches: The main reason is that EUREKA has a different approach. The European Union's approach is basically "top down." First you have to agree in the Council of Ministers and with the concurrence of the European Parliament on the program contents, on the funds to be allotted for promoting these programs, then on how to do it, how to cooperate, and, for example, how to exploit and use the results coming out of research and development promoted by the European Union.

On the other hand, you have the EUREKA approach in which the project participants are free to decide on the content of their project, on who is cooperating in the project, who is going to use the results, the intellectual property rights, and whatever the end results are.

Funding base: There is another big difference. The European Union has money. EUREKA has none. In the case of EUREKA, it is clear that it is up to the project participants to secure the funds they need for a project. Now, to an increasing extent, the money is put up by the project participants themselves, be it from their private company money or from their regular budgets, which may be from public sources, or by seeking access to one of the promotion schemes, be it of the member states or also the European Union programs.

In the case of the European Union, the money is there but you have to compete for it. And this is a rather lengthy process to undertake before you even know whether you are one of the winners or not.

This then also explains why the EUREKA initiative is a very small organization. The only central institution we have is the EUREKA Secretariat, which I have been heading for three years and will be heading until the end of next month.

The Secretariat has 15 people, which includes all support staff. Our budget is on the order of $3 million a year, about half of which is spent on publications and public information, the rest on administrative expenses, including running our database on all EUREKA projects and project proposals.

Funding levels: In regard to the volume of R&D expenditure mobilized by

the different schemes, the European Union framework program has a total funding of 12.3 billion ECU [European Currency Units] for 1994 to 1998. This may be increased to 13 billion ECU depending on a decision expected next year.

This 2-3 billion ECU per year mobilizes, of course, a higher amount of R&D expenditure because the companies involved get no more then 50 percent of the total project cost from the EU and they must seek the rest elsewhere.

The European Union program mobilizes approximately 5 billion ECU per year, whereas EUREKA mobilizes approximately 1.5 to 2 billion ECU per year. Altogether, in the eight years of EUREKA cooperation, we have committed something like 15 billion ECU on about a 1,000 different projects involving 4,000 participants. Of these 4,000 participants, approximately two-thirds are from industry. There is a very high SME participation, and one-third are research institutes of universities and public agencies.

I have one more word of praise for EUREKA. I believe that the EUREKA initiative taken in 1985 has been a worthwhile experience. By the way, this initiative was a direct response to the shock many people in Europe felt after the announcement of President Reagan's SDI [Strategic Defense Initiative] program; the shock was not that there would be an SDI, but that this may be the perfect dual-use technology developed from defense resources so as to be ready to capture practically all civilian technologies of the future. But this has been a worthwhile adventure, and I do not say this only on the basis of a lot of *ex post* project evaluations that we undertook. I say this by listening to the participants.

The ratio of people who, after completing their EUREKA exercise, would do it again is approximately 10 to 1. So, if our customers are happy, we are happy. And therefore, we hope to continue. We have volunteers to chair the EUREKA initiative up to the year 2002, so there is a certain long-term job assurance for EUREKA.

But keep in mind that the European Union also provides the prospect of long-term reliable funding of R&D in international cooperation in Europe.

Thank you.

DISCUSSION

ANNE SOLOMON: A number of our speakers have referred to the difficulty of balancing the objectives of international technological cooperation and the objectives to remain competitive.

The OECD and the APEC [Asia-Pacific Economic Cooperation] are both considering basic principles for international technological cooperation that touch on this challenge, and I would like Ozzie Silverman, the Canadian representative to OECD, to discuss briefly the OECD efforts in this area.

OZZIE SILVERMAN: At the OECD the work that is going on seems to be a deep secret for the rest of the world. But this a work is quite important and it is

consistent with the discussions that have been taking place here over the past two days.

The Committee for Scientific and Technological Policy [CSTP] set up a working group on technology and innovation, and that working group met for the first time in November 1993 under the chairmanship of Joe Clark, who is with the U.S. Department of Commerce. And in May 1994, the United States convened a conference hosted with the OECD in Paris on the matter of international technology cooperation.

Since that time, the deliberations of the CSTP have lead to the drafting of a set of principles. The idea is that these principles would be endorsed by science ministers when they meet later in September of this year and then go on to the OECD council.

Basically, the notion behind these principles is to encourage governments to maintain an openness, to be a catalyst, and to encourage collaboration between industries in technology that is of interest to them.

The benefit of having these principles is that they are built on experience that industry actually has at the present time, particularly the IMS. Anyone who was associated with the IMS at its inception, or at the time that the MITI was proposing it, will recall that this was an extremely contentious issue until such time that the test cases and the feasibility study were negotiated between governments at the outset.

But then it became industry led, and I would say that it is close to a miracle that the chairman of Toyo Engineering is here today promoting IMS and encouraging other countries to participate, because this effort has come a very long way. Many lessons were learned from IMS that can be incorporated and codified. And in part, these principles are going to do that. We are quite hopeful that they will be adopted by ministers.

Tomorrow in parallel, the Business and Industry Advisory Committee of OECD is meeting, and they will be discussing the topic of international technology collaboration. Only one of the items on their agenda will be these principles. They will look at it in draft form. And they will be discussing other issues of collaboration. So it is very worthwhile to find a way to feed back to people the types of deliberations that they are conducting. You can access that through your own governments through the OECD.

One final comment. By mid June I would expect that these principles will be in the final draft form and that all countries, including Japan, Germany, the United States, and Canada, will have accepted them, at least at the level of officials, and then they would go on to ministers in the autumn.

HANS SCHARRER: I have a question for Mr. Loosch. If you look at JESSI [Joint European Submicron Silicon Initiative], which is a EUREKA project, or at ESPRIT [European Union Information Technology programs], which is a com-

munity project, and compare this to SEMATECH, where would you see the major differences or similarities?

REINHARD LOOSCH: In terms of the structure, SEMATECH is much closer to JESSI than to ESPRIT, ESPRIT being a program of a particular directed initiative. In fact, JESSI is a special animal in the EUREKA family. It is by far the biggest project. It alone accounts for approximately a fourth of the sums that I mentioned before, something like 3.8 billion ECU over eight years.

But clearly also, between JESSI and SEMATECH, there is more than just a certain similarity in structure. There is also increasing linkage, not between JESSI as such and SEMATECH as such, but between the partners in SEMATECH and the partners in JESSI.

ESPRIT is a different animal because, as I said, it is a program broken down into many different areas and many different projects, many of which are not really related to each other.

KARL-HEINZ PAQUÉ?: I have a short question for Mr. Loosch about EUREKA. In your talk I heard that the two striking characteristics of EUREKA are, first, that it is bottom-up, not top-down, and second that it has no funds. The question arises, why do we need it? Because apparently it is just a clearinghouse for private corporations, and it appears to give something like a quality stamp to particular corporations. So I do not see the deep economic rationale for its existence, although I am sympathetic.

REINHARD LOOSCH: As we just heard, there is a general tendency to support the idea that governments should support industry-led international cooperation. The OECD apparently wants to take over the EUREKA message, because that is exactly what we have been doing. It is the joint role of the European governments concerned and the European Union to say, please cooperate.

Clearly, what we can provide is only certain brokerage help. On the other hand, this is very necessary, particularly when you are looking at the smaller companies. They are not used to international cooperation; they need a little prodding. And for that reason, it is a good attempt because it is clear, since all the governments are behind it, if somebody comes and says I would like to do this as a EUREKA project, he may also find a more open ear when applying for national or European Union funding, although there is certainly no defined preference for a EUREKA project in any one of the national schemes, except that some of the member governments have allotted particular seed money for launching and for preparing EUREKA projects, but not for the project work itself.

Session 11

Strategic Alliances Among Private Firms

Moderator:
Stephen Merrill, National Research Council

STEPHEN MERRILL: The purpose of this session is twofold: One is that, of course, we want to understand what the dynamics of high-technology development, competition, and trade are, and how they are evolving. We heard yesterday a compelling rationale from the semiconductor industry for strategic alliances. There has been an increasing amount of research on this intriguing and rather new phenomenon.

The second reason, an equally simple-minded articulation of it, is simply that this competition makes some people nervous. And if people are nervous, there is the potential for spillover to have a policy agenda and political debate.

So to discuss these two aspects we have today first Carol Evans, who is an assistant professor of international business diplomacy at Georgetown University. In addition to serving as an advisor to the Central Intelligence Agency, she has participated in two major projects of the Office of Technology Assessment, including the one that we have heard mentioned several times in the past two years on multinationals and the U.S. national interest.

Second, we are pleased to welcome Charles White from Motorola. In that company he has fulfilled a number of roles, from strategic and capital planning to technology acquisition and transfer, to public policy, particularly trade policy through his chairmanship of the U.S. Semiconductor Industry Association's public policy group and advisory committee on the U.S. and Japan semiconductor trade agreement.

Finally, we will hear from Alan Tonelson, who is a fellow of the Economic Strategy Institute and a former associate editor of *Foreign Policy* magazine and a prolific writer on foreign policy and its relation to economic interests.

The Growth in Strategic Alliances: Rationales and Types

Carol Evans, Georgetown University

What I would like to do in my presentation is talk about some of the emerging trends in international strategic alliances. For most people in the field of business such as myself, or even in economics, we have often talked about competition traditionally being between company A in one particular country and company B in another particular country. Currently, however, there are some very important implications for international interfirm teaming arrangements, such as those characterized by strategic alliances.

There has been a tremendous amount of strategic activity during the 1980s. In particular, the greatest jump or increase in alliance partnering internationally has been in biotechnology, the automotive industry, and the information technology industry. These three make up the large core of alliance partnering among the advanced industrialized countries.

Traditionally, the aviation and military industries have had international cooperative programs, many of which are on a government-to-government sponsored basis. Nevertheless, there is now a tremendous amount of private sector initiative in terms of collaboration.

One issue that I want to address is why international strategic alliances are on the rise. One way of looking at this is to look at an explanation from several different angles—an obvious angle being technological. There are a lot of very important technological factors driving strategic alliance partnering internationally. Other factors that I suggest are very much related to considerations inside firms.

We have heard a lot from, for example, Motorola, Siemens, and a number of distinguished companies, as to why they perceived the need for collaboration. When I talk about primary motivations, I want to discuss some of the generic ones that would apply pretty much across the high-technology field.

I will also address the need to look at the role of government. Government is extraordinarily important in shaping alliances, not only in terms of influencing the types of alliances that are being formed—an easy and obvious example is Airbus—but governments also shape which companies are going to be partners with whom, for example, the telecommunications industry. Governments are very important in the partnering decisions of companies.

Technological Factors

Obsolescence: One is the fast rate of technological obsolescence. This is very important in the semiconductor industry and in the computer industry, combined with escalating costs of R&D. This means that you have to get to the market quickly and you have to be able to generate those economies of scale so as to drive your prices down.

Diversity: One of the most important technological factors that has not been touched on in this conference is that companies are being faced with an increasingly diverse array of new technologies that they have to manage. Sometimes, these new technologies are outside their core competencies.

Some of these core technologies lie in the very basic fields of science and research. So for many companies, technology is driving them to partner so as to gain access to a very diverse portfolio of technologies. And this is very important to appreciate, particularly if you are in the information technology industry or if you are in an aircraft industry, or even in an older industry, such as automobiles.

Convergence: A related trend that I believe is important to identify in looking at alliance partnering is technological convergence. This is especially true in the information technology industry that relies on satellite telecommunications, semiconductors, and telecommunications equipment integration. And again, companies do not necessarily have these core competencies in such a diverse array of fields.

And as technologies converge, they need to be able to pool that technological capability together. Very few firms are capable of doing that in-house. IBM, for example, is making a corporate policy of separating out a lot of these activities. But for small- or medium-sized companies, it is very difficult to build an array of technologies in-house. So partnering can be a very important factor.

Asset pooling and market access: Again, many of these technology factors are self-evident, and I am not going to go over cost and risk sharing, generations of economies of scale, and scope. But one area that I will briefly touch on is asset pooling. Asset pooling could be a technology, but it could also be human beings. It could be access to a particular distribution network. So companies have a number of assets. Again, pooling them is very important internationally. And this relates closely to market access. You need to get to a market if you might have a particular technology or a project. If you do not have market familiarity or that market is closed to your product, you need to form an alliance so as to gain entry into that market.

Speed and flexibility: Although some of these factors are obvious, some are often ignored. In today's fast-paced global economy, companies need to move quickly and flexibly. So the issue of speed and flexibility is important in looking at why alliances are so critical to firm-level strategies, unlike, say, mergers and acquisitions.

We have seen Siemens acquire a number of companies and gain market entry into various types of products. For a number of companies, however, mergers and acquisitions are a very expensive proposition. You are going to put a lot of resources into a technology or a project that you are not sure will be essential to your core product line.

So an alliance is a nice in-between strategy of developing other product lines or other types of technologies without incurring the necessarily more expensive fixed costs related to a merger and acquisition strategy. So speed and flexibility are very important in motivating firms to form alliances internationally.

Competitive Positioning

Finally, what we in the business area spend a lot of time thinking about is competitive positioning. What do I mean by competitive positioning? Here a company might want to monitor a particular rival. For example, General Motors's alliance with Toyota to form NUMMI [New United Motor Manufacturing Inc.] in Freemont, California. This alliance was much geared around General Motors trying to figure out what the Japanese lean production technology was and how to you integrate it. You can do that by forming an alliance.

You might want to gain information in terms of what new product lines your competitors might be developing. Again, a good way of doing that is to get close to your competitor and monitor their activities. So competitive positioning is increasingly important, particularly in markets that are oligopolitically structured—for example, the automotive and aircraft industries. This is a key motivating factor for firms.

The Government's Role

Another factor driving international strategic alliance activity is clearly the government. In this conference we have talked a lot about the role of government. What I want to do is break out what I believe are a group of government policies that drive alliance activity.

Trade and investment policies: The first area is in trade and investment policies. Today we have talked here about how some markets are closed; there are restrictions on direct foreign investment. Equal national treatment policies across, for example, the triad countries do not exist. You can have other nontariff barriers, such as the voluntary export restraints [VERs] that were enacted during the late 1970s and 1980s against the Japanese automotive industry here in the United States.

Those VERs were instrumental in bringing Japanese automobile manufacturers to form strategic alliances with U.S. auto manufacturers. If you look at any U.S. auto manufacturer today, you will see a very intricate and tight web of alliances with Korean and Japanese companies.

Industrial policies: The second area is in regard to industrial and technology policies. We had an entire session in this conference dedicated to Airbus. This is the clearest example of a government-sponsored strategic alliance, and an international one at that. SEMATECH is another example of a type of strategic alliance, a precompetitive R&D alliance.

Procurement policies have played a very important role, obviously, in the telecommunications and defense industries. And so government procurement policies will provide a barrier, if you like, for a lot of companies trying to enter into each other's markets. So, again, one way that companies can enter the market, given those types of discriminatory procurement policies, is to ally with a national champion or with a domestic company.

Regulatory policy: Regulatory policies have a much more indirect but extremely pervasive effect on promoting international strategic alliances among multinationals as well as smaller companies. The first set of policies that we can look at are the competition or antitrust policies.

We heard from William Spencer about the emergence and rise of SEMATECH. That would not have been possible had it not been for the weakening of our antitrust legislation here in the United States and the passage of the National Cooperative Research Act. So the American government has used antitrust as a way to sponsor a particular strategic alliance, a domestic alliance. But that also has an international impact in spurring other countries, as we have seen with JESSI and ESPRIT, to do likewise.

Deregulation is clearly important in the telecommunications industries, as was the case in the United States. Deregulation created a big market for European companies to enter into the U.S. market, but they did not have market familiarity. So there is a lot of alliance partnering occurring. Similarly, AT&T was then freed up to compete in European markets, where previously because of U.S. antitrust considerations, it had been banned from competing in those markets.

For example, within two years AT&T formed alliances with almost all the top national champions in Europe in the telecommunications industry, approximately 50 alliances in all.

So deregulation policies are critical. They are becoming less critical as governments liberalize their industry and companies are able to compete more freely. But deregulation is a critical factor for companies intending to enter the big emerging markets, such as China, India, or Russia. The markets in those three countries are still highly regulated and highly closed in the telecommunications field.

Technical standards: Finally, standards are an extremely pervasive influence on alliance formation. A good example is the European, Japanese, and American battle over HDTV [high-definition television]. The setting of the technical standard using the digital versus the analog standard threw into the ring an entire new reordering of different alliances formed between U.S., Japanese, and European companies. So technical standards will continue to be a driving element and will be an influence in a number of industries for strategic alliance formation. These are some of the most important factors that are driving alliances.

IMPLICATIONS

Now what are some of the implications? Strategic alliances are creating both interdependence between international firms as well as a tremendous amount of rivalry.

Charles White, our next speaker, will give you some insight from a corporate level when he discusses Motorola's important alliances, especially with Toshiba. We see tremendous synergies now in many important high-technology industries, because industries are all teamed with one another. And that creates an underlying pattern of trade, which is a very different type of matrix or network of different companies involved with one another.

The second point to consider is that we really do not have any especially clear implications because strategic alliances have only flourished since the 1980s. The implications for U.S. policy are still a bit unclear and ambiguous. But I would like to break out what are some of the implications of international strategic alliances for companies and some of the implications for the U.S. government.

What we are finding is that pitting firms against firms in different countries, or policymakers in different countries, is not the source of friction. Increasingly, strategic alliances are generating friction between domestic companies and their national governments. This is a very different type of trend than what we are seeing today when we talk about competition policies and different types of direct foreign investment policies. Let me start with the firms.

International strategic alliances have helped improve the productivity of a number of key U.S. industries. The most obvious one is the U.S. automotive industry. The transfer of lean production technology through strategic alliances was vital to the rekindling of the U.S. auto industry in the 1980s. So in a number of industries you can easily see the tremendous gain in terms of national economic competitiveness that strategic alliances has brought U.S. companies.

Risks of alliances: At the same time, not all companies are capable of using strategic alliances effectively. Motorola stands out as a stellar example of how to enter into an alliance and safeguard technology very carefully, particularly from important competitors.

But what we found in a number of U.S. and other companies is that there is not that type of safeguarding mechanism going on. And at times a number of companies have been hollowed out by the transfer of key technologies through alliance partners. So you can lose competitiveness at the national level if various companies and key industries are being hollowed out.

There is a recently published report that looked at and tried to assess the ability of many foreign companies to dominate the active-matrix liquid-crystal display technology field and the impact of strategic alliances on U.S. competitiveness. This particular report concluded that foreign acquisition of advanced U.S. active-matrix liquid-crystal display manufacturing technology through alliances may limit U.S. companies' ability to translate their technology advantages into competitive advantages.

So there is a growing concern, not only within companies but within the government, about how to safeguard this process. How can companies not only use alliances effectively but prevent transfers of critical technologies? This issue is especially relevant to those alliances such as SEMATECH that have been developed at the taxpayers' expense.

Policy Implications

Some of the implications for firms lead to some of the implications for U.S. policy. Let me give you a couple of examples.

Critical asymmetries: For the past two days at this conference we have been talking about critical asymmetries across a range of government policies. These asymmetries between the Japanese, between the Europeans, and between the Americans, have not only, in essence, helped create international strategic alliances, but at the same time there is the potential that these asymmetries are leading to the competitive disadvantage of U.S. companies. The reason for this, as we have heard for the last few days, is that our markets are relatively open, that the European and Japanese markets are not as open. In different industries there is not the type of liberalization that has occurred in our particular market.

What does this mean? It can mean that American companies are exchanging, for short-term reasons, market access, and this could be wrong from a national perspective, but from a firm's perspective that desire for market access is driving the company.

While you may be trading market access, you may be trading publicly some key technology or product base. So this asymmetry, as a consequence, does put some U.S. firms at a disadvantage.

The policy challenge: The challenge for U.S. policy makers, whether it is here, or in Europe, or in Japan, is how to address such asymmetries. If the issue is the asymmetry, do you address it in terms of seeking harmonization, greater liberalization? Or do you pursue an industrial policy? Do you create SEMATECH, at the same time that you have a semiconductor agreement, to help boost the competitiveness of firms when markets remain a little bit closed?

This is a really important new trend that not many people think about—the nature of what international competition is about. I began my talk stating that competition is based less on individual companies competing in the international economy, but rather is about competing coalitions of firms. This has tremendous implications for governments. I will give you an example.

In regard to semiconductors, in 1991, all of the alliances in the semiconductor industry within the triad were too complex. There were and still are too many companies organized and linked with each other. We have a number of alliances within Asia (e,g, Samsung and NEC). In the United States we have SEMATECH. But at the same time we have competing coalitions—Motorola and Toshiba, Hitachi and Texas Instruments. It is difficult to get at key policy issues when the entire issue of what constitutes a U.S. firm is a difficult thing to assess, particularly as more and more strategic alliances involve cross-equity investment exchanges.

Coalitions and national treatment: When we look at coalitions, devising national treatment policies can be very tricky in terms of how to assess the national identity of a particular company, particularly if you are sharing production facilities across a range of different countries, which is what is occurring in many industries.

From the consumer perspective of the United States, will such big international coalitions emerge in a number of industries to lead to greater cartelization? Are they going to lead to collusion, or the potential for collusion?

What happens if Boeing and Airbus, who have been engaged in talks, do decide to go into very large transport aircraft? One aircraft in the market, two big companies. What will happen to McDonnell Douglas? McDonnell Douglas and Boeing obviously cannot collaborate at present. So, in some sense, our antitrust policies are driving a lot of our international alliance activity.

This is also important in terms of cartelization and collusion around technical standards. In areas where technical standards are very important, what is the impact of a particular coalition of companies, which gets ahead of a particular standard? That may have a dangerous precedent, again, for consumers.

So I believe that these issues pose new challenges for U.S. policymakers in the area of competition policy, in the area of antitrust.

Finally, we have talked a lot about business-government relationships, such as the EUREKA project and other types of R&D consortia. One of the issues that we have not touched on effectively is, can a nation's policymakers be sure of capturing national technological gain when its domestic firms are completely allied with and permeated by strategic alliances internationally?

In essence, are international strategic alliances making obsolete any attempt at national technology or industrial policies?

Thank you.

CHARLES WESSNER: Your last question may have been addressed to William Spencer and others. Do the ISAs [international strategic alliances] make national technology programs obsolete? Some argue that to form an ISA you have to have something to trade. To work interdependently you have to not be dependent. We have had some discussion of the previous weakness of the U.S. semiconductor industry. Some of these alliances resulted from the MITI policy guidance after the 1987 sanctions. Some of the alliances reflect the success of SEMATECH and the technological rebound of the U.S. industry. For example, would Toshiba want to work with Motorola if Motorola had a declining market share and no access to the latest technology?

CAROL EVANS: There is no question that, in terms of the particular example of SEMATECH, a lot of small American companies, through their participation in SEMATECH, have become very valuable targets of opportunity for alliance activity simply because of their participation in a key government-sponsored R&D consortium. That is a benefit and it can also be a disadvantage, depending on how companies use technologies and safeguard them responsibly.

At the same time, however, we do not see many examples of SEMATECH elsewhere in other industries. We have a lot of underlying technology programs, whether it is around aerospace or a number of other programs that place firms in a difficult position. On the one hand, they are enjoying the access to some of the basic R&D, but they are being pressured to transfer some of their core technologies to foreign competitors.

And this is the danger. This is the balancing act that companies must manage. On the one hand, in order to have a successful alliance, you need to transfer technologies. You need to develop a trust and make these relationships work. But at the same time, how do you not develop a potential and future competitor? Not all companies do this successfully.

In key areas we have to be concerned about whether there is sort of a net failure. In certain critical industries we should be concerned. The active-matrix liquid-crystal display area is a very critical area that we should be concerned about.

ERHARD KANTZENBACH: Do you have the definition of what a strategic alliance is? It could be a cartel agreement, it could be a joint venture, it could be another cooperative agreement in R&D.

CAROL EVANS: There are many definitions that exist for international strategic alliances. There is no single definition. The one that I am using indirectly here today is that, on the one hand, you have transactions such as licensing agreements. These are not strategic alliances. On the other hand, at the other extreme you would see mergers and acquisitions.

In between, as you rightly point out, there is a huge role, and that can include precompetitive R&D consortia; it can be different types of informal cooperation; it might include exchange of distribution markets—this is happening a lot. Companies decide to allocate globally what markets they will compete in.

Fuji and Xerox have a very important strategic alliance that has been going on for 30 years, a very successful alliance. They have agreed not to compete in each other's markets. So that is an example of exchanging marketing distribution.

You can have a joint venture, a joint venture without the cross-equity sharing, or you can have equity involved. I have done some research on this question in which the definitions are expanded on.

WILLIAM SPENCER: One of the questions I get asked regularly is, how can companies that are in SEMATECH form strategic alliances with foreign countries and not share the information that SEMATECH has developed that is just for members only?

There is very little of that, but the answer that I get—and I am interested in seeing whether it relates to the other strategic alliances you have looked at—is we have been, in SEMATECH, focused on manufacturing technology. It does not matter what type of microchips you manufacture, technology should be useful. But the strategic alliances in the semiconductor industry quite often focus on products—joint development of the 64-mg or 256-megabyte DRAMS or flash memories. Does that tend to be true in other alliances as well, where the strategic alliances are product oriented?

CAROL EVANS: Increasingly, because of all the technological factors and the market, it is the cost of technology and the constraints of markets that are often driving alliances. One of the important things for companies to be aware of is that a lot of companies go into alliances thinking that they are a shortcut to competitiveness. You can employ them quickly. And the shortsightedness comes from a lot of companies not reinvesting in their actual technologies. They just let the foreign partner take care of it. And that is the worst thing for companies to do.

So it is the reinvestment, it is the ability to learn. These are very critical elements to building a successful alliance. It makes you stronger as it makes your partners stronger. It is an important base for cooperation.

Issues for Alliance Partners

Charles White, Motorola

As I listened to Dr. Evan's presentation, I reflected upon Motorola's relationship with most of the major electronic companies around the world—Siemens and Phillips in Europe; Sony, Toshiba, and Matsushita in Japan; Hewlett-Packard and IBM in the United States—and I realized that we are creating a big problem for public policy makers. The firms I just mentioned are examples of companies that are simultaneously suppliers, customers, partners, and competitors to Motorola. This is a fairly recent phenomenon in world trade, and it adds a complexity to the formation of public policy that our predecessors did not have to worry about.

Now I will discuss the rationale for industry alliances, followed by some detail on Motorola's alliance with Toshiba. The first and most important reason for the increase in alliances between semiconductor companies is the rapid pace and proliferation of technological change.

The first 36 years of the semiconductor industry's history, ending in 1994, resulted in a $100 billion market. Within the next five or six years, our industry will generate its second $100 billion in annual sales growth, which means that we will double our revenue in just five to six years.

Also, technological change is growing at a rapid rate. The average desktop PC today has 1,200 times the computing power of the computer that guided the lunar lander during the Apollo mission. Simultaneously, the cost of that computing power has been dramatically reduced. In 1986, the early days of desktop computers, the cost per million instructions per second (MIPS) was approximately $5,000. The cost per MIPS today is approximately $180. So you can see, costs are declining rapidly, promoting fast-paced change.

In addition, the accelerating cost of R&D and plant and equipment have increased to the point where alliances are being formed to share the necessary investments.

The semiconductor industry routinely spends 25–30 percent of sales dollars on R&D, plant, and equipment. As we continue to pack more and more capabil-

ity onto a single chip, using finer and finer geometrics, the cost of the factories to manufacture semiconductors will continue to accelerate. For example, in 1970 a single wafer fabrication facility cost approximately $10 million. Today it is over $1 billion, and this will climb to nearly $2 billion by the year 2000.

Alliances also are being driven by the global nature and persuasiveness of our industry. For example, users of DRAMs have little regard for where they are manufactured, because the parts meet worldwide standards, are very portable, and have a high value-to-weight ratio. Also, most nations are eager to participate in this high-growth industry, which is at the heart of the information age. To illustrate, I recently received a letter from an official in Zimbabwe who was looking for a partner to assist in starting up a chip factory. Which emerging country will be next?

Chip applications continue to grow at a fast pace. The average person, for example, encounters at least 50 microcontrollers a day. There are seven to ten in today's cars, and it is estimated that a car will have 50 microcontrollers by the year 2000. Other usage includes VCRs, camcorders, kitchen appliances, remote controls, printers, cellular phones, and virtually all electronic devices.

In addition to the obvious need to share cost and risk, alliances are formed frequently to speed market entry, establish de facto standards, and gain access to restricted markets.

Finally, customers enter alliances to gain guaranteed supply, whereas governments participate to ensure that their citizens are not just consumers of high technology, but producers as well.

This leads to a discussion of Motorola's alliance with Toshiba, which was established in 1986, and was the first alliance between major U.S. and Japanese semiconductor companies. Since then, numerous Japanese-American alliances have been formed, several of which were patterned after our experience.

In addition to our objectives to re-enter the DRAM business and gain increased access to the Japanese market, Motorola hoped to win wider acceptance of its microprocessor architecture. Toshiba's objectives were to gain access to a mainstream microprocessor technology, while sharing the cost and risk of building a DRAM factory and ramping it to full production.

The alliance was structured to pace the release of Motorola's microprocessor technology to Toshiba, as Motorola assimilated DRAM capability from Toshiba and achieved specific marketshare targets in Japan.

When transferring Toshiba's DRAM technology to Motorola's U.S. factory, care was taken to duplicate exactly the equipment set and materials, including gases and chemicals. By doing so, we were able to achieve comparable manufacturing results.

The Motorola-Toshiba alliance includes a 50-50 joint venture factory, which is managed jointly. Each of the three phases to date started with DRAMs and included plans to migrate to logic products as new generations of DRAMs required new facilities.

During the early years of the alliance, revenue earned by Motorola from Toshiba's DRAM technology was substantially larger than Toshiba's revenues from Motorola's processors. Both parties then agreed to restructure the alliance to substitute royalty payments instead of microprocessor technology for Toshiba's DRAM technology.

Fortunately, both partners had the wisdom to build flexibility into the original agreement to ensure fairness and preserve the partnership. From the beginning, the Motorola-Toshiba alliance was intended to be a long-term relationship held together by substantial shared investment. It has been financially successful for both parties, and we continue to broaden it with additional joint activities. Motorola has benefitted through increased sales and profits, most of which were reinvested in R&D, design, and facilities for new generations of products.

In summary, the partnership has provided Motorola increased local presence and acceptance in Japan, where our marketshare has more than tripled.

Thank you.

National Technology Programs and Strategic Alliances in a Global Economy: A Challenge for Public Policy?

Alan Tonelson, Economic Strategy Institute

I would like to thank the National Research Council for the chance to make some brief remarks about the public policy challenge of national technology programs, corporate strategic alliances, and their interaction.

Before the 1994 election, I would give a rather conventional pro and con analysis of different responses to specific public policy problems created by these new arrangements. But today, given the level of ideologically driven, indiscriminate opposition to any government involvement and economic activity and technology development that we see in Washington, I believe that it is more important to review the rationale for any policy responses at all; in other words, for the American body politic to act collectively to meet needs and to achieve goals that simply cannot be addressed adequately by market forces and private actors.

It is also critical at this point to emphasize that the purpose of these policies is not, as is so often supposed, to stop globalization, to slow globalization down, but to ensure that globalization, cooperation, and interdependence can continue by ensuring that they continue to work to raise living standards around the world. Sometimes we lose sight of that goal.

Why, then, do we need public policy responses in the related areas of access to national technology programs and corporate strategic alliances? My answers will proceed from the mundanely political to the loftily conceptual.

First, should the U.S. government support technology development? We all assume that this support will continue at some level. Most legislators and certainly taxpayers will insist that most of the benefits flow to the American people in very concrete ways in a reasonable time frame.

Many Americans have been disappointed too often in the past when the benefits of traditional trade liberalization policies fell short of the promises made about them over many, many decades. And they will clearly no longer be satisfied with the argument that market forces eventually will give Americans their share of the benefits of these arrangements, especially if market principles are so often honored in the breach around the world.

We can argue about measuring and defining the various benefits of these programs, but there will have to be eligibility requirements of some type, and yes, it is harder to define national interests in an age of rampant corporate strategic alliances and international technology cooperation.

But this means that it is all the more important to think harder about them. And in that vein, we need much better data gathering and also data analysis capabilities in the public sector. We simply do not know enough about these new arrangements at this point to make truly informed decisions.

We are really proceeding in something of an information vacuum. And I am especially concerned that the various proposals to reduce or even to eliminate those agencies that have served as the public policy eyes and ears of the American people will make this task even harder than it has ever been before, at precisely the time when its importance has never been greater.

The second reason is, because Kant was right, and because men are not angels, the United States is going to need leverage if it wants to persuade other countries to reduce their own barriers to capital and technology flows. We will need bargaining chips in the form of certain comparable restrictions of our own.

A wise man once said that there may be good policy in retaliations of this type when there is a probability that they will procure the repeal of the high duties or prohibitions complained of. The recovery of a great foreign market will generally more than compensate for the transitory inconvenience of paying dearer during a shorter time for some sorts of goods.

Now, that comment was not made by Frederich Liszt, it was not made by a Senator, it was not even made by Pat Buchanan. It was made by a fellow named Adam Smith, who wrote a book called *The Wealth of Nations*.

Third, and here we get a bit loftier and more conceptual, the failure to develop adequate public policy responses to globalized capital and technology flows will have staggering economic, social, and political implications that few are thinking about systematically today.

Just one example. The creative destruction sparked by unfettered economic flows can certainly stimulate innovation and productivity and raise living standards. But it can also hinder them by destabilizing and even sweeping away the institutional underpinning—legal, political, and social—required by all constructive economic activity.

Business, let alone countries, cannot flourish in a world of total chaos and total flux. Look at the problems that we are suddenly discovering with flows of hot money around the world. For decades, free market advocates said that we

would be so much better off if all the restrictions on capital flows were just lifted, if investors had a perfect capability to invest and withdraw from investments whenever they wanted. And all of a sudden, due to the widespread financial deregulation starting in the early 1980s, that is what we have. And we find that a world of hot money is not such a great world after all.

Fourth, I will make explicit some points that I believe have been a little bit too implicit in other sessions of this conference. Everyone in the economic, business, and political science fields throws around words such as interdependence, integration, globalization, even cooperation.

In my view, without fully recognizing their implications, the prevailing assumption seems to be that these are forces that are strangely one dimensional in their nature, in the sense that they can only unfold naturally in ways consistent with the worldwide triumph of pure laissez faire and comparative advantage, whether static or dynamic or whatever form of comparative advantage you happen to believe in. And the only thing that could mess this up would be if governments step in and try to capture advantages for their own particular community.

What is too often forgotten is that these words describe relationships, and that all relationships, especially relationships as complex as the ones we are talking about, have terms. They have structure, they have content. Even cooperation has terms in the private sector. That is why we have contracts.

Contracts are not simply a jobs program for lawyers. We have contracts because different parties want to make sure that cooperation works as well as it possibly can for them.

And because these terms have to be shaped by someone or something, and because the actors playing this role will inevitably bring different experiences, interests, values, and economic structures to this process, the terms will not always be equally desirable for everyone involved. Let me just give you one quick example. The master-slave relationship is an interdependent relationship. But it is not equally desirable for both parties. Therefore, the process of shaping the terms of interdependence will inevitably be political in nature to a very large extent.

So my closing thought is that we should spend less time discussing whether interdependence, integration, and globalization are good or bad in the abstract. We need to understand that they can turn out in many different ways, and we should spend more time figuring out how actively to shape the terms of interdependence to favor whichever community or communities we happen to feel loyalty to. In my view, that is the main public policy challenge involved here.

Thank you.

Concluding Remarks

National Investments and Global Economic Competition

Lionel Johns, Office of Science and Technology Policy

STEPHEN MERRILL: I would like to introduce Lionel Johns, who will be giving the concluding remarks. Mr. Johns joined the White House Science Office in the very earliest days of the Clinton administration, having come from the Office of Technology Assessment. Mr. Johns was instrumental in defining the Office of Technology Assessment and its work on industrial technology.

LIONEL JOHNS: Fair and open international trade is important to competitive success in U.S. high-technology firms, and it is a goal worth fighting for. However, there is one thing we have learned in the past 15 or 20 years. When U.S. firms lose marketshare in one important industry after another and then, in some cases, laboriously regain it, we learn that it is what we do at home that matters most.

Success in a fiercely competitive global marketplace depends most on all the abilities to develop and quickly bring to market well-designed, highly reliable goods for sale at reasonable prices.

A great deal of this success depends, in turn, on private sector managers, the ability to learn and to put into practice the lessons of lean management and good use of human resources. This includes high-quality training, assignment of responsibility, a shop full of workers, dedication to continuous improvement, commitments to in-line quality control, and getting it right the first time. It also includes small inventories and just-in-time delivery of parts to uncover hitches in production, rather than fat inventories, replacement of defective parts, and extensive rework.

Private companies cannot do it alone in this fast-moving and intensely competitive world. Industry needs help from and partnership with government. Our

best competitors in Europe and on the Pacific Rim certainly know this. Many of us know it, too, although right now it seems we have a lot of educating to do with the new majority in Congress.

Some of the positive things government can do to foster competitive success are broadly enabling, such as a stable, predictable business environment, a tax structure that encourages long-term private investment in new technology and productive equipment, regulation that reduces costs and unnecessary burdens but still achieves widely agreed-on goals of protecting public health and the environment. We also need a first-class education for all children and lifelong learning opportunities, including adult retraining when needed.

We need shared public investment in high-risk, but potentially high-pay-off new technologies. The accelerating pace of technology, the ever-shortening product cycles, and the rapid worldwide diffusion of technologies means that many companies are finding it harder to justify investment in risky R&D than in the past.

This means that government R&D partnerships with industry in growth-enhancing technologies are more important than ever. Without government to share the risk, individual companies are reluctant to take the plunge. Government partnership fosters a technological advance that might otherwise not be made, or would be made in foreign countries with most of the benefits going to their citizens.

The United States has had some outstanding successes with government-industry partnerships. Agriculture is a good example, starting with the Merrill Act in 1862. Aeronautics is another example, and it dates back to 1916 with the creation of the National Advisory Committee on Aeronautics. Other examples are the semiconductor industry and SEMATECH. And early returns from the advanced technology program, which started in 1990, are highly favorable.

Of course, our national investments in technology have always included infrastructure that supports commerce and industry: canals, roads, railroads, and, since the turn of the twentieth century, standards of measurement—the *sine quo non* of technological advance.

You might think that the government provision of technically superb measurements and assistance to voluntary private sector standards development might be sacrosanct. But the plans of at least some of the Republicans in the current Congress include putting the laboratories of the National Institute for Standards and Technology up for sale.

Most of the U.S. government-industry partnerships are in research, development, and provision for facilities for R&D, such as NASA's wind tunnels and one-of-a-kind scientific equipment in the Department of Energy laboratories. We have also recently begun to share costs with local governments and industries and extension services that help 370,000 small- and medium-sized manufacturers adopt up-to-date technologies and business practices.

Our best competitors in Europe and the Pacific Rim do all of this and much

more. Besides sharing in R&D investments, besides supporting industrial extension services that are much larger and more experienced than ours, they have also provided subsidies for actual commercialization, such as the success-dependent loans that European countries gave Airbus and that the Japanese provided through a spin-off for private industry ventures in aircraft engines.

Production and export subsidies are not in the U.S. tradition, and they are either discouraged or banned under the new world trade agreement. Of course, government-industry investments and research and development and deployment of new technologies are in a different category. They are blessed by the world trade agreement. They are part of an old and sturdy American tradition.

In today's world, corporate cost cutting has led to targeting of in-house research in technologies that are close to commercialization at the expense of longer-term or riskier research. That makes investments in technology critical to economic growth more vital than ever.

I would like to share with you some data from the World Economic Forum's 14th Annual World Competitiveness Report of 1994. This data provide a sense of how the U.S. government and U.S. industry compare with other nations in nondefense R&D in the recent past.

For total expenditure on R&D in the public and private sector as a percentage of GDP [gross domestic product] in 1992, the U.S. was at 2.62 percent. The larger percentage of this is on the government's side for defense spending. If we did not include defense spending then the United States would drop down around Austria and Belgium.

If we look at nondefense R&D as a percentage of government spending allocated to nondefense research in 1992, the United States was at 41.4 percent, which put the United States 28th among other nations. All of our formidable competitors are well above us. For Spain or Taiwan, 80 percent or more of their investments are in nondefense R&D.

The United States would like to believe that it has an aggressive private sector area and that it does not have to worry because, while other nations' governments make investments in R&D, U.S. corporations make up the difference. This is one of the fallacies in the U.S. Congress at the moment. As any U.S.-based company will tell you, their attempts to invest in longer-term R&D are sure to be punished in Wall Street.

The United States was 19th in actual real compound percentage growth in 1988 to 1982. These were good years and bad years for other countries as well. During the Clinton administration, we have passed a three-year R&D tax credit, which has changed the way accountants look at R&D investment. And the good news is that U.S. investment, as a result, is up.

Unfortunately, the data indicate that, of that R&D investment, less than 8 percent is long term. And again, if one looks at our formidable competitors, their numbers are imposing indeed, compared with our negative numbers.

To find out how the United States is doing in terms of world competitive-

ness, we would have to look at the balance of trade. I realize that economists have macro explanations for these things. Some will say that the United States imports $50 billion worth of oil. That is about a third of what we consume. The Japanese import virtually all of their oil and still have a positive balance that is very impressive indeed.

The reasons for these variations are complex. Nevertheless, if the United States is underinvesting as a nation, if it is underinvesting in the private sector and the results indicate that we are not doing so well, this does not seem to be a very good time to be cutting those investments and increasing the investments in the defense area by sacrificing those in the nondefense areas.

We will be doing our best to encourage Congress to understand the danger of this to our nation and to our economy. And I hope that others will support that notion.

Thank you.

WILLIAM SPENCER: I agree with you that the industry investment in R&D has gone down in the last couple of years. Someone made the point earlier today that one of the problems is that we had a series of some type of natural monopolies in the United States—IBM, AT&T, Xerox, Kodak-Polaroid. And as those monopolies have gone away, those companies have been forced to roll back R&D.

My hope is that this will not continue. Certainly in the semiconductor area, the industry is growing so rapidly that they are having a hard time keeping up a 10 or 12 percent investment in R&D because the industry is growing 25 percent per year. All this is a long preamble to the question of what is the right level of R&D in the United States. Currently it is somewhere between $160 billion and $200 billion, depending on what you count and who you listen to.

Is that enough? Is it a problem of not enough investment in R&D? Do we have the wrong set of priorities? The Clinton administration is moving $10 billion out of defense into commercial areas. What is the real problem—too little spent in the wrong directions?

LIONEL JOHNS: For anyone who looks at R&D investment, the importance of consistency is fundamental. To be unpredictable will certainly not attract the best and the brightest in any of the areas that are involved. In fact, you drive them away.

My own view is that we are indeed underinvesting, and I believe that U.S. companies will underinvest until we devise a way for them to make longer-term R&D investments without punishing them. There is no easy solution to this problem. Even though we would rather have capital gains go to a very low number, to reduce it for short-term holdings is to encourage to those who hold stock for short periods of time and who trade rather than invest.

We need to solve this problem. If we do, it will greatly reduce the imperative for a federal partnership or a federal investment. I would argue that with the great

reduction in our defense spending over the past few years, if we intend to sustain a world-class technology capability so as to provide for our national security, we will have to make investments in critical technologies.

And we will have to make them consistently, cooperatively with industry, and in a manner that is not the DoD buying for special purposes, but the DoD depending increasingly, to the degree that it is possible, on the private sector markets as other nations do.

STEPHEN COONEY: Despite what was said yesterday about causality, the fact is that the very large trade deficits began in the United States after the very large budget deficits started. Most of the executives that I talk to both in Germany and in the United States believe that it does not matter how the United States cuts the trade deficit—the first priority is to cut the budget deficit. And unless you start cutting the budget deficit substantially, you are really trying to swim up Niagara Falls with respect to getting the trade balance back in order.

My final comment is a political one, which is that there has been an underrepresentation in this conference of the Republican views on this matter.

I would also say that I believe that everyone in this room agrees that heavy cuts in nondefense technological R&D are not good. My company, Siemens, is fighting it in certain areas. But the first obligation of the Clinton administration is to show that, if the overall goal is to reduce the budget deficit, where are you going to reduce it elsewhere so as to save the nondefense R&D investment? I believe that the Clinton administration has not shown leadership in that area.

LIONEL JOHNS: Let me disagree with you and disagree strongly. First of all, in the past three years this administration has reduced the deficit. This is the first time that such a reduction has occurred since the Truman administration. There have been very sizable reductions, in fact there has been over $600 billion in reductions.

I certainly do agree that we need to reduce the deficit. But we delude ourselves if we think we cannot get costs under control for health care, get the costs under control for Medicare and the other entitlement programs, and just deal with solving the problem by cutting the discretionary budget.

Why it is that other nations have very positive balances of trade when they have deficits that are comparable? Compared with other central governments' total debt, the United States was 17th. I imagine that this shocks a lot of people, because we have had the characterization that the United States was off the scale with regard to our deficit.

Japan was 12th and they had a very positive balance of trade. I would agree with the arguments that the U.S. savings rate is a serious problem, and there is no doubt that that is the case, because the corollary of not saving is spending, and that is part of the problem.

But it is too simple to say that it is the size of the debt and the relationship of

the debt to GDP. And you have to look at it in that manner, because we are a $7 trillion economy and Japan is next with $4 trillion. So you have to look at that as a percentage.

Nevertheless, we certainly agree that we must continue to reduce the deficit. It should not be done irresponsibly. The country will pay long and dearly if we proceed along the path we are presently going.

ERHARD KANTZENBACH: I must admit that I am concerned about the implications of these strategic alliances with respect to competition. My question is directed to Charles White. I would like to know how many competitors you have in the world market for your alliance, and is there any clearance of these alliance by the American antitrust authorities?

CHARLES WHITE: There is no antitrust concern about Motorola's DRAM alliance with Toshiba because it is not anticompetitive. Worldwide, there are more than 20 DRAM suppliers, and their prices have historically declined in accordance with the semiconductor learning-curve theory. This strong competition, which is clearly present today, is a primary cause of declining prices for personal computers and other electronic products powered by semiconductors.

The IBM-Toshiba-Siemens alliance was established for the joint development of manufacturing process technology. Almost all major semiconductor participants are involved in some form of joint process development. Of the major players, only Motorola comes to mind as one that is not involved in some type of process development alliance.

We mentioned earlier the Texas Instrument-Hitachi alliance, and Intel recently joined with Hewlett-Packard. You have already covered the IBM-Toshiba-Siemens alliance, AMD [Advanced Micro Devices] has joined with Fujitsu on flash technology, and NEC and AT&T are allied, for process development, etc.

The type of consolidation that would cause concern about monopoly or oligopoly does not exist in semiconductors. The only potential exception to that assertion is that some might argue that Intel's dominance of the microprocessor used in DOS Windows platforms is cause for concern.

Precompetitive cooperation, such as cost-sharing and semiconductor alliances, as we have discussed, serve to benefit the consumer because of lower prices, which result from that cost-sharing, as opposed to each competitor funding 100 percent of its R&D.

HORST SIEBERT: I want to thank the National Research Council for their hospitality, for putting together such an interesting conference, and for giving us some insight into some practical aspects from the industry point of view. I also want to thank our hosts for providing us some exposure to policymakers in Washington, which has been an interesting insight to the U.S. political arena. Thank you very much for this conference and I hope that this research project will come to some interesting conclusions.

III

PROJECT PAPERS

III

PROJECT PAPERS

The Concept of National Economic Strategy

Bruce R. Scott
Harvard Business School

National economic strategy, as used in this paper, comprises a vision of a desired future state of the economy, a time frame within which that state is to be achieved, and a set of policies and institutions for influencing the mobilization and allocation of resources and for promoting their efficient utilization. As with firm strategy, the vision provides the frame of reference for establishing priorities for the mobilization of resources as well as the fractions to be allocated across various product markets. Also like firm strategy, national economic strategies are articulated and implemented through institutions. The structure and culture of these institutions determine in considerable measure how the strategy will be implemented as well as its potential effectiveness.

Economic strategies can influence economic performance by influencing the volume and structure of resources (supply), the volume and structure of demand, and/or the distribution of incomes. With governments around the world consuming from 10 to 30 percent of gross domestic product (GDP), and spending additional amounts as transfer payments, it is hard to imagine a circumstance in which governments do not have an important influence on the mobilization of resources. Recognizing that this involvement is inevitable, a baseline strategy might be one in which government aimed to raise and spend those funds so as to have the minimum impact on private decisions, whether on resource mobilization or allocation. This would mean, for example, that there would be no "targeted" tax breaks for any industries or groups of people. The economic rationale for this strategy would be that the market knows best. If, on the other hand, one recognizes that markets are imperfect, an economic strategy can conceivably enhance economic performance by promoting

- more (or less) resource mobilization,
- more effective allocation of those resources across sectors of the economy and among economic actors, and/or
- more efficient utilization of resources by the various economic actors.

A vision helps establish goals that in turn animate an economic strategy. A vision of achieving economic and/or political equality with other nations is fundamentally different from one of achieving maximum consumer purchasing power today, let alone increased equality or increased security of incomes. The former is likely to justify "exceptional" levels of resource mobilization and personal responsibility, whereas the latter typically would not. Government intervention to promote increased security of incomes is apt to involve transfers that promote consumption while at the same time relieving individuals of a measure of responsibility for their own welfare. Thus, economic strategies are based on differing roles and responsibilities for the economic actors as well as differing notions of resource mobilization and allocation.

Economic strategies can employ more or less direct means to influence the mobilization and disposition of resources and the incomes they generate. Within a given economic structure the efficiency of resource utilization seems best promoted indirectly, as suggested long ago by Adam Smith and others, by ensuring that markets work effectively. High levels of resource mobilization, in contrast, typically require more direct government intervention, such as "forced" saving or higher standards of admission for university entrance, a point that is central to the analysis of the producer orientation described below. High levels of resource mobilization can achieve increased growth rates, but often because seemingly high levels of labor productivity are offset by low level of return to capital. High growth, based at least in part on high total factor productivity, seems to require shifting the structure of an economy from current advantages and opportunities toward those of the future, for nations as it does for firms. It is no accident that the high-performing Asian countries have experienced export-led growth, the exports have been led by manufactures, and, beginning with Japan, several seem to have had remarkable success in moving their manufactured exports upscale to higher-technology, higher-growth sectors.

One of the central issues in this paper is to consider how and why some countries have been more successful in shifting their economic structures toward future opportunities and why others, such as the OPEC countries with their great natural advantages, have been conspicuously unsuccessful in doing so. A related issue is the role of these opportunities in creating a rationale for enhanced resource mobilization. High levels of resource mobilization in the absence of appropriate market opportunities can lead rapidly to low rates of return, at least in terms of the domestic currency, or to capital outflows. Japan, for example, has saved and invested about as much of its GDP during this decade as it did in the 1960s, but the returns (at least in yen) have dropped from approximately 10 per-

cent economic growth to approximately two percent. Japan's rising exchange rate has reduced domestic opportunities in a way that has negated much of the effect of its massive investments in human as well as physical capital. Its private sector, and notably its large manufacturing firms, are technically and financially stronger than ever, but they are not able to develop opportunities at home the way they did in previous decades. Thus, the notion of structural shifts, toward or away from future opportunities, and the role of public policy in those shifts is of central concern.

Economic strategies are not just a matter of economics; the vision, the goals, and the directness of intervention all have important political implications. An ambitious growth strategy may assume a consistency of purpose and personnel that is difficult to achieve in a democratic context except, perhaps, in war time. In addition, economic strategies can be implemented only through institutions. Mobilization and allocation of resources through institutions involve fundamental issues of governance. Direct intervention is associated typically with authoritarian government, indirect intervention with democracy. At a minimum there are strong ideological differences between the two. Indeed, strong political and/or ideological differences may rule out some strategic options. We must recognize at the outset that it is not possible to discuss economic strategies without taking account of political considerations and differing ideologies. At the same time we must also recognize that differences in economic theory can also influence a nation's perceived strategic options.

An example of the rise and fall of an economic strategy can illustrate the argument thus far. A distinction between the rise and fall of a particular variant of economic strategy and generic propositions about economic strategies per se needs to be drawn.

KEYNESIAN ECONOMICS AS ECONOMIC STRATEGY

The "Keynesian revolution," which dominated economic thought from the end of World War II until approximately 1980, was, at heart, a concept of how governments could "manage" aggregate demand to achieve full employment of a nation's human resources. Keynes' ideas were considered revolutionary, both as a reconceptualization of economic strategies of governments and because they opened a new avenue for the economic strategies of governments based on the management of aggregate demand. The intellectual origins of this strategy owe much to the economic circumstances of Britain as well as the insights of Keynes.[1]

Beginning in the 1920s, Britain experienced an apparent excess of supply, and notably an excess supply of labor, a problem experienced by most other developed nations during the Depression of the 1930s. It was Keynes' insight that this problem could be solved in the sense of achieving full employment by in-

[1]Ckidelsky, Vol. 2

creasing aggregate demand, which in turn could be achieved through increased government spending, financed by fiscal deficits if necessary. With the "new economics," government could reduce economic and social inequalities by eliminating their "root cause" (i.e., unemployment). The Keynesian vision was one of growth, stability, and increased equality, all led by government. It had the particular merit that good economics seemed to be good politics as well.

Ironically, by the time conservative political leaders such as Richard Nixon could claim that "we are all Keynesians," the Keynesian concept of economic strategy was largely obsolete. Inflation of demand to end the 1970 recession aggravated the U.S. balance of payments deficits that had emerged in the early 1960s. Rather than restrain demand to reestablish the balance of payments, on August 15, 1971, President Nixon "temporarily" suspended convertibility of the dollar. Early in 1973, dollar convertibility was suspended altogether. The Keynesian model was incompatible with an increasingly open economy and a fixed exchange rate.

Keynes' strategy of sustained growth through government-led demand management was conceived when rising trade barriers around the world had reduced world trade to record lows relative to gross national product (GNP). World War II caused further disruptions, as did the "dollar shortage" in the following decade (1945–1955). In these circumstances, supply was largely domestic supply. If government promoted demand, as suggested by the Keynesian model, this led to increases in domestic supply and eventually to full employment of resources.

However, in an economy open to world trade, nations that tried to promote growth and full employment by way of promoting aggregate demand found that more and more of the demand was met by imports instead of domestic sources of supply. Increased imports led to persistent balance of trade and payments deficits. At the same time they were likely to lead to persistent government budget deficits and often to inflation as well. Unemployment, which had been reduced to record lows in the developed countries in the 1960s, returned in the 1970s and continued to increase in the 1980s.

Some countries, such as France, seemed to make Keynesian economics work remarkably well by a strategy of "inflate and devalue." Deficit-financed government spending sustained full employment, and above average inflation was offset with periodic devaluations.[2] However, in the slower growth and more open world economy after 1973, devaluations gave little respite; rising import prices and rising wages soon offset the devaluations. The French experiment with reflating demand in 1981 lasted only 18 months. Brazil's attempts to offset the effects of continuous devaluation by way of indexation of prices and wages met a similar fate; an ever-increasing rate of inflation causes ever-larger distortions, shifting attention from the production of real good and services to how to delay accounts payable and accelerate the collection of receivables.

[2]Source: Stephen Cohen on French Planning.

The limitations of the Keynesian model in a progressively more open world economy are now widely recognized and accepted. Indeed it has become fashionable to generalize from this and other failures to conclude that there is little that government can do by way of economic strategy other than to get certain "basics" right. Although it is indeed true that governmental capabilities are all too often sorely tested just to minimize distortions that might cause the misallocation of resources and to maintain overall stability and an environment conducive to risk taking, this is a problem with the practice of government more that with economic strategies per se.

It is important to recognize the limitations of the Keynesian model while at the same time recognizing that it was an ingenious response to a particular set of circumstances. Keynes's breakthrough came from recognizing that, contrary to the accepted theory of the time, supply did not beget its own demand. There was no necessary connection (ex ante) between the desire to save, which reduces demand, and the desire to invest, which reestablishes that demand. Inadequate demand was both possible and curable.

In an open economy the strategic challenge is how to maintain external balance while promoting growth at home. As an economy grows, incomes rise, and a rising fraction of those incomes go for intermediate inputs and capital goods. Although the coefficients relating imports and GDP will vary from country to country, the general trend of trade (including imports) is to grow more rapidly than GDP. In a regime of fixed exchange rates the trade balance becomes a governing force on the growth rate. Floating rates have often been associated with weak economic policies, including low rates of saving. The consequences are likely to include above-average levels of inflation and the inevitable distortions that accompany that inflation.

Broadly speaking, governments have four alternatives to deal with trade or current account restraint; they can (1) promote domestic sources of supply while restricting imports; (2) promote exports to match the rising imports; (3) keep hands off and, if necessary, accept a lower rate of growth; and (4) finance a trade gap temporarily through capital imports, whether debt or equity. The first two of these options require direct government intervention in the structure and functioning of the economy; although they differ sharply in content they are the underlying rationale for the developmental strategies explored in this paper. The third option presumes that government avoids direct intervention in favor of a facilitating role in the economy. This leaves the direction and speed of growth to market forces.

The fourth option can be used as a supplement to any of the first three, but it cannot be used for very long unless the capital inflows support high-return investments that yield returns adequate to meet future payments of dividends, interest, and, at some point, perhaps principal as well. Canada, in the first half of this century, was an extreme—and apparently successful—case of this fourth option, with capital inflows financing more than 25 percent of domestic investment for

more than 40 years.[3] With the cessation of net capital inflows in the 1970s Canada has also become an example of the illusions that this strategy can support. In any event it is not treated as a separate case.

If Keynes were still alive he probably would have refocused his attention in light of changing world conditions. Indeed he might well have ceased being a "Keynesian" about the time Richard Nixon decided to become one. In any event, it is not unreasonable to imagine him exploring one or both of the developmental strategies as a preferred alternative to laissez faire.

The central questions to be addressed in considering the development strategies are (1) whether either can improve upon market outcomes in promoting economic growth and, if so, under what conditions; and (2) whether they are indefinitely sustainable or, on the contrary, one or both contains the seeds of its own demise. A third question, also central to this analysis, is whether all the high-income countries face a more or less new challenge of how to satisfactorily employ their low-skilled citizens. The Keynesian model cannot shed much light on any of these questions, but we need some theory to guide us nonetheless.

ECONOMIC STRATEGY AND ECONOMIC THEORY

Economic strategy does not exist independent of a theory or model of economic development, however, explicit or implicit they each may be. Theory establishes connections between cause and effect. Whether the desired effect or result is high-growth, high-efficiency, or high-income security, theory is indispensable to a strategy for its successful achievement. However, economics is not a science like biology let alone chemistry or physics. Controlled experiments are the exception, not the rule, and replicating results is usually impossible. "Proof" is to some degree in the eye of the beholder; a conservative analyst may arrive at one interpretation while a liberal arrives at another.

In these circumstances a mix of ideology and theory can be said to drive economic strategy, and competing versions or interpretations of theory are often to be found behind competing economic strategies. For example, neoclassical theory follows the analytic insights of Adam Smith and others that efficiency and equity are the real concerns of policy; the mobilization and allocation of resources is best left to market signals. This theory presumes that competitive forces, working through markets, will mobilize resources to the point where the present value of prospective returns equals the present value of those resources for current consumption. Arrow and Debreu won a Nobel prize for showing that, in equilibrium conditions, these same competitive forces will reallocate resources until prospective marginal returns are equal across sectors, at which point they will be achieving their more effective use. In these hypothesized circumstances (equilibrium) it is impossible, by definition, for government to improve on the allocation of resources.

[3]See the World Bank, *World Development Report,* 1985 for exact figures.

In an open economy competition will create continuous pressure for organizational innovations to make efficient use of a given flow of resources, thereby ensuring efficient usage as well as effective allocation. Thus in an open, laissez-faire economy it is the job of government to maintain economic stability while minimizing distortions in various markets. There is little government can do to improve on market outcomes, and there are many things it can do that will reduce those outcomes.

This neoclassical notion of market superiority creates something of a dilemma for developing nations. How are the latter to achieve economic and/or political equality with more "advanced" nations? Their circumstances, including their desire to catch up, strongly suggest the need for an economic strategy to promote rapid growth. Because they can hardly expect to be more efficient than advanced nations, their options lie in higher levels of resource mobilization and/or more rapid sectoral reallocation, either of which is likely to require a strong role for government. At the same time, experts from advanced countries have a tendency to rely on theory that has little if any room for such a strategy. Their political and/or ideological views seem to have little if any room for a strategy that might entail extraordinary measures to mobilize resources for productive purposes if that required some sacrifice in current levels of consumption (to finance additional investment), let alone some curtailment of individual liberties.[5]

The key theoretical issue, however, is whether governments can improve on market outcomes if they attempt a reallocation of resources from a structure that maximizes present returns toward one "targeted" on future opportunities. How can subsidized investments (industrial policy) be justified in targeted sectors if they are at below-market returns? It is important to consider this question in theoretical terms before introducing the not irrelevant question of governmental competence.

Chenery et al. point out that there are two competing theoretical positions:

> There are two contrasting views of the way economic growth occurs. In the neoclassical tradition, GNP rises as the result of long-term effects of capital formation, labor force expansion, and technological change, which are assumed to take place under conditions of competitive equilibrium. . . . Movement of resources from one sector to another is considered relatively unimportant because labor and capital produce equal marginal returns in all uses.[5]

In the equilibrium model there is little or no constructive role for trade or industrial policies because, by definition, if returns by sector are equal at the margin, then prospective returns from additions to one sector would be less than the returns lost from the sectors that were deprived of those same resources. Reallocation in the equilibrium context occurs gradually and spontaneously, driven

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[4]Cf Paul Krugman in Foreign Affairs, 1994

[5]Hollis Chenery, Sherman Robinson and Moshe Syrquin, *Industrialization and Growth* (A World Bank Research Publication) Oxford University Press, 1986, p. 13.

by relative rates of return. A trade regime or other industrial policy intervention by government would by definition reallocate resources in such a way as to "over-invest" at below market rates in the targeted sectors, while reducing investments (at market rates) in others. The equilibrium view holds that the optimal role of government is to limit its interventions to those that level the playing field by correcting market imperfections; it should not attempt to tilt the playing field for policy-based reasons. But Chenery et al. suggest a broader policy view in which:

> economic growth is regarded as one aspect of the transformation of the structure of production that is required to meet changing demands and to make more productive use of technology. Given imperfect foresight and limits to factor mobility, structural changes are most likely to occur under conditions of disequilibrium. . . . Thus a shift of labor and capital from less productive to more productive sectors can accelerate growth.[6]

Disequilibrium may be an essential condition for a strategy of above-average growth, for a nation as for a firm. But markets in disequilibrium do not necessarily work smoothly, returns should not be assumed to be equal across sectors, and market imperfections may be the rule instead of the exception. Key opportunities may entail excessive risks for entrepreneurs and/or their potential backers. In these circumstances government can play a positive role.

Accelerating the movement of labor out of agriculture has been one of the prime forces for growth in developed nations. Acceleration of the growth of the manufacturing sector is a second. Promotion of information-based services may soon be recognized as another. In addition, governments can play a key role, through purchases and subsidies, in helping firms achieve advantages in specific industries that promise above-average rates of growth and/or technological progress, such as commercial aircraft, computer chips, or certain biotechnologies. Returns to society as a whole may exceed returns to the firms in question, in part through opportunities for technical achievement at schools and universities as well as at work, in part through import reduction or export development, and perhaps through additional tax revenues as well.

Obviously, social returns are more difficult to measure than those to a firm. These complexities, plus the fact that a society may have a greater tolerance for risk than its private firms, open a door not only for developmental strategies but for waste and fraud, a point that can hardly be overemphasized in light of the experience of nations of various sizes and governments of various types and inclinations. Nonetheless, Chenery et al.'s notion of developmental strategy has very important implications, notably when it comes to trade regimes. For example, the International Bank for Reconstruction and Development (the World Bank) and others have identified an outward orientation as one where domestic prices are aligned with the equilibrium model. The disequilibrium view would suggest domestic prices either higher or lower than those in the world market,

[6]Ibid.

(i.e. an over- or undervalued exchange rate). Both regimes have been tried, and each with some success.

A development model based on deliberate disequilibrium is particularly important in understanding the strategy of East Asian countries, beginning with Japan and most recently China. Equilibrium versus disequilibrium is not the only important theoretical issue. Douglas North, in accepting his Nobel Prize in "economic sciences" in 1993, underlined some additional theoretical issues by drawing a distinction between an economic analysis of how markets function at a point in time and the corresponding analysis of how economies develop over time.

> There is no mystery why the field of development has failed to develop during these five decades since the end of World War II. Neoclassical theory is simply an inappropriate tool to analyze and prescribe policies that will induce development. It is concerned with the operation of markets, not how markets develop. . . . The very methods employed by neoclassical economists have dictated the subject matter and militated against such a development. That theory in the pristine form that gave it mathematical elegance modeled a frictionless and static world. . . . When applied to economic history and development it focused on technological development and more recently human-capital investment but ignored the incentive structure embodied in the institutions that determined the extent of societal investment in those factors. In the analysis of economic performance through time it contained two erroneous assumptions: (1) that institutions do not matter and (2) that time does not matter.[7]

Institutions and time are key instruments of economic strategy; specific goals help clarify direction and priorities. An economic strategy aimed at rapid growth and/or catching up with leading countries justifies a high level of resource mobilization. All of the high-performing countries have had high levels of resource mobilization (e.g., savings and investment in excess of thirty percent of GDP) as an essential element in their strategies. These high levels of resource mobilization obviously entail short-term sacrifices in consumption and thus in standard of living. It is as though these countries have rejected Smith's basic axiom that "the only purpose of production is consumption" in favor of one to the effect that "the first and foremost purpose of production is the achievement of political equality through economic power." They have rejected an essentially consumer-oriented notion of economic strategy in favor of one that is producer oriented.

If a nation is guided by a producer-oriented vision of achieving political equality through economic power, then it is open to consider some producer-oriented propositions that might be the backbone of a producer-oriented theory of development. Economic power is to be found in productive firms in growth industries. The economic power of firms can be enhanced through preferential access to low-cost capital, below-market wage levels, and high rates of profit

[7]"Economic Performance Through Time," Nobel Prize acceptance speech, December 1993, as reprinted in *The American Economic Review* (June 1994): 359.

retention. Reallocation of resources into high-growth areas where firms do not, at the time, have obvious advantages can be accelerated by tying preferential access to subsidized resources to just such performance, that is by an industrial policy.

Increased levels of resource mobilization are less a theoretical issue than one of politics and ideology. There is no magic involved, no claims of gains in total factor productivity. It is largely a matter of increased mobilization leading to increased capacity for growth. At the same time, however, industrial policies to promote a "faster than market" reallocation of resources can be greatly facilitated by the availability of resources at below-market cost. A subsidy is involved. In general, consumers will subsidize producers. Thus, Chenery et al.'s notion of accelerated restructuring as a strategy of growth is much more compatible with the high levels of resource mobilization associated with producer orientation than with the lower levels associated with the more familiar consumer variant. Economic strategy is a matter of mobilization as well as allocation.

Increased resource mobilization is typically part of a catch-up strategy. It may justify forced savings, a longer work week, restrictions on wage increases and/or union activities, or other similar interventions. The Soviet Union did this for decades, and more recent examples would include Japan, Korea, and Singapore.

The context is quite different for high-income countries, however. They are likely to see themselves as fully "competitive," and thus see the role of government as promoting higher levels of current consumption, perhaps by taxing saving and subsidizing consumer borrowing, even if this means a significantly lower level of resource mobilization and consequently a lower rate of economic growth. Keynesian economics was a central part of many such strategies.

As incomes rise, priorities may well shift, as though there were a hierarchy of social needs. Producer-oriented countries may become more consumer oriented and may decide to modify their economic strategies accordingly. Consumer-oriented nations may also shift their priorities, from raising their levels of consumption to ensuring the security of that level. John Kenneth Galbraith has identified the rationale for such a change:

> "In the industrial countries most people, when employed, are not primarily occupied with the size of their income. . . . Their principal worry is the danger of losing all or most of their income—of losing employment and the consequent loss of all or most of their livelihood. . . . In consequence, the factors affecting the security of employment are now socially far more important than those determining the level of reward."[8]

Governments of high-income or "industrial" countries have responded to this change in priorities by shifting their focus from promoting economic growth to promoting economic security. Increased emphasis on economic security is surely

[8]John Kenneth Galbraith, "The Present as the Future" in *Economics in Perspective, A Critical History.* Houghton Mifflin Co., Boston, Mass., 1987, pp. 290-291.

the number one cause of the growth of government spending in the industrial countries in the twentieth century. Beginning in the late 1980s, first in Europe and then in the United States, governments accepted responsibility to ensure against illness and accidental injury, either of which might result in loss of income if not loss of employment. With the Great Depression, many governments accepted responsibility for unemployment insurance, and then for countercyclical fiscal policies intended to maintain a level of aggregate demand consistent with full employment. With the prosperity of the 1950s and 1960s many governments accepted added responsibility to ensure against poverty or low incomes. These added responsibilities required institutional innovations, while at the same time the added spending meant that government's economic strategy had an increased impact on the performance of the economy.

Governmental responsibility for redistribution of income means that economic strategies can be analyzed in terms of their effect on the distribution of income as well as its level. Although a focus on incomes inevitably overlaps somewhat the previous discussion of the mobilization and allocation of resources, it helps clarify government's strategic options in a dimension that seems sure to receive increased attention as competitive pressures intensify in world markets and especially as these pressures lead to increased inequalities of incomes. Because it may be easier to visualize strategic options with respect to incomes, a framework based on income distribution is presented first before proceeding to a second approach based on the mobilization and allocation of resources in product markets.

STRATEGIC CHOICE IN AN INCOME FRAMEWORK

Strategies for reallocating resources by way of trade regimes (e.g., import substitution) have been much studied, notably by economists associated with the World Bank. We can also learn from an additional approach in which a population is arrayed by skill and/or income level. If we assume there is some connection between skill level and income then we can array a population from low to high, as shown in Figure 1. In this framework, government has three broad options for promoting "competitiveness": it can promote a rise in average incomes; it can favor those at the high end of the income curve, thereby increasing inequalities; or it can favor those at the low end of the curve, thereby reducing inequalities. Although it is somewhat arbitrary to divide the income curve into three segments, the concepts are quite distinct as are the methods used to promote incomes.

As incomes have risen, particularly in the industrial nations, governments have played an active role in increasing the security of all incomes while at the same time trying to boost the incomes of the least fortunate. Each of these activities has a social rationale: the promotion of a more humane and/or egalitarian society. At the same time it can be argued that each neglects, if indeed it does not

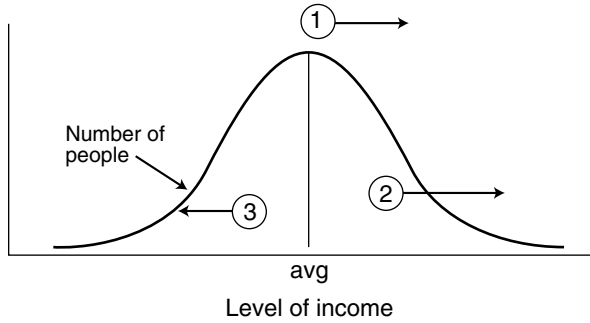

FIGURE 1 Alternative concepts of intervention by level of income.

run flatly against, market forces. Thus, as we look at economic strategies in a skill/income framework, we may find government working at cross-purposes, promoting competitiveness in some of its actions and reducing it in others. Because the primary concern is with the strategic options of high-income countries, this framework plays a significant role in the analysis as we shift from examining the strategies of the challengers to considering those of the current leaders.

Average incomes can be promoted through increased resource mobilization and/or the promotion of increased efficiency in the use of resources, as symbolized by arrow 1 in Figure 1. Obviously, a higher level of resource mobilization to promote future income requires either a reduction in income available for consumption, or the importation of foreign capital, or both. Increased resource mobilization puts more of society's resources in the hands of producers and, correspondingly, less in the hands of consumers. Additional resources, even if used at rates slightly below current "market rates," will yield more rapid income growth, albeit at the cost of a lower level of consumption for a time.

Government can also attempt to increase the security of all incomes—high, middle, or low. Insurance against accident, illness, disability, unemployment, and old age all fall in this category. Keynesian economics aimed to assure a level of aggregate demand that more or less provides employment security or "full employment." Creating a minimum wage and raising it is a way to ensure those with a job against low incomes. Transfer payments such as "the dole" do much the same for the long-term unemployed.

Each of these types of intervention is subject to errors, abuse, and/or the creation of unintended distortions. Mobilization of additional resources may lead to significant inefficiencies if they are misallocated, for example by state-owned enterprises. In particular, forced mobilization of savings can be a recipe for gross abuse if the savings are to be placed in the hands of dishonest, not to mention,

incompetent public officials (e.g., in state-owned banks or trust funds). Even policies to promote full employment have risks. If they succeed, they are likely to enhance the bargaining power of labor relative to capital. If this results in reduced returns to capital, as seems to have been the case in several countries, it may reduce the rate of investment and thus the rate of growth. Therefore, there may be trade-offs between economic security and economic growth as there are between efficiency and equity. At the least, one must recognize that none of these policy options is without its downside risks.

Government intervention to promote the front or higher-income end of the curve (arrow 2 in Figure 1) is still more controversial. Shifting additional resources to high-growth and/or high-technology sectors is at the heart of industrial policy. One argument for such interventions is that society may stand to gain more than the specific firms (i.e., there are positive externalities). Employees will learn skills they may then take to other firms or for starting a firm on their own. Development at the front edge of the curve requires continuous adaptation and learning, and thus numerous institutions progressing together such as secondary schools, universities, research institutes, and firms. Government has a role in seeing that this happens and in supporting the various institutions in appropriate ways.[9] The important judgmental issue is how important such externalities may be, and thus how much of an effort should be made to see that they are developed.

Whatever their potential advantages, industrial policies entail obvious risks. First there is the much observed problem that government will target a lagging sector for political reasons while claiming that it is nonetheless "strategic" (i.e., at the front end of the curve). In addition, many economists doubt that there is any prospect that government officials can, through selective intervention, improve on market-directed investments except in very obvious and therefore very limited cases of "market failures."

Industrial policies may be more appropriate for low-, middle-, or high-income countries. Middle- and low-income countries can look about them and see the frontiers; they do not have to accept the inevitable risks associated with attempting to push those frontiers back. At the same time, they may have a good deal less to work with than richer countries. High-income countries, and particularly those at the technical frontiers, face higher risks of betting on the wrong technologies if not necessarily the wrong fields altogether. However, they have more resources to work with, including more-skilled human resources and more-sophisticated human institutions. Regardless of income level, the basic question seems to be one of governance or, in business language, of the quality of management, and notably the quality of government itself.

If government cannot get the so-called "basics" right, does it really have much business attempting the far more challenging task of selective targeting?

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[9]Haque, Irfan et al., *Trade, Technology, and International Competitiveness.* The World Bank, Washington, D.C., 1996, Chapters 4 and 5.

To date there are not many nations that have a clear track record of successful industrial policies; one would be pushed to identify a dozen. On the other hand, it is clear that industrial policies have played an important part in all of the remarkable successes to date, with the possible exception of Hong Kong.[10] There is opportunity, but there is also great risk.

Some of the more radical innovations of the postwar era have been in the area of raising and/or protecting low incomes (arrow 3 in Figure 1). Minimum wage legislation was designed to cut off the extreme low end of the curve, perhaps thereby shifting much of the curve to the right. The enactment of "means tested" programs, or those based on "need" and not performance, represents a far more radical innovation. Familiar U.S. examples would include food stamps, access to subsidized housing, aid for families with dependent children, and Medicaid for the poor. These programs were reserved for those in or near poverty as a way to enhance their incomes. Because those with low incomes contribute little in terms of tax revenues, this spending is largely a matter of transferring income from the more successful segments of the population to those that are less successful. The experience of the last 30 years suggests that transfers based on need are not an adequate way to address the circumstances of low-skilled and/or low-income people.

Even this simplified, stylized picture is enough to suggest some major issues for economic strategists. Additional mobilization has merit not because it requires "sacrifice" and may thus perhaps "build character," but because it enhances the productivity of labor and raises average incomes. However, it has a cost in terms of current consumption. On what basis can government claim to make better judgments about the present value of future income than individuals exercising their judgment through the market place? The same question may be raised with respect to tilting resources towards areas with above-average prospective (not actual) incomes and/or growth prospects, that is, toward industries, services, or technologies at the front end of the curve. Does government have a better vantage point for assessing potential returns than the world's most sophisticated capital markets?

Government can take quite different approaches toward promoting the front end of the curve. Tax expenditures, such as a R&D tax credit, have a broad impact, tend to favor manufacturing, but also tend to be nonselective as to industry. Support for infrastructure may favor some industries or regions somewhat more than others. More selective interventions to promote critical technologies or industries are more problematic; they require far more than a reallocation of resources. They are almost sure to require skillful institution building and steady, long-term commitment, neither of which is an obvious comparative advantage of most governments.

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[10]For a comparison of the industrial policies of Hong Kong, Singapore, and Taiwan, see Haque, *op. cit.,* Chapter 6.

Promoting economic security raises different, but not necessarily less challenging problems. Promotion of full employment was plausible in the 1950s and 1960s when the industrial nations were much less open to foreign trade. With the opening of the world market, government efforts to enhance domestic demand through fiscal deficits are likely to lead to rapidly increased imports and thus trade and current account deficits. Such deficits are not likely to be sustainable for long periods, except for nations with exceptionally strong credit ratings. Efforts to provide security through minimum wages and/or barriers against layoffs are likely to lead to reduced levels of job creation and thus to rising levels of unemployment.

Tilting resources toward those with low incomes on the basis of need appears to raise even more significant problems. It provides added income without a corresponding requirement for performance. In so doing it creates a problem of moral hazard: The more generous such programs become, the greater the temptation to show "need." Someone who quits a job or who fails and is discharged can potentially qualify for income on the basis of need. As a result, poverty programs, if they are generous enough, can be expected to promote failure rather than improved performance. Thus, a rich country is potentially at risk to create and/or sustain poverty by some of the very programs designed to reduce or eradicate it.

Conceptualizing economic strategies in terms of their impact on various income segments of the population does not have an obvious parallel in the strategic planning of the firm. It is used as an introductory framework because it is a way to illustrate how governments can respond to a problem that has emerged clearly in a number of high-income nations in recent decades, and particularly in the United States. Increased inequality seems likely to become more acute as the world economy continues to open and as competitive pressures intensify, as suggested by Stolper and Samuelson almost half a century ago.

Already there is evidence of a clear shift in the economic strategy of the U.S. government, as suggested by Figure 2. Government spending for means-tested programs, for those with low incomes, has increased tenfold in constant dollars since 1960. Roughly two-thirds of this spending has been by the federal government, the remainder by state and local governments. In spite of the tenfold increase in spending targeted towards those with low incomes, income inequalities have continued to increase.

A similar situation is found in most of the high-income nations in western Europe. Spending for various forms of economic security now dominates the budgets of all. In general they have been more successful in avoiding increased inequalities than has the United States, but most have done so at the cost of large budget deficits or rising unemployment or both.

Identification of strategic options according to their potential influence on incomes by segment helps us consider the impact of economic strategies on the stakeholders in society. It does not help much, however, when it comes to the

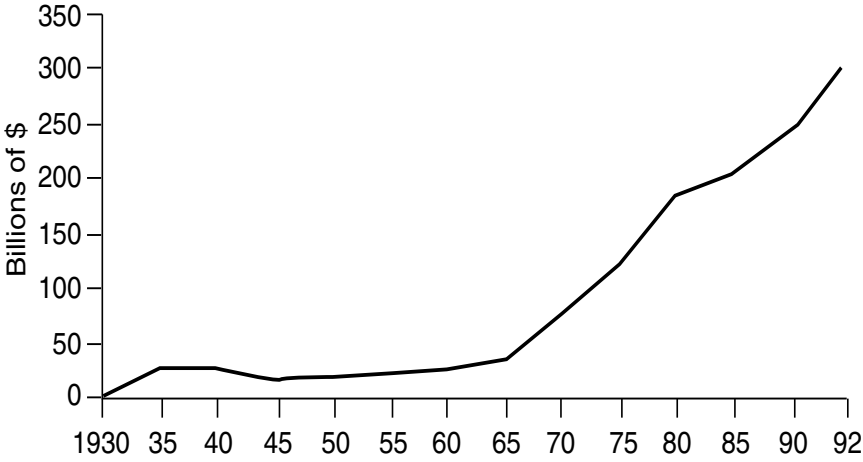

FIGURE 2 The rise in means-tested spending in the United States.

issue of how to increase the productivity and competitiveness of an economy. Here there is reason to draw upon ideas that have been developed for thinking about the strategies of firms.

STRATEGIC CHOICE IN A PRODUCT MARKET FRAMEWORK

There are well-recognized generic orientations for firms, such as low-cost producer versus producer of differentiated goods; niche verses full-line producer; and single-industry business enterprise versus one that is diversified (in either related or unrelated areas). Firms combine these orientations in different ways, together with choices about degree of financial leverage, dividend policies, and so forth, to arrive at an economic strategy. These combinations are oriented by a vision of the firm at a future time (perhaps with projected sales or earnings growth rate and marketshare target) and a strategy for achieving that vision over time through the mobilization, allocation, and utilization of available resources.

It is both possible and useful to describe the strategies of nations in a similar fashion. Nations can be characterized as inward oriented, outward oriented, or neutral, depending on whether their trade regimes favor the home market, export markets, or are neutral between the two. In addition, nations can be characterized as producer or consumer oriented depending on the degree to which they mobilize their resources to promote future income versus consuming today. These generic orientations can be combined to yield generic economic strategies, a point returned to later in the paper.

Inward versus Outward Investment

The inward-outward dimension refers to "trade regimes," which include not only exchange rates and varying types and rates of import protection and export incentives, but also associated policies that often reach deep into the fabric of the economy. In this framework there are three distinctive trade regimes: inward oriented, outward oriented, and neutral. The first two are interventionist, although very different in purpose and design, while neutrality is meant to indicate that domestic prices are approximately in line with those in the world marketplace. Although the framework builds on a long line of research associated with the World Bank, it differs in important ways.

The World Bank differentiates trade regimes according to whether they discriminate against exports or are neutral between home and export markets. Government policy that favors production for the home market is termed inward looking or import substituting. The inward-looking economic strategy is clearly defined and well established in the economic literature, and it is adopted here without modification. However, what the Bank calls an "outward-looking" strategy is not outward oriented in the sense of deliberately favoring exports. It described its "strongly outward-oriented" strategy in the following terms:

> Trade controls are either non-existent or very low in the sense that any disincentives to export resulting from imports are more or less counterbalanced by export incentives. There is little or no use of direct controls and licensing arrangements, and the exchange rates for imports and exports are roughly equal.

This is a description of neutrality, not one of true outward orientation. It does not speak of export incentives as such, but only of incentives to counterbalance any disincentives to export (which typically arise from import protection measures). In addition, the Bank does not speak of an undervalued exchange rate but only of equality in the rate used for imports and exports.

This essay takes a different point of view, characterizing the outward orientation as export promotion, not market neutrality. The essential characteristics of outward orientation are an undervalued exchange rate and the use of additional incentives to promote selected exports.[11] Import restrictions that create a protected market with prices above those that would otherwise prevail can be part of such an export promotion regime. They create a "profit sanctuary" that can help finance exports if continued protection is tied to export performance. In addition, one would expect the "band of protection" and/or export subsidies to move upscale technologically, since typically that is where higher rates of growth in productivity and in volume are to be found.

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[11]Chenery et al. make a similar distinction using three trade regimes instead of two, with the real exchange rate as the main policy instrument distinguishing their export promotion regime from the one that is balanced, or neutral. See Chenery et al., *op. cit.,* Table 11.2, p. 320.

This approach enables us to recognize the existence of economic strategies that "go beyond neutrality" to favor exports. Because the nations with the highest economic performance seem to have availed themselves of undervalued currencies and deliberate export promotion schemes, these differences with respect to outward orientation are very significant to all that follows.

In this framework, both inward and outward orientations are developmental strategies. They presuppose the visible hand of a strategist. Market neutrality relies instead on the invisible hand of market forces.

Recognizing a strategy of neutrality as distinct from export promotion is important for another reason as well. Neutrality is presumed to be the norm for the trading system. It is the strategy nations are expected to adopt once they understand their "best interests" or, failing that, once they are rich enough to accept their share of responsibility for the successful functioning of the trading system. In fact, rough neutrality now characterizes the strategies of most of the industrial nations. Japan has been the notable exception.

Producer versus Consumer Orientation

Producer orientation is built on the notion of increased resource mobilization so as to have, in Keynes' words, "more jam tomorrow." Producer-oriented nations favor saving and investment, technology acquisition, and skills upgrading through education and training, all of which imply less jam today as well as more tomorrow. In addition to increased resource mobilization, producer-oriented societies are characterized by market structures—capital, product, and labor—that permit producer institutions, firms, and associations to hold a great deal of power, while restricting that allowed to labor as well as to consumers. Individuals gain through enhanced productivity and rising wages, not necessarily through low prices.

Consumer orientation is built on the notion of "more jam today." Policies that favor consumption, consumer borrowing, and leisure are components of a consumer orientation. Public provision of enhanced economic security is also a consumer-oriented notion; it allows consumers to take less responsibility for themselves, and thus to leverage a given level of income with additional debt. In addition, a guaranteed minimum income may well remove an important incentive for low-skilled people to commit energy to develop those skills and abilities they possess, including skills and abilities for forming families to parent the children they bring into the world.

There is middle ground between these two orientations, termed here "mixed" to distinguish it from neutrality in the inward-outward dimension. A mixed (or neutral) position in this dimension can be characterized by the notion of providing security against accidental misfortune but not against low income, and by the attempt to create a level playing field between today and tomorrow, as well as across industries and/or sectors of the economy. One could imagine Adam Smith as an advocate of the mixed position, placing heavy reliance on individuals to see their own self-interest and act accordingly.

TABLE 1 Income Levels and Savings Rates[a] for Selected Nations, Based on 1989 Comparisons

	Saving Rate				
	High			Low	
Income Level	1965	1989		1965	1989
High					
Canada	20	23	U.K.	12	18
Germany	23	27	USA	12	13
Japan	30	34			
Singapore	10	43			
Low					
China	25	36	Pakistan	13	11
India	15	21	Tanzania	16	–5
Indonesia	8	37	Zambia	40	5

[a]Gross domestic savings as a share of GDP.

Source: World Bank, *World Development Report, 1991,* Table 9. Note: low and high income countries are as defined by the World Bank.

Orientations are multidimensional; there is no single dimension (such as savings or investment or social spending) that is key. At the same time, however, there are clear differences among nations, for example, in the mobilization of capital resources, which can be shown with familiar quantitative indicators, as can be seen in Table 1. Among low-income nations, China and Indonesia have saved far more of their incomes than Pakistan and Tanzania. China and Indonesia have also dramatically increased their savings rates since the 1960s. India's savings rate has increased over time, but remains far behind China or Indonesia. In contrast, Pakistan, Tanzania, and Zambia mobilized much smaller fractions of their incomes in 1989 than in 1965. Very high rates of saving do not necessarily result from high or low levels of income; they are in significant measure the result of policies of forced saving. Singapore, Malaysia, and more recently Chile, are extreme examples in which public policy has mandated savings by way of payroll deduction while limiting access to these funds prior to retirement.

Most of the high-growth nations have financed high rates of investment from domestic savings (i.e., savings rates of at least 30 percent of GDP). Korea appears to be an exception in that its national savings rate was 2 percent in 1960, on the eve of its rapid growth era, and only 17 percent a decade later. Korea is a conspicuous example of successful use of foreign borrowing; which at 10 percent of GDP was enough to finance more than one-third of total investment. It was only in 1985 that Korea achieved a 30 percent savings rate.[12]

[12]"The State and Markets in Korea," Harvard Business School Case No. 387-181, Exhibit 2.

In the developed world, Britain and the United States are competing with Japan while mobilizing less than half the fraction of income for savings and investment that Japan does. Germany occupies something of a middle ground. These differences reflect implicit differences in economic strategies; Britain and the United States tilt their incomes toward consumption, supplemented by subsidized consumer credit in the U.S. case, whereas Japan tilts its income towards savings, investment, and production.

Saving and investment rates are obvious indicators of the producer or consumer orientation but are not the only ones. Countries vary in their rate of expenditures for education and for research and development. Countries also vary in the fraction of the population mobilized for work in the length of the work week. Japanese save more, invest more, spend more of their income for civilian research, and work longer hours than any of their closest rivals among industrial nations, as suggested in Table 2. By the same token, Britons and Americans save less and consume more of their incomes than their leading industrial competitors.

For a nation, resource mobilization is fundamentally a matter of public policy, not industry structure. Public policies promote saving and influence the development of institutions to receive the savings. A relatively stable macroeconomic environment is more conducive to long-term planning and long-term investment than one that is unstable. A stable economy tilts resources toward investment for future gains and away from current consumption or exit from the country. At a still more basic level the establishment of property rights and the rule of law to protect these rights also favors investment for the future. We in the United States take these "basics" for granted, but creation of market economies in the former communist countries requires the establishment of property rights, corporate law, an independent judiciary, and, more generally, limiting the arbitrary powers of the state, which roughly parallels changes made in Britain at the end of the seventeenth century and in other west European nations and North America in the eighteenth century.

Paradoxically, producer-oriented countries seem to achieve more equal distribution of incomes than consumer-oriented countries, and they seem to achieve

TABLE 2 Resource Mobilization, Selected Countries, 1990

	Investment/GDP (%)	Civilian R&D/GDP	Hours Worked
France	22	1.9	1533
Germany	22	2.6	1630
Japan	33	3.0	2129
U.K.	19	1.8	1511
U.S.	16	1.9	1609

Sources: The World Bank, *World Development Report, 1992;* The National Science Foundation; hours worked from Angus Maddison, *The World Economy in the Twentieth Century.*

TABLE 3 Public expenditure on Social Protection as a Percentage of GDP

	1960	1965	1970	1975	1980
Belgium		16	19.3	26.7	30.4
France	13.4	16.5	16.7	17.7	22.6
Germany	18.1	18.9	19.5	26.2	25.7
Japan	4	5.5	5.7	9.3	11.9
Sweden	10.8	13.2	16.8	21.2	25.9
U.K.	10.2	11.7	13.2	15.6	16.4
U.S.	7.3	7.9	10.4	14.5	13.4

Source: OECD, *New Orientations for Social Policy,* 1994, pp. 57–58. (Figures include health care.)

this result through earned incomes and presumably productive activity, not through unearned transfer payments awarded by government on the basis of need. Consumer-oriented societies not only consume a higher fraction of their income and save less to build future incomes, they transfer more—through government—from rich to poor.

> As a result of increasing enfranchisement, political struggle, and the vast rise in real income, the nature of the state has been transformed. The major change was the emergence of "welfare state" expenditures. From the 1880s onwards there was a steady expansion in public provision for education and health, and over the past seventy years there has been a huge growth of pensions, sickness, and unemployment benefits, and family allowances.[13]

Education and health care can be seen as part of the producer orientation; they are likely to add to productive capabilities as much or more than they add to consumption. Pensions, unemployment benefits, and family allowances would seem to be in quite a different category, particularly where they involve significant transfers from one group to another.

Acceptance of new responsibilities explains most of the rise in government spending for six of the richest nations, from 27 percent of GDP in 1950 to 37 percent in 1973 to 46 percent in 1987.[14] Obviously, taxes could not be far behind. Social spending accounted for the biggest increases in government spending, and most of the increases occurred during the 1960s and 1970s. Table 3 shows OECD data for a sample of nations for the period.

All the west European countries experienced large increases, with Belgium the leader and the United Kingdom the laggard. The United States appears to lag, in part because, in contrast with the other nations, much of its health care spending takes place in the private sector. In Japan, health care expenditures by government exceed those in the United States, but those for social protection are

[13]Angus Maddison, *The Economy of the Twentieth Century,* p. 78.
[14]Angus Maddison, *Dynamic Forces in Capitalist Development,* Table 3.17, p. 77.

lower, at least as measured by budgetary expenditures. The practice of lifetime employment for those who work for large companies provides a partial explanation for this difference.

Japan is clearly distinct from other OECD countries in according higher priority to resource mobilization (see Table 2). It is also much lower than most in public spending for social protection, and would be in a class by itself if all health care spending (most of which is private in the United States) were included. These differences are attributable to Japan's producer orientation; with incomes like the typical west European nation, its economic strategy is quite distinct.

The Economic Strategy Matrix

It is useful to classify economic strategies in a two-dimensional framework as shown in Figure 3. First, it sorts nations in a producer-consumer dimension, with an intermediate position labeled "mixed" to distinguish it from the neutral position in the other dimension. Second, it sorts nations based on their trade regimes, but this dimension is characterized by discontinuity, not smooth transition from one end to the other.

For years, it seemed logical to organize this second dimension from inward through neutral to outward in recognition of the considerable importance of the exchange rate.[15] This inward orientation is characterized by overvaluation; neutrality (or Chenery's balance) is characterized by an "appropriate" exchange rate or one that will yield approximate balance on the trade or current account; while undervaluation is key to the outward orientation as defined here.

More recently, it seems more useful to distinguish between intervention, whether inward or outward oriented, and neutrality. The strategic question facing all but the very high-income nations is how to accelerate economic growth in a sustainable way. In practice this means moving from an economy dominated by raw materials to one led by industry, and eventually, to one led by industry and high-value services. At the outset this requires intervention, if only to help infant industries get started. In many nations, but especially those with significant natural wealth, there are significant generic problems to overcome to establish infant industries on a competitive footing. But if it is clear that intervention is called for at the beginning, there are sharp differences of opinion on what types of intervention are most appropriate and for what periods of time.

The development of infant industries almost always begins with an inward-looking, or import-substitution, strategy. Subsequent change reflects a choice between outward orientation (intervention to promote the development of specialized exporters) and neutrality or nonintervention. This suggests a sequence of orientations, first inward and then either outward or neutral. It seems no nation

[15]Cf Bruce R. Scott, "Economic Strategy and Economic Performance," Harvard Business School Case No. 792-086, revised June 1992, figures 19 and 20.

RESOURCE MOBILIZATION	TRADE REGIME		
Producer oriented (high)			
Mixed			
Consumer oriented (low)			
	Inward oriented	Outward oriented	Neutral

FIGURE 3 The economic strategy matrix.

has moved from neutrality to an outward orientation; to do so would require an ideological shift from neutrality to intervention. Inward and outward orientations are thus closer to one another in a strategic sense, and also in the role played by government, than either is to market neutrality. Hence, the second dimension is defined as inward—outward neutral, in spite of the fact that it makes this dimension discontinuous in terms of the exchange rate.

Characterizing economic orientations as producer or consumer and inward, outward, or neutral enables us to compare them along two broad, multifactor dimensions. It also accommodates consideration of changes over time. Figure 3 combines the two dimensions into an economic strategy matrix. We plot on the x axis the extent to which a society mobilizes and allocates its resources for productive purposes, and on the y axis its trade regime for influencing the allocation of resources in favor of home versus external markets. Inward and outward orientations reflect explicit government attempts to tilt market forces; neutrality means attempting to level the playing field instead of tilting it in any particular direction.

Using these definitions, most countries are in fact inward oriented, though in varying degrees. In addition, inward orientation is compatible with either the producer or consumer orientation as well as with the mixed orientation in between. Since the mid-1970s the inward orientation has been increasingly recognized as a low-performing strategy regardless of where a country is located on the producer-consumer dimension. This has two important implications. First, there are many nations that need to change their economic strategy—specifically to abandon their inward orientation in whatever form it has been practiced. Second, these nations do in fact have a choice between outward orientation and neutrality. This fact is quite important and in sharp contrast with the implications of the framework used to date by the World Bank. In the Bank's framework an inward orientation is recognized as low performing, but only one option is recognized as a way out of that strategy. Although the Bank calls that option outward oriented, it is in fact neutrality.

The Outward-Producer Strategy

Most of the older industrial countries are characterized here as neutral/consumer oriented and most of the high-performing East Asian nations as outward/producer oriented. The outward/producer strategy has played a vital role in the superior performance of those nations. Classifying the high-performing Asian economies as outward/producer oriented has four implications:

- First, the economic strategy associated with the highest levels of economic performance is *not* based on the neoclassical equilibrium model. To the contrary, it is based on the deliberate introduction of disequilibrium (outward) to promote structural change.
- Second, the highest performing strategy is not the norm for the trading system. Outward orientation means government is promoting exports. It is interested in outcomes, not just the rules of the trade regime and their proper enforcement.
- Third, the highest performing nations have vested more power in the hands of producer institutions than is the norm among industrial nations, as well as mobilizing a higher fraction of their incomes for productive purposes. In addition, they have enhanced the power of their producer organizations, notably their large firms, by institutional arrangements that force their consumers to subsidize their producers. Although perhaps not at variance with the norms of the trading system, this orientation adds greatly to the export promotion capabilities of nations that have chosen an outward orientation.
- A fourth and overarching implication is that competition between the North Atlantic area and East Asia is not simply a matter of reallocating activities on the basis of shifting comparative advantage. To a degree it is competition between differing economic strategies. East Asian economic strategies, with their outward-producer orientation, are focused on achieving higher growth as a way to enhance their economic and political power, not their short-term standard of living. Global economic competition is, therefore, in part between neoclassical strategies focused on short-term consumer welfare and neomercantilist strategies focused on development of economic power.

An outward/producer orientation builds on opportunities. To pursue opportunities, producer-oriented nations mobilize additional resources for a period of time. In addition, they accelerate reallocation of their resources from low-performing areas to high. This strategy is particularly important to a nation trying to catch up. Like a firm that draws resources from existing product lines to support the launch of a new product (i.e., "milks" one or more established businesses so as to subsidize one or more newer activities), a producer-oriented nation can shift resources to areas of opportunity. Typically, some of these resources are made

available at below-market cost; this requires that consumers subsidize producers or, in some cases, that some producers subsidize others. Later, the increased productivity and profits associated with exploited opportunities are shared with workers, who are, in turn, consumers. The analogy is to a firm that keeps wages low to build business, then returns part of the proceeds to workers as higher wages, bonuses, or long-term employment, in contrast to allocating most or all of the opportunistic gains to shareholders. In the producer orientation, government is more active on the producer side but less active on the consumer side, and notably less active in providing safety nets and income transfers unrelated to productive performance.

Outward/producer strategies seek to capitalize on opportunities in the *world* market. This is a crucial difference between the inward- and outward-producer-oriented strategies. Inward orientation prevented a number of socialist and communist countries from capitalizing on their increased levels of resource mobilization. By limiting their focus to their home markets, they, like many of the smaller nations of Africa and Latin America, were unable to continue to achieve economies of scale and thus exploit world market opportunities.

In a world characterized by economies of scale and learning, participation in the world market is of fundamental importance. Particularly as goods become more knowledge intensive, close races among firms depend on human endeavor and continuous learning more than natural endowments. Increases in marketshare translate into increased volume and experience, which in turn translates into increased advantage. Short-term sacrifice to build marketshare can occasion reversals in market position; firms and nations can come from behind to usurp a leadership position. Market position and cost advantages at any given time thus reflect strategies and the skill with which they are implemented, not just a preordained, natural order of advantages. This suggests that the nations following neomercantilist strategies may well take increased share of high-growth areas in part at the expense of nations following less aggressive neoclassical, market-driven, and consumer-oriented strategies.

Implications for developing nations: This analysis has significant implications for developing nations. The economic strategies of the high-growth countries have not been based on the neutral/consumer orientation officially favored by the World Bank. At the same time, high-growth strategies cannot be adopted wholesale; they require a combination of political and administrative conditions that are not present in many developing nations. Effective adoption of the neomercantilist strategy is beyond their current or immediately foreseeable capabilities. In addition to the visible hand of a strategist, it requires capable, trained hands and a considerable period of continuity and stability, as well as moderate levels of consumption, by government as well as consumers. These are not easy conditions to meet, and to meet most or all of them is surely beyond the capabilities of most governments.

De facto strategies: Perhaps the most basic implication is that all nations

need to be aware that they have an economic strategy. Some government leaders have trouble with "the vision thing," and some business executives have trouble accepting any but the most rudimentary role for government in the economy. But government needs a vision of where it is heading. When government is responsible for taxing and spending from thirty to fifty percent of GNP—as is the case in the industrial nations, Britain, and the United States included—its influence is significant and constitutes a strategy no matter how implicit, incoherent, or shortsighted it may be.

Explicitly identifying and comparing these economic strategies will facilitate their evaluation in terms of relative competitiveness. Figure 4 places a small sample of nations in the matrix. Of the nearly 200 nations currently recognized, most of the older industrial nations have adopted strategies that are neutral between home and export markets and favor consumers over producers. This neutral-consumer strategy is illustrated by the placement of Britain and the United States. If the framework permitted, we could show consumer orientation increasing in a number of countries with the passage of time, including in the United Kingdom and the United States. The strategies of Japan and Korea are classed here as outward and producer oriented; Singapore, Taiwan and, more recently, a number of other nations would also be placed in this category.

This matrix opens up "space" and thus choice for developing nations. At the same time one must emphasize that it does not imply *a priori* a "best choice" for developing nations. Some strategies are clearly more difficult to implement than others. Not all developing nations have the institutional competence let alone the political will to implement the outward/producer-oriented strategy effectively. There is no "one size that fits all."

Suppose a number of developing nations were to attempt to adopt strategies similar to those carried out by Korea and Taiwan. How many could expect to implement such a strategy successfully? Clearly some of the protectionist measures adopted by Japan and then Korea would not be accepted in today's world trading context. Are there other means for accomplishing similar resource shifts? Is China attempting much the same strategy with a massively undervalued cur-

Producer	India	Japan Korea	
Mixed	Mexico		
Consumer	Australia		Britain USA
	Inward	Outward	Neutral

FIGURE 4 Economic strategy matrix (*circa* 1980).

rency as a way to protect home industry and promote exports at the same time? What would it mean if they were able to, with more than one billion people? What if, in addition, India were to achieve sustained high growth, perhaps without quite reaching East Asian levels of performance? Should the industrial countries be still more concerned about the implications of factor-price equalization and the growth of a less and less employable underclass?

Questions

The economic strategy matrix is also helpful in thinking about the challenges that the two most influential strategies may be facing in the years ahead. Japan's trade surpluses have forced its exchange rate from undervaluation in the high-growth years to a level currently approximating double its purchasing power parity. Clearly it can no longer remain strongly outward oriented in any public policy sense. Japanese firms are transferring activities to lower-wage countries, as U.S. firms have done for several decades, thus contributing to a "hollowing out" of Japan, as well as to reduced growth.

Is it time for Japan to move away from its producer orientation? If so, is it likely to adopt consumerism on the British-American model or some European variant? This seems to be the expectation of some observers when they refer to Japan's inevitable transition to a "normal country." What if the Japanese choose a neutral/mixed orientation? Can they deregulate their producer markets, for example, while still sharply limiting government's role in providing economic security? Specifically, can they deregulate wholesale and retail trade within a very high-wage economy without creating high unemployment among the low-skilled workers? If they deregulate their financial markets, will they maintain a very limited market for corporate control?

In a similar vein we might also ask whether it is time for at least some of the consumer-oriented nations to reverse direction and become less consumer oriented. Under what circumstances might they reestablish something like market neutrality in the producer-consumer dimension? Alternatively, if a reversal of direction seems close to impossible, whether for economic or political reasons, what does this imply with respect to competition in an increasingly open world economy?

In this framework, a nation's strategic options should take account of opportunities in the world market as well as resources and/or advantages at its disposal. Korea moved upscale in terms of technological complexity as it gained skills and resources. But to catch up in a high-technology, high-growth market such as semiconductors requires long periods of investment and subnormal returns. Such a strategy incurs a cost in terms of standard of living; part of the formula for superior performance is short-term sacrifice for longer-term gain. Some societies are more capable of sacrifice than others.

Where nations stand in the economic "pecking order" also influences their

strategic options. Some countries began industrialization long before others. Some have been more successful than others. Some are at or near the leading edge; others lag far behind. What is appropriate for one nation may not be appropriate for another. Other things being equal, one would expect a country at or near the leading edge of development to earn high incomes from differentiated products, and a less-developed country to earn much lower incomes from less specialized, labor-intensive goods. But the development and proliferation of digital technologies and global communications networks is enabling low-income nations such as China, India, and the Philippines to compete in sophisticated engineering services and software development. At the same time, the increasing mobility of capital has abetted the transfer of sophisticated manufacturing facilities to low-income countries. These developments threaten to exacerbate income inequalities in both high- and low-wage nations.

Dealing with inequalities of income will be a strategic challenge for more and more nations, but especially for those with the highest incomes. With high incomes it is tempting if not incumbent to have a safety net for the least fortunate. Is it possible to have a safety net that catches all? Is it desirable? Does this require providing incomes based on "need," regardless of skill or effort? If so, how are such safety nets to be distinguished from that well-known "vision" of Karl Marx: from each according to ability, to each according to need? Is such an axiom any more appropriate in Western Europe or North America than it was in Eastern Europe or the Soviet Union?

High-income nations seem destined for profound challenges to their economic strategies in the years ahead. These challenges are of central concern.

Japan: The Philosophy of Government Support for Information Technology

John P. Stern
Asian Technology Information Program

The Congress, the administration, and the American electronics industry arguably have a bright future together—if we can only figure out what it is. Perhaps by engaging in a dialogue, we can avoid the mistakes of the past—mistakes in technology policy that have cost Americans jobs, prestige, and control of their future.

Before this essay takes up the framework for government support of information technology in Japan, it might be useful to review why Tokyo remains an instructive case for Washington. After all, we have been told that Japan is financially crippled and afflicted with backward technology and that it is shrinking in influence compared with the emerging markets of Asia.

Jack Welch, the Chairman and CEO of General Electric, has cautioned American businessmen against "believing their own press clips." In 1994, Welch observed:

> I like to think of what we U.S. manufacturers have come through over the past decade as the leading edge of a hurricane, buffeting and turbulent. . . . Now we find ourselves not in the clear air of fair weather, but in the deceptively tranquil center of the storm—the eye of the hurricane. . . . How much would we be selling; how bold and innovative would American managers be; how envious would the world be of American manufacturing prowess, if that yen and that mark were at the same strength they were not nine years ago, but only three—about 140 yen to the dollar. . . . If the Japanese are preparing to compete at 90 yen, the U.S. must be ready to compete at 130 yen. Until we are, we delude ourselves if we think we are in control of our own fate.[1]

[1] *The Wall Street Journal,* June 21, 1994.

To those who believe that the Japanese electronics industry is mired in recession, a few facts are in order. The major Japanese electronics companies closed their worst year in recent memory on March 31, 1994. Even during this nadir of financial performance, NTT recorded over a billion dollars of profit, and Hitachi, Toshiba, and Matsushita over $500 million.[2] When an American information technology company is in dire straits, it *loses* a billion dollars, yet somehow the media convinced Americans that Japanese companies were in deep financial trouble even as they continued to record profits. Since then, financial performance, and more importantly, morale, among Japanese information technology companies has improved. True, American stock analysts may be unimpressed, and there are many medium- and long-term business issues besetting Japanese information technology companies, but they *will* be around for a long time.

What about the notion that the United States enjoys a huge technological lead over Japan in all the right areas of information technology? Of course, even if the United States were ahead in, for example, signal processing, Japan can and does recruit that talent in America's open job market. Nevertheless, when advocates of American technical superiority focus on particular products, they often point to semiconductors. It is true that, in 1993, the U.S. share of the $77 billion world semiconductor market was larger than Japan's. But not by much: in 1993, the U.S. share by revenue was 43.4 percent, whereas the Japanese share by revenue was 40.1 percent, according to the World Semiconductor Trade Service, less than a 4 percent lead. So the United States is ahead by a nose. That is more encouraging than the 1990 ratio, in which the Japanese semiconductor industry had more than a 10 percent lead. But it is nowhere near the 53 percent of the world market that the U.S. semiconductor industry enjoyed in 1984.

If we consider the "food chain" leading up to the highest value-added information technology in which the United States excels, the situation is more disturbing. As a result of technological dependency on Japan, the United States was unable effectively to punish a company that sold missile parts to Iran and perhaps Iraq; the U.S. semiconductor industry was panicked by a sudden shortage of epoxy resin for semiconductor packaging resulting from an accident; and the U.S. computer industry has been unable at times to offer customers better or less-expensive products.

Significant progress has been made in promoting U.S. sources of supply for certain critical technologies, but very little progress has been made in countering the growing ideological influence of Japan. Japan is an attractive model of economic success for the rest of Asia. The U.S. press often describes the Japanese consumer as downtrodden. Yet in 1960, Japan had a per capita gross national product (GNP) of only $477, barely 20 percent of that of the United States. By 1990, Japan's per capita GNP exceeded that of the United States, and had multi-

[2] *Keijo rieki* (operating profit) for FY 1993 (April 1, 1993–March 31, 1994) for NTT was 109.4 billion yen, for Hitachi 71.8 billion yen, for Matsushita 63.8 billion yen, and for Toshiba 53.7 billion yen.

plied nearly fiftyfold. The Council of Competitiveness found that Japan's standard of living showed 77 percent real growth between 1973 and 1993, compared with only 29 percent real growth for the American standard of living.[3] Many countries in Asia look at Japan's demonstrated success, consider the alien nature of many U.S. notions of economy, society, and development, and conclude that the way to riches is to close one's domestic market and export to America.[4] The United States is wrong to assume that it can decline to compete with Japan in markets and negotiations and still win the minds and purchase orders of non-Japanese Asia.

Social structure is the foundation on which the legal structure of a nation's technology policy is built. It is not generally appreciated how different Japan's philosophy is on certain key social issues. For example, Japan does not have a "Who Is Us?" debate. Although many information technology companies in Japan, including Hitachi, Toshiba, and others, are trying to restructure, the popular press attacked only the foreign-capital companies. An example is an article from a weekly magazine entitled "American-Style Firing Lands in Japan: The Panic of Japanese Employees in Foreign-Capital Firms" (*Shukan Asahi*, 1993). One of the firms is NCR Japan, which was incorporated in Japan in 1920 and is the oldest U.S.-capital electronics company in Japan.[5] Even after 74 years, even with thousands of Japanese employees and factories in Japan, the company is not treated as fully Japanese.

Japanese companies may advertise in the same American news media that vaunt the "borderless economy" inhabited by the "global corporation," but their leaders do not believe that the ownership of manufacturing capacity is irrelevant. The best put-down of these arguments that I have seen is a comment by the president of Honda Motors on hearing the news that the British car company Rover had been acquired by BMW. Honda had a 20 percent stake in Rover and a long-standing relationship with the British company that was suddenly upset by the BMW acquisition. Britain, like Japan, is an island nation, but unlike Japan, is one that has allowed dominant foreign investment in its key technology sectors. The president of Honda, Nobuhiko Kawamoto, commented:

> The British view is that it is not necessary to be concerned about the nationality of the capital of industrial groups. If you take the case of Japan, industry is the only way to survive. . . . I wonder how the British people expect to make a living in the future (*International Herald Tribune*, 1994).

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[3]Standard of living is defined as gross domestic product per person.

[4]Indeed, China, the leader among "big, emerging markets," announced in October 1994 that it would eliminate its trade deficit in electronics through an increase in exports of $150 billion by the year 2010 (United Press International, 1994).

[5]NCR Japan is the oldest U.S.-capital electronics company in Japan continuing in the same legal form from its inception. Other U.S. information technology companies were active in Japan prior to 1920 but in different legal forms. On October 1, 1994, NCR Japan changed its name to AT&T Global Information Technologies, but changed it back again to NCR Japan in 1996.

Domestic manufacturing in particular is viewed as vital to the national economy. Manufacturing technology is what raised Japan's standard of living, because one can get foreigners to pay Japanese for manufactured exports. In contrast, service industries are harder to export, typically employ fewer subcontractors, and inevitably involve the rendering of services by non-Japanese employees overseas. When 25.4 percent of the graduates of the elite University of Tokyo's Engineering Department entered the financial services industry in 1988, it was such a cause for alarm that the president of Fujitsu was called in by the Ministry of International Trade and Industry (MITI) to head a commission to stem Japan's drift away from manufacturing talent.[6] It is believed that manufacturing has led to Japan's world economic power because only manufacturing allows a nation to resist being the pawn of foreign nations. A 1991–1992 nationwide six-hour television series on how electronics built post-war Japan[7] included a patriotic scene from the yearly get-together of the engineers and officials in charge of Japan's VLSI [Very Large-Scale Integrated Circuits] semiconductor technology project of the 1970s. Keep in mind the standard line in Japan is that Japanese actions in the fall of 1941 were triggered by a desire to avoid economic encirclement by the Western powers.

To avoid technological encirclement, Japan monitors its competitors' research. The "not invented here" syndrome is rare in Japan. A single Japanese organization, JETRO [Japan External Trade Organization], that is affiliated with MITI is said to have a budget of $80 million and a staff of 80 people for its New York office alone.[8] Part of JETRO's role is to report on American technological developments that affect Japanese companies. The United States has at least 10 government organizations in Japan monitoring Japanese technology.[9] Unfortunately, many of these organizations have not identified the demand for, or usefulness of, the information they collect to potential users in industry, according to a recent report by the U.S. General Accounting Office. In addition, "the U.S. organizations' efforts are limited by the lack of . . . coordination of activities among the various . . . offices."[10]

It follows that if manufacturing technology is the way to trade up the standard of living ladder and guarantee national security, one should not lightly transfer technology. Japan's reluctance to transfer technology is a standard complaint of Japan's potential competitors in Singapore, Korea, China, and Taiwan. This

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[6]MITI, *Seizo hanare e no taio-2000 nen ni mukete no wagakuni kikai sangyo no shorai tenbo ni tsuite* (responding to the drift away from manufacturing: the future development of Japan's machinery industry approaching the year 2000), June 1989.

[7]*Denshi rikkoku* (A Nation Built on Electronics). The series was broadcast at intervals throughout 1991, and a complete six-hour broadcast was aired on January 13, 1992, NHK Channel 3.

[8]U.S. General Accounting Office, *Foreign Technologies: Collection and Dissemination of Japanese Information Can be Proved.* GAO/NSIAD-93-251, Washington, D.C., 1993.

[9]*Ibid.*

[10]*Ibid.*

reluctance has so damaged Japan's relations with Asia that there is actually a Japanese corporate tax credit for technology transfer to prod companies to share privately developed technology with their Asian neighbors, provided those Asian neighbors pay in currency other than yen.[11] Currency-induced and stock-market-induced changes in the financial situation of Japanese information technology companies are causing some of them to consider licensing recent-generation technology for additional revenues.

The situation for Japanese government-owned intellectual property is different. Under Japan's National Property Law,[12] any fruit of research funded with Japanese government money is owned by the Japanese government. It is wholly owned if the researcher is a government employee, which includes national university professors and national laboratory staff, and jointly owned if the research was done by private industry with government money. Policy on the proper use of government property is determined by the National Property Study Council (Kokuyu zaisan shingikai), a statutory advisory group under the Ministry of Finance. The law was passed to prevent the abuse or waste of government property, and has been amended frequently to make sure that government-funded research remains attractive to Japanese industry and relevant to technology trends. Nevertheless, the practical effect, as many American companies have found out to their chagrin, is that if one does research in a Japanese government project, typically one ends up with a Japanese ministry as the joint owner of any patents that emerge from the research. The official in charge is sure to investigate the competitiveness of Japanese industry in the technology concerned before signing off on a license of the technology to foreign companies. Even for those technologies developed entirely by Japanese government laboratories without private industry participation, and freely listed as being available for license (e.g., through the Japan Industrial Technology Association [*Zaidan hojin Nihon sangyo gijutsu shinko kyokai*]) at a fee set according to standard royalty tables, there is a requirement that the technology be used for manufacture in Japan.

The Japanese school house is the stuff of legend. We have all heard that little Taro excels at mathematics and listens obediently to his teacher's lectures. Commentators in the United States and Japan have suggested that rote learning has stunted Japan's capacity for software development, but why has it not similarly stunted Indian and Chinese software engineers? Perhaps Japan's lack of venture capital is more properly to blame. At any rate, few commentators have stressed that the Japanese school house also inculcates a strong sense of community with other Japanese. When an American boy learns about trains, he learns about the engineer. When a Japanese boy learns about trains, he learns that the train only runs if everyone does their job well—not merely the engineer, but the conductor,

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[11]The credit is 7 percent of revenues (royalties) or 35 percent of income for the tax year, whichever is less. *Sangyo zeisei* handbook (Handbook of Industrial Taxes, 1994:136).

[12]*Kokuyu zaisan ho,* Law No. 73 of June 30, 1948.

the switchman, the maintenance workers, even the janitorial staff who clean up at the end of the day. As a result, Japanese are reluctant to beggar their Japanese neighbors: A poll released in January 1994 by the Prime Minister's Office showed that 41.5 percent of Japanese surveyed worried that "price buster" discounted goods would hurt Japanese manufacturers.[13] The Japan Fair Trade Commission pilloried Nippon Denchi, a battery maker, for failing prominently to label its car battery as "Made in Taiwan," since it found that 45 percent of Japanese consumers are concerned about the country of origin if it is not Japan.[14] As a result, there is considerable popular support for government assistance to Japanese manufacturing, particularly if it is threatened by foreign competitors.

The fact is, most Japanese government officials do not believe they exist to help the private sector. They exist to help Japan, to promote national goals and the common good. Some Japanese government officials, even in ministries in charge of industry, are contemptuous of businessmen. They realize, however, that in the course of its operations, Japanese business creates technology, jobs, and manufactured exports, and that these attributes of business are useful to national security, national prestige, and the national standard of living.

Most Japanese government officials also believe that their training and neutral position allow them to take a broader view of where an industry should be going than is afforded to a company involved in the daily fluctuations of commerce. It is commonly said in Washington that this leads to Japanese government officials "picking winners and losers." This is wrong: The French pick winners and losers. The Japanese government, in my experience, *reduces business risk* by fostering discussion of technology trends, developing support for technologies in the Japanese press and in the Japanese legislature, promoting standardization, blunting foreign competition, and supplying seed funding. Not everything the Japanese government promotes leads to success: Japan has dumped billions of dollars in national funds into its software industry, to be sucked up by many of the larger Japanese computer firms. Japan's packaged software industry is still less competitive than that of the United States, in part due to the dominance of the very same hardware firms that take advantage of Japanese government largesse.

As the Ministry of Finance is faced with a variety of social costs in an aging Japan, it has become more reluctant to give money to the private sector to develop technology than it was 20 years ago. Government officials have bred a wide variety of fund-raising creatures to bear the financial burden. These include legalized motorboat gambling, a portion of the proceeds of which funds the development of ships powered by superconductivity; and legalized bicycle race gambling, a portion of the proceeds of which funds publication of telecommunications technology standards. Considering that Americans spent an estimated

[13]Survey of 3,000 adult Japanese in October 1994, released by Office of the Prime Minister January 15, 1995. For the English coverage, see *The Japan Times* (1995).

[14]Nikkei Sangyo Shimbun, August 26, 1992.

$16 billion on gambling in 1993, perhaps the solution to our advanced technology funding problems is to locate a flat-panel factory on an Indian reservation! Government guarantees or bonds for infrastructure investment are common, but have to be carefully structured: The Ministry of Finance has repeatedly refused to fund Japan's version of the information superhighway with bonds, stating that they can only be used for bricks and mortar construction, not network construction.

Japan's Telecommunications Business Law, in force since April 1, 1985, left large sections of the domestic telecommunications market dominated by the former monopoly carrier, NTT. This situation is being revisited by the Ministry of Posts and Telecommunications, but in the meantime, the 65 percent government-owned NTT has continued to function as a laboratory for Japan's progress in information technology research.

Japan also funds targeted research through precise research and development tax credits and depreciation schedules. In addition to a general research and development credit for, say, a new kind of ketchup, Japan defines over 130 specific technologies that will qualify for a credit. In addition, Japanese depreciation schedules frequently encourage the immediate introduction of new equipment—such as semiconductor production equipment, telecommunications switches, and mobile radio equipment—by offering accelerated depreciation that is greatest in the year in which the tax law first comes into effect.[15] As a result, information technology infrastructure is funded indirectly by the government from taxes forgone.

In the United States, any person can start a trade association or foundation. In Japan, under Article 34 of the Civil Code, only the ministry in charge of the proposed association's activities can grant the tax-free spark of life that transforms articles of incorporation into an approved nonprofit organization. The ministry continues to approve the organization's financial statements, often places a retired ministry official in charge, and tries to control the organization's activities. Some nonprofit organizations in Japan, particularly foundations *(zaidan hojin)* focus money from industry on research problems in such areas as telecommunications and optoelectronics. Occasionally, the activities of major foundations, such as the Key Technology Center, will be funded by government sources such as the Japan Development Bank and the dividends from NTT stock held by the Ministry of Finance.

Perhaps the most pervasive method of funding Japanese research is for the Japanese government to buy primarily from Japanese manufacturers, even if they are less competitive. An American currency-counting equipment manufacturer, whose products are used in 37 countries, once tried to sell to the Bank of Japan. They were reportedly told, "We've been buying from a Japanese company for 30 years, and we will continue to do so even if your products were better and less

[15]Stern, J.P., "Technotaxes: Japan's Subtle Competitive Weapon." *Global Competitor,* vol. 1, no. 1, 1993.

expensive." Since the Bank of Japan was left out of the Tokyo Round GATT Procurement Code, there was no recourse for the U.S. company. But even given GATT, there are many ways in which the Japanese government provides a safe harbor for domestic industry. For example, when a U.S. company will supply equipment inside a special structure, one can make the construction costs of the structure exceed the cost of the equipment, call the resulting contract a contract for construction services instead of a contract for "goods," and argue that GATT codes do not apply. Or one can limit procurement of airport control software to companies with a "Class A Electrical Manufacturer's License" in Japan, thereby cutting out every American company without a factory in Japan, and every American software company by definition.

Japan's system of promoting information technology research faces challenges due to a variety of global and domestic forces. But so long as there is at least a majority opinion on the desirable social and economic fabric of Japan, and a recognition that government and industry play different roles toward the common goal of promoting the general welfare, Japan can continue to respond rationally to those challenges. This National Research Council project is fundamentally not about how to promote the technology America wants, it is about how to promote the kind of nation America wants to be.

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TABLE 1 Who Is Really on Top

U.S. Leading Technology	Dependency on Japan
Computers	Floppy disk drives
	CD-ROM drives
	Optical disk drives
	High-resolution displays
	Flat-panel displays
	OCR scanner engines
	High-performance batteries
Semiconductors	High-purity silicon steppers
	Dicing saws
	Ceramic packages
	Epoxy for plastic packages
	Copper foil for PCBs
Printers	Laser diodes
	Laser printer engines
Multimedia	Video conferencing cameras
	CD-ROM drives
	High-resolution displays
	Flat-panel displays
Cellular telephones	Gallium arsenide
	High-performance batteries
Smart weapons	Ceramic packages
	Video cameras
	Flat-panel displays
	Micromotors
	Gyrocompasses
Aviation	Gyrocompasses
	Flat-panel displays
	Micromotors
	Composite materials
	Entertainment systems
Satellites	Sensors
	Communications module

TABLE 2 Asian Economic Development: Japan's Model

Idea	U.S.	Asia
Wellspring of economic power	Technical economic factors (e.g., exchange/interest rates, inflation)	Social organization, ownership of industry, movement up value-of-production scale
Solutions to economic problems	Market mechanism	Plan to extract maximum advantage
Goal of manufacturing	Consumer spending	Exports
Public relations	Expends few resources on weakening economic opponents	Keep United States off balance by picking scab of "racism" or "managed trade"
Foreign investment	Allow "insider" status to foreign companies	Hint at "insider" status but never grant it
National identity	Who is "Us"?	But we are (Japanese, Chinese, Bumi Putra)!
Fountain of world power	Military "throw weight"	Economic "throw weight"
Roots of politics	Consumers want democracy	Money complements authority
Role of the individual	Reject societal hierarchy	Follow societal hierarchy
Role of the press	Attack authority	Bolster authority
Corporate governance	Public disclosure	Reveal as little as possible
Foreign relations	A babble of views about Asia	Widely held beliefs about relations with America
Quality of life	Save the turtles!	Eat the turtles!

SOURCE: Byrnes (1994).

TABLE 3 Examples of Japanese Research and Development Tax Credits

1-1.	Class 100 clean room
2.	Recombinant DNA isolation laboratory
8.	Superconducting ≥4.7 tesla NMR device
12-1.	X-Ray CT scanner
13-2.	DNA sequencer
21-2.	Laser beam particle dispersion counter
27.1.	Amorphous material continuous testing apparatus
30-3.	Superconductivity critical point magnetic detector
32-1.	Solar cell testing device
32-2.	Optical fiber signal loss testing equipment
33-1.	≥50 MHz IC logic tester
33-2.	≤1 micron beam spot E-beam IC tester
33-3.	Tester for IC patterns of ≤20 microns
34.	Flat-panel display tester
35-3.	Optical data storage media tester
35-4.	Magneto-optical data storage media tester
37.	Semiconductor material purity thermal tester
41.	Optical recording media tester
42.	Laser beam mask pattern measuring equipment
43.	Computerized three-dimensional micromeasuring equipment
44.	Three-dimensional robot motion noncontact measuring device
45.	Outer space robot weightlessness simulator
46.	Machine tool electromagnetic noise measuring device
50.	Molecular structure analysis graphic workstation
51.	Multiuser, multitask software engineering workstation
52.	≥400 MFLOPS scientific supercomputer
66-1.	Carbon fiber filament process apparatus
66-2.	Rocket nozzle graphitized carbon processing apparatus
73.	≤100 Hz ~ ≥60-GHz microwave network analyzer
74.	≥3 gigabit per second fiber optic digital signal analyzer
107-5.	Spacecraft reentry heat shield production device
126.	Rocket engine spin test apparatus
127.	Rare earth recovery equipment
130.	Real-time computerized continuous-forming apparatus

SOURCE: Stern, *Technotax*, Asian Technology Information Project, Tokyo.

Asymmetries in National Patterns of Foreign Direct Investment: Consequences for Trade and Technology Development[1]

Simon Reich
University of Pittsburgh

This paper addresses the plausibility of an argument concerning the increasingly complex relationship that is emerging among trade, investment, finance, and the development of new high technology in today's global economy. Specifically, my purpose is to consider firm behavior and public policy in the context of encouraging the emergence of a strategic understanding of how these components work in conjunction with each other.

INTRODUCTION

In a *Newsweek* article, Robert J. Samuelson (1986:59) wrote,

> The trade surpluses create a huge imbalance in foreign-exchange markets that inevitably raises the Yen's value and subverts the competitiveness of Japanese industry. . . . The message is that unless Japan acts effectively to reduce its trade surpluses, economic forces will ultimately act for it. . . . The surpluses can't last indefinitely and no one should want them cured by a slump in Japan's export industries.

At the date of publication of this article in 1986, the yen value then stood at approximately 170 to the dollar. The yen's exchange rate had risen from 238 to

[1]This paper relies on work prepared for two studies for the Office of Technology Assessment published under the titles of *Multinationals and the National Interest: Playing by Different Rules* (Office of Technology Assessment, 1993) and *Multinationals and the U.S. Technology Base* (Office of Technology Assessment, 1994). The results of this study will be published in a forthcoming volume entitled *Globalization and Convergence in the 1990s? The Comparative Political Economy of Multinational Corporations* (Reich et al., forthcoming).

the dollar the prior year, when Japan earned a $50 billion current account surplus, the overwhelming proportion in manufacturing trade exports. In May of 1986, the bilateral trade deficit stood at $4.7 billion, the bilateral annual merchandise trade deficit for that year being $54.4 billion. Samuelson's prescription was for Japan to grow faster at home, cut domestic interest rates, and to import more.

In a *Los Angeles Times* article nearly a decade later, relatively soon after an announcement that Japan's January bilateral trade surplus with the United States had reached over $14.7 billion, Samuelson (1995) wrote, "Japan's huge trade surpluses are unsustainable. If they aren't corrected, the cycle of stagnation may continue, and the Japanese will have only themselves to blame." Within weeks, the yen exchange rate grew to 80 to the dollar. By then Japan's monthly surplus with the United States had grown by an order of magnitude. For 1993, the latest available figures, the annual U.S. trade deficit with Japan had reached $60.5 billion.

In the time between these two comments, Japan had earned billions of U.S. dollars, and the deficit grew despite the best-devised policies of successive Republican and Democratic administrations in raising and then lowering interest rates, despite strengthening the dollar's value and then letting it weaken, despite introducing and then discarding protectionist trade measures, and, of course, despite seemingly innumerable rounds of bilateral negotiations between successive U.S. administrations and their Japanese counterparts.

And in contrast to the public warnings of the imminent "hollowing out" of the Japanese economy as the high value of the yen drives Japanese firms off shore, recent and forthcoming studies indicate quite clearly that the economic structure of Japan's most strategically important industries remain firmly intact. Although assembly facilities have moved off shore as part of an ongoing process for the last two decades, the heart of Japan's manufacturing capability and its industrial basis remains firmly entrenched in its traditional domestic centers.[2]

In June of 1995, Samsung, a Korean firm, announced that it had "beaten" both its American and Japanese rivals "to the punch" by being the first to develop a fully functional "next-generation" 256-k semiconductor DRAM chip. But such a development marks a startling change from a decade ago, just as Japanese firms confounded their American critics by first developing computer components, then full hardware systems, and subsequently software.

In this paper I argue that these facts are not altogether unrelated. Indeed, in stronger terms, I suggest that patterns of trade, strategies of investment, and the development of the next generation of technology share an intrinsic relationship

[2]For an extensive, critical assessment of the rectitude of the claim of the "hollowing out" of the Japanese economy, see Tilton (1995). On page 14, Tilton suggests that, "Although the Japanese talked about hollowing out as domestic production was replaced by imports, it never happened, except in aluminum smelting, in apparel, and to a very limited degree, lumber and furniture."

as we enter the new millennium that both American firms and the U.S. government cannot afford to ignore. I contend that direct investment is often a supplement to trade, and the inability to invest therefore creates sanctuary markets for the protected producers that not only provide them with the money to fund subsidized exports, but also the essential cash needed to fund the development of new technologies whose costs are growing at an exponential rate.

ANALYSIS

A recent study conducted by the Office of Technology Assessment (1994), entitled *Multinationals and the U.S. Technology Base*, entailed an extensive empirical assessment of the behavior of the world's leading multinationals, combining aggregate statistical analysis with interviews with senior corporate executives from many of the Fortune 500 companies in the United States, Japan, and Europe. The findings of that study provide strong evidence of at least two distinct patterns of behavior among the world's leading multinational corporations in regard to how they link their trade and overseas investment policies—and a plenitude of anecdotal evidence that such strategic choices by the world's largest firms have an impact on their capacity to design and manufacture the next generation of technology, whether a billion-dollar fabrication plant that will be redundant within six years, or a new software program whose life expectancy will be considerably shorter.

Prevalent View of Investment Patterns: Product Cycle Theory

Traditional patterns of behavior have often meant policies designed to substitute foreign trade for foreign direct investment (FDI). The export of finished products has therefore eventually been replaced by the formation of overseas affiliates and the building of fully integrated overseas plants. The manufacturing process subsequently has been shipped abroad by firms—first, the final assembly process but eventually the entire process—as they seek, characteristically, to take advantage of lower overseas labor costs and avoid protectionist trade barriers. Economists, studying this pattern of corporate behavior, claim to have identified a routine pattern that they label "product cycle theory."

Certainly, the function of FDI really defines the multinational corporation. It is what distinguishes a multinational firm from a national one, whether that investment is in the form of acquiring either wholesale or manufacturing facilities. Of course, the first wave of multinationals (Dutch and British) were largely trading companies who invested in extractive plants for natural resources and in wholesale and service facilities. Subsequent theories, however, about multinational corporate behavior focused increasingly on the patterns of corporate investment in manufacturing facilities with an emphasis on the transplant of manufacturing facilities abroad, notably to what was alternatively described as the third

world, the underdeveloped world, the lesser developed countries, the periphery or—in contemporary parlance—the "emerging markets."

John Hobson's, Karl Kautsky's and Vladimir Lenin's early debates were focused on the distributional consequences of such development—primarily whether the investing country of the first world or the recipient third world country benefited more, and secondarily, what the distributional consequences of investment were within the first world between classes (Kautsky, 1915; Hobson, 1938; Lenin, 1977). The belated liberal response was encapsulated in the theory of the product cycle that, in contrast to these earlier formulations that stressed the divisive and zero-sum effects of FDI, emphasized the mutually beneficial, cyclical, and routinized pattern of foreign investment.

In theory, the product cycle is quite straightforward. When multinational corporations establish affiliates in a foreign country, these new firms tend to pursue a familiar, consistently replicated strategy. Initially firms, located in their home countries, tend to export finished products to foreign markets. These are produced in the first world and sold in (successively) other markets of the advanced industrialized world and then, as economies of scale bring the product price down, limited third world markets.

As competition emerges from other firms in advanced industrial countries, producers have to cut prices and thus seek to reduce costs by developing production facilities off shore. Initially, the aspects of the manufacturing process that are relocated to foreign plants are the most simple assembly jobs, with more sophisticated production processes that require intensive capitalization remaining within, broadly speaking, the advanced industrialized world. As a result, multinationals heavily import intermediate goods early in the foreign direct investment cycle, because they have more developed business relations, established standards and certification procedures, and secure sources in the home market.

Critically, however, foreign affiliates can be expected to increase their local sourcing over time, as they become more deeply integrated into the local economy and consequently can realize the efficiencies of local sourcing. Eventually, product sales will service both local markets and export markets, with the production plants of the affiliate serving as the primary manufacturing base of individual products, as the home plants of the multinational corporation move on to the production of new, more technologically sophisticated goods. The development of the consumer electronics industry provides an example of this pattern, as production shifted from within the Triad to facilities in Southeast Asia.

Problems with the Functioning of Product Cycle Theory

There are, however, problems with the product cycle theory popularized in recent decades by the work of liberal political economists who have continued to focus on patterns of investment between the advanced industrialized and third world countries. The most vocal and eloquent proponents of this theory have

been Raymond Vernon and, in continuing work that builds on these basic assumptions to form more sophisticated formulations, John Dunning.[3]

These problems become evident in trying to observe or operationalize the theory. First, there is no standard expectation regarding the amount of time that firms need to operate in local markets before it is reasonable to expect high degrees of local content. By this explanation, Japanese affiliates in the United States have different sourcing patterns than their European counterparts because Japanese investment in the United States is relatively new. Over time, the theory predicts, the volume of Japanese intra-firm trade will decrease and local content will increase as Japanese affiliates become more deeply embedded in the U.S. economy.

Furthermore, the theory predicts that foreign affiliates will shift over time from purely domestic to more internationally diversified sales. Yet there often appear to be important exceptions to this apparent rule. In the case of Japanese manufacturing affiliates in North America, for example, while exports have increased as a percentage of all sales since the late 1980s, they were the highest in 1983 at 12.8 percent and actually decreased from then until 1988, when they hit a low of 6.2 percent.

The issue of timing—of growing domestic local manufacturing content and diversified sales—is therefore underspecified in the theory. This proves problematic in the theory's utilization.

Second, data limitations make it very difficult to measure local content, particularly in industries that produce goods with large numbers of complex manufactured parts and components. Further complications arise when it proves unwieldy to define local content in industries that include a large number of foreign affiliates that produce intermediate goods locally. The arrival of a "second wave" of affiliates of traditional suppliers to the parent of the multinational corporation in the country of origin therefore presents all types of problems for evaluating local production.

For example, the formation of affiliates of Japanese auto firms in the United States has been accompanied by the formation of affiliates of traditional *keiretsu* (trading group) members, leading to all types of complications in measuring local content. As these affiliates have increased U.S. production capacity, they have also increased the volume of purchases from domestic parts suppliers. Toyota Motor Corporation's own data, for example, indicate that it increased its local purchases in the United States from $800 million in 1988 to a projected $3.8 billion in 1994, as its U.S. production grew from 164,500 to 600,000 vehicles—a rate of increase in Toyota's U.S. sourcing that was somewhat faster than that anticipated by product cycle theory (Toyota Motor Corporation, 1994).

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[3]One of the early, most comprehensive formulations of the FDI life-cycle theory by an economist was offered by Dunning as the "eclectic theory" of FDI (see Dunning, 1977, 1986, 1993). Vernon's major contributions include *Sovereignty at Bay* (1971) and *The Storm Over the Multinationals: The Real Issues* (1977). But Vernon's most succinct and perhaps widest read analysis of this issue is in an article entitled "International Investment and International Trade in the Product Cycle. Other notable contributions on this issue are to be found in work by Hennert (1985) and Barnet and Müller (1974).

Yet a definitional issue remains unresolved. Much of what constitutes domestic production, for example, remains contested, as critics contend that a substantial portion of the purchases of the U.S. affiliates of Japanese auto firms (to continue the example) are merely imports of components that have been redirected through affiliates. Evidence in support of that critical view is anecdotal and uneven. Yet work by Howes (1993) has suggested that most U.S. purchases by transplants are either by import from traditional Japanese suppliers or purchases from their subsidiaries in new greenfield plants.

Support for Howes' position is provided by another study (Newman, 1990) whose author notes that the formation of affiliates of Japanese assemblers has been accompanied by the formation of affiliates of their traditional suppliers. And a further study documents that 115 traditional Japanese automobile suppliers have established U.S. subsidiaries, constituting more than 20 percent of the total number of Japanese manufacturing subsidiaries in the United States. In addition, 66 Japanese firms in the potentially allied area of electrical components have established U.S. subsidiaries, along with a number of firms that are involved in the manufacture of paints and ink, plastic products, and electric wire and cable. These latter firms are likely to supply their products as inputs to automobile production (Yamawaki, 1994). Thus, without proving definitive on the issue, this example demonstrates that local content is often a complicated and even impossible element to measure.

Third, much of product cycle theory work (although by no means all, as Dunning's work attests) has either a theoretical or empirical focus which assumes the investing firm is based in the advanced industrialized world and the recipient in the third world, with remarkably little consideration given to the differing factors that might apply when investment remains within the Triad or, more broadly, the Organization of Economic Cooperation and Development (OECD). Even in the context of the globalization of investment and deregulation of markets in the 1980s and early 1990s, however, Europe generally accounted for approximately 37 percent of inward investment and Japan for less than 1 percent in this period, while the U.S. percentage grew from 16.4 to 22 percent (Organization for Economic Cooperation and Development, 1993).

Therefore, even as the world's stock of FDI grew precipitously in the 1980s and early 1990s, increasing from $491 billion in 1980 to nearly $2.0 trillion by 1992, and as it became fashionable to focus on emerging markets as a location for FDI, the proportion of global FDI accounted for by intra-Triadic investment also grew.[4] Given this fact, the renewed attention to the importance of "emergent

[4]Inward investment refers to the flows of FDI into a given country. Outward investment refers to the flows of direct investment abroad from a given country. In principle, world inflows and outflows should balance. In practice, however, they often do not (as is the case with other balance-of-payments items). Reasons for the discrepancy between total inflows and outflows of investment include cross-national differences in accounting for unremitted branch profits, capital gains and losses, reinvested earnings, real estate and construction investment, and the transactions of offshore enterprises.

market" investment as important in the formulation of policy appeared to be a case of the "tail wagging the dog." Such discussion about investments in the third world shifted focus away from considering whether any contrasting dynamic conditions apply in the case of intra-Triadic investment.

Finally, structural, if not necessarily regulatory, barriers to investment remained in effect in some (if not all) OECD countries despite the institution of the OECD's "code of conduct." Barriers greatly vary, both in form and by degree, among different countries. Although U.S. policy was officially neutral but, in fact, informally encouraged the growth of FDI, the same was not true of some of its major economic competitors in Europe and East Asia. Sustained barriers are important because product cycle theory is reliant on the assumption of investment access. If this assumption is unjustified, the theory cannot possibly provide a description of actual investment behavior.[5]

These structural impediments may constitute the largest and most effective barriers to the effective functioning of product cycle theory. Among the problems I have identified, such barriers may also have the greatest practical policy implication for my argument that sanctuary markets exist which generate artificial profits for investment.

Certainly, among Triadic countries, the most significant problematic case concerning market access continues to be Japan—as recent discussions between the United States and Japanese governments over the auto industry and the accusations made by Kodak seem to indicate. So what are these apparent barriers to investment?

Private Sector Impediments

Despite the trend toward liberalization and the pressures exerted on Japan by the sustained national recession, many analysts and managers of U.S.-based multinationals argue that official government restrictions have been supplanted by "private sector impediments" emanating from an "interior layer of business practices" (Johnson, 1982:200). One report published by the Office of the United States Trade Representative (1993:143) suggested that access is still limited by ingrained structural factors that "stem from particular features of the Japanese economic structure, business organizations, and relations between the Japanese private sector and the government."[6]

What form do these constraints take? The claim that some are the product of cultural factors and others stem from an arcane distribution system imply that they are not accessible to reform.[7] Yet, in contrast, some analysts highlight both private and public sector policies that they say are amenable to reform.

[5]This point is discussed at greater length below; but for a discussion of this point elsewhere, see, for example, Office of Technology Assessment (1993:68–79).

[6]These constraints are systematically outlined in detail in The Second Annual Working Report of the U.S. Japan Working Group on the Structural Impediments Initiative (Department of Commerce, 1992).

[7]These are discussed in U.S. Department of the Treasury (1988:2), and U.S. Congress (1993:6).

First, in contrast to most countries, new FDI in Japan occurs primarily through greenfield establishments and/or joint ventures (Lawrence, 1992:47). This pattern can be explained by Japanese attitudes toward mergers and acquisitions. Many companies in Japan are hostile to unsolicited takeovers, and the private sector in Japan instituted a system of "stable shareholders" as part of the liberalization of investment rules by the Japanese government. According to this view, the Ministry of International Trade and Industry (MITI) encourages companies to exchange shares and thus make acquisitions by foreign investors more difficult. Dating from General Motors' attempt to purchase shares of Isuzu in 1969:

> MITI finally announced that it would accept up to 35 percent foreign capital participation, on the condition that a substantial portion of the shares be held by stable shareholders. The term was used to indicate shareholders of Japanese nationality who could be counted on to retain their shares, even if the stock declined in market value and favorable prices were offered by foreign interests. . . . A feasible means of finding stable shareholders would be for companies in a group or industry to hold each other's shares Ballon and Tomita, 1988:50–51).

Since then, companies have sought stable shareholders, who must obtain approval of the issuing company if they wish to sell their stock, but who are also explicitly not interested in participating in the management of said company. The maximum shareholding for financial institutions was reduced to 5 percent in 1987, apparently encouraging the wider distribution of company shares. But, in practice, members of the same *keiretsu* commonly exchange shares, binding their business relationships together more tightly and making foreign acquisition of their respective companies correspondingly more difficult.

It has been suggested that firms such as Toyota, as well as broader business groups such as Mitsubishi, Mitsui, and Sumitomo, consciously pursued stable shareholding acquisitions designed to achieve the "keiretsu-ization" (*Keiretsuka*) of their firms Mason, 1992a:205–204.[8] *Keiretsu* members and their related companies account for approximately 34 percent of all corporate assets in Japan (Ballon and Tomita, 1988:42). And despite much discussion of the apparently imminent disintegration of the *keiretsu* system, Table 1, reflecting calculations of cross-shareholdings within Japan's leading bank-centered *keiretsu,* provides an example of how remarkably little change there has been in cross-shareholdings between the end of the 1970s and the most recent figures available for the 1990s.

In practice, hostile takeovers are rare, and foreign takeovers usually occur only after all domestic possibilities have been exhausted U.S. Department of the Treasury, 1988:2). Consistent with these claims, common to recent foreign acquisitions of Japanese companies in the early 1990s, was the belief that the domestic firms procured were generally described as economically "distressed" or "unprofitable" (Friedland, 1993).

[8]See cite in Mason (1992a:207) Nakashima Shuzo *Kabushiki no mochiai to kigyo ho* (p. 46).

TABLE 1 Cross-Shareholdings Within Bank-Centered Japanese *Keiretsu*

Year	Mitsui	Mitsubishi	Sumitomo	Fuyo	Sanwa	DKB
1980	17.62	29.26	26.74	16.26	16.78	14.12
1985	17.87	25.18	25.01	15.79	16.84	13.33
1988	17.09	26.87	24.42	15.29	16.38	12.24
1991	16.58	26.37	24.67	15.62	16.67	12.16
1992	16.58	26.33	24.65	15.62	16.72	12.19

NOTE: Cross-shareholdings are the average of the ratios of stocks in one member company owned by other companies within the group.

SOURCE: Adapted from *Kigyo Krietsu Soran* (1987, 1990, and 1993).

Determined foreign investors may turn to greenfield site construction or licensing. But the high cost of land renders the greenfield option available to only a few companies, encouraging U.S. firms to settle for licensing agreements, which save them the costs of manufacturing and market entry (Lawrence, 1992:47, 51–52, 63). Indeed, despite the liberalization of formal Japanese rules regarding inward FDI, in 1990 the $1.2 billion earned by U.S. companies from royalties and licensing fees from Japan accounted for 35 percent of worldwide U.S. receipts from unaffiliated foreigners (Lawrence, 1992).[9] This figure of $1.2 billion was 61 percent of the figure for U.S. direct investment abroad (DIA) in Japan in the same year (a percentage wildly out of line with both the ratio between U.S. licenses and U.S. DIA in other countries and with the ratio between Japanese licenses and FDI in the United States). This proportion of fees to U.S. DIA in Japan has grown over the prior ten years when liberalization of the rules for FDI in Japan suggests that it should have decreased. According to product cycle theory, with liberalization, U.S. firms would expect to invest more and license less Lawrence, 1992:52–53).

These figures indicate that the constraints on mergers and acquisitions, which many believe are caused by *keiretsu* behavior, push U.S. firms into business arrangements that effectively limit their market access and thus their capacity to compete in Japan. In joint ventures, U.S. firms often take a minority share. As compared with Europe, U.S. shareholders in Japan are more likely to be the minority partner.[10] At the same time, licensing ensures that Japanese firms gain

[9]Lawrence (p. 50) notes that Japanese firms earned only $185 million in royalties and license fees from U.S. firms.

[10]"In 1990, majority-owned companies accounted for about 78 per cent of the FDI assets of United States firms. By contrast, only 34 per cent of the FDI assets in Japan and only 26 per cent of the assets in manufacturing were in majority-owned companies. Indeed, there is a relationship between countries that have generally discriminated against FDI and the share of majority-owned firms in FDI assets. While in developed countries that ratio averaged 76 per cent, the conspicuous outliers are the Republic of Korea (18 per cent), India (14 per cent), and Japan (34 per cent)" (Lawrence, 1992:53).

access to U.S. technology, leading to widescale, nonreciprocated technology transfer from the United States to Japan. As Lawrence (1992:55), an advocate of this position, states:

> In sum, the continued dependence on licensing, the heavy reliance on minority-interest ventures and the relatively large investments in majority-owned wholesale trade ventures support the argument that the marketing and distribution of foreign products in Japan is unusually difficult, or that current inflows have been too small to offset the impact of earlier policies.

Merger and acquisition activity among domestic Japanese firms is vibrant and unhindered, in contrast to that by foreign investors in Japan, suggesting that no systemwide limit on activity exists. Figures provided by Japan's Fair Trade Commission (FTC) (1990:32) for 1990 note that 1,532 mergers and 969 acquisitions occurred. Another source indicates that, of 584 mergers and acquisitions involving Japanese firms in 1992, 387 involved Japanese firms acquiring other Japanese firms, and 165 were Japanese firms acquiring foreign firms. In only 32 cases did foreign firms acquire Japanese firms Bergsten and Noland (1993:81).[11]

Consistent with this view of Japan as providing limited access, an American Chamber of Commerce in Japan (ACCJ) (1993) report stressed the exclusionary business relationships that continually hinder the capacity of its members to trade in Japan. The report noted that the *keiretsu* arrangements "have affected the ability of certain American industries, such as the automotive, flat glass, insurance, and semiconductor industries, to take full advantage of market opportunities in Japan, even when the product is highly competitive."[12]

A final effective impediment to FDI instituted by the private sector in Japan has been the adoption of articles in company charters that preclude any form of foreign participation in the running of the companies, such as excluding non-Japanese citizens from their boards. Toyota, for example, wrote this provision into its charter in the 1960s Mason, 1992a:207).

The combined effect of these private sector limitations was to reduce new FDI in Japan in the 1980s to a nominal sum while it was growing rapidly on a global basis. As a result, the greatest source of new FDI in Japan came primarily from the reinvested earnings of existing firms there (Lawrence, 1992:70).

Foreign firms that are able to establish a presence in Japan often face supply and distribution problems when one or a few firms control the supply of essential products in Japan. For example, efforts by Toys "R" Us to establish itself in

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[11]The large discrepancy in the total number of mergers and acquisitions between this source and the Japan FTC (cited in the text) may result from different counting rules. Bergsten and Noland give the following statistics for 1990: total mergers and acquisitions, 801; Japanese firms acquiring Japanese firms, 341; Japanese acquiring foreign firms, 450; foreign firms acquiring Japanese firms, 10.

[12]The details of these limits are offered in American Chamber of Commerce in Japan (1993:30–34, 49–50, 64–68, 90–92). For an academic study noting similar problems, see Gerlach (1992:36–37, 262–268).

Japan as a low-cost toy retailer often have been impeded by a few supplier firms trying to ensure that other retailers are not damaged by the entry of a new competitor (for details, see Mason, 1992b).

The recent case of Kodak provides a comparable example of this tendency, as does that of the automobile industry. Certainly foreign automobile firms suffer from restricted market access in Japan, a problem that the Clinton administration sought to address by attempting to ensure U.S. producers of a guaranteed minimum share of the components market as had (proponents claim) successfully worked in the case of the semiconductor agreement of the 1980s. European auto firms complain about the collusion and exclusivity of the distribution system in Japan as well as unfair taxation, administrative guidance, inadequate protection of intellectual property rights, and the cost of land (see International Trade Reporter, 1993). Indeed, confidential interviews with European component suppliers revealed that some Japanese firms demanded licensing agreements with the parent company in Japan before allowing European firms to sell to the affiliates of Japanese companies in the United States.

And the perennial problem of access to dealership networks has been raised but remains largely unresolved by recent negotiations. Automobile companies in Japan have much greater control of their dealership network than do their counterparts in the United States, through both direct ownership and individually negotiated contracts between the independent dealerships and the automobile manufacturers. In the absence of the active encouragement of the auto company that controls the dealership, penetration of the market through dual dealerships is exceptionally difficult, making the creation of an effective dealership network in Japan extremely time-consuming and expensive. Estimates suggest that establishing a new distribution network in Japan, with sales outlets equal in number to Mazda or Honda (about 2,500) could be expected to cost in excess of $1 billion, not including the recruiting and training of staff.[13]

Public Sector Impediments to Investment

To these private sector constraints must be added the sustained public sector ones.[14] As a 1992 Keidanren report stated:

> Japan has considerably more regulations on business than most other countries, and this undoubtedly obstructs the entry of new firms, both domestic and foreign, into the market. Many foreign firms, which are able to enter other markets,

[13]This estimate is based on a 10 percent share of Autorama, which cost Ford $10 million in 1992. Autorama had 328 sales outlets. Honda and Mazda each had approximately 2,500 sales outlets in 1990. Indirect investments by Mazda (currently 25 percent owned by Ford) to support Autorama, in which it has presently a 41 percent stake, probably exceeds $100 million (Ford Motor Co. and Japan Automobile Manufacturers Association (1990:3).

[14]For a proponent of the view that the Japanese government has indeed liberalized FDI access, see, for example, Julius (1990:33).

> face greater difficulties in entering the Japanese market due to such regulations and administrative guidance (Committee on Foreign Affiliated Corporations, 1992:5).

The report concluded that the solution lay in a shift toward transparency in government administration. U.S. companies in Japan have made similar claims, suggesting that transparency in the decisionmaking process remains inadequate in Japanese agencies, which have denied U.S. firms access to information concerning rules and regulations.[15]

This criticism appears consistent with U.S. claims that Japan's Anti-Monopoly Law is administered "with inadequate penalties, less than vigorous enforcement, and numerous exceptions" (Office of the United States Trade Representative, 1993:144). Furthermore, the law allows for "exemption cartels" that meet specified legal conditions. These exemption cartels numbered 256 at the beginning of the 1990s, and were defined as either "depression cartels" or "rationalization cartels" under the Anti-Monopoly Act (for details, see Japan Fair Trade Commission, 1990:30–31). One ACCJ report (1993:3) contends that monopolistic practices still exist in Japan as a result of selective application of the anticompetitive laws by Japan's Fair Trade Commission. Because of these measures, U.S.-based multinationals investing in Japan are, in effect, often unable to compete directly with their Japanese counterparts in areas where the Japanese firms are least competitive.

Furthermore, Japanese government proscriptions against foreign investments that threaten national security or public order, that affect existing producers, or that disrupt the national economy are vague enough to justify government intervention under many different circumstances (U.S. Department of the Treasury, 1988:5; for a list, see 1992:1–63). The Japanese government's concern about the effects of disruptive practices may result in a variety of problems for foreign products and firms. As the ACCJ (American Chamber of Commerce in Japan, 1993) report noted:

> Foreign air transport companies face difficult and time-consuming obstacles to acquiring airport landing rights and brokerage licenses. Medical equipment companies have experienced both slowing of approvals of new medical technology in which the U.S. has a leadership position, and funding of Japanese products directly competing with U.S. products. Imported food products face rigid barriers such as unrealistic short delivery deadlines and onerous date-labeling requirements, in addition to being required to meet food safety standards different from those used in other countries. Restrictions on premium pricing and sales promotions handicap foreign and new-to-market companies, such as travel and tourism agencies and processed food importers.

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[15]Examples of the adverse effects of such problems are evident in the case of construction projects, the setting of regulations for solid wood products use, and the procedures for date labeling of certain food products (American Chamber of Commerce in Japan, 1993:5).

The definition of a legitimate basis for government intervention to deny foreign investment employed in Japan is therefore far broader than that used in the United States.

Furthermore, according to a recent report of the United States Trade Representative (USTR), government measures that are transparent often remain, nevertheless, discriminatory. The USTR reported that the Japanese government retains the authority to restrict investment in specified sectors, including aircraft, space development, agriculture, fishing and forestry, oil and gas, mining, leather and leather product manufacturing, nuclear power, weapons and ordnance manufacturing, and tobacco (Office of the United States Trade Representative, 1993:16).

Finally, U.S. firms raise the issues of procurement patterns and patent rights. U.S.-based multinationals repeatedly express their concern that Japanese patent protection rules and the longer duration of patent registration (compared with other nations) have a deleterious effect on the competitiveness of foreign firms (Office of the United States Trade Representative, 1993:18–20).[16] This claim is not new—it dates to initial postwar U.S. efforts to re-enter the Japanese market—but the situation has become more acute, however, because of the heightened competitiveness of Japanese firms, the access of Japanese firms to America's best technology, and the importance attached to patent issues at the continuing Uruguay Round of the General Agreement on Tariffs and Trade (GATT).

The procurement issue focuses on the claim that pervasive " 'Buy Japanese' attitudes and practices persist in such sectors as construction and engineering, radio communications (wireless telecommunications equipment), and semiconductors, for which major 'market-opening' or purchasing agreements exist." The same claim has been advanced about U.S. supercomputers. Despite the clear superiority of U.S.-made supercomputers, the Japanese government procured only five machines from U.S. companies in the 1980s, preferring to source an additional 46 machines from Japanese firms. This led to agreements between the United States and Japan over supercomputer procurement in 1987 and 1990.[17]

In some cases, specifications for Japanese government procurement are not made public. But even when they are, critics suggest, they often effectively deny foreign firms the right to participate. The U.S. firms remain unable to penetrate the Japanese market despite transparent, nondiscriminatory procurement standards adopted under a 1990 agreement that was revised in 1992. MITI officials agree that only limited progress has been made and that "there is a need to do more to improve transparency and avoid discrimination in procurement practices." Progress in reaching an agreement has been made in a number of areas, including

[16]Reforms at the end of the 1980s cut the patent examination period from 37 months in 1988 to 30 months in 1991 (1992:50) .

[17]For a detailed discussion of this issue, see Office of Technology Assessment (1991:273–278).

software and a variety of chemical treatments (American Chamber of Commerce in Japan, 1993).

In addition to restrictions authorized under the Foreign Exchange Control Law, Japanese sources cite specific restrictive industry laws in sectors such as air and marine transport, communications, and broadcasting. A 1992 Keidanren report indicated that these individual industry regulations "are actually more responsible for restricting foreign investment than the Foreign Exchange Control Law" (Committee on Foreign Affiliated Corporations, 1992:8). Thus "opaque restriction of entry by policies and administrative guidance based on specific industry laws virtually discriminates [against] foreign capital and limits the competition." These laws often complement the industry-, group-, or firm-specific private impediments that originated in the 1970s.

U.S. sources support these generalizations with specific examples. An ACCJ report (1993:4) concluded that:

> While deregulation has proceeded to some extent in recent years, many archaic and arbitrary regulations and guidelines remain in effect, serving as impediments to trade. Many building codes preclude the use of certain wood products. Radio communications and telecommunication services and equipment continue to be highly regulated sectors. These regulations keep prices high and delay access for competitive and high-quality American goods and services. . . . Air transport services suffer from regulations that control the prices they charge and the services they offer. In some cases all that is required is simplification and clarification of regulations (cosmetics), or modification of guidelines for existing 'liberalizing' laws (telecommunications services carriers).

A third impediment is that institutions with programs designed to encourage FDI in Japan, such as the Export-Import Bank of Japan's Product Import Promotion Financing Program, lack adequate funding. The Japanese government has also established artificially low ceilings for the financing of projects by foreign corporations through the Japan Development Bank (American Chamber of Commerce in Japan, 1993:8–9).

A fourth barrier is that the government has sustained an artificially high withholding tax rate of 10 percent on dividends paid from the subsidiary in Japan, in contravention of the 5 percent OECD model convention. Some analysts suggest that this constitutes discrimination; a Keidanren report separately advocates that the Japanese government lower its rate to 5 percent, consistent with the multilateral tax convention (American Chamber of Commerce in Japan, 1993:10).

Finally, one congressional report identified a fifth impediment, arguing that pervasive government measures continue to regulate land and financial markets. In effect, this regulation sustains extremely high prices despite the bursting of the speculative bubble in Japan U.S. Congress, 1993:iii).

The evidence therefore suggests that both the public and the private sector impede FDI in Japan. Like the proverbially cited onion, peeling back one layer of impediments simply reveals another layer. Indeed, Amaya Naohiro, a high-level

MITI official, suggested as early as 1969 that making minor concessions while retaining the major impediments in place was the major thrust of MITI policy Mason, 1992b:201).

Concrete results indicate how little progress has been made. In 1990, Japan's level of inward FDI per capita was much lower than other OECD countries such as Germany and the United Kingdom. Japanese figures demonstrate an asymmetry in the comparable position of foreign firms in the United States and foreign firms in Japan. According to MITI, foreign-owned firms employed 0.5 percent of the work force in Japan in 1991, compared with 3.8 percent in the United States. Products of foreign companies came to 1.2 percent of total sales in Japan, compared with 16.5 percent in the United States. Moreover, foreign affiliates controlled only 0.9 percent of total assets in Japan, compared with 20.4 percent in the United States.[18] This asymmetric pattern is not confined to the United States; in 1992, Japanese DIA in the U.S. reached approximately $250 billion, more that ten times the amount of U.S. FDI in Japan.

It should be noted that Japan represents a most extreme and important example of the impediments to FDI among the Triadic states. But it is not the sole example. In confidential interviews, U.S. and European investors repeatedly stressed that joint ventures were preferred because takeovers may be precluded through national laws and practices.[19] Among European countries, investors associated this problem most closely with Germany, where the dominant form of corporate governance differs from the United States and the United Kingdom. Other studies[20] corroborate this view:

> Many contested takeovers do not take place for the simple reason that nobody really believes that they can happen. For example, the unsuccessful hostile bid by Italy's Pirelli for Germany's Continental Tyre company in 1991 may confirm the view that German companies are impregnable as long as they have the support of big German banks.

A 1990 report identifies two types of barriers to takeovers of public companies in the European Union. The first is "structural"—e.g., impediments that arise from the ownership structure and the cultural characteristics of individual markets. For example:

> In Italy . . . only eight out of over 200 listed companies have issued more than 50 percent of their shares to the public. That means that they remain tightly

[18]From *Gaishi-Kei Kigyou Koudou Chousa, Houjin Kigyou Toukei*, MITI 1991 cited in U.S. Congress (1993:4). Lawrence (1992:48) suggests that all FDI in Japan totals 1 percent.

[19]Thomsen (1994:203) suggests, in relation to FDI regulations, that "non-EC firms face national restrictions with the Community even though the EC has no community-wide restrictions on the establishment of foreign companies through greenfield investment or acquisition. To suggest that the absence of restrictive Community policies makes the EC more open than the U.S.A. is clearly farfetched. Each and every Member State in the Community has potentially more restrictive policies toward investors than does the U.S.A. member under the Exon-Florio amendment."

[20]Study by Coopers and Lybrand as cited in Commission of the European Communities (1993:51).

> controlled by small cabals of like-minded industrialists and financiers who are not minded to give up control (Commission of the European Communities, 1993:51).[21]

The study found structural barriers in the major European economies to be strongest in France, Germany, Italy, and Switzerland.

The second impediment to acquisitions identified by the report was a series of technical barriers that inhibit or prevent the transfer of control by contested takeover. For example, in Germany, Switzerland, and The Netherlands, companies often restrict the voting rights of ordinary shareholders and instead concentrate voting power in the hands of shareholder groups that are friendly to management. Among European Union members, the United Kingdom has relatively weak structural and technical barriers. As a result, management in the United Kingdom is much more likely to be responsive to shareholders' short-term interests. In addition, the value and number of cross-border acquisitions in the United Kingdom often exceed those found in the rest of the European Union Commission of the European Communities, 1993:51–52).

Despite the sustained claims of deregulation and liberalization voiced by proponents of the process of globalization, the eradication of impediments to investment appears at best partial, at worst, grounds for sustained concern.

Combined, the relatively recent presence of much of the world's FDI, the complexity and uncertain origin of manufactured inputs, the increasingly nuanced patterns of national affiliation among producers and their suppliers as strategic alliances weave companies together in new and unusual configurations, and the continued importance of government and corporate sector inhibitions on foreign investment all make the utility of product cycle theory inherently problematic. It remains difficult to confirm by analyzing the sourcing behavior of foreign affiliates. And indicators that focus on the output of affiliates also provide important but often stubbornly inconclusive evidence. In addition, sustained barriers to investment complicated the situation by generating conditions under which the theory was *not* likely to work.[22]

As a consequence, the problems in the formulation and operationalization of the product cycle theory—concerns about whether the same conditions apply in the case of intra-Triadic FDI as apply to outward investment in the rest of the world's

[21]This image of Italy is consistent with broader data on inward FDI flows, which remain small and relatively volatile. Although the stock of investment grew in the late 1980s and early 1990s, the flow was uneven, peaking in 1988 and 1990 and dropping substantially in subsequent years. For further discussion and data on FDI flows in and out of Italy, see Commission of the European Communities (1993:61).

[22]This paper does not provide a comprehensive comparison of multinational behavior with the Triad by nationality or sector. Such an analysis, consistent with these claims is, however, available in Office of Technology Assessment (1994).

economies by the Triadic countries, a series of empirical anomalies, and the durability of barriers to entry—all therefore raise a series of theoretical and empirical challenges to the generalizability of product cycle theory.

AN ALTERNATIVE FORMULATION

An abiding question, however, concerns the issue of what happens in the absence of impediments to market access of the type outlined above. Product cycle theory would expect convergence toward the type of investment behavior outlined by the theory. In the product cycle formulation, investment and trade are interchangeable, with investment replacing trade over time, substituting for it.

Yet empirical data suggest that behavior need not conform to the expectations generated by the theory. To be more specific, substitutability between trade and investment need not be guaranteed. Nearly three decades ago, Japanese economists, notably Kiyoshi Kojima, wrote about a differing form of relationship between trade and investment.

Kojima, in his study of the investment behavior of Japanese multinational corporations abroad, concluded that at least two forms of relationship existed between trade and investment. The first, implicit in traditional product cycle theory as described in the prior section, concluded that investment was "trade-destroying," meaning that, over time, investment abroad would result in a reduction in exported goods; first finished goods, then intermediate goods. The process would gradually extend from the firm level to a macroeconomic one. Thus "when FDI in manufacturing replaces domestic production followed by export to a foreign market, it substitutes for trade, and could be termed 'trade-destroying'" (Gilpin, 1989:337).

In his study of the behavior of Japanese firms, however, Kojima concluded that a second pattern of FDI existed that was "trade-creating," rather than destroying. In this context, he suggested that multinational corporations used their FDIs as a conduit, if not for the creation of more exports, then certainly the maintenance of those exports. In this formulation, therefore, investment was not a substitute for trade but a supplement to trade.

Anglo-American critics of Kojima initially ignored his work, adjudging it simply as a vestige of a mercantilist approach that an evolving Japanese economy would have to discard. But underlying this criticism of Kojima's approach was a strikingly important point: That because the product cycle theory was (perhaps unkindly but accurately stated) written by Anglo-Americans, developed in the study of Anglo-American firms, primarily for an Anglo-American audience, then it promulgated the view that everybody would come to behave the way Anglo-American firms did.

When Kojima's work simply could not be dismissed, western critics noted that his analysis was focused empirically on the behavior of Japanese multinationals in the context of their accumulation of extractive resources in (mostly

Southeast) Asia. Accordingly, they largely dismissed the applicability of this alternative trade-creating model to the behavior of Japanese (or any other) multinational corporations within the advanced industrialized world.

But while resisting the temptation to label this a "Japanese model," unlike Gilpin who does so in interpreting Kojima's analysis,[23] what appears clear is that this model has been adapted for application in the context of the 1980s and 1990s. And Japanese firms have been the most common practitioners of this approach. The key additional component to that model, the element that distinguishes it from product cycle theory, is the use of intrafirm trade as the mechanism for a trade-creating strategy. This may have been, in part, what Akio Morita, the famous, late President of the Sony Corporation may have meant in observing that Japanese multinationals have institutional characteristics that encourage them to behave differently than their European and U.S.-based counterparts (see Morita, 1992).

For as international trade and investment expanded throughout the 1970s and 1980s, intrafirm trade increased in tandem (albeit unevenly) across the Triad. Indeed, by the early 1990s, intrafirm trade within multinational corporations accounted for more trade within the Triad than did interfirm trade. At its most extreme, this reached startling proportions. For example, U.S. intrafirm trade with Japan makes up a much larger proportion of all U.S.-Japan merchandise trade than does inter-firm trade, at an average of 71 percent of the total of all trade between 1983–1992 U.S. Department of Commerce, 1983–1991a,b, 1993). Furthermore, over the same period Japanese multinationals and their affiliates conducted an average of 92 percent of all U.S.-Japan intrafirm trade. This asymmetry is even more pronounced than that associated with the bilateral U.S.-Japan imbalances in direct investment and merchandise trade. Taken together, these two statistics indicate that most U.S. trade with Japan takes place within and is dominated by affiliated networks of Japanese multinationals.

The ability to pursue strategies with high levels of intrafirm trade is, of course, contingent on the capacity to invest freely, as is the traditional form of FDI. Thus, both are circumscribed when direct investment is limited or heavily regulated. But, in practice, this "trade-creating" form of FDI may require a greater degree of freedom—notably from domestic content or market-access prohibiting forms of regulations. Thus, although firms that advocate this strategy may seek to adopt this approach in differing markets, they are as limited by governmental regulation

[23]Gilpin reflects this sentiment in citing the work of Kojima. Gilpin states that "[c]ontrasting Japan's foreign direct investment with that of the United States, Kojima argues that Japanese foreign direct investment attempts to be 'trade-creating,' whereas American foreign direct investment has been 'trade-destroying.' Japanese foreign direct investment has sought to increase, or at least maintain, Japanese exports; U.S. foreign direct investment, on the other hand, has tended to replace U.S. exports by establishing production facilities abroad to serve the U.S. or world markets. Although Kojima was referring specifically to direct investment by Japanese corporations, his characterization is applicable to almost all Japanese foreign investment" (Gilpin, 1989:337).

as by the peculiarities of sectoral requirements. Where none of the regulations outlined above in the case of Japan exists, multinational corporations have a greater latitude to act.

Certainly recent extensive empirical work I conducted under the auspices of the Office of Technology Assessment adds support to the notion that a second, alternative corporate strategy exists (Office of Technology Assessment, 1993, 1994). Instead of replacing domestic production with production at the manufacturing plants of their foreign affiliates, some multinational corporations focus their direct investment policy on efforts to increase domestic exports. This trade-promoting corporate strategy places a premium on intrafirm trade or, more broadly, trade within traditional parent-supplier networks as a conduit for increased exports. To achieve this goal, FDI focuses on the development of wholesale and manufacturing assembly facilities rather than fully integrated plants.

The optimal goal of such an investment strategy is to increase domestic exports, not to substitute domestic production for foreign production. Minimally, although the overall volume of exports might nevertheless fall as a result of overseas investment, it will not fall as precipitously as would normally be expected. Crucially, the high value-added end of the production process will be retained at home. This "trade-promoting" approach to investment by corporations challenges the traditional FDI pattern of behavior because it is designed to sustain the firm's domestic manufacturing base and shift as little of the production process off shore as possible.

Evidence suggests that such a pattern of trade-promoting behavior by multinational corporations is systematic, widespread, and, where appropriate, effective in sustaining a vibrant domestic manufacturing base while increasing foreign sales. The capacity to pursue this strategy is, however, curtailed by three factors: the limits of host government regulation, the exogenous effects of macroeconomic forces, and requisites of sectoral constraints. Nevertheless, a major bifurcation in the preferred patterns of direct investment behavior among the world's leading firms is becoming readily evident—not the converging pattern that product cycle theory would predict.

The preference in corporate behavior appears strongly correlated with the country of origin of the foreign direct investor. Japanese firms appear to be the leading exponents of this alternative, trade-promoting strategy, as measured by the concentration of their investments and consistently high levels of intra-firm trade. This observation is evident both in data concerning their global patterns of investment as well as their investments within the United States, where they enjoy sustained free market access within a market characterized by minimally intrusive regulations. Likewise, other, new investments by some German and Korean firms show preliminary evidence that they too are or will be engaging in similar patterns of behavior.

The capacity of these firms to invest in ways that maximize exports to the United States, for example, is in part a product of the American policy of national

treatment. This approach minimizes government regulation in the hope of maximizing the volume and gains of FDI. National treatment articulates the principle that foreign investors, whatever form their investment takes, should be treated as if they were domestic investors and encourages the influx of FDI, as was clearly articulated in 1991 by the Bush administration:

> The Administration supports maintaining an open foreign investment policy, with limited exceptions related to national security. This policy produces the greatest possible national benefits from all investments made in the U.S. economy. The United States has long recognized that unhindered international investment is beneficial to all nations, that it is a "positive sum" game (White House, 1991:262).

Anglo-American firms have often encountered a different pattern of regulation when investing abroad. They have often been forced by host governments to invest in fully integrated production facilities, exchange market access for patents, or have often been denied any investment access at all. Recent evidence suggests, for example, that a series of "structural barriers" continue to deny U.S. firms the kind of reciprocal access to some foreign markets that their rivals enjoy in the United States—as was outlined in the case of Japan. Indeed, the denial of such access has become so routine that both government and corporate officials have confidentially concurred that it may be better to avoid trying to enter such markets at all, and to move on to other, less regulated or "structurally impeded" investment markets. This approach has become an implicit part of government policy, with the decision to focus on "emergent markets" for both trade and investment, and to turn away from some mature markets.

THE CONSEQUENCES OF A STRATEGY OF AVOIDANCE

In tandem, the asymmetry in market access and the decision to focus on alternative markets rather than to persist in breaking down the barriers of protected ones, and the "avoidance strategy" it has spawned, bears a potentially heavy cost for both corporate America and the national competitiveness of the U.S. economy for at least three reasons.

First, if the analysis suggesting that FDI has taken on increased importance in enhancing the significance of intrafirm trade is indeed correct, then the persistent inability of U.S. firms to invest in the economies of major competitors such as Japan naturally curtails the capacity of U.S. firms to export to those same countries. With the majority of U.S.-Japanese trade, for example, accounted for by intrafirm trade, and the overwhelming proportion of that trade being among and within Japanese firms, the inability of U.S. firms to invest in Japan and thus sell goods there has major implications for the recent, present, and future size of the U.S.–Japan bilateral trade deficit. Indeed, this phenomenon may indeed go a

long way toward explaining the relatively inelastic response of the trade deficit in the face of volatile currency fluctuations.

In contrast, where the United States has a relatively balanced investment situation, and lower ratios of intrafirm trade as a percentage of all trade, it tends toward balanced trade accounts. The bilateral U.S. trade surpluses and deficits with Europe, for example, have proved to be far more cyclical and responsive to macroeconomic forces over the last decade than has been the case with Japan (for figures, see Office of Technology Assessment, 1994:14–15). This evidence suggests that investment access is therefore key to generating trade surpluses in the 1990s.

Second, constraints on the ability of foreign firms to invest in another country afford the firms that do compete in that country a sanctuary home market. Although competition between domestic firms may exist, it is, nonetheless, limited. The cumulative effect of this limited competition is the creation of a sanctuary market and, in some cases, this generates cartelistic arrangements.[24] Here, artificial profits are often generated as domestic consumers are forced to pay artificially high prices. This is undoubtedly the case in many sectors in Japan, where a variety of goods—from agricultural to consumer products—cost more than identical goods sold overseas by those same firms. Thus, the inability to invest thwarts competition and awards domestic firms artificial profits to subsidize exports. Although there is no doubt that competition may exist—and, indeed, may be fierce—in some sectors in Japan, that competition may not exist at all or may not be price-based competition. The cost of automobiles in Japan represents an interesting example of an industry in which competition does exist, yet the cost of purchasing an automobile far exceeds that for identical products in the United States. In other cases, such as that of the Japanese film market, Fuji exerts the type of monopolistic production position that would not be tolerated under U.S. antitrust law. And, in some cases, Japanese governmental procurement practices have subsidized domestic firms in niche markets—such as the case of supercomputers.

Finally, how does this argument about trade and investment relate to the development of new technology? Well, preliminary—albeit extensive anecdotal, if often undocumented—evidence drawn from interviews suggests that these same artificial profits serve domestic firms in a new, irreplaceable manner. Formerly, the focus on artificially high prices in domestic markets lay in the issue of how these extra profits subsidized export prices. But these profits now serve an additional and perhaps even more important purpose.

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[24]For a most recent example, see the case involving Japanese electrical machinery makers, in which they prearranged "winners of 84 contracts worth about 17.27 billion yet, or $196 million, for local water supply and sewerage systems in 1992 and 1993." Those found guilty include Toshiba Corporation, Hitachi, Mitsubishi Electric, Fuji Electric, and Meidensha—some of Japan's most notable producers of new technologies (*New York Times*, 1995).

Returning to the much-publicized case of Kodak proves instructive on this point. Kodak is presently developing a system of optical imaging that could one day make conventional cameras obsolete. To finance the cost of such development requires relying on "cash cows" such as sales of conventional film. If Kodak cannot sell in the Japanese market, it then loses a valuable source of revenue to finance the development of this revolutionary new technology.

As the cost of successive rounds of development of new high technology grows at exponential rates, firms are therefore increasingly pressed as to how to successfully finance the research, development, engineering, marketing, and distribution of innovative products. Even the largest computer companies, for example, have had to enter into strategic alliances so as to raise the necessary capital to develop the next round of semiconductor chips. Sanctuary markets are therefore crucial in that they provide firms with artificial profits that prove to be an effective source of capital in financing these efforts.

In interviews, firms of all sizes and nationalities repeatedly stressed that the cost of developing new technologies was growing exponentially. American firms, it should be noted, were generally persuaded to enter into joint ventures with Japanese and European counterparts not because they were confounded by ideas about how to generate new technologies, but by the lack of the funds necessary to develop them. It was repeatedly the case that Japanese or European partners were providing the funding rather than the ideas. That funding was often (although, it is crucial to add, not always) generated by a pool of profits that had come from domestic sales. In the case of many small U.S. firms, such agreements began as joint ventures and ended with those firms being affiliates of the foreign producer with whom they had originally entered into a joint partnership. In the case of large firms, the terms of the deal often included provisions that limited the partners in terms of the markets in which they could sell their new technologies. Confidential interviews reveal once again that, American firms, for example, have repeatedly found themselves prohibited from competing in the Japanese markets in the case of the new technologies that they jointly developed with Japanese partners.

We therefore should not be deceived into thinking that this age of globalization has created a financial environment in which it is easy for firms to roam the globe and garner the capital necessary to finance these projects. Far from the oft-cited stereotype, the world's largest firms continue to get an overwhelming percentage of their capital from their home market. With three very different forms of capital markets operating across the United States, Japan, and Europe, access to capital remains constrained and the importance of earnings to finance new projects has become greater than ever. When IBM has to enter into joint development agreements with some of its biggest Japanese and European competitors so as to finance the development of a new semiconductor chip, and the terms of that agreement include proprietary access to sales by region, then it appears that trade, investment, technology development, and financing have become indelibly and inseparably linked.

POLICY IMPLICATIONS

The policy implications of major constraints on investment access are not without major significance. I focus here on three.

First, how have government and corporate officials reacted? Faced with this problem in the case of Japan, administration officials have tended to advocate the pursuit of economic possibilities in large, untapped potential markets such as the People's Republic of China, Brazil, Southeast Asia, and Eastern Europe. Although making some efforts to break down investment barriers in recalcitrant OECD partners, they (similarly to corporate officials) have privately confided that the low possibilities for successful market entry, coupled with the high cost of business in Japan as a result of the yen's appreciation, have pushed them to pursue, more aggressively, entry into what they perceive to be easier and more promising markets.

The potential flaw in this approach is that it is a shrinking world, and American firms often face competition from the very same firms in these third markets that benefit from the privileges of sanctuary markets. Armed with artificial profits that subsidize sales and finance new technological development, American firms face the short- and long-term prospect of being out-competed in their efforts to attract new customers.

Second, the investment access problem may not be confined to Japan. It may prove to be a growing problem, even in the age of apparent growing liberalization, globalization, and deregulation. A variety of regional requisites and agreements, nontariff (such as technical) barriers and the consolidation of private sector access barriers have compounded a tendency by some countries to use Japan's traditional public sector regulatory behavior as a model for development. Although this tendency has been most avidly discussed in the behavior of South Korea, the newly industrializing countries, and NIEs, recent evidence points to the use of discriminatory trade barriers in the Vizegrad countries of Eastern Europe against American products, as well as the denial of trade and investment access in select cases in other OECD countries—such as Westinghouse's recent experience in Germany.

Finally, it appears increasingly likely that such issues as the linkages between trade, investment, and high technology will have to be managed in the context of multilateral, regional, and bilateral cooperative frameworks if policy friction is to be avoided. Anecdotal evidence suggests that the onus of responsibility increasingly lies with those critics of negotiated agreements to justify their claim that a laissez-faire approach yields an optimal outcome for all parties. Left alone, the international economic system appears under too much stress to hope for satisfactory, non-negotiated outcomes.

In sum, FDI access appears key to the realization of global and regional liberalization, to mutually beneficial and balanced trade, and to the capacity to fund the next generation of technological development. In turn, the failure to

secure satisfactory access among the home of the world's largest multinational corporations does not augur well—for global free trade, for the future competitiveness of America's largest and most prosperous firms, or for the vitality of the U.S. economy.

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Technology Issues in the International Trading System

Sylvia Ostry
University of Toronto

WHY ARE TECHNOLOGY ISSUES IMPORTANT?

During the 1980s a number of disputes centered on trade and investment in technology—and capital-intensive sectors. These include so-called high-technology sectors (such as pharmaceuticals and aircraft), as well as some (such as autos) that are classified as medium-technology sectors because the Organization of Economic Cooperation and Development (OECD) definitions are based on research and development intensity, which reflects only one, albeit important, characteristic of such industries.[1] For the sake of convenience, the term high-technology could be applied to both.

There are a number of reasons why technology issues have featured more prominently in the international agenda over the past decade and a half. Perhaps the most fundamental was the emergence by the end of the 1970s of the "convergence club" of the developed countries (i.e., convergence in technological and managerial capabilities, capital intensity, and education levels). This convergence was largely a result of "catch-up." The main driver of catch-up was the diffusion of the advanced technology of the United States, the undisputed postwar leader. (The convergence was greatly facilitated by the reduction of barriers to trade and

[1]OECD classification categories are based on R&D intensities. Other characteristics such as patent activity and scientific and engineering manpower are also relevant, and the OECD provides data on these aspects as well. But no other complex categorization has been developed that would consider input and output measures as well as capital intensity, concentration measures, product and process innovation, specialized suppliers of technology-intensive components, etc. For a sectoral taxonomy that attempts to deal with some of the aspects of Paolo Guerrieri, see Harris and Moore, (eds.) (1992:29–37).

financial flows promoted by the postwar international institutions, as discussed below.) So one source of the technology focus of the 1980s was rising concern in the United States about challenges to American technological preeminence in both medium-technology (capital-intensive sectors such as autos and technology-intensive components and equipment) as well as high-technology sectors.

Thus, as can be seen from Table 1, the U.S. postwar dominance in both medium technology as well as high technology has been increasingly challenged by Japan, and even more so by Europe. Furthermore, as is clear from Table 1, the real impact of the Japanese challenge over the past two decades has been rising import penetration rather than declining export share. But Japan's import shares did not follow this trend. Thus, one consequence of *le defi Japanais* was a marked increase in international friction that centered on *export* access rather than *import* protection in these technology-intensive sectors.

But there is more to the story than opening international markets for particular goods. High-technology industries became a domestic concern as well, both in the United States and Europe, in part as a response to what were believed to be successful Japanese industrial policies, especially industrial R&D consortia targeted at advancing new generic technologies. In the 1980s there was a change in the climate of ideas among economists and policymakers that generated a lively (and still ongoing) debate about why high-technology matters and what governments should do about nurturing high-technology industries located in their own countries.

Although European technology and industrial policies had started much earlier in member states, in the 1980s there was a new drive at the European Community level. And in the United States, a traditional aversion to such policies gave way to new initiatives by both the Reagan and Bush administrations that have continued in recent years. In both Europe and the United States a major focus has been R&D consortia.[2]

The rationale for fostering domestic-based high technology—the change in the climate of ideas—rested on economists' notion of market failure. A firm that performs R&D usually is unable to keep the technology behind its new products and processes completely private, and sooner or later its competitors will be able to draw significantly from the new technology it has created to fashion their own substitutes. If a firm is unable to appropriate fully the returns to its investments, it will tend to underinvest in that activity from a social point of view. Hence government action, for example through patents or by research subsidies, can improve public welfare.

Furthermore, in the 1980s it became clear that patents were ineffectual in some leading sectors, such as semiconductors, computers, telecommunications, and aircraft. In these sectors, companies reap return mainly by achieving a head

[2]For a full discussion of these developments, see Ostry and Nelson (1994).

TABLE 1 Export Shares, Revealed Comparative Advantage, and Import Penetration in the Developed Economies, 1970 and 1990

Country and Technology Level	Export Shares[a]		RCA[b]		Import Penetration[c]	
	1970	1990	1970	1990	1970	1990
United States						
High	31.1	26.3	1.54	1.51	4.2	18.4
Medium	21.7	15.4	1.07	0.89	5.6	18.5
Low	13.4	13.3	0.66	0.76	3.8	8.8
Japan						
High	13.2	21.1	1.20	1.41	5.2	5.4
Medium	8.5	16.9	0.77	1.12	4.5	5.9
Low	13.2	7.1	1.19	0.47	3.0	6.6
Germany						
High	17.7	16.2	0.93	0.79	14.9	37.0
Medium	23.1	24.7	1.22	1.20	17.2	29.5
Low	15.0	17.9	0.79	0.87	11.1	20.9
France						
High	7.7	8.7	0.83	0.84	21.6	31.6
Medium	8.5	10.0	0.92	0.97	19.7	34.1
Low	10.7	12.1	1.15	1.18	10.7	21.4
United Kingdom						
High	10.5	10.2	10.1	1.16	17.4	42.4
Medium	11.9	8.5	1.14	0.96	n.a.	39.4
Low	8.9	8.5	0.85	0.94	12.4	19.8
Italy						
High	5.5	5.1	0.75	0.59	16.2	22.8
Medium	7.1	7.7	0.97	0.89	23.6	28.9
Low	8.5	12.8	1.16	1.49	11.6	15.7
Canada						
High	3.9	2.8	0.54	0.55	42.2	63.4
Medium	8.9	5.9	1.22	1.14	42.9	53.3
Low	7.0	6.1	0.96	1.19	12.1	16.8

[a]Share of OECD exports in each category.

[b]Revealed comparative advantage is calculated as a country's exports in an industry divided by its total exports, normalized by the same ratio for the OECD countries.

[c]Imports divided by total domestic demand *j* (production plus imports less exports).

Source: OECD (1993:87).

start on their rivals, which they then exploit by seizing the market and moving rapidly down the learning curve. They fully expect their rivals to pick up and use their invention, but with a lag. That lag has become shorter and shorter in recent years. So the basic argument presented in support of government intervention was to capture, on home territory, the externalities generated by innovation in these high-technology industries, which—another argument in support of inter-

vention—also generated high-paying jobs. Furthermore, because other countries see these possibilities, and often the world market may be able to sustain only a small number of firms, a country that seizes them first or pursues them most aggressively and sustainedly can reap significant national returns not only in a particular sector but also, more broadly, because of inter-industry spillovers in the case of intermediate products.

Of course there were many economists who argued that market failure did not make a case for intervention because government failure (picking winners) was even more likely. The debate continues. But the shift in domestic policy to nurture high-technology sectors and to lessen the speed of diffusion of technology across borders was and is an extremely important element in high-technology friction in both trade and investment.

In addition to these two factors—OECD convergence and changes in domestic policies—there were also changes in the patterns of both trade and investment that have heightened the international significance of technology issues. Increasingly, trade among developed economies has involved the exchange of specialized products within the same industry, i.e. intra- rather than inter-industry (see Table 2). Intra-industry trade develops mainly in technology- and capital-intensive sectors and in industries that supply highly sophisticated intermediate goods for these industries. This shows up in the shift of share away from low-technology goods in manufacturing trade among OECD and, increasingly, the dynamic Asian countries. The changing composition of trade among industrialized countries provides a backdrop for the escalation of international rivalry for marketshare to capture economies of scale in these oligopolistic industries. This rivalry is intensified as fixed costs, including up-front R&D, mount and time to market shortens.

But, again, this is not the entire story. These developments on the trading front cannot be understood without taking account of equally profound changes in international investment. As mentioned above, much of the trade in high-technology sectors flows within the firm. Although figures are unfortunately scarce, it is estimated that in 1989 nearly 40 percent of U.S. merchandise exports and more than 60 percent of imports were intrafirm transactions. However, these figures do not capture the full impact of multinational enterprises (MNEs) on the global economy. Worldwide sales of foreign affiliates in host countries in 1992 amounted to $5.8 trillion, nearly twice the value of world exports of goods and services, and considerably more than twice their value in 1984 (UNCTAD, 1995) (see Table 3). This remarkable enlargement of the activities of the MNEs reflects the surge in foreign direct investment in the second half of the 1980s (see Table 4).

It was the investment surge of the 1980s that spawned the term globalization. Growth of investment from 1985 to 1990 averaged nearly 30 percent per year, four times the rate of world output and three times the rate of trade. Most of it was in capital- and technology-intensive sectors. Technology flows (as captured

TABLE 2 Bilateral Intra-Industry Trade Indices,[a] Total Products,[b] G-7 Countries

Country and Year	Japan	Germany	France	U.K.	Italy	Canada
United States						
1970	32	44	52	52	34	63
1980	31	48	59	55	42	71
1990	48	64	69	63	56	71
Japan						
1970		54	62	45	50	9
1980		69	47	66	41	12
1990		77	31	62	44	9
Germany						
1970			72	77	55	16
1980			83	59	54	24
1990			88	76	66	31
France						
1970				66	63	19
1980				69	59	30
1990				81	71	39
United Kingdom						
1970					64	36
1980					75	39
1990					75	38
Italy						
1970						14
1980						22
1990						24

[a]Definition and measurement: intra-industry trade (IIT) is a measure of two-way trade within the same industrial or product classification. An example of intra-industry trade is when Japan exports laptop computers to the United States while the United States exports mainframe computers to Japan. For a particular product of industry *I*, ITT is defined as the value of total trade ($Xi + Mi$) remaining after subtraction of the absolute value of net exports or imports ($Xi + Mi$). To be able to compare between countries and industries, the measure is expressed as a percentage of each industry's combined exports and imports. A measure of inter-industry trade is then expressed as 100 [($Xi - Mi$) / ($Xi + Mi$)], and the intra-industry trade measure is given by 100 [$I - (Xi - Mi) / (Xi + Mi)$]. The index varies between 0 and 100. If a country exports and imports roughly equal quantities of a certain product, the IIT index is high. If it is mainly one-way trade *j* (whether exporting or importing), the IIT index is low. For aggregation purposes, the measure can be summed over many industries.

[b]Figures are calculated from SITC Rev. 2 three-digit product categories and are adjusted for overall trade imbalances.

Source: OECD (1992:209).

TABLE 3 Modalities of International Transactions, 1994-1993 (billions of dollars)

Year	Sales of Foreign Affliates	Sales Associated with Licensing and Un-affiliated Firms	Estimated Intrafirm Exports	Exports of Goods and Nonfactor Services	Exports of Goods and Nonfactor Services Excluding Estimates of Intra-Firm Exports
1984	2,500	30	770	2,310	1,540
1985	2,500	40	780	2,340	1.560
1986	2,900	50	860	2,580	1,720
1987	3,500	60	1,020	3,050	2,030
1988	4,200	80	1,090	3,270	2,180
1989	4,400	80	1,180	3,540	2,370
1990	5,500	110	1,370	4,110	2,750
1991	4,800	120	1,450	4,350	2,900
1992	5,800	120	1,570	4,720	3,150

Source: UNCTAD (1993).

from the very inadequate measure of royalties and fees) also exploded, increasing from an annual growth rate of 0.1–19 percent between the first and second half of the decade (UNCTAD, 1994). After a slowdown in the early 1990s (because of a recession in the OECD countries), investment flows have started to pick up again, especially in the East Asian dynamic economies.

Although part of the "bulge" of the 1980s was due to one-off factors (e.g., protectionist actions and wide exchange rate swings), the outflows also reflected underlying structural forces, in particular the revolution in information, computer, and communication technologies (ICCT), which is both an enabling factor and a driver, fostering innovation in products and processes and also in organization at the level of the firm and the industry. Thus, the traditional international rivalry among MNEs is greatly intensified by the ongoing technological revolution, as corporations seek to capture economies of scale and scope, customize products to satisfy consumer tastes, generate sophisticated high-quality inter- and intra-corporate networks, and strive to gain access to knowledge, both technological and "tacit," which is accessible only by continuing on-site learning.

For the globalizing MNE, preponderantly in high-technology sectors, market entry by means of trade *and* investment is essential: The two modes are complements rather than alternatives. And market presence is a two-way channel for both technology *diffusion* and technology *access*. Impediments to effective access are no longer confined to overt border barriers to trade or explicit restrictions

TABLE 4 Inward and Outward Average Annual Foreign Direct Investment for the G-7: 1981–1985 and 1986–1990 (millions of U.S. dollars per annum and shares of G-7 total)

	1981–1985				1986–1990			
	Inward		Outward		Inward		Outward	
Country	$	%	$	%	$	%	$	%
United States	19,062	74.8	10,927	27.7	51,879	58.9	22,757	16.8
Canada	–463	–1.8	3,608	9.1	3,887	4.4	5,421	4.0
Japan	683	2.7	9,430	23.9	2,407	2.7	45,431	33.5
France	1,998	7.8	2,732	6.9	6,451	7.3	11,985	8.8
Germany	808	3.2	3,818	9.7	2,739	3.1	14,424	10.6
United Kingdom	2,375	9.3	7,323	18.6	16,547	18.8	31,413	23.2
G-7 Total	25,484	100.0	39,469	100.0	88,055	100.0	135,545	100.0

Source: UN (1993).

that limit foreign investment. Rather, impediments to effective access can often arise from domestic regulatory policies or private sector actions that have an exclusionary effect by accident or design.

In summary, a number of fundamental changes in both the international environment and in the tilt of domestic "industrial" policies that emerged in the 1980s generated new types of international friction, much of it centered on technology-intensive sectors. In the following section these issues are presented by a matrix so as to illustrate the cross-cutting dimension of high-technology friction that effectively rules out proposals for an overall, or comprehensive, high-technology international policy. For the most part, the only feasible approach is to devise adaptations to existing rules that are discussed in the section on high-technology policymaking. There is one exception, however, to this adaptive incrementalism, which is the need for *new* rules for international cooperation in science and technology, which is discussed in the concluding remarks.

TECHNOLOGY ISSUES IN INTERNATIONAL POLICY

As the review in the preceding discussion suggests, high-technology frictions in international trade and investment arise basically from two main sources: the international spillover from domestic policies designed to enhance the technological capabilities of home-based firms (including policies designed to increase technology inflows and decrease outflows) and from policies targeted at opening foreign markets for their MNEs. On both of these fronts American policy making has played a lead role for reasons mentioned above.

But this categorization is too simplified to capture the full range of relevant

issues. Thus, for example, antidumping policy concerns private action related to price behavior, yet, as many studies have demonstrated, both dumping and antidumping can be used for purposes of corporate strategy, and this is most likely in high-technology sectors with significant dynamic economies of scale and high fixed costs including heavy up-front R&D expenditure (see Ostry, 1995). Similarly, firms may, under certain circumstances, seek to use private standards as a means of achieving market dominance and, again, when economies of scale are important, this dominance may not be eroded easily. "Strategic dumping" or the capture of private standard setting cannot be regarded as explicit government policy: Indeed it could be regarded as an absence of policy, especially, perhaps, competition policy. Yet the result may be to enhance the monopoly profits of home-based firms as well as home-based technological capabilities. In the case of private strategic R&D alliances, which are now proliferating, the main policy issue, both domestic and international, is market dominance.

The above is by way of a warning about the preliminary nature of the matrix that is presented. It is intended to serve primarily as a means of beginning a discussion on a number of complex and interrelated issues, especially relevant to the high-technology sectors, that have been neglected or overlooked both in the Uruguay Round and in the ongoing debate about the post-Uruguay agenda.

As the policy matrix below illustrates, some existing trade policy rules in the World Trade Organization (WTO) could be adapted to improve their effective-

TABLE 5 Technology Policy Matrix

	International Policy Domain		
High-Technology Policies	Trade	Investment	Competition
Enhancing Domestic Technology Capabilities			
Subsidies	x	x	
Government procurement	x		x
Product standards	x		x
Antidumping	x		x
Intellectual property	x		x
Technology flows			
inflow incentives		x	
outflow disincentives		x	
strategic technology alliances		x	x
Increasing Effective Access and Presence			
Structural impediments to trade	x		x
Structural impediments to investment		x	?

ness in high-technology sectors. Suggestions in this respect are presented below. But it is important to note that, in the case of some of these trade policy instruments (and strategic alliances in the investment box), effective adaptation would also involve competition policy. Because no international competition policy regime exists in the WTO, the only feasible option at present would be to promote bilateral or plurilateral cooperative arrangements. Similarly, in the case of investment, apart from the trade-related investment measures (TRIMs) agreement, no comprehensive set of rules is included in the WTO. But because the OECD negotiations are to be concluded in two years, initiating discussions both in the OECD and the WTO would be timely. Finally, the proposals with respect to structural impediments are intended to launch a discussion rather than propose rules because there is little agreement today even about the legitimacy of the concept, let alone its precise dimensions.

HIGH-TECHNOLOGY POLICYMAKING

Trade Policy

Subsidies

The Uruguay Round Agreement provides specified exemptions from countervailing duties for basic and applied industrial research. Continuing disputes are likely to arise from definitions of what is "basic" and what is "applied" and therefore what should or should not be "greenlighted." The Agreement provides a mechanism for securing exemption through a review by the Committee on Subsidies and Countervailing Measures after notification. However, a provision also permits a potentially enormous escape hatch by allowing countervailing without prenotification and removal if the subsidy was proved nonactionable ex post, leaving it to other countries to bring action so that subsidizers can buy valuable time (and reduce transparency).

Because even scientific and technology experts are unlikely to agree about definitions—for one thing, differences across industries are so great that rules for one may make no sense for others—the WTO committee looks set for a lot of fruitless haggling. This is a field in which the OECD can play a role. More specifically, for over 30 years the OECD Directorate for Science, Technology, and Industry has developed and refined extremely detailed definitions to collect information on the measurement of human and financial resources devoted to R&D. These definitions and this methodology should form the basis for the Committee on Subsidies and Countervailing Measures' reviews, data collection, and the WTO dispute settlement procedure. Indeed, it might be useful to consider an expert advisory group on innovation policy issues, should the need arise (as it is likely to do), in the fractious area of R&D subsidies in future years. Although this proposal may not solve all the difficult and complex definitional issues, it would

promote constructive, plurilateral debate and perhaps foster progress on eventual harmonization, while helping to constrain serious and destabilizing friction.

Another potentially fractious aspect of the subsidies code concerns the national security exemption. The impact of the end of the Cold War on the extent and nature of defense expenditure will be profound. But only one aspect need concern us here: the likely shift, in the United States in particular, to dual-use R&D programs.[3] (This will involve a shift away from basic to applied research, which echoes the shift in the R&D aspect of the new subsidies code as well, which is discussed below.)

Because the national security exemption in the subsidies code is not precisely specified, the shift to dual-use R&D programs opens up the specter of a replay—writ large!—of the Airbus dispute as well as tit-for-tat "strategic industry" plays by countries.

So what could be done to mitigate this potential but probable friction? It is an irony of history that the OECD, at its inception, was urged to cooperate with the North Atlantic Treaty Organization (NATO) on the relationship between the fields of security and economics. Perhaps the time has come to initiate this process! (see, e.g., Labohm, 1994). One possibility could be a joint OECD-NATO task force of experts in both military and commercial technology to explore the concept of dual use with a view to producing a taxonomy of more precisely specified and graduated exemptions in the WTO subsidies code.

Also, the issue of dual use arises in a somewhat different fashion in the investment field. The U.S. Defense Authorization Act of 1993 requires a report by the President to the Congress on the results of each investigation by the Committee on Foreign Investment in the U.S. which includes, among other factors, consideration of "the potential effect of the proposed pending transaction on U.S.'s international technological leadership in areas affecting U.S. national security" (Graham and Krugman, 1995).

Government Procurement

Government procurement for high-technology products should be tackled by a separate negotiation in the WTO on a conditional most-favored-nation basis. But as the experience of the disputes of the 1980s in this area illustrates, the codes of behavior that would govern the action of government agents for many high-technology products would not be adequate to avert international conflict if acceptable *norms of performance* are not established. For some of these products, an internationally funded performance center could be established to develop technical standards for performance evaluation. [The experience of the European Union's (EU's) program of prenormative research should provide valuable insight in this respect.] Such a performance approach would not only

[3]For a full analysis, see Ham and Mowery (1995).

reduce friction but would also significantly reduce the transaction costs of national testing and certification, as well as capture economies of scale in complex areas of assessment.

In addition to performance standards, another issue that has emerged from high-technology procurement disputes concerns "bid rigging" or collusive arrangements among domestic suppliers on pricing offers. More transparency in procurement specifications on both performance and price, as well as an agreement to bring bid-rigging (or other pricing behavior such as deep discounting) charges under the new WTO dispute settlement mechanism, which are discussed in more detail below, are also options worth exploring. The government procurement market for high-technology products is enormous. Great benefits, in the form of long and secure time horizons for sale of their products, accrue to firms that need to invest heavily in R&D. So the new code, a major accomplishment of the Uruguay Round, provides a good launching pad for further negotiations.

Product Standards

The Uruguay Round Agreement on Technical Barriers to Trade shows a marked improvement over the previous Tokyo Round code by covering all signatories, including a strong push for transparency, mutual recognition, and international standards, enjoining countries to participate in international bodies.

One issue in private standard setting of particular relevance in the high-technology sector, especially in the fast-changing ICCT, is the capture of private standards by one or a subset of firms. If a proprietary standard becomes a de facto industry standard, enormous market power accrues from network economies of scale and technological tie-ins or, in the case of components, systems economies of scale. This market dominance is not challenged easily because of the costs of conversion known as the "installed base" problem (Sykes, 1995).

There is general agreement that "standards capture" is a potential problem, especially in the rapidly changing ICCT area, but there is no agreement among experts on what, if anything, should be done—as the debate over the antitrust actions regarding Microsoft amply demonstrates. Nonetheless, there is a generic issue here that certainly deserves further study and debate, and the OECD is the logical forum to launch such an initiative. In this regard, it is essential to emphasize that this is not only a *domestic* antitrust issue, but quintessentially an *international* issue because networks and systems products are globalizing or are global.

Antidumping

Although, ideally, antidumping rules should be replaced by international competition policy rules on price discrimination and predatory pricing, that is unlikely to happen in the foreseeable future. In the meantime, there is one aspect of dumping that is especially relevant to capital- and technology-intensive sec-

tors. A new initiative could be launched in the WTO (perhaps in cooperation with the OECD on analytics) to tackle *strategic dumping*. Strategic dumping essentially involves subsidizing exports through higher home prices sustained by collusive price behavior and a protected home market. In industries with significant dynamic economies of scale, high fixed costs—for example by coordinated R&D expenditure—would serve to deter entry. Thus the essential dimensions of strategic dumping are the exporting country's trade policy and competition policy. The injury to the importing country's firms involves both restriction of exports and loss of dynamic efficiency gains ("learning by doing") that may be cumulative and dispersed over a wide range of products. The best way of dealing with strategic dumping would be to tackle the root causes of the problem: the exporting country's trade and competition policy.

To remove the barriers to access into the exporter's market, the first step would be to agree to a list of industry characteristics; for example, degree of concentration as measured by the exporting firms' share of home market, the exporting firms' share of world market (which would affect alternative third country producers), the extent and nature of barriers to entry of new firms or expansion of existing firms, the degree of import penetration, the prices in the exporting country's home market relative to prices elsewhere, etc. (the basic analysis could be done in the OECD). The purpose of selecting specific industries would be to focus the negotiations on eliminating protection for sectors where strategic behavior is feasible. Clearly, these are high-technology industries, for example, sectors with oligopolistic structures, high entry barriers, significant static and dynamic efficiencies, and dominance in global markets.

From this agreed-on industry list one could then assemble a group of products and for these compile a list of specific import barriers. This would then form the basis for a "zero-for-zero" negotiation (i.e., the removal of all border restraints on a reciprocal basis). The negotiations could begin with a small group of countries, including the United States, the EU and Japan, and then they could decide whether the agreement should be conditional or full most favored nation. If conditional, the agreement should be open to all countries willing to accede to the zero tariffs.

The removal of trade barriers will not, on its own, remove the threat of strategic dumping, which also requires action on competition policy in the exporting market. Because convergence, or agreeing to new international rules, will be a lengthy process, a strong case could be made that, in the absence of a supranational authority, bilateral agreements might be contemplated to ensure a fair hearing of disputes over enforcement where there is a charge of spillover on the trade front.

Intellectual Property Rights

The Uruguay Round achieved a major breakthrough in establishing trade rules for the protection of intellectual property rights (IPRs). The trade-related

intellectual property rights (TRIPs) agreement, however, provided little by way of harmonization. Now the main conflicts will arise among the developed countries where there is still a significant divergence between the United States on the one hand and the EU and Japan on the other. This divergence is especially clear, and especially contentious in patents, where the U.S. system favors creation of intellectual property over its diffusion and the others tilt in the opposite direction. The compromise negotiated in TRIPs did not resolve the matter.[4] Hence, bilateral or plurilateral negotiations to achieve harmonization in selected types of IPRs should be undertaken as a first step before moving to further multilateral negotiations in the WTO.

Although a push to harmonization is an important policy issue to mitigate further friction, in a sense it deals only with the status quo. Rapid and ongoing technological change in ICCT and biotechnology are raising a host of new issues that will require major adaptation of the existing IPR architecture. One obvious example concerns copyright protection on the Internet, or more broadly, copyright protection in a world of digital distribution. Although some countries are already grappling with the issue, it is, again, quintessentially a *global* issue and merits international discussion, to begin in the OECD. In the same vein, patents for satellites or genes can no longer be regarded as national policies. Thus, establishing an international forum for discussion is the only sensible way to go. Perhaps cooperative arrangements between the OECD, the World Intellectual Property Organization (WIPO), and the WTO could be explored. Although new rules will be difficult to achieve, exchange of information and analysis of issues would be a useful first step.

Technology Flows

Improving the balance of technology flows is, as noted above, a high priority for a growing number of countries. But just as in trade, every country cannot achieve a surplus. Efforts to induce inflows and reduce outflows are bound to lead to disputes and also will reduce global welfare.

Two policy initiatives can be launched to mitigate this friction. On the inflow side, a key issue concerns the proliferation of investment incentives, often designed to attract "good" investment involving significant technology transfer.

A recent report from the Commission on International Investment and Transnational Corporations (UNCTAD) documents the increase in both the number and range of incentives for MNEs since the mid-1980s in both developing and OECD countries. The report noted that "an increasing number of countries target

[4]The U.S. patent system is based on first-to-invent rather than first-to-file in other OECD countries. The TRIPs agreement involved superimposing on the U.S. system an extension of patent rights to 20 years from filing data (an extension of 2 years for many existing patentholders). There is no discrimination against foreign applicants, but the evidentiary costs of inventorship outside the United States will likely be extremely high.

investment activity in industries involving technology and high value added products (such as electronics, robotics, computer software)" (UNCTAD, 1995:8).

Because the TRIMs agreement in the Uruguay Round did not cover investment incentives, there is an opportunity for the OECD to tackle the issue in the Multinational Accord on Investment (MAI). In particular, it would be useful to establish a database that covers not only the quantitative aspects but also the nature of the "target objective" so as to have a better grasp of the R&D element. In addition, in the WTO it would be useful to launch discussions to expand the TRIMs to cover mandatory technology transfers, which was dropped from the Uruguay Round negotiations.

On the technology outflow side, an increasingly contentious issue concerns participation by foreign subsidiaries in research consortia jointly funded by government and the private sector. In an effort to limit or slow diffusion (and hence capture the benefits for the domestic economy), foreign subsidiaries are treated differently from domestic firms in a number of countries: hence the new term "conditional national treatment." Also, specific reciprocity rather than nondiscrimination may be required as one of the conditions, particularly in the United States.[5]

To begin discussions on the consortia issue it is essential to secure a better information base. For example, in the EU there are no formal guidelines for participation in projects governed by the Commission Framework Program, and membership is negotiated on a case-by-case basis or through bilateral treaties. But "unofficial" conditions are usually standard and include a number of performance requirements. In the United States the situation is even murkier, with different rather general criteria in different pieces of legislation, mostly focused on aspects of reciprocity. An OECD project to document the *rules* for foreign participation in consortia should be followed by collecting information on actual foreign participation so we know the *numbers* as well.

But the information base, however useful in defusing the strident charges and countercharges now so prevalent, is clearly not sufficient. The need to reach agreement on common rules would have to confront at least three issues:

- criteria for participation in consortia,
- treatment of foreign subsidiaries, and
- IPRs.

The domestic criteria are important for governmental evaluation of the program. Common criteria, if agreed on, would facilitate adoption of national treatment, an essential element in a new MAI. Finally, there should be clear agreed-on rules on the treatment of IPRs governing the consortia arrangement.

Strategic technology alliances (STAs), a new form of investment, as they are sometimes termed, have exploded in the 1980s and 1990s from near zero in the 1970s, especially in the three most significant current technologies: information,

[5]For a useful review of the American position, see Beltz (1995).

biotechnology, and new materials (see Figure 1). These alliances take place in a wide variety of organizational modes: equity arrangements such as joint ventures, research corporations and minority investments, contractual joint development agreements, R&D contracts, etc. The basic reason for these alliances is an exchange of complementary assets. The costs of R&D and the widening range of technologies that feed innovation today mean that few firms want to undertake the risk of development alone and thus seek partners to reduce cost and spread risk. Often these partners are competitors in final markets, and so the alliance is risky as well—one reason for a high failure rate reported in a number of case studies. Nonetheless, the trend to strategic alliances shows no sign of abatement and is indeed accelerating.

Two issues arise with respect to STAs. Despite the data exhibited, for example, in Figure 1, there are no comprehensive statistics on this new form of investment. Yet if an MAI excludes STAs (and, indeed, other kinds of alliances that are also proliferating), it will exclude a key feature of the new techno-globalism. Although it will be difficult to elicit information on alliances (indeed, if the term "strategic" is accurate, many corporations may not be prepared to reveal much; the data currently available are based on published information), the issue of how statistics bureaus of member OECD countries might tackle the data problem could be launched in the OECD, which has long experience in this field.

Second, since STAs are not formal mergers, their treatment under current competition policy is not clear. Yet in both domestic and international terms the issue of contestability should be explored. Is it relevant only to traditional forms of investment or also to new forms, especially those involving key technologies?

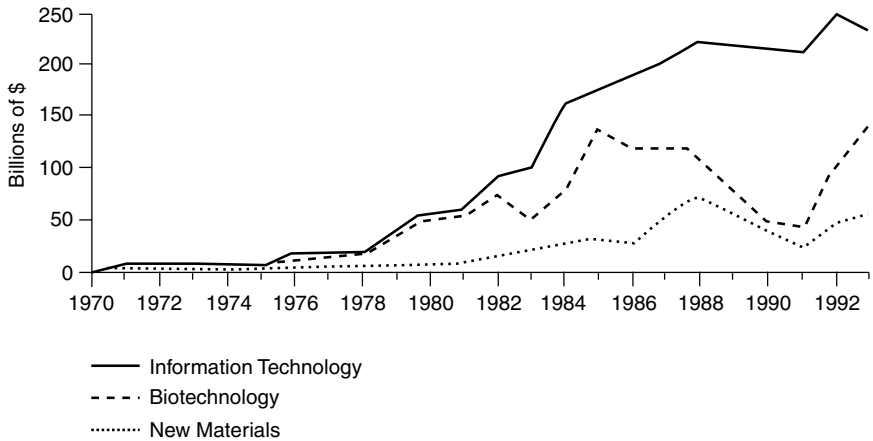

FIGURE 1 Growth of newly established strategic technology alliances in information technologies, biotechnology, and new materials, 1970–1993. Source: MERIT-CATI (1994).

Increasing Effective Access and Presence

As border barriers have been reduced, the focus of trade policy has shifted to so-called structural impediments inside the border. This shift was already evident in the Tokyo Round (subsidies, government procurement, technical barriers, etc.) but much more so in the Uruguay Round, where services exemplified this trend in dealing with government regulation designed primarily to achieve specific domestic objectives. In the domains of investment and technology, most impediments are inside the border, arising from government or private actions or from embedded structural characteristics such as the nature of financial markets and corporate governance or the role of universities in the innovation system. Moreover, differences in embedded structural or institutional characteristics of different countries—system differences—can result in marked asymmetries of access by trade or presence by investment (with effects on technology flows) so that the basic General Agreement on Tariffs and Trade (GATT) principle of broad or overall reciprocity cannot easily be attained. This has generated considerable international friction in bilateral disputes, and for this reason, if for no other, it is essential to deal with the notion of structural impediments in multilateral or plurilateral forums. Although these impediments are not specifically a technology issue, some of the most high-profile disputes have been in capital- and technology-intensive sectors such as autos.

So what can be done? The first proposal is to try to limit the definition of structural impediments because there is a real danger that it could, especially if unilaterally determined, include "everything" and strike at the heart of the notion of comparative advantage. Thus, the WTO, perhaps in cooperation with the OECD, should establish a working group to prepare a comprehensive listing of government regulatory practices wherein member countries could consider structural impediments to effective market access. The practice of country notification of trade barriers was well established under the GATT and in the OECD trade committee, so there is precedence for the concept of notification that should now be updated to recognize the move of international negotiations inside the border. However, simply listing barriers would not provide a definition of government-related structural impediments. Rather, the purpose of the exercise would be to initiate discussions on an agreed-on definition of these impediments for multilateral negotiations.

Thus, parallel with these efforts, a research project should be undertaken to develop an impediments index in the form of price differentials between domestic prices of traded goods in member countries to assess the openness to market competition or "market contestability." The overall objective of market contestability is an elusive concept, and reaching agreement on definition and measurement will take considerable time and effort (as did, for example, the production of an index of agriculture protection, the Producer Subsidy Equivalent, which helped launch the Uruguay Round negotiations). So although these would not be easy

tasks, the alternative approach—unilateral definitions or quantitative targets—represents a threat to the system perhaps serious enough to energize WTO member countries.

In addition to government policies and practices, business practices can also impede effective access or presence to some markets. Thus, for example, vertical upstream or downstream long-term agreements may have the unintended effect of impeding imports, whereas bank-centered corporate governance arrangements may, again unintentionally, impede foreign direct investment by means of mergers acquisitions. Although some have argued that these impediments stem from inadequate enforcement of competition policy, that view is not supported by many antitrust experts. In any case, while discussions on harmonizing competition policy have been under way for some years in the OECD and elsewhere, progress has been limited and international agreement will be a long and difficult process even among the OECD countries, let alone the much larger number of WTO members. Furthermore, because neither vertical nor horizontal agreements (except those involving price collusion) are per se offenses in any current competition policy regime, negotiating new international rules for removing private sector structural impediments would require reconciling conflicts between competition policy and trade policy objectives.

The new WTO dispute settlement agreement provides an opportunity to begin a discussion of this issue and also to promote more consultation and discussion between competition policy and trade policy authorities in national capitals. The mechanism would be to bring a complaint about structural impediments (in this instance involving private sector practices) under the so-called "non-violation nullification and impairment" provisions of the new Dispute Settlement Understanding (DSU). The GATT language on disputes always contained the phrase "nullification and impairment" in a little-used and rather vague section [Article 23:1(b)]. The term implied that a member country had an imbalance with another country in overall benefits, not through violation of a specific GATT rule but through "the application by another contracting party of any measure whether or not it conflicts with the provisions of the Agreement." The EU issued a complaint against Japan in 1983 under this broad and vague rubric which, in effect, charged that structural impediments blocked effective market access, but subsequently withdrew the request for a panel. Under the new DSU an additional provision has been added to the so-called nonviolation cases that allows the panel to provide a remedy in cases in which a perfectly legal action nonetheless impairs the "reasonable expectations" of the overall balance of benefits of a member country.

The inclusion of nonviolation cases in the strict new procedures was to replicate the Section 301 concept of "unreasonable" measures that were nonetheless legal under the GATT. To constrain U.S. unilateralism, the Uruguay negotiations brought Section 301 into the WTO, thus providing an opportunity for panel consideration of a "test case." A panel ruling cannot mandate removal of the dis-

puted measures but can make a recommendation for ways and means of reaching "a mutually satisfactory adjustment." Under the new WTO provisions it is possible to seek expert advice from "any relevant source" or "request an advisory report—from an expert review group." Thus the views of experts in competition policy and industrial organization could be integrated into the process to begin the multilateralization of the definition of structural impediments. In this regard, the 1995 auto dispute between the United States and Japan was a lost opportunity to launch that process. A case concerning exclusive dealerships, for example, could have served two purposes: to establish a foothold in the WTO for consideration of international rules for competition policy and, equally important, to launch a review of such vertical arrangements in national capitals since they exist in a number of OECD countries. It would be useful to launch such a review of domestic policies and their impact on import access in the OECD.

On the investment front, although an MAI should seek to cover as full a range as possible of government impediments to effective presence, the main impediment stemming from private action relates to corporate governance, and it is not possible to devise acceptable rules to deal with it. Most experts agree that it is not an issue for competition policy. Issues of greater transparency certainly arise. But, basically, bank-centered governance arrangements (as in Japan and to some degree Germany) are more resistant to mergers and acquisitions than equity-oriented arrangements (as in the Anglo-Saxon countries). There are advantages and disadvantages in each model, but both can be defended as rational attempts to resolve the universal problem of coordination and control. Because the equity markets are in effect markets for corporate control and thus much more transparent and much more accessible by means of mergers and acquisitions, one result is asymmetry. An "ideal" model would include elements of both types and indeed policy proposals to promote convergence have been suggested by both American and Japanese experts, the latter more insistently because of the serious financial crises now evident in Japan Ostry and Nelson, 1994). Furthermore, the Japanese are well aware of the need to encourage more foreign investment and have undertaken a number of policy initiatives by way of greenfield financial and other incentives.

Finally, the marked structural differences in innovation systems are also a continuing source of friction. Thus, for example, where most research is carried out in private firms, access is more difficult than situations in which universities play a prominent role, acquisitions of high-technology firms are more feasible, and so on.[6] These structural differences will erode over time as a result of deeper integration in the global economy. But they are a given element of diversity among countries and will not be significantly altered by welfare-reducing techno-nationalist policies. Greater international cooperation in science and technology would be a far better route to follow.

[6]For a full exposition, see Nelson (1993).

RULES FOR INTERNATIONAL COOPERATION IN SCIENCE AND TECHNOLOGY

As noted above, markets produce less R&D than is socially desirable because private firms cannot fully capture the benefits flowing from their expenditure. Furthermore, countries cannot fully capture the benefits from government expenditure on R&D because knowledge flows across borders and other countries can, as it were, enjoy a "free ride." A nonconflictual solution to the free rider problem would be to promote international cooperation in both basic science and precompetitive generic technology. This would increase global welfare and permit private firms in all countries to compete in using the results of the research to improve their own products and processes. In other words, promoting technoglobalism is better than pursuing technonationalism.

The free rider problem is the fundamental rationale for promoting international cooperation in science and technology (S&T). But there are also other compelling reasons. First, international cooperation may be a route for offsetting asymmetry of access. In this regard it is noteworthy that Japan has been the initiator of two international projects, one in basic science (the human frontiers science program) and the other in precompetitive research, the intelligent manufacturing system (IMS). Both encountered serious difficulties in the early stages, which points to the need to establish clear, mutually agreed-on rules for international cooperation in S&T, which is discussed further below. But the asymmetry issue might have to be tackled more directly, through some arrangement on "burden sharing," in both monetary and other terms.

The second point relates to basic science. Although there is no clear evidence, because of the lack of adequate information, the internationalization of technology and heightened competition in high-technology industries together seem to be eroding the support of basic and long-run research programs, both private and public. Although firms in high-technology industries are, in many cases, being forced to invest even more than they used to in product and process development so as to stay ahead of or up with the pack, companies that used to support significant basic research seem to be withdrawing from that. And governments seem to be shifting the portfolios of research they support toward the areas and types of projects that promise short-run and specific results and away from fundamental research.

Although current discussions on government research expenditure in the United States seem to run counter to this trend, it is by no means clear that basic research will be saved from a fiscal pruning of all R&D and, as pointed out, the impact on defense R&D could well involve a shift to the more commercial end of the S&T spectrum. In the American private sector, the trend looks clear. As the title of a recent article on the subject succinctly states "Blue-Sky Research Comes Down to Earth" *Business Week*, 1995).

The OECD should, as soon as possible, produce a study on trends in the

composition (i.e., basic and other) of R&D expenditures at the private and government levels. There are, admittedly, difficulties in definitions over time and across countries, so it might be useful if at least some member governments agreed to cooperate in special surveys or studies to supplement the OECD analysis. It is worth emphasizing that this issue is very important because a decline in basic research has serious global implications. The impact will not be immediate, but over the longer run a decline in the generation of the new knowledge, which is essential to cope with pervasive global problems (environment, health, security, and so on) as well as essential to technological progress, will have profound and pervasive consequences.

Thus the case for more international cooperation is strong. What is needed are mutually agreed-on, transparent rules to establish a new architecture of international research consortia. As a very important step in this direction, OECD principles for technology cooperation, based on the IMS experience, are now under consideration. These broad principles relate to both government and private sector roles and establish the specifics to be included in private sector agreements (such as, for example, IPRs, consortia structure, standards, etc.). Because the main players in technology consortia are private (although universities and government research institutions will often be involved), the rules are designed on a case-by-case basis through private agreements.

This technology model would have to be adapted for basic research consortia for several reasons. Although such consortia will also involve a government-university-private-sector mix, the role of governments and universities will be far greater. Thus the principles relating to government's role would have to be more detailed. Furthermore, the rules or principles for collaboration might well vary by scientific discipline, so that advisory boards of scientists would have to be part of the structure of cooperation. Certainly scientists would also have to be involved in establishing priorities for consortia. Finally, the principle of "burden sharing" should be spelled out since government expenditure is involved. But expenditure is only one aspect of the contribution; the other is scientific input. How this complex issue is to be tackled will affect the sustainability of cooperation; it is necessary to avoid the free rider problem or friction will be serious. Thus it would be useful, before attempting to draft any principles, if the OECD were to establish a working group of both government officials and academic scientists to discuss these (and no doubt many other) issues. Perhaps the OECD Megascience Forum could be considered in this regard.

CONCLUSION

This paper has illustrated the broad range of technology issues that cut across the domains of trade, investment, competition, innovation, and science policies. An overall, international technology policy is not feasible, unlike, say a trade or investment policy, because the essence of technology is its pervasive impact on

all social and economic behavior—thus the reason for the approach of adaptive incrementalism both to mitigate friction and to stimulate momentum to greater liberalization and enhanced contestability of national and international markets. The one exception, however, which proves the rule, is the need for far greater cooperation in science and technology itself to enhance global welfare.

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Dumping: Still a Problem in International Trade

Thomas R. Howell
Dewey Ballantine

SUMMARY

Dumping is the export of products at less than "normal value," often defined as the price at which those products are sold in the home market. Since its inception, the General Agreement on Tariffs and Trade (GATT) has authorized signatories to apply duties to offset dumping when it causes, or threatens to cause, material injury to an industry in the territory of a GATT member.[1] National antidumping legislation dates from well before the GATT. For example, the United States passed its first antidumping statutes in 1921.

Despite their longevity, antidumping measures are frequently subject to sharp criticism, especially from academic economists. Indeed, some observers advocate their complete elimination, raising the question whether dumping itself is a problem sufficiently serious to warrant retention of the antidumping regime provided for under the GATT. This paper notes that antidumping measures, like any complex regulatory regime, may give rise to anomalous or undesirable results in some cases, but argues that dumping itself remains a "problem in international trade," as described by Jacob Viner in his seminal 1923 study of the subject. As such, dumping requires continued regulation, especially for countries with relatively open national markets.

[1]As noted in the Recommendations and Findings of this project, dumping and antidumping are subjects that elicit strongly divergent views. As a result, no consensus could be reached on dumping and antidumping issues. See Recommendation 21 in the summary report of the study, *Conflict and Cooperation in National Competition for High-Technology Industry.* This paper outlines why some practitioners believe antidumping measures should be retained as an integral part of national trade policy. For a contrary view, see Section V, pp. 223–233, of *Conflict and Cooperation.* For a summary discussion of the issue, see Box G. *Ibid,* pp. 82–84.

The existence of price discrimination between domestic and export markets generally indicates the presence of a market distortion in the home market, such as import barriers, a monopoly or cartel, or some combination of these factors that gives domestic producers the ability to maintain domestic prices at a level higher than export prices. Under such circumstances, dumping is a mechanism through which competitive outcomes are determined, in effect by the distortion itself, not the relative competitiveness of individual producers. In the short run, dumping enables protected firms to run their facilities at higher utilization rates than would be economically feasible in an open market, giving them a major cost advantage unrelated to their comparative cost competitiveness. Over the long run, dumping can deter investment in the market where it is occurring and, conversely, may well foster increased investment in the protected market. Over time, through such dynamics, dumping may permit an initially less efficient (but protected and cartelized) industry to displace an equally or efficient competitor, that is, not benefiting from a protected home market.

Because dumping can result in the erosion or destruction of national industries for reasons unrelated to normal market competition, simply permitting dumping to occur without any regulation could endanger the political consensus which supports the current liberal multilateral trading system. Friction arising out of dumping can become particularly acute when dumping injures or destroys industries regarded as vital to national economic well-being and national security, a phenomenon which has been observable at a number of points in this century.

Fundamentally, the controversy surrounding antidumping is a symptom of a larger phenomenon, the divergence which exists between various national markets with respect to competition policy and which has frustrated all attempts at consensus for at least half a century. Antidumping measures have been assigned, more or less by default, the task of addressing specific problems created by this divergence. They are admittedly an imperfect tool. But until broader national differences with respect to competition policy are reconciled, these measures remain essential to the world trading system, acting, in the words of John Jackson, as an "interface mechanism. . . necessary to allow different trade systems to trade harmoniously."

* * *

Today's open multilateral trading system stands as one of the greatest achievements of the generation of statesmen that laid the foundations of the postwar world order. The legal underpinning of this system is provided by the General Agreement on Tariffs and Trade (GATT) and its ancillary agreements and codes, currently administered by the newly formed World Trade Organization. The GATT has made possible the progressive liberalization of world trade through the basic mechanism of binding commitments by signatories to reduce trade barriers on a most-favored-nation basis. The GATT has survived, however, in significant part, because its framers were wise enough to recognize that the system would not be sustainable in the absence of certain exceptions to the general com-

mitments undertaken by the signatories. These exceptions, which include "escape clause" provisions, special rules for developing countries, and antidumping and countervailing duty measures, have functioned as interface mechanisms to soften the dislocations that have occurred as the reduction in border restrictions has brought differing national economic systems into progressively closer competitive contact. Without the existence of these mechanisms, given

> the politically sensitive subject of international trade . . . the General Agreement might never have been concluded or might never have endured in the face of the pressures that have buffeted it.[2]

One of the most significant exceptions to the basic GATT principle for most favored nation treatment authorizes contracting parties to apply duties "in order to offset or prevent dumping." GATT Article VI provides that

> **dumping**, by which products of one country are introduced into the commerce of another country at less than the normal value of the products, is to be condemned if it causes or threatens material injury to an established industry in the territory of a contracting party or materially retards the establishment of a domestic industry.[3]

The right to apply antidumping measures was an important element in the original consensus that made the formation of the GATT possible, and the contracting parties to the GATT subsequently elaborated a complex system of rules and procedures pursuant to which members may apply antidumping duties in appropriate cases.[4] Within these parameters, most major trading nations have enacted antidumping rules. It is often overlooked that the most active users of antidumping measures have been GATT members with the more open markets—countries such as Australia, Canada, the European Union, and the United States. As a number of newly industrializing nations liberalize their trade regimes, they are becoming more active in applying antidumping measures.

Antidumping policy is now the subject of scathing attacks from many quarters, including prominent figures in law, business, and academia.[5] *Forbes* characterizes the antidumping laws as tools that U.S. firms use to push foreign firms into "a quick descent into legal hell" as they "lustfully anticipat[e] a price hike" for domestic consumers.[6] Claude Barfield of the American Enterprise Institute calls antidumping measures "the chemical weapons of the trade wars," a "system

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[2]John H. Jackson, *World Trade and the Law of GATT* (Charlottesville, Va.: Michie Company, 1969), p. 536.

[3]GATT Article VI(1).

[4]"There was general consent among the majority of countries in the discussion on Antidumping and Countervailing Duties, that circumstances might arise in which such duties might properly be applied" (U.N. Doc. EPCT/C.II/SY at II [1946], cited in Jackson [1969], *op. cit.*, at 404n).

[5]See, for example, the essays in Richard Boltuck and Robert E. Litan (eds.) *Down in the Dumps: Administration of the Unfair Trade Laws* (Washington, D.C.: The Brookings Institution, 1991).

[6]David Frum, "Dump It," *Forbes* (September 28, 1992).

of price-fixing cartelization . . . that stacks the deck in favor of local producers against their foreign competitors."[7] In a 1993 *Wall Street Journal* commentary, James Bovard branded the U.S. antidumping laws as a "fraud," castigating the laws for their "hypocrisy and absurdity," which enable "a few greedy producers" to invoke remedies that cause the U.S. government "to inflict unlimited amounts of unfairness in the name of fair trade."[8] Although academic critics are usually less colorful in their choice of words, the sheer number of eminent economists who have attacked antidumping is impressive. One might ask why laws so odious have not been quickly repealed. This has not occurred in the United States at least, according to some critics, because of "lobbying" by "protected U.S. producers,"[9] because of "bureaucrats" at the Department of Commerce seeking "to flaunt the fact that there are few restraints on [their] power over foreign companies,"[10] and, perhaps inevitably, because of the baneful influence of "lawyers."[11]

Curiously, there has been little response to the rising chorus of criticism of antidumping policy. Apart from a few obscure monographs and articles, little has been published defending the rationale for antidumping policy since Professor Jacob Viner, one of the draftsmen of the original U.S. antidumping laws, produced what remains the seminal work on the subject in 1923.[12]

The purpose of antidumping measures is to offset economic injury caused by the commercial practice of dumping. Although antidumping measures can be, and sometimes are, applied in an arbitrary, irrational, or unnecessarily burdensome manner, the same can be said of any major regulatory program or system of legal redress, and such problems do not, by themselves, constitute a basis for

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[7]Claude Barfield, "Dumping Know-Nothingism," *Journal of Commerce* (March 18, 1993).

[8]James Bovard, "Commerce's Latest Fair Trade Fraud," *Wall Street Journal* (January 28, 1993).

[9]Hans Mueller "Backdoor Protection for Steel," *Journal of Commerce* (February 5, 1993).

[10]James Bovard, *The Fair Trade Fraud: How Congress Pillages the Consumer and Decimates American Competitiveness* (New York: St. Martin's Press, 1991), p. 48.

[11]According to one recent monograph, the antidumping law "benefits a powerful lobby in Washington, D.C.—the international trade bar. Eliminating antidumping law would dramatically reduce the business of international trade lawyers" (Raj Bhala, "Rethinking Antidumping Law," *George Washington Journal of International Law & Economics* 29(1), 1995, p. 20). By far the majority of practitioners of antidumping law in Washington represent foreign firms seeking to avoid the imposition of antidumping duties. Many of them have been vocal in criticizing the antidumping law, and if the "international trade bar" were polled on the subject, it is likely that a majority would support repeal of the law. Prominent international trade lawyers who have sharply criticized antidumping include N. David Palmeter and Gary O. Horlick.

[12]Viner was the author of *Dumping: A Problem in International Trade* (Chicago: University of Chicago Press, 1923) and helped draft the Antidumping Act of 1921. Noteworthy exceptions to the general lack of academic work supporting antidumping include Jorge Miranda, "Should Antidumping Laws Be Dumped?," a monograph presented at a conference on "Antidumping and Competition Policy: Complementary or Supplementary," Center for Applied Studies in International Negotiations, Geneva (July 11–12, 1996) and Clarisse Morgan, "Competition Policy and Antidumping: Is It Time for a Reality Check?" *Journal of World Trade* 30(5) (1996).

scrapping an entire system. The real issue is whether *dumping* itself is a practice that warrants continuing restriction by national governments. The common strand that unites most critiques of antidumping is the extent to which they avoid that question, tending to minimize or dismiss altogether the phenomenon of dumping itself as not warranting serious examination. In the thousands of pages that have been written attacking antidumping, it is a challenge to find any detailed case study of an actual episode of dumping or an examination of its problematic aspects and implications. Were such inquiries more common, it would be evident that dumping remains "a problem in international trade" that warrants the continued existence of workable regulatory constraints on the practice.

The term "dumping" has enjoyed a casual business use for at least two centuries and is still loosely applied in a lay context to a variety of export practices involving low pricing. Jacob Viner's groundbreaking 1923 work proposed a precise definition, "price discrimination between national markets," that has gained general acceptance as the definition of "classic" dumping and is now embodied in the GATT and national antidumping legislation. Under classic dumping, a seller charges higher prices in the home market than in export markets, or, much less commonly, charges higher prices in one export market than in another. The dumper is able to maintain a price differential because some factor or combination of factors separates the two markets—generally either the sheer distance between the markets or a protective barrier around the market where the higher price is charged, coupled with restraints on competition in the latter market.[13] The first antidumping statutes, which were enacted between the end of the nineteenth century and the early 1920s, were directed against classic dumping only, but during the postwar era, their scope has been expanded, in effect, to embrace some types of export sales that are made below the cost of production, notwithstanding the absence of price discrimination between national markets.

THE EFFECTS OF DUMPING

Dumping leads to the erosion and in some cases the disappearance of industries in markets where dumping is occurring for reasons unrelated to the relative competitiveness of those industries—put most simply, dumping enables less efficient firms to prevail over more efficient firms in international competition. Competitive outcomes are determined by market distortions, that is, the factors that make dumping possible, rather than the relative competitiveness of individual producers. This occurs for two reasons:

[13]Viner recognized that in his time businessmen also tended to use term "dumping" to apply to the practice of export sales below the cost of production, which, although "closely related" to dumping in its nature and "in its economic objectives or consequences," was not strictly speaking, classic dumping.

- **Capacity utilization.** Over the short run, other things being equal, dumping firms tend to enjoy lower unit costs than comparable firms in markets where dumping is occurring because dumpers can operate their plants at higher rates of capacity utilization—a factor that often has a far greater impact on cost than any other consideration. Firms in the market where dumping is occurring cannot respond in kind if the market of the dumper is closed to them. In this way, a relatively inefficient plant run at 100 percent utilization rates may well enjoy lower unit costs than a state-of-the-art facility run at a 50 percent rate.
- **Investment deterrent.** Over the longer term, dumping discourages investment in markets where dumping is occurring, and, at the same time, encourages higher levels of investment in the protected markets from which dumping is taking place. This occurs because investment risks are higher, and returns lower, in markets where dumping is taking place, and risks are lower, and returns higher, in the protected market from which dumping is taking place. The short-run cost advantage that dumping firms enjoy is thus eventually translated into a capital and technological advantage as investment dries up in the one market and intensifies in the other.

The fact that unconstrained dumping can gradually lead to a shift in competitive advantage has implications that extend beyond the firms directly affected. A given nation's economic well-being, standard of living, and security are all determined in significant part by the composition of its industrial base. The ultimate implication of the competitive dynamics of dumping is that the industrial base can be altered in deleterious ways as a result of market distortions abroad, such as protected markets and cartels, that make dumping feasible. Because such distortions can be deliberately created and manipulated, whether by governments or by private syndicates enjoying the toleration or tacit encouragement of state authorities, the decision to permit unrestricted dumping is a decision to allow a national economy to be shaped by anticompetitive strategies and market distortions that are engineered in other countries. Although experience has shown that GATT signatories will accept, as part of the price of an open trading system, the need for adjustment by domestic industries that have lost international competitiveness, it is quite another matter to expect signatories to accept the burdens of adjustment that arise out of anticompetitive practices in other countries. It is unlikely that many nations would accept such a result for any sustained period. It is equally unlikely that a political consensus could be sustained for any multilateral regime that attempted to enforce it through proscriptions on national antidumping measures.

DUMPING UNRESTRICTED: THE BRITISH CASE

Would the world trading system as a whole, and its members individually, be better off if all antidumping measures were eliminated and dumping allowed to

occur without interference? A distinguished contemporary critic of antidumping policy, J. Michael Finger of The World Bank, argues that

> The most appealing option is to get rid of antidumping laws and to put nothing in their place. Then all of the evils of such policy—its power politics, its bad economics, and its corrupted law–would be eliminated.[14]

Is Finger's proposal a sound one? Fortunately, this question is not altogether speculative, since trade between industrialized nations did occur for at least half a century before the widespread adoption of antidumping measures in the 1920s. Dumping was pervasive and its dynamics and effects widely reported and discussed. While many countries (including the United States) were relatively unaffected by dumping because high tariff walls severely limited import competition, Britain offers an example of a major, fully industrialized country that elected to avoid any policy action against dumping and to remain, in effect, an open "dumping ground" for a protracted period. Britain's rationale for adhering to free trade in the face of widespread dumping in her domestic and overseas markets was based on many of the lines of reasoning that are used today by those who urge the complete elimination of antidumping measures. Britain's disheartening industrial and commercial performance during this period, which saw the precipitous competitive decline of the industries most severely affected by dumping and a disastrous (and very near fatal) erosion of the country's strategic industrial base, is now an established historical fact. Although the "British disease" was the product of an extraordinarily complex tangle of economic and social problems of which dumping comprised only one strand, the historical record yields enough evidence of the harmful effect of unrestricted dumping on British industry to cast serious doubt on the wisdom of the policy that was followed.

In 1870 Britain accounted for more of the world's manufacturing output than any other nation, its industries boasted the lowest costs and the most advanced production technologies, and its banks and shipping firms dominated world commerce. Britain's prosperity and commercial dominance appeared to validate the philosophy of the Free Trade movement that, after a series of intense political battles, had in the 1840s succeeded in clearing away most of Britain's import restrictions.[15] In retrospect, however, it is evident that Britain's success prior to 1870 was attributable, in substantial part, simply to the fact that the country had industrialized before any other nation. Beginning in the 1870s, and growing in intensity thereafter, the rapidly growing manufacturing industries of Germany and the United States mounted a commercial assault on traditional British mar-

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[14]J. Michael Finger, "Reform" in J. Michael Finger, ed., *Antidumping: How It Works and Who Gets Hurt* (Ann Arbor: University of Michigan Press, 1993), p. 57.

[15]See generally W. Cunningham, *The Rise and Decline of the Free Trade Movement* (Cambridge, England: Cambridge University Press, 1912).

kets. In contrast to Britain, both the United States and Germany were avowedly protectionist; by 1880 both national markets were surrounded by high tariff walls. In addition, in both of these countries, highly organized and sophisticated anti-competitive industrial combinations were formed for the purpose of reducing competition and exploiting their partial or complete monopoly power. In the United States, so-called "trusts" regulated output and prices in many major manufacturing industries, and in Germany, manufacturing was dominated by *kartells* (cartels) in which price and output restrictions were maintained through legally enforceable contractual commitments.[16] It was the standard practice of both the American trusts and the German kartells to engage in large-scale dumping as a deliberate export strategy.[17]

British industries did not exist in a competitive milieu that permitted them to respond in kind to this challenge. They could do nothing to reopen the American or German markets that had been lost to them, and they lacked both the protected home market and the organized character needed to engage in dumping on an American or German scale.[18] American and German firms not only captured sales from British firms, but began surpassing British industry in the level of industrial technology, productivity, and economies of scale. British producers confronted a strategic dilemma for which the Free Trade doctrine offered no obvious answers. Britain's Tariff Commission summarized this quandary in 1904 as follows:

> [I]t is the control of the home market which their tariffs give to foreign countries, combined with the facilities for exportation which they secure through their trusts and kartells, and the free access to the British market, which is the condition of their rapid progress relative to the United Kingdom. These tariffs were, in many instances, deliberately adopted to shut out British products which came into competition with home manufacturers. Their adoption has been followed by (i.) the extinction or diminution of British competition in the foreign protected markets; (ii.) the closing of British works or of departments of British works which depended on these markets; (iii.) the rapid growth of the foreign

[16]See generally J.H. Clapham, *The Economic Development of France and Germany, 1815–1914.* (Cambridge, England: University Press, 1928); Robert Brady, *The Rationalization Movement in German Industry*. (New York: Howard Fertig, 1974); Hans B. Thorelli, *The Federal Antitrust Policy: Origination of an American Tradition* (Baltimore, Md.: The Johns University Hopkins Press, 1955).

[17]Witness No. 11, *Report of the Tariff Commission*, Vol. I (London: P.S. King & Son, 1904), pars. 795, 806.

[18]Episodes of dumping by British manufacturers were reported throughout the nineteenth century, but they were precisely that—episodic, and generally poorly documented as well. Jacob Viner catalogs an anecdotal history of alleged dumping by English manufacturers in the late eighteenth and early nineteenth centuries. He concludes that most of the allegations were poorly supported, if not altogether unfounded, and that there was no evidence of predatory dumping by British manufacturers. There was "less reason to doubt that there were occasional instances of the practice of dumping in less objectionable form, especially as such branches of English industry as were in the control of relatively few individuals or combinations of producers" (Viner, [1923], *op. cit.*, pp. 35–50).

> competing industry; (iv.) the appearance in the British market of the products of that industry at prices which the British manufacturer cannot touch. Thus, the positions of the United Kingdom and its most powerful competitors have been reversed.[19]

Britain's eroding competitive position relative to two dynamic protectionist powers began to foster dissent from the prevailing free trade orthodoxy, and in 1895, the issue was moved to the center of the nation's political arena by the governing Conservative Unionist party.[20] In that year, Joseph Chamberlain, the government's Colonial Secretary and an avowed imperialist, began a crusade against free trade in favor of an imperial customs union that would establish a wall of protective tariffs around Britain and the Empire. Conservative Unionist Prime Ministers Lord Salisbury (1895–1902) and Arthur Balfour (1902–1906) shared Chamberlain's skepticism about free trade and were concerned over mounting evidence of Britain's economic decline relative to Germany and America, but were ultimately unwilling to commit their party and their country to a renunciation of free trade. Instead, Balfour sought a middle ground, the selective imposition of retaliatory tariffs against trading partners that practiced restrictive trade which hurt British industry.

The British debate over dumping at the turn of the century closely parallels the current controversy in the United States at the century's end. The Chamberlain and Balfour factions singled out "dumping" by foreign "trust system[s] working behind tariffs"[21] and argued that dumping was injuring or destroying key industries on which Britain's economy and security rested.[22] Dumping, it was argued, placed domestic industries at a cost disadvantage, eroded producers' profits, and jeopardized "the provision of adequate capital for carrying on great modern industries."[23] Nonsense, responded the Free Traders. British industry was still faring well under free trade.[24] The industries complaining of dumping were

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[19]*Report of the Tariff Commission* (1904), Vol. I, par. 58.

[20]See, generally, Aaron L. Friedberg, *The Weary Titan: Britain and the Experience of Relative Decline, 1895–1905* (Princeton, N.J.: Princeton University Press, 1988), pp. 45–79.

[21]Speech by Prime Minister Balfour in House of Commons, May 28, 1903, cited in Friedberg (1988), *op. cit.*, p. 63.

[22]Joseph Chamberlain used the example of the sugar industry: "Free imports have destroyed sugar refining . . . one of the great staple industries of the country, which it ought always to have remained. . . . Sugar has gone; let us not weep for it; jam and pickles remain." Cited in William Smart, *Return to Protection: Being a Re-Statement of the Case for Free Trade* (London: MacMillan and Co. Ltd, 1906), p. 154.

[23]Speech by Prime Minister Arthur Balfour, June 26, 1903, cited in Friedberg (1988) *op. cit.*, p. 63.

[24]The Free Traders drew considerable support from a substantial study by Sir Robert Giffen, which contended that the trade data showed trends that were quite favorable, Britain's exports were growing faster than those of Germany, the British trade position was sound, and there was "no weakening in the hold of the United Kingdom upon either the import or export trade of the world." Giffen reached these conclusions by using statistics for Germany for only the period 1890–1892, thereby producing distorted results when the country was in a recession; nevertheless, Giffen was a "high authority," and

seeking to blame imports for problems that were really of their own making. Dumping was actually a positive good, not only because it provided a stimulus to such firms to reform their ways, but because it provided cheap inputs for many other industries, lowering their costs.[25] The alleged threat to "staple" industries was brushed off as exaggerated; moreover, it was pointed out, the disappearance of staple industries was more than offset by the appearance of new industries utilizing dumped inputs.

The arguments against antidumping measures carried the day in turn-of-the-century Britain, and the Conservative Unionist assault on free trade served only to bring an electoral debacle upon the governing party.[26] Britain took no measures to restrict dumping until a number of years after World War I. But while the Free Traders won the political debate, what were the consequences? Did Britain ultimately fare better or worse for having allowed itself to exist as a "dumping ground" until well after World War I?

Dumping and the Erosion of British Competitiveness

From the perspective of the late twentieth century it is evident that in the period 1880–1914 British industry was moving on a path of decline relative to the industries of the United States and Germany, a trend that would become increas-

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his study was seized on by the defenders of the status quo and widely cited. One historian writing from the perspective of three decades later characterized it as an "excellent example of official optimism, Cobdenite certainty that nothing could be basically wrong with a nation adhering to free trade principles, and the misleading possibilities of statistics" (J.S. Ross, *Great Britain and the German Trade Rivalry 1875–1914.* (Philadelphia, University of Pennsylvania Press, 1933), p. 231., citing Sir Robert Giffen, *Foreign Trade: Statistical Tables Relating to the Progress of the Foreign Trade of the United Kingdom, and of other Foreign Countries, with Report to the Board of Trade Thereon.* [C-7349, 1894]).

[25]By dumping in Britain, "the Germans are in this way our benefactors, and last year supplied to us sugar to the extent of nearly £9,400,000 at less than its cost, not to speak of other articles outside the class of food products . . . " (*Manchester Guardian* [July 27, 1896], cited in Hoffman [1933], *op. cit.*, p. 253).

[26]Following months of internal debate, Chamberlain and several like-minded ministers, who felt that Balfour's "selective retaliation" proposals did not go far enough in the direction of protection, quit the Cabinet to wage a campaign of public education against free trade. At the same time, despite Balfour's comparative moderation, his party was identified in the public's eye with protectionism, which, it was believed, would result in higher food prices for consumers (the so-called "dear loaf"). His attempt to find a middle ground between the extremes of free trade and protection satisfied neither camp; instead, his government entered its "death agony," a protracted and bitter public controversy over trade policy that culminated in the election of 1906, in which Balfour's party suffered one of the worst electoral defeats in British history. The trade issue played the major role in the Conservative Unionist defeat. "All the evidence suggests that nothing was more disastrous to [Balfour's] party than Joseph Chamberlain's campaign for tariff reform" (Robert Blake, *The Conservative Party from Peel to Churchill* [London: Eyre and Spottswood, 1970], p. 180, cited in Friedberg [1988], *op. cit.*, p. 77).

ingly obvious as the twentieth century progressed.[27] Britain's decline from the zenith of the mid-1800s has been extensively examined, but its causes remain something of an enigma.[28] Dumping in British markets by foreign cartels was not the sole or even the primary proximate cause of Britain's relative industrial decline, but it does not follow that dumping played no role, or that Britain was, on the whole, better off for having permitted unrestricted dumping. Dumping *was* identified by many contemporary partisans in the trade debate as a significant factor contributing to both the erosion of British cost competitiveness and the inadequate levels of British capital investment.[29] Both of these factors have been cited by subsequent generations of scholars as important, if not central, elements underlying British industrial decline.[30]

The British iron and steel industry was the centerpiece of the British debate over dumping, and its particular experience with dumping in this industry is probably of greatest relevance to the current dumping controversy because dumping in this industry was more pervasive in its extent and effects than in most other sectors, and because of steel's central importance to Britain's economy and national defense. The slump in Britain's position as a steel producer in the 1890s "was particularly alarming,"[31] given steel's status at the time as the most important of all strategic industries, and it was addressed and analyzed by virtually all of the partisans on both sides of the trade controversy. While Free Traders argued that there was insufficient evidence that dumping was substantially injuring domestic producers,[32] the weight of evidence from the period makes it clear that by the mid-1890s, British steelmakers were under attack from low-priced Ger-

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[27]Between 1880 and 1913 Britain's share of total world manufacturing output fell from 22.9 to 13.6 percent. Britain's competitive position eroded in basic industries such as iron, coal, and textiles, where it had led the world in 1880; more seriously, British industry failed to invest adequately in the new industries that made possible the so-called "second industrial revolution"—electrical products, steel, specialty steel, mass-produced machinery, industrial chemicals, and pharmaceuticals (Paul Kennedy, *The Rise and Fall of the Great Powers* [New York: Random House, 1987], p. 228; Alfred D. Chandler, Jr., *Scale and Scope: The Dynamics of Industrial Capitalism* [Cambridge, Mass.: Belknap Press, Harvard University, 1990], pp. 12, 62–67).

[28]Paul Kennedy writes that "[t]he slowdown of British productivity and the decrease in competitiveness in the late nineteenth century has been one of the most investigated issues in economic history. It involved such complex issues as national character, generational differences, the social ethos, and the educational system as well as more specific economic reasons like low investment, out-of-date plant, bad labor relations, poor salesmanship, and the rest" (Kennedy [1987], *op. cit.*, p. 228).

[29]In general, see the materials appended to the *Report of the Tariff Commission* (1904), Vol. I, "The Iron and Steel Trades."

[30]Chandler (1990), *op. cit.*, p. 330; Peter Temin, "The Relative Decline of the British Steel Industry, 1880–1913," in Henry Rosovsky, ed., *Industrialization in Two Systems: Essays in Honor of Alexander Gerschenkran* (New York: John Wiley & Sons, 1966).

[31]Peter Cain, "Political Economy in Edwardian England: The Tariff-Reform Controversy," in Alan O'Day, ed., *The Edwardian Age: Conflict and Stability, 1900–1914* (Hampden, Conn.: Acchon Books, 1979), p. 35.

[32]See Smart (1906), *op. cit.*, p. 156.

man and American steel across a broad product range in both overseas and domestic markets, and that they were being badly hurt by the loss of business.[33]

The mere loss of sales described in contemporary reports does not by itself necessarily indicate the existence of a problem that would have warranted a change in government trade policy. The American-German onslaught might, for example, simply have reflected the emergence of more efficient competitors abroad, confronting British producers with the choice of adapting to remain competitive or getting out of the business, a point that was in fact made many times during the debate over dumping. However, a close examination of the situation confronting British steelmakers at the turn of the century suggests that there was more at work than simply shifting comparative advantage. The combination of high tariffs, cartels, and the incentive to sell products below average cost had powerful effects both on immediate commercial positions and long-term relative competitiveness. Specifically:

1. The tariff-cartel dumping systems of America and Germany operated in a way that lowered American and German unit costs and raised British unit costs, facilitating constant undercutting of British prices and erosion of British market-share.

2. The short-run cost disadvantage of the British mills was progressively translated into a long-run loss of competitiveness as American and German mills maintained higher levels of capital investment. Dumping affected this process directly by increasing British investment risk and diminishing American and German investment risk.

Dumping Lowers Cost

The aspect of dumping that most engaged the attention of contemporary steel producers was its effects on the relative unit costs of dumping firms, on the one hand, and of firms in whose markets dumping was occurring, on the other hand. It was the consensus of British, American, and German industrialists that dumping lowered the unit costs of the dumpers and raised the unit costs of the "dumpees." The reason was quite simple—the dumpers could engage in the practice known then as "continuous running" or "rapid driving," that is, running their mills at high operating rates, which resulted in progressively lower per unit pro-

[33]In addition to the contemporary testimony of many British businessmen, a 1916 study by the U.S. Federal Trade Commission supports this conclusion. It noted that in steel, "the [British] home market may at any time be made a dumping ground by foreign producers. . . . The iron and steel bar manufacturers of England have had to contend with a great deal of dumping on both home and foreign markets. . . ." Through the use of export bounties paid by the *Stählwerksverband* (German steel cartel), "German iron and steel goods have gained a foothold in the markets previously regarded as British preserves, and have materially affected British trade" (Federal Trade Commission, *Cooperation in American Export Trade* [Washington, D.C.: Federal Trade Commission, 1916], pp. 215, 219, 222).

duction costs for each additional unit of output. Because of high tariffs, they could dispose of surpluses abroad without spoiling domestic prices, and in fact could maintain high domestic prices by limiting the available supply within the home market. British "dumpees" generally could not do this; foreign markets were increasingly closed to their exports, and continuous running for purposes of serving only the home market tended simply to further depress prices in that market, without necessarily increasing sales volume.[34] "Continuous running" had a particularly dramatic impact in capital-intensive industries with high fixed costs, that is, sunk costs incurred whether or not goods were actually produced. In such industries (steel, chemicals, machinery) in competition between two facilities of equal efficiency, the producer able to operate at the highest rate would enjoy the lower costs, and hence, the competitive edge. The most modern and efficient production equipment carried with it very high fixed costs. While such facilities, if run "flat out," could produce goods at a lower cost per unit than those of any competitor, if the utilization rate dropped and the works were put on half-time or quarter-time, the cost per unit could easily be higher than that of older, less efficient facilities.[35] This dynamic could thus enable a less efficient producer to operate at lower unit costs than a more efficient firm.

The ability to run plants "flat out" was one of the principal policy justifications offered for a high tariff and the "trust" form of combination that was offered by Carnegie, Schwab, and other U.S. industrialists of the time.[36] The German

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[34]*Report of the Tariff Commission* (1904), *op. cit.*, pars. 62, 64–65.

[35]A British steelmaker testified in 1904 that "I should say that, generally speaking, British works are fully up to date. Some of our modern plants would be as much up to date as any foreign works. The disadvantages which we are under I attribute chiefly to our not running full time. . . . The reason why we are unable to work full time, as compared with the Germans, is that the Germans have a protected market at home at a high price and can afford to sell their surplus production at a much lower price than we can make it, and even than they can make it" (Witness No. 8, *Report of the Tariff Commission* [1904], *op. cit.*, Vol. I, pars. 726–727). Another testified that "I have worked out before my own works, the difference between the cost of production at its present rate of output, and at its maximum rate, and if we could produce to the full extent of our capacity, we could sell the extra quantity at 10 percent less than our present cost price, and should make, on the whole, an increased output twice our present profit. These figures are very startling, even to myself, when I worked them out" (Testimony of Witness No. 3, *Report of the Tariff Commission* [1904], *op. cit.*, Vol. I, pars. 626–627). Another observed that "[t]he additional output for their works caused by their foreign sales enables them to reduce their export price for all the additional quantity, the establishment charges having been borne by the lesser produce for their home market. A huge output is of first importance in reducing cost and this is never lost sight of by American and German manufacturers" (Testimony of Firm No. 1,512, *Report of the Tariff Commission* [1904], Vol. I, par. 300).

[36]Testimony of Andrew Carnegie before the House Ways and Means Committee, December 21, 1908, pp. 1853–1855. President Schwab of the U.S. Steel Corporation testified as follows before the U.S. Industrial Commission in 1901: "It is quite true . . . that export prices are made at a very much lower rate than those here; but there is no one who has been a manufacturer for any length of time who will not tell you that the reason he sold, even at a loss, was to run his works full and steady." United States Industrial Commission *Report,* (1901), Vol. XIII, p. 455.

Stählwerksverband (steel cartel) likewise justified its dumping policy primarily in terms of the beneficial effect on operating rates.[37] For the British, the inability to match the American-German practice of "continuous running" produced a vicious circle—loss of sales volume effectively raised British mills' unit costs, making them vulnerable to still further loss of sales and additional increases in costs.[38] A British scholar, noting this phenomenon, observes that

> The importance of 'dumping' in any explanation of Britain's difficulties [in steel] may well have been overstated in the *Report of the Tariff Commission*, but there is no question that selling below average cost gave both German and American exporters a very real competitive advantage in world markets. The constant refrain of witnesses before the 1904 Tariff Commission was that British manufacturers were inhibited from pursuing a like policy because of 'the openness' of the home market, in which American, German, and Belgian manufacturers were making growing inroads by 'unfairly' undercutting domestic producers. If the home market—relatively stagnant though it was—wasn't reserved for native manufacturers, it was no wonder that they were slowly demoralized by being placed in a disadvantageous position in overseas trade.[39]

Dumping and Capital Investment

In 1870 Britain possessed the most modern, competitive iron and steel industry in the world, but by 1914 it had fallen behind its rivals by virtually every standard used to measure international competitiveness.[40] Subsequent generations of scholars have concluded that a decisive element in this competitive rever-

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[37]The U.S. Consul General in Berlin reported in 1916 that "the Steel Verband believes in dumping. They justify their position as follows: Large steel plants must work at a certain maximum capacity without interruption if they are to remain efficient and produce at a minimum cost. It is impossible for the home market of any plant in any country to absorb a large output without interruption in the flow of orders due to periods of depression, from economic causes outside the influence of the steel industry. Also, the increased complication of the coal, iron, and steel industries, the increased use of furnace gases for industrial purposes (gas engines), for running lighting plants for neighboring towns, also the concentration of all stages of production in a few large mills, have made it increasingly difficult to reduce production in any one line of all the allied processes, without causing grave losses and disorganization in other lines. The Steel Verband therefore maintains that it is better for the entire economic life of the country in slack years at home to dispose of surplus products abroad at prices which may even cause a loss, inasmuch as the loss incurred by dumping abroad is in no comparison to the losses which would be incurred if production were reduced at home. Also, if production were reduced at home, the cost of production would rise in mills running at half the time. . . ." (Special Report of Consul General Julius G. Lay, Berlin, November 2–16, 1915, reproduced as Exhibit I in Federal Trade Commission [1916], *op. cit.*).

[38]See testimony of Witness No. 1, *Report of the Tariff Commission* (1904), *op. cit.*, Vol. I, par. 490.

[39]P.L. Payne, "Iron and Steel Manufacturers," in Derek H. Aldcroft, ed., *The Development of British Industry and Foreign Competition*, 1875–1914 (London: George Allen & Unwin Ltd., 1968), pp. 79.

[40]See Temin (1996), *op. cit.* In the mid-1870s Britain produced roughly 36 percent of the world's iron and steel, compared with 26 percent for the United States and 17 percent for Germany; by 1886 the United States surpassed Britain, and in 1893, so did Germany. By 1914, Britain produced less

sal was the fact that the British iron and steel industry did not make the capital investments prior to 1914 that would have enabled it to remain competitive in subsequent decades.[41]

In fact, at the turn of the century British steelmakers were quite aware that their competitive edge was slipping away due to their own failure to invest in state-of-the-art technology, and they said that dumping was a principal cause of that failure. One of them testified as follows in 1904:

> I state emphatically that, in my opinion, some fiscal provision for meeting dumping is essential to the maintenance of the trade of this country. . . . I may explain the above statement further—continual changes and improvements are being made in the manufacture of steel. I know of no trade which of late years has been subject to so many changes and improvements in the mode of manufacture. All these changes involve enormous outlays. If the manufacturers in this country are unable, from the instability of their market and from the liability of being overwhelmed from the stuff being dumped upon them at prices with which neither they nor anybody else can compete, if they are deterred from making the necessary improvements from availing themselves of new inventions, and if the foreigners, by reason of their protected market and of the certain large returns which they get from their home trade, are enabled to make these outlays, they will place themselves in such a position that, even if we got a free market and a free interchange, we should be some years before we could overcome them. I fear that if this state of things goes on for a considerable time longer, we never shall get on equal terms; they will attain so much superiority, and, when we are driven out of the market, our competitors would raise their prices to us.[42]

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than half the volume of steel that Germany produced and less than one-fourth that of the United States. With respect to efficiency and productivity, the British industry was regarded universally as the world leader in the last quarter of the nineteenth century, but by the outbreak of World War I had fallen behind Germany, the United States, and possibly Belgium (Payne [1968], *op. cit.*, p. 72–75).

[41]Alfred Chandler writes of the British iron and steel industry in the 1920s that it is "clear why the British steelmakers were unable to carry out the plans that all agreed were needed to modernize their industry and make it competitive in international markets. Essentially they were paying the price [in the 1920s] for the earlier failure to make an investment large enough and to recruit a management organization large and effective enough to exploit fully the new technologies of mass-producing steel" (Chandler [1990], *op. cit.*, p. 330).

[42]Testimony of Witness No. 2, *Report of the Tariff Commission* (1904), *op. cit.*, Vol. I, par. 547. Another manufacturer made a similar observation: "Taking the whole of this country, I do not consider the plant and equipment of British works are, as a whole, as up to date as those of the United States and Germany. This is due to the Americans having made very rapid strides in recent years, and having never been burdened with much original plant, such as existed in this country. They have been compelled to introduce many improved economical labour-saving machines, whereas this country could not apply similar methods to existing machinery; consequently, we have been unable to adapt ourselves to these new conditions, but the advantage, which is slight, is only a temporary one; there is certainly some truth in the statement that a sense of insecurity with the British manufacturer prevents him from laying down new plant. We are so alarmed and disheartened at the approaching foreign competition that we fear to spend money" (Testimony of Witness No. 6, *Report of the Tariff Commission* [1904], *op. cit.*, par. 678).

For British entrepreneurs, the decision as to whether to invest in the latest steel-making technologies turned, in large degree, on their assessment—and that of the capital markets—of the risks involved. Although large new mills could produce goods at lower average costs than a collection of smaller facilities, because of the higher fixed costs of the biggest facility, its losses were potentially larger if demand fell and it could not be utilized adequately. If demand were sharply and continuously cyclical, the biggest facility might not have the lowest average costs even over the long run because its unit fixed costs would be so high in each recession. Alternatively, if cyclicality were somewhat less sharp, the biggest facility might suffer higher losses in recessions, but enjoy lower average costs over the long run, and thus be more profitable.[43] Whether this prospect was sufficient to entice a given entrepreneur into committing the massive sums of capital needed to establish the largest facilities depended on the entrepreneur's assessment of the risks involved:

> [T]he rational choice depends upon the entrepreneur's attitude toward risk and his ability to insure himself against it. In either case greater variability in demand can make it rational to invest in less capital-intensive plants, even if those plants are less efficient in terms of minimum average cost. Only if demand fluctuations were reduced would the most efficient, capital-intensive technologies always be the most attractive.[44]

Dumping—or rather the protection/cartel system to which dumping was integral—affected this equation in several ways. First, for the Germans and Americans, by reducing competition and enhancing profitability in the home market, dumping diminished cyclicality and reduced investment risk, making it less hazardous for entrepreneurs to invest in the most advanced capital facilities.[45] Many German scholars concluded that the tariff-cartel system enabled German industry to achieve higher levels of technological advance and production efficiency than could have occurred under laissez faire:[46]

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[43]The foregoing argument was summarized by Stevan B. Webb, "Tariffs, Cartels, Technology and Growth in the German Steel Industry, 1879 to 1914" in *Journal of Economic History, vol. XL, No. 2* (June 1980), pp. 323–324.

[44]Webb (1980), *op. cit.*, p. 324.

[45][D]umping contributed to the growth of the German iron and steel industry—and hence to Britain's long-run differences . . . because German manufacturers knew that if demand fell off in their guaranteed home markets they could always export surpluses by undercutting competitors" (Payne [1968], *op. cit.*, p. 79).

[46]German scholars conceded that cartels and high tariffs protected some inefficient firms from competitive pressure, but argue that this was more than offset by the role played by protection and restraints on competition in reducing investment risks for the most modern equipment, thus fostering the rapid growth of large, efficient firms (Max Krawinkel, *Die Verbandsbildung in der Deutschen Drahtindustrie* [Cologne, Germany, 1968], p. 10; Robert Liefman, *Kartelle und Trusts und die Weiterbildung der Volkwirtschaftlichen Organization*, 2nd ed. [Stuttgart, Germany, 1924], p. 47; Franz Rips, *Die Stellung der Deutschen Eisenindustrie in der Aussenhandelspolitik* 1870 bis 1914 [Jena,

> The tariff-cartel system could keep domestic prices high enough to cover fixed costs, while firms added to their profits by selling at marginal cost on the depressed world market. . . . In ten of the years between 1876 and 1896 the average cost (Selbskosten) of rails from the Krupp firm exceeded the average export price, the world price with which the British had to contend. The domestic price, on the other hand, always exceeded average cost by over 10 marks per ton. Thus, the tariff-cartel system kept the German mills like Krupp profitable through times of recession. The national statistics also reflect such a pattern. In 1886, 1891, 1901, and 1908, when international trade crisis struck, British pig iron output declined 10 percent on average from the previous year, and the number of furnaces in blast fell 14 percent. German pig iron output fell only 6 percent, and the number of furnaces in blast dropped only 5 percent. Given the greater riskiness of their market environment, British steelmakers may have been rational to use less capital-intensive techniques, even if that meant slightly higher average costs.[47]

Second, the British confronted not only the loss of sales in protected foreign markets, but more violent cyclical swings in their own market as a result of intermittent incursions of dumped products, which exacerbated the intensity of recessions. This was the nub of the British strategic dilemma—investment risk was higher for them than for the Germans or the Americans. "In England there is not the same security for capital," as one steel tubemaker put it.[48] Prime Minister Balfour explained the problem at the height of the British trade policy debate in 1903:

> Now, there is no reason to expect that the plant erected to meet an average demand would reach the exact size most conducive to economy of manufacture. . . . Neither is it practicable to arrange that the plant shall always be kept working full time. If it is, there must evidently be recurrent period, during which over-production . . . must inevitably take place. Such is the ordinary position of the manufacturer under free trade. Compare it with the position of his protected rival, who controls his home markets. He is not haunted by the fear of overproduction. . . . [S]o long as other countries are good enough to offer him open markets, he can dispose of his surplus abroad, at prices no doubt lower, often

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Germany, 1941], pp. 40–46). "Thus, taken as a whole, the development of German industry is inconceivable [ist . . . nicht . . . zu dencken] without the high tariff rates, which were repeatedly raised" (Friedrich Lütge, *Deutsche Sozial-und Wirtschaftsgeschichte* [Berlin, Germany, 1966]. "[T]he pig iron duty was the foundation of our iron and steel industry and whoever destroyed this foundation would ruin the whole industry" (Reichsant des Innern, *Kontradiktorische Verhandlungen über Deutsche Kartelle* [Berlin, Germany, 1904–1905], Vol. 3, p. 196). All references in this note are cited in Webb (1980), *op. cit.*, p. 314.

[47]Webb (1980), *op cit.*, p. 324–325.

[48]Testimony of Witness No. 14, *Report of the Tariff Commission* (1904), *op. cit.*, par. 863. Another steelmaker commented that, "Owing to insecurity of trade at home, we do not spend as much money on plant as we would. [sic] is not the same inducement in this country to go and spend money" (Testimony of Witness No. 1, *Report of the Tariff Commission* [1904], *op. cit.*, par. 515).

> very much lower, than the price which his quasi-monopoly enables him to obtain at home, but at prices which nevertheless make the double transaction, domestic and foreign, remunerative as a whole. . . . The manufacturing capitalist [in the free trade country], when investing his money in costly plants has, in any case, many risks to run—new inventions, new discoveries, new fashions. Add to these his loss, actual or anticipated, through the operation of foreign protection, and his burden becomes insensibly increased. But add yet again the further uncertainty and the further loss due to the system [of protection/cartels/dumping] and he is overweighed indeed. Will the hostile combination keep together long enough to ruin him? Can his credit stand the strain? Is it worthwhile holding on in the face of certain loss and possible ruin? These are questions which the lenders of the threatened industry cannot but ask. And surely the mere fact that they have to be asked must shatter the buoyant energy which is the very soul of successful enterprise.[49]

Balfour's diagnosis was corroborated by the contemporary testimony of many British steelmakers.[50] But the cure was never found. No action was taken to curtail dumping or to open the foreign markets from which dumping was occurring. The immediate cost disadvantages and loss of sales confronting British steelmakers as a result of dumping were gradually translated into a loss of competitiveness that would, in the years to come, prove to be irremediable.

Dumping and Consuming Industries

During the British dumping debate, free trade advocates argued persuasively that dumping of intermediate products had actually enhanced the international competitiveness of British industries that used those products as inputs. Thus, although dumped sugar may have weakened England's sugar refining industry, cheap imported sugar fostered new food processing industries—jam, confectionery, biscuits, condensed milk—that employed far more people than the sugar refining industry had ever utilized. British shipbuilders reported that they bought dumped German castings and forgings, "built them into ships and machines, and sent them back to Germany."[51] Even within the British iron and steel industry

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[49]Arthur James Balfour, *Economic Notes on Insular Free Trade* (London: Langmans, Green & Co., 1903), pp. 26–27.

[50]As one British steelmaker summarized his situation, "companies hitherto prosperous can keep a certain measure of trade by enlarging their works, and thereby reducing the cost of production, but it is becoming more and more difficult to entice the requisite capital into the trade, either for that, or for introducing more labour-saving appliances. My company, as I have stated, largely increased their works recently, and, speaking personally, I should be exceedingly chary of investing anything more in extensions, unless we get some measure of security against the foreign dumper." Report of the Tariff Commission; Witness No. 6, pp. 628–629.

[51]Smart (1906), *op. cit.*, pp. 154–157. "America makes her own tin plates excessively dear, and spoils her own trade in canned goods. At the same time she dumps steel into South Wales. Our tinplate manufacturers, in consequence, send out cheap tin plates to German, Russia, Australia and

itself—the principal source of alarm over dumping—many manufacturers benefited, at least in the short run, by purchasing low-priced German and American iron and semifinished steel and said as much.[52] Dumped imported steel not only fostered a price advantage, but occasionally offset domestic shortages or attempts by domestic iron and semifinished producers to "boycott" downstream steelmakers.[53] But even the firms that gained apparent short-run advantages from buying dumped inputs expressed misgivings about their growing dependency for inputs on foreign syndicates that were beginning to move into areas further downstream in the production process. Switching to a foreign source was not always a discretionary option; the price advantages associated with buying dumped inputs in some cases forced British manufacturers to abandon their own internal production of those inputs[54] and in other cases, to switch from domestic suppliers to foreign sources so as to remain competitive, despite certain troubling long-run implications.[55] Reflecting this concern, a pattern that emerges from contempo-

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Canada, and give them a hold of the canned fruit and meat trade which otherwise America might have kept from them. It reminds one of a besieging army smuggling ammunition and food into the beleaguered town." *Ibid.*

[52]"This German steel found its way to every steel-making centre. . . . Many sheet mills would have had to have stopped in consequence of the high price of pig iron if it had not been for German steel, and it cannot be said that the late advent of German steel has done any harm, but that it has actually supplied a want. . . . Black sheet makers are helped very considerably by using German steel sheet bars, which are so cheap comparatively" (*Ryland's* [December 28, 1901 and December 13, 1902], cited in *German and American Iron and Steel in the British Market* [Appendix II to *Great Britain, Board of Trade, memorandum on the Export Policy of Trusts, 1903 (cd. 1761)*], pp. 348, 350).

[53]Testimony of Witness No. 1, *Report of the Tariff Commission*, (1904), *op. cit.*, par. 490.

[54]"Wire rods we formerly made ourselves, until we found it quite impossible to make them at the price at which we could buy them. The same applies to sheet bars. This has thrown idle three Siemens-Martin steel furnaces, a cogging mill and a wire rod mill, in all, about £20,0000 worth of plant, and dispensed with the labour of about 250 men" (Firm No. 1,003, *Report of the Tariff Commission* [1904], *op. cit.*, Vol. I, par. 236).

[55]"We used at one time to buy all English wire rods, but of latter years the English firms would not compete at the price the Germans were prepared to take. Consequently, we had to buy German, in order to compete with our competitors who did so, much against our wish" (Firm No. 1276, *Report of the Tariff Commission* [1904], *op. cit.*, Vol I, par. 238). One British barmaker, who had experienced difficulties procuring billets (semifinished steel from which bars are made) from domestic suppliers, indicated that it was turning to German sources, but only reluctantly: "The billets which are being purchased in the West of Scotland from Germany has [sic] now become an established business between us. It has grown within the last year or two, and now they have really won the whole trade. . . . The Germans are now taking the next stage in producing iron bars. In Düsseldorf there are large works. I saw them doing so at the Essen works. At the moment it is an advantage to us to have this free importation of German stuff at so cheap a rate, but it is a fact that we cannot depend upon a continuation of cheap prices from abroad when they happen to have a great demand of their own. At those times we have to buy at home. The basis of our present working is a very unsound one. There is no dependence on it, and unless we can encourage the production of raw material at home, our position is a very unstable one" (Testimony of Witness No. 1, *Report of the Tariff Commission* [1904], *op. cit*., pars. 500, 502).

rary surveys is the intermittent and unpredictable character of the German and American sales; they occurred in waves that surged and receded, discomfiting competing British producers in the former case and British consuming industries in the latter.[56]

German steelmakers recognized that their dumping abroad created serious competitive problems for their domestic steel-consuming customers, who had to compete with foreign firms that were able to buy dumped German steel. Thus, for example, Dutch producers of barges for river transport were able to capture most of this business from their German rivals at the end of the nineteenth century because they could buy dumped German plate, while their German competitors paid the higher domestic price set by the German steel cartel.[57] The German syndicates counteracted this problem, however, by developing a sophisticated system of "export bonuses" or "bonifications"—payments to domestic customers who could demonstrate that their inputs would be utilized for producing products for export.[58] This system underwent continual refinement that served to strengthen the vertical and horizontal cohesion of German industry even as German dumping was weakening and in some cases breaking the vertical relationships between British producers. Thus, German export bounties were paid only to downstream exporters who brought exclusively from the upstream cartels, and only downstream firms that were themselves members of cartels in their own industries could qualify for export premiums from upstream cartels.

With the advent of the system of export bonuses, the focus of German dumping began shifting from intermediate industrial products toward finished products and higher value-added products. The Germans found that under the new system, the purchasing power of the home market was increased because downstream firms could, in effect, buy semifinished materials for use in production for export at "dumping" prices and expand their export sales of finished products through

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[56]Typically, following months of reports of widespread sales of low-priced German steel in various parts of the United Kingdom, *Ryland's* reported that "Germans are declining to quote owing to the improvement of their home market. The withdrawal of cheap German steel has caused home sheet makers some inconvenience [February 21, 1903]. . . . We understand that the German Wire Rod Syndicate have withdrawn all quotations for steel wire rods. . . . Swansea reports that German offers of steel tin-plate bars are off the market" ([March 21, 1903], cited in Great Britain, Board of Trade, *German and American Iron and Steel in the British Market, op. cit.,* p. 351).

[57]Great Britain Board of Trade, "Memorandum on the Export Policy of Trusts in Certain Foreign Countries," in *Report on British and Foreign Trade and Industrial Combinations, 1903*, p. 4.

[58]At the turn of the century the German Union of Sheet Manufacturers was paying an export bounty to customers who incorporated sheets in export products of 15 DM per ton. The Wire Syndicate's bylaws stipulated that the organization's "main object is to promote export by granting premiums." The Rhenisch-Westphalian Coal Syndicate, the Westphalian Coke Syndicate, and the various pig iron, structural steel, and semifinished steel syndicates established the *Düsseldorfer Abrechnungsstelle für die Ausfuhur*, a joint "Clearinghouse for Export" where the complex task of sorting out the various export premiums owed by the syndicates to their customers was performed (see Board of Trade [1903], *op. cit.*, p. 303).

price reductions. The U.S. Consul General in Berlin, commenting on this phenomenon in 1916, observed that through the new selling policy

> [t]he Steel Verband therefore shifted the entire movement of half-finished materials, and the ultimate result was the struggle for supremacy in finished manufactured products in South America and the colonies.[59]

A number of British manufacturers abandoned intermediate production processes in the face of German dumping, retreating into production activities further "downstream," in many cases becoming dependent on dumped German products as inputs. This was rationalized on the grounds that the downstream product areas were more specialized and remunerative, and that it therefore made sense to allow the Germans to supply the commodity-grade inputs while concentrating on areas requiring the greatest craftsmanship. But British industrialists soon found that they had not only lost control of the upstream part of the production process, but confronted German dumping in the downstream product lines as well. One British steelmaker testified in 1904:

> Our profits dropped from £30,000 in 1899, to about £2,600 in 1900. The following year, there was a loss of nearly £10,000, and it became obvious to those interested, that the cause of this sudden and alarming change in the prosperity was due to the heavy dumping of steel from Germany and America, at a price sold in this country considerably below the cost price at which the steel could be made here. . . . The alternatives we had before us were either to wait in the hope of a change in the conditions of trade or to put down fresh plant and get into a higher class of manufacture. We settled to do the latter, and by large expenditure gradually got into a different trade. . . . Then the proceeding was this. First, we began to make rails, sheet bars, & c., then the Germans, by dumping, stopped the trade in bars, blooms and billets. We then went into the tram rails and electric rails, and they are now beginning to dump those articles; finally, we were driven into a general trade in which we also suffered from German competition. There is no part of our trade in which they are not to some extent dumping, only this is not so acute as when we were confined to the lower grade of material worth from £3 15s to £5 per ton. . . . Then again, if we get into a still higher class of trade where wages per ton are greater still, they cannot touch us—at all events at present—but I think they are bound in time to touch us in higher products. We are beginning to feel it already.[60]

National Security Implications

British imperialists noted that dumping was destroying certain "primary" and "staple" industries and warned that foreign competition could weaken or eliminate industries that were essential to national security. The Free Traders ques-

[59]Special Report of Consul General Lucius G. Lay, Berlin, November 2–16, 1915, in Federal Trade Commission (1916), *op. cit.*, Exhibit I, p. 18.

[60]Testimony of Witness No. 4, *Report of The Tariff Commission* (1904), Vol. I, pars. 579, 581.

tioned whether, in light of their poor competitive performance, such industries were, in any event, "one[s] which we could expect to keep." The loss of "staple" industries was more than offset, they argued, by the advent of specialized downstream industries processing the cheaper imported inputs formerly produced by the supposedly vital basic industries.[61] Others made the point that rapid strides in human technological progress and global economic and financial integration had made war virtually unthinkable; the advent of technological breakthroughs in communications and transportation and growing foreign direct investment were bringing about the very international "division of labor" envisioned by Adam Smith. Commenting on globalization in 1910, one observer noted that there now existed

> a financial interdependence of the capitals of the world so complex that disturbance in New York involves financial and commercial disturbance in London, and, if sufficiently grave, compels financiers of London to co-operate with those of New York to put an end to the crisis, not as a matter of altruism, but as a matter of commercial self-protection. . . . [T]his complexity of the international division of labor tends to render futile the . . . contrivances of conquest. . . .[62]

The Surprise of 1914

Such ruminations were abruptly removed from the realm of abstract argument on the morning of August 4, 1914, when thousands of German troops crossed the Belgian frontier and began an assault on the fortress city of Liège, the beginning of an onslaught by 1.5 million men against the eastern boundaries of Belgium and France. A few hours later, to the considerable surprise, if not outright disbelief, of most of its citizens, Britain found itself at war with Imperial Germany. Five days later, on August 9, 1914, 80,000 men of the British Expeditionary Force, representing virtually all of Britain's professional army that could be gathered in the home islands, began embarking for the continent, and within days its "tiny numbers were sucked inexorably into the military planning of the great continental powers."[63] On August 13, 1914, the Germans began bombarding the forts defending Liège—which had been expected to hold out for months—with terrifying new weapons that the British did not know existed—huge 420-mm howitzers, the "Big Berthas"—that had been developed secretly at the Krupp steelworks in Essen. Smashed to pieces by these guns, all of the forts fell within four days; the German armies passed through Liège and began a sweep across Belgium. Brussels fell on August 20. On August 21, 400 German guns, includ-

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[61]Smart (1906), *op. cit*., pp. 154–155.

[62]Sir Newman Angell, *The Great Illusion: A Study of the Relation of Military Power to National Advantage* (New York: G.P. Putnam's Sons, 1910), pp. 53–67.

[63]Trevor Wilson, *The Myriad Faces of War: Britain and the Great War, 1914–1918* (Cambridge, England: Polity Press, 1986), p. 38.

ing the Big Berthas, began bombarding the Belgian fortress city of Namur; the city fell two days later, unhinging the whole Franco-Belgian line and forcing the French army into a general retreat along its entire front.[64] The same day, a little further to the west, the British Expeditionary Force, which had advanced into Belgium and taken up positions along the Mons Canal, came under attack by greatly superior German forces. Outnumbered, out of contact with the French, and threatened with envelopment on both flanks, the British began a fighting retreat that did not end until they reached the Aisne River, 250 miles to the south.

The stunning events of this fortnight in August 1914, which catapulted Britain into a major war on the continent and saw the unravelling of pre-war allied strategy, brought only the first of a succession of unpleasant surprises to the nation. The military had expected that if war came, it would be short and sharp, resolved with a few decisive battles, such as the Franco-Prussian contest of 1870. British marksmanship, pluck, and military professionalism would carry the day. There was no reserve army to call up, no store of munitions to sustain a long war, and no arrangement for industrial production to support a continental-scale army in the field.[65] Instead, after the first engagements in Belgium and Northern France, the war degenerated into the ghastly deadlock of trench warfare, in which, as was quickly demonstrated, sheer weight of munitions and numbers counted most.[66] Less than three months after the outbreak of the war, the Germans launched a massive attack on British positions in front of Ypres, concentrating what was at that time the greatest weight of artillery that had ever been brought to bear on a British force in the field and mounting successive, massive infantry assaults with a numerical superiority of between four and seven to one. This continued for four weeks. The British held their ground, but by mid-November, 1914, the original British Expeditionary Force had largely ceased to exist; a third

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[64]Sir Winston Churchill wrote later of the impact of this event: "Namur fallen! Namur taken in a single day. . . . We were evidently in the presence of new facts and of a new standard of values. If strong fortresses were to melt like wisps of vapour in a morning sun, many judgments would have to be revised. The foundations of thought were quaking" (Churchill, *The World Crisis* [New York: Charles Scribner's Sons, 1923], Vol. I, pp. 289–290).

[65]The British Expeditionary Force consisted of six regular infantry divisions and a cavalry division, which were augmented later by two divisions withdrawn from India. Behind these forces stood 14 lightly armed "territorial" divisions and 13 Mounted Brigades with little if any organic artillery. By way of comparison, the Germans committed 70 combat-ready infantry divisions and 3 cavalry divisions to the invasion of Belgium and France in August 1914 (Churchill [1923], *op. cit.*, Vol. I, pp. 252–253).

[66]A British officer on the scene who witnessed the onset of the trench war observed that "[t]he growing resemblance of this battle to siege warfare has already been pointed out. . . . [W]e at all times suffered from the great preponderance of the Germans in artillery, especially in heavy field howitzers. As, however, we had not got the material means with which to counter this disadvantage, we could only try to mislead the enemy as to the damage he was doing us" (Sir Ernest D. Swinton, *Eyewitness: Being Personal Reminiscences of Certain Phases of the Great War, Including the Genesis of the Tank* [New York: Arno Press, 1972], pp. 42–43).

of its original members had been killed outright, and many others were wounded; "the British regular army no longer had the capacity to fight a major battle."[67] Thereafter, Britain, like the other belligerents, had no choice but to mobilize its civilian population and its economy to fight a protracted war of attrition.

The unexpected development of a stalemate on the Western Front brought in its wake other, even more fundamental surprises. One was the extent to which Britain's principal strategic asset, its fleet, was neutralized by German industrial power. The British blockade against Napoleon had played an important role in bringing him down; but the British blockade against Imperial Germany was countered, to a considerable degree, by German industrial science and technology. German manufacturing concerns quickly converted to the mass production of munitions, spewing out guns, shells, and bullets at an incredible rate.[68] Chemical companies churned out not only high explosives but a vast range of *ersatz* products to replace items that had been cut off by the British blockade. German railroads shifted huge armies rapidly around the interior of Europe, whereas the British fleet operated more or less ineffectually around the periphery. Indeed, Britain soon found itself under partial blockade as German U-boats began sinking the merchant ships that constituted the country's lifeline.

But the most appalling surprise—known to Britain's leaders but not the public—was the sheer extent to which the country's industrial base had decayed. In the wars against Napoleon, the "workshop of the world" had outfitted not only the British fleet and army, but also the large armies of its continental allies—Prussia, Russia, Austria, and Spain. But, by 1914, so many industries had disappeared or fallen behind technologically that Britain could not sustain her own army and navy, much less those of her allies:

> [T]he first two years of the Great War showed England to be incapable of fighting a major war from her own industrial resources.[69]

The Ammunition Shortage

An early and continuing manifestation of British industrial weakness was the ammunition shortage, a scandal that erupted several months after the outbreak of the war. In the midst of the Ypres battle, the British commander on the scene warned London that unless he received large quantities of ammunition, he would

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[67]Wilson (1986), *op. cit.*, p. 48.

[68]When the German army began its assault on Verdun in February 1916, it began with a 12-hour barrage of 100,000 shells per hour fired from 1,200 guns. By the third year of the war the Krupp works at Essen was turning out 9 million shells and 3,000 artillery pieces a month (William Manchester, *Arms of Krupp*. Bantam Books, New York, 1981, p. 326.

[69]Correlli Barnett, *The Collapse of British Power* (Atlantic Highlands, N.J.: Humanities Press International, Inc., 1986), p. 83.

be forced to fight without artillery support. He was told to economize.[70] Several months later, in March 1915, Douglas Haig, in command of Britain's First Army in Flanders, proposed a major assault on German positions along Aubers Ridge, but there was a problem:

> I went out to Hazebrouck about 10:00 am and saw Sir John French. He approved my plan of operations but **there was no ammunition**. . . . This lack of ammunition seems serious. It effectually prevents us from profiting by our recent success and pressing the enemy before he can reorganize and strengthen his position [original emphasis][71]

The British army lacked, in particular, large numbers of high-explosive artillery shells of the type needed to make an impression on the Germans' well-engineered and deeply dug trench systems; for the most part, the British possessed only airburst shrapnel shells that made little impression on an entrenched foe. Over the next four years, the British army paid dearly for this deficiency, which was never wholly made good; the shell shortage limited the army's ability to sustain offensive action, or, if an attack was made, greatly increased the cost to the attackers, since the German trench systems were seldom adequately softened up by preliminary artillery fire.[72] On May 15, 1915, a British offensive at Festubert was broken off because the British forces had expended their ammunition along the entire front.[73] In the fall of 1915, compelled to take the attack at Loos to relieve German pressure on their Russian allies, the British assaulted the German trenches despite the fact that the shell shortage left them without adequate artillery support—"all we wanted was ammunition." They suffered 60,000 casualties, making no appreciable dent in the German lines.[74] In Britain the shell shortage fueled

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[70]John Terraine, *Douglas Haig: The Educated Soldier* (London: Hutchinson & Co., 1963), p. 107.

[71]Douglas Haig, Diary entry for March 16, 1915, in Robert Blake, ed., *The Private Papers of Douglas Haig* (London: Eyre and Spottiswoode, 1952), p. 88.

[72]For an eyewitness account of a disastrous, and all too typical, British assault on German trenches, supported only by shrapnel, in May 1915, see Swinton (1972), *op. cit*., p. 92–93. "As soon as our short bombardment of the German position—almost entirely with field-gun shrapnel—ceased, our infantry went over the top. As they clambered up, the Germans in their dug-outs, unhurt and hardly shaken by our shrapnel, swarmed up and manned their parapets. . . . [They] poured on a steady hail of bullets into our advancing infantry, their machine guns firing from emplacements fitted with loopholes just clear of the ground. Some of our men got as far as the German wire; but in most cases our assault was stopped dead on the top of our parapets or a few yards in front, where the ground was strewn with bodies."

[73]Later in 1915, the British command decided against further offensive action in Flanders for the remainder of the year because British forces were "gravely short of the war's most important implements, heavy artillery and shells"; the most they could do was offer to take over portions of the French defensive lines to free up French troops for the offensive (Haig, Diary entries and editors' notes for May 9, 1915 [1952], *op. cit*.).

[74]Much of the British-made ammunition that was produced was "of such poor quality that it might have been saved the trip to the battlefield."

public outrage, and much angry finger-pointing took place over who bore the blame; partly as a result, Prime Minister Asquith was compelled to ask the resignations of all of his ministers in 1915 and to form a coalition government.[75]

The Steel Shortage

The ammunition shortage was, in part, a function of poor planning and bureaucratic bungling, but it was much more fundamentally a reflection of the fact that Britain's industrial base could not meet the demands that were being placed on it. It was evident in 1915 that the British steel industry could not even begin to produce enough shell-quality steel; the three firms that could make such steel had a combined output of 5,000 tons per week, while the government was asking for 35,700 tons per week.[76] The shortfall was slightly alleviated by reducing the quality requirements for shell steel and by attempts to import shell steel from the United States, but Britain's shortage of shell steel "remained acute until the end of the war."[77] In 1918 Britain's ability to go on the offensive on the Western Front was still constrained by a shortage of artillery shells, with respect to which "steel [was] the limiting factor."[78] The Ministry of Munitions concluded at war's end that

> It was only the ability of the Allies to import shell and shell steel from America and iron ore from neutral Spain that averted the decisive victory of the enemy.[79]

The ammunition shortage was only one symptom of a broader problem, the inability of the nation's steel industry to produce the quantity and quality of steel needed by the nation's armed forces to fight the war. It was a "steel war," in the words of Sir Winston Churchill, the Minister of Munitions. Steel was needed, most critically, to produce the merchant ships that constituted Britain's supply lifeline; after that, steel was needed for naval vessels, shells, artillery pieces, rails, construction of fortifications, and later, for tanks. The demand could not be met

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[75]Britain's commander-in-chief, Lord Kitchener, blamed the army in Flanders for its profligate expenditure of bullets and shells. The War Office was faulted for not paying earlier attention to munitions production. Many in the government blamed the work force for its sluggish response to exhortations to produce more guns, bullets and shells (see Churchill [1923], Vol. II, pp. 319, 365; Wilson [19xx], *op. cit*., p. 141).

[76]*History of the Ministry of Munitions*, Vol. X, "The Supply of Munitions" HMSO, London, 1922, pp. 79–81. Shell steel required precise percentages of sulphur and phosphorus in the metal to prevent it from becoming brittle in extremes of temperature.

[77]*History of Ministry of Munitions*, Vol. X (1922), *op. cit*., p. 87.

[78]Churchill, Memorandum of October 21, 1917, reproduced in *The World Crisis*, Vol. IV (1923), *op. cit*, p. 303; see also Churchill to Mr. Layton (undated memorandum, late 1917) reproduced in *The World Crisis*, Vol. IV (1923), *op. cit*., p. 290.

[79]*History of Ministry of Munitions*, Vol II (1922), *op. cit.*, p. 58.

from the domestic production base that was, moreover, heavily dependent on imported ore and semifinished steel that had to be brought in through U-boat-infested waters. The Germans identified Britain's steel dependency as one of its greatest strategic vulnerabilities and made the overseas steel lifeline the primary target of its policy of unrestricted submarine warfare.[80] Moreover, even leaving aside the U-boat problem, the overseas sources of ore and semifinished and finished steel were precarious at best. Germany, the principal source of imported semifinished steel, was now the enemy; Belgium, another source of steel, was occupied, as were most of the iron ore fields of France.[81] Britain's allies, Italy and France, were utterly unable to meet their own steel needs and looked to Britain to do so. Sweden, a primary source of iron ore, was an unfriendly neutral. The United States proved to be an important, but erratic source of supply.[82]

These problems were never overcome. The shortage of steel meant that it had to be rationed between competing demands; Churchill identified steel as one of the four limiting factors of production (the others being labor, shipping, and money) confronting the Ministry of Munitions.[83] The country's annual wartime needs were estimated at 10 million tons; it could only produce 8.5 million tons, and "out of this, every requirement must be met, and if through shipping shrinkage the total production is reduced, all programmes will be affected."[84] Because of the shortage, a constant tug of war raged within the British war effort to secure supplies of steel. In 1917, Churchill wrote to Haig and observed that

> there are many difficulties here, both with labour and materials, especially steel, and at this stage of the war, it will often become necessary to choose between desirable things and to throw special emphasis on this or that branch of production.[85]

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[80]When Chancellor Dr. Bethmann-Hollweg announced the policy of unlimited submarine warfare on January 31, 1917, he gave "as his first object the cutting off of British ore imports, putting this on the same level of importance as his other object, namely, depriving the country of food imports" (*History of the Ministry of Munitions*, Vol. II [1922], *op. cit*., p. 58).

[81]"The importance of steel as one of the essential materials for the supply of munitions seems to have been ignored to a remarkable extent by the military and naval authorities of the Allied Powers . . . [a]pparently no cognizance was ever taken [by the French] that the Briey ore fields, which produced 80 percent of French iron ore, were commanded by the enemy fortress of Metz. Italy, with practically no natural resources of iron ore or fuel, had maintained military forces beyond her financial powers, depending on her Allies of the Triple Alliance for steel and coal" (*History of the Ministry of Munitions*, Vol. VII [1922], *op. cit*., pp. 4–5).

[82]British attempts to buy American shell steel drove up the price of that commodity, and the quality of American steel did not satisfy British requirements. French and Italian efforts to buy their own shell steel in America resulted in "the steel works . . . becoming congested with orders as far forward as 1917" (*History of the Ministry of Munitions*, Vol. VII [1922], *op cit*., pp. 68–69).

[83]Churchill (1923), *op.cit.*, Vol. IV, p. 4.

[84]*Provisional Munitions Budget for 1918*, to the War Cabinet (November 1, 1917), reproduced in Churchill (1923), *op. cit*., Vol. IV, p. 25.

[85]Churchill to Haig, July 26, 1917, reproduced in Churchill (1923), *op. cit.*, Vol. IV, p. 285.

Britain, which a few years earlier had debated whether it should worry at all about the erosion of its steel industry, now frantically attempted to expand that industry and make good the many deficiencies that the war had revealed. "It was . . . urgently necessary to increase the capacity of the British steel works at once." The government appealed to the steelmakers to expand their capacity, but the British mills replied that capital expenditures on the scale needed were too risky. They expressed concern about the international competitive environment they would face after the war. The government advanced much of the capital required, but the expansions of existing mills proceeded much more slowly than hoped, due to the recalcitrance of the steelmakers to expand and shortages of supplies and labor, which were "urgently needed for war purposes." Most of the steel works "extensions" were still incomplete when the war ended in 1918.[86]

The Sluggish Production of Tanks

Because the steel shortage touched every aspect of Britain's war effort, major and minor, it is impossible to assess its full effect. In a myriad of specific cases, the shortage meant that there was not enough merchant tonnage, not enough shells, or not enough artillery pieces to perform the task at hand.[87] Often, the deficit was made up in additional lives lost, the most dramatic example of which was Britain's sluggish deployment of tanks, the weapon that ultimately broke the deadlock in the trenches. The idea of armored caterpillar-tracked vehicles as a way out of the trench stalemate was conceived at the very beginning of the trench deadlock in late 1914 and early 1915.[88] But it took over three years to develop this idea from a prototype stage to that of a weapon capable of being employed on a mass basis in the field; only small batches of tanks were available before late 1917, not enough to achieve any decisive result. During this interval, from early 1915 to late 1917, the British army launched repeated mass infantry offensives against the German trenches at the Somme (1916) and Passchendaele (1917), suffering truly horrific losses without achieving any significant result.[89]

Britain's tardiness in employing tanks on a mass scale was due to several

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[86]*Ibid*., Vol. VII, pp. 55–63.

[87]*Ibid.*, p. 84. Aircraft production was hampered by the inability to produce sufficient quantities of alloy steel. The British fleet's narrow (and costly) victory at Jutland may have been attributable, in part, to the fact British battleships were shielded by superior-quality German plate procured from Krupp before the war (Manchester [1981], *op. cit*., p. 327).

[88]Colonel Maurice Hankey and Lieutenant Colonel Henry Swinton advanced proposals to the government during this period for the development of armored vehicles to assault enemy trenches. The idea was seized on by Winston Churchill, then First Lord of the Admiralty, who played a key role in advancing it through the bureaucracy (see, generally, Swinton [1972], *op. cit*., pp. 71–81).

[89]All told, Britain suffered 2.5 million casualties on the Western Front (Terraine [1963], *op. cit.*, p. 480).

factors, including resistance by some elements of the military, labor shortages, training bottlenecks, and disputes over design issues.[90] But material shortages and shortcomings played a crucial limiting role. The Admiralty engaged in a continuous struggle with the tank program over the supply of steel plates, and the Admiralty usually came out on top.[91] Perhaps more seriously, the British steel industry experienced great difficulty producing adequate numbers of castings that would join together the links of the tanks' caterpillar tracks. Until mid-1917 British steel manufacturers could not make adequate numbers of track links at the tensile strength required. As a result,

> the production of track links proved a limiting factor in the output of tanks and contributed considerably to the accumulation of arrears, since it was always some six months from the time of placing a contract before a new foundry could produce satisfactory links in considerable quantities.[92]

What might have been achieved, and the losses that could have been avoided, had tanks been employed en masse at an earlier date, was revealed when the first mass tank assault was undertaken by the British at Cambrai on November 20, 1917, in the last year of the war. Four hundred seventy-six tanks, backed by infantry, broke a six-mile wide hole through the vaunted German Hindenberg Line, penetrating four and one-half miles through the German positions in a single day. Winston Churchill commented as follows:

> Accusing as I do without exception all the great ally offensives of 1915, 1916 and 1917, as needless and wrongly conceived operations of infinite cost, I am bound to reply to the question, What else could be done? And I answer it, pointing to the Battle of Cambrai, 'This could have been done.' This in many variants, this in larger and better forms ought to have been done. . . .[93]

A later author points out that Churchill was wrong insofar as he implied British leaders were at fault for the delay; the real problem was with the production base:

> [O]f greatest significance was the fact that only now [late 1917] had tank production reached a level at which this weapon had the weight of numbers largely to affect a military operation. This matter of numbers, depending on the painful development of a productive capacity, needs to be stressed.[94]

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[90]See, generally, Swinton (1972), *op. cit.*; *History of the Ministry of Munitions* (1922), *op. cit.*, Vol. XII, Part III.

[91]"Each of the armed services was fighting to obtain every ton of steel and freight for itself in a free-for-all in which the Royal Navy seemed to come off best" (Bryan Cooper, *The Battle of Cambrai* [New York: Stein and Day, 1967], pp. 52–53).

[92]The problem was "blowholes and segregation of sulphur and phosphorus at the parts of the link where soundness was particularly essential" (*History of the Ministry of Munitions* [1922], *op. cit.*, Vol. XII, p. 48).

[93]Churchill (1923), *op. cit.*, Vol. IV, p. 61.

[94]Wilson (1986), *op. cit.*, p. 487.

Consequences of a Weakened Industrial Base

Although the problems of the steel industry posed the greatest difficulties for Britain in World War I, the nation's industrial shortcomings went far beyond this industry or any of the industries normally associated with munitions production. The domestic industrial base producing consumer goods had also eroded, and therefore could not be converted to war production on the scale required. Before the war, Britain's clockmaking and mechanical toy industries had been displaced by imported clocks and toys; when war came there was no precision clock or toymaking industry that could be converted to the production of accurate shell fuses. Britain had to create a light engineering industry to fill this gap, but the effort to do so revealed another hole in the nation's industrial fabric: the lack of a modern machine–tool industry that could make the machines needed to run the production lines. The nation had become dependent on imported machines, and only the importation of machine tools from America, Switzerland, and Sweden "prevented a total breakdown of the British effort to create new industries between 1914 and 1916."[95]

Britain had become dependent on Germany, now her enemy, for many of the industrial products needed to wage a modern war. At the outbreak of the war, Britain looked to Germany for 90 percent of the optical glass used for precision instruments, for 75 percent of its glass for electric lights, and even most of the laboratory instruments used by British scientists. Britain was dependent on Germany for chemicals needed for explosives and even drugs such as aspirin; during the war it "had no alternative but to continue importing German drugs via neutral countries." Britain was dependent on Germany for precision bearings and magnetos, both of which were indispensable for every type of motorized equipment—aircraft, tanks, trucks, cars. Britain tried, but never succeeded, in making up for this shortcoming by imports from Sweden and Switzerland; in fact, Britain was never able to produce the number of engines needed to fight the war and had to rely on its allies to make good at least part of the difference.[96]

Although the decline of Britain's strategic industrial base that had occurred by 1914 had multiple causes, dumping was an important contributing factor. The stagnation of investment by the British steelmakers in the years prior to the war, and indeed, through the war years themselves, reflected the demoralization that had set in as the British confronted a competitive dilemma for which they had no solution. While it is impossible to state with certainty that the qualitative problems revealed by the war, such as the difficulties in making track links for tanks, could have been resolved more readily by a larger and more robust steel industry, it is reasonable to assume that a bigger and a more vibrant industry would have grappled with such challenges more successfully.

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[95]*History of Ministry of Munitions*, *op. cit.*, Vol. XII, p. 110, cited in Barnett (1986), *op. cit.*, p. 85.
[96]Barnett (1986), *op. cit.*, pp. 86–87.

Britain's experience allowing unrestricted dumping a century ago is obviously subject to varying interpretations, but on balance its experience can hardly be held up as a ringing testimonial to the wholly passive policy that was actually followed. Dumping in the markets of the British Empire by cartels operating behind high tariff walls placed a number of key British industrial sectors at a permanent competitive disadvantage. Over time, this led to declining relative competitiveness and, ultimately, disinvestment. This erosion of the British industry left the Empire dangerously vulnerable when it was unexpectedly plunged into a major war in 1914. Although it was argued contemporaneously that dumping of industrial inputs such as steel enhanced the competitiveness of downstream industries that consumed these inputs, it was also noted at the time that the downstream industries themselves suffered from the erratic availability of dumped inputs, the growing dependency on their direct competitors for key inputs, and ultimately by dumping in their own downstream markets—and it was not merely the steel industry, but British industry *as a whole* that had declined dramatically by 1914. Finally, unrestricted dumping surely gave rise to short-run benefits to consumers of dumped products, a fact that was recognized and played a major role in the electoral victory of the Free Traders in 1906. However, seven hundred thousand of those same British "consumers" were killed several years later in the war, and millions more wounded, a toll far higher than it would have been but for the erosion of Britain's industrial base.

DUMPING TODAY: STILL A PROBLEM?

In the decades following World War I, many countries enacted antidumping rules that provided for the imposition of duties at the border on imports that were being sold at "less than fair value" and injured a domestic industry.[97] The "problem" of dumping was recognized in many bilateral trade agreements in which treaty partners agreed to the mutual use of antidumping measures to offset dumping. When the GATT was negotiated in 1947, Article VI provided that contracting parties could use antidumping duties to offset dumping that caused material injury. In subsequent rounds of multilateral trade negotiations, the contracting parties have adopted and refined a succession of antidumping codes that prescribe detailed procedural and methodological rules for the application of antidumping duties.

[97]These measures defined dumping by reference to the domestic price in the market of the dumper and calculated the margin of dumping as the difference between the home market price and the export price. If goods were not sold in the home market, or if too few were sold to use as the basis of a valid home market price, the rules required reference to other measures of "normal value," such as export prices in third country markets or a "constructed" price based on an evaluation of cost plus a reasonable profit. Under some systems, home market prices that did not represent full recovery of cost plus a reasonable profit were excluded from the calculation of home market average prices.

Notwithstanding the proliferation and refinement of antidumping rules, antidumping measures remain controversial. As a leading GATT scholar observes, "central to the whole subject is the perplexing question whether antidumping law and policy, as related to international trade, makes any real policy sense today at all."[98] A chorus of academic commentary answers that question in the negative.

The British experience at the turn of the century would suggest that unrestricted dumping, at least in that era, was harmful. The question remains whether the events of that earlier era have any relevance today. It might well be argued that the widespread adoption of liberal trade and competition policies worldwide has changed the international commercial environment so profoundly that the dilemma which Britain once confronted does not and could not exist today. In addition, it may be that technological change has rendered obsolete the competitive dynamics that existed at the turn of the century. In fact however, while the world has undergone revolutionary political and technological change since that time, the factors that made dumping harmful remain with us today.

Dumping and Cartels: the Evolution of Trade and Competition Regimes

Superficially little remains of the international trading order that existed in the early twentieth century. The world is no longer clearly bifurcated between a single, major free-trading empire and a group of protectionist states and empires. Since the inception of the GATT in the late 1940s, quantitative import restraints have been phased out and tariff walls have been progressively dismantled. In the United States, an antitrust movement fostered enactment of strong antitrust laws and the breakup of many American business trusts. Following World War II, U.S. antitrust thinking was widely (albeit not universally) embraced abroad and some large industrial groups were dismantled by U.S. occupation authorities in Germany and Japan. National competition authorities were established, under U.S. prodding and tutelage, to curtail anticompetitive business behavior. On the basis of such changes, many observers concluded that the types of problems once posed by German cartels and American trusts had become marginal issues in the world economy.

In fact, a significant portion of the debate over the need for antidumping measures turns on the question whether the market barriers and cartels of an earlier time have really been banished from the world economy to the extent assumed by many, or whether they have simply been driven underground by the evolution of national and multilateral competition rules. Numerous critics of antidumping measures concede that dumping from protected "sanctuary" mar-

[98]John J. Jackson, "Dumping in International Trade: Its Meaning and Context," in John J. Jackson and Edwin A. Vermulst, eds., *Antidumping Law and Practice: A Comparative Study* (Ann Arbor: University of Michigan Press, 1989), p.16.

kets by cartels or monopolies may well be a potential problem, were it to occur, but that such practices are rare today:

> The world has changed somewhat in the last eighty years. The operations of foreign cartels are likely to be a smaller problem today than in 1900, in part, at least, because of the operation of national competition laws. Accordingly, even if a persuasive argument that dumping of this type creates economic losses for the receiver of the dumped goods was available, the relevance of the argument to the modern world might be doubted.[99]

There is no question that markets are more open today and that restrictive private arrangements have much less effect on trade today than was the case in the first half of this century. However, the dismantling of tariff walls has not necessarily resulted in open markets, and it does not follow that because national antitrust laws and enforcement agencies now exist, anticompetitive business behavior has ceased or been reduced to marginal importance.[100]

Although "national competition laws" are cited reassuringly by antidumping's critics as a latter-day bulwark against cartels, the assumption that such laws have largely eliminated cartels does not withstand scrutiny. It is true that following World War II many countries enacted competition laws that incorporated elements of U.S. antitrust doctrine, including proscriptions against price fixing, joint restraints on output, and the like. But these laws were grafted onto political systems whose industrial traditions were quite different from those of the United States, and in which antipathy toward joint industrial action, and even cartels, was far less. Following the immediate postwar era—a sort of high water mark for U.S. antitrust ideals—some national competition laws were amended to permit the formation of cartels as industrial policy tools. In other cases the laws were simply not enforced, with governments either tacitly consenting to cartel activity or, in some cases, actually encouraging and directing it.[101] The U.S. government gradually acceded to such arrangements, initially reflecting practical foreign policy considerations (e.g., the onset of the Cold War) but increasingly because it lacked the ability to do anything about the problem without incurring

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[99]Brian Hindley, "The Economics of Dumping and Anti-Dumping Action: Is There a Baby in the Bathwater?" in P.K.M. Thoradan, ed., *Policy Implications of Antidumping Measures* (Amsterdam: North-Holland, 1991).

[100]It should not be forgotten that the American trusts did not disappear or even alter their behavior very substantially for the generation after the Sherman Act and other antitrust legislation were enacted; they continued to thrive alongside laws and enforcement agencies that were supposed to break them up, and even briefly emerged as an element of U.S. industrial policy during the early stages of the New Deal (see Ellis W. Hawley, *The New Deal and the Problem of Monopoly* [Princeton, N.J.: Princeton University Press, 1966]).

[101]See, for example, with respect to Japan, Kiyoshi Humakawa, "Industrial Policy Law Regime," *Jurisuto* No. 1073, 8/01–15/1995, pp. 244–250. With respect to Germany, see Peter J. Katzenstein, *Policy and Politics in West Germany: The Growth of a Semisovereign State* (Philadelphia, Pa.: Temple University Press, 1987).

political costs that were unacceptably high.[102] Over time, a rough modus vivendi emerged in which many countries' governments and competition authorities paid obeisance to U.S.-type antitrust principles, while at the same time cartels and cartel-type arrangements were allowed to regulate a substantial volume of world trade.[103]

THE FACTUAL DEFICIT

Public discussion of the persistence of a "cartel problem" is hampered by the deficit of readily available hard information on the subject. Although at one time the U.S. government and the academic community possessed a wealth of information about national and international cartels, that information base has largely disappeared. The U.S. government agencies that once gathered information on this subject no longer do so and do not possess the capability that once existed. The U.S. economics profession has largely abandoned empirical study of such practices in favor of theoretical mathematical modeling exercises, and this approach has come to dominate the thinking of U.S. antitrust enforcement agencies. As a result, apart from the piecemeal facts that may emerge from a particular episode of civil litigation or as a result of sectoral studies by individual scholars, very little of a practical nature is known about the extent and pervasiveness of restrictive business practices outside of the borders of the United States.

The factual void with respect to anticompetitive business practices in international markets plays a central role in the present debate over antidumping. Critics of antidumping policy are able to ignore or downplay the notion that cartels, monopolies, and similar entities exist abroad that foster dumping because there is little empirical information on the subject that offers a contrary perspective. The result, typically, is a steady stream of highly visible, authoritative pronouncements by prominent scholars on the subject of dumping, which, when juxtaposed against market realities, serves simply to underscore the surreal character of the debate.

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[102]For an account of how U.S. "decartelization" efforts in Germany were brought to halt by political factors, see James Steward Murthin, *All Honorable Men.* Little, Brown, and Co., Boston, Mass., 1950.

[103]In 1994 a gathering of antitrust officials from many OECD countries was presented with a detailed description of a vast web of cartels in flat-rolled steel products, linking the principal mills of the European Union, Japan, Korea, and a number of newly industrializing countries. These arrangements, conducted in a relatively open manner which was sometimes reported in the press, included agreed floor prices, division of world markets into spheres of influence, and delivery quotas into various markets. No competition official from any country denied the essential accuracy of the information presented on this occasion or afterward. Yet at this writing, nearly three years later, these arrangements continue and do not appear to have been the subject of any action by national competition authority within the OECD (see remarks of Alan Wm. Wolff before the OECD Market Access Roundtable, "The Problems of Market Access in the Global Economy: Trade and Competition Policy" [Paris: presented June 30, 1994]).

Several examples of how the factual deficit colors the antidumping debate were provided by the investigation conducted by the U.S. International Trade Commission in 1994–1995 with respect to the rationale for antidumping and countervailing duty laws.[104] The Commission's staff chose to approach this question through a mathematical modeling exercise, and its factual inquiry was largely limited to the gathering of quantitative duty for use in its models. The existence, extent, and implications of anticompetitive combinations abroad giving rise to dumping was not considered relevant to the exercise. A number of prominent academic witnesses who testified similarly ignored or downplayed the role of anticompetitive practices in fostering dumping. Based on this approach, the academic witnesses and the Commission staff tended to reach similar conclusions—that antidumping measures are unwarranted, at least in most cases. But a fleshing out of the facts surrounding cases presented in the investigation calls into question the soundness of the conclusions reached.[105]

One prominent witness before the U.S. International Trade Commission, Professor Robert Willig of Princeton, concluded that so-called "strategic dumping," involving aggressive pricing of exports in combination with protection of the home markets of the exporter, "may, in the long run, harm consumers in the country that receives the exports," as well as domestic industries in those countries. So-called predatory dumping (designed to drive competitors out of business) posed similar concerns. That said, however, he reported that a study conducted by one of his colleagues, Dr. Hyun Ju Shin, had concluded that almost all recent U.S. antidumping cases with a non-negative outcome did not involve either strategic dumping or predatory dumping. The approach suggested by Willig was sensible—that is, to examine the central question of how truly prevalent are the anticompetitive arrangements that supposedly give rise to problematic dumping. However, the examination itself was flawed because of the lack of factual information available. The conclusion was based on Dr. Shin's assumptions rather than on empirical study.

Dr. Shin examined 282 non-negative outcome antidumping cases, "screened out" all cases that did not involve a threat to competition in the United States (e.g., "strategic" or "predatory" dumping), and found that only 20 to 30 cases

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[104]U.S. International Trade Commission, *The Economic Effects of Antidumping and Countervailing Duty Orders and Suspension Agreements* (Investigation No. 332-344) (Washington, D.C.: U.S. International Trade Commission, June 1995).

[105]Two of the International Trade Commission's six Commissioners voted to disapprove the staff study, citing the theoretical nature of the exercise: "Although economic modeling is a useful tool, it cannot substitute for `real world' experience" (views of Commissioner Bragg). Two other Commissioners voted to approve the report to enable the Commission to comply with the deadline set by the Office of the U.S. Trade Representative when it requested the study, while expressing "reservations . . . about the adequacy of this report in presenting a balanced and comprehensive discussion of the issues" (views of Vice Chairman Nuzum and Commissioner Rohr). Two Commissioners approved the study without reservation.

involved actual threats to competition in the United States. This would appear to be a fairly serious indictment of the entire antidumping regime. But the standards that Dr. Shin used to eliminate cases were not based on empirical sectoral case studies, but on her own *assumptions* concerning what seemed logical to include or exclude (e.g., "fairly sensible screens"). Although her reasoning is quite defensible, in an abstract sense, at least one of her most important assumptions was sharply at odds with commercial reality. She surmised that

> [i]f the imports that were challenged were coming from five or more different countries, then it seemed implausible that even if U.S. suppliers were eliminated from the market place, that importers from five different countries could form a cartel—although I am interested in checking this out with other panelists—and thereby participate in a monopolizing episode of the U.S. market.[106]

The assumption that producers from five or more countries could not form a cartel is inaccurate with respect to most cases involving steel products, which in turn comprise the largest single group of antidumping cases.[107] It is also erroneous with respect to a number of other industries.[108] It is, in other words, a factual error of sufficient magnitude to throw into question the validity of the study's

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[106]Transcript of hearing at 443–444 (September 30, 1994).

[107]Virtually all steel cases against the European Community (EC) between 1978 and 1988 involved products that were subject to the Davignon Plan and ancillary market-regulating measures implemented by Eurofer, the European integrated steel producers' association. The Davignon-Eurofer regime was a system of production and delivery quotas, recommended and mandatory minimum prices, fines for violations, and allocation of market shares among Eurofer's members. The EC cartel was linked to a similar cartel in Japan throughout the 1970s, 1980s, and 1990s pursuant to which shipments were limited in both directions and third-country export markets were divided, allocated, and subject to agreements on price and volume. Producers in Sweden, Finland, Korea, and other countries also coordinated their sales with the EC and Japanese groups. The Davignon Plan has been followed by other market-regulating schemes designed to stabilize prices through production restraints (see *Official Journal C.* 83/6, April 21, 1993). In other words, the preponderance of U.S. antidumping cases brought between the late 1970s and the present in the steel sector involved exporting firms that were parties to multinational cartel arrangements. A rough count from Fed-Track turns up a total of 43 U.S. antidumping actions after 1980 that involved EC carbon steel products that were concurrently subject to cartel restrictions under the Davignon Plan or its subsequent (and illegal) descendants. This count does not include numerous cases involving Japan, Korea, Sweden, and Finland. Detailed accounts of the EC steel cartel are set forth in Yves Meny and Vincent Wright, eds. *The Politics of Steel: Western Europe and the Steel Industry in the Crisis Years* (1974–1984) (Berlin, Germany: De Gruyter, 1987); Thomas R. Howell, William A. Noellert, Jesse G. Kreier and Alan Wm. Wolff, *Steel and the State: Government Intervention and Steel's Structural Crisis.* (Boulder and London: Westview Press, 1988), pp. 72–108.

[108]In 1994, for example, the EC Competition Directorate disclosed that ten European producers of carton board from nine European countries had operated a "pernicious. . . high tech cartel operation" involving price fixing and marketshare allocation. The cartel's activities involved "flagrant violation" of EC competition rules and "reveals once again a disturbing level of sophisticated cartel activity in a major industrial sector" (*European Report* No. 1967 [July 16, 1994]).

basic conclusion, which is that truly problematic dumping (strategic) is relatively rare.

Another example is offered by the work of one of antidumping's harshest critics, J. Michael Finger of The World Bank, who also testified in the 1994 U.S. International Trade Commission proceeding. His book, *Antidumping: How It Works and Who Gets Hurt*, denounces antidumping measures based on a series of case studies of the application of U.S. antidumping measures.[109] The case studies are less interesting for what they contain—a series of accounts of the difficulties experienced by foreign firms subject to antidumping measures—than for what is omitted, that is, any description whatsoever of the cartelized milieu out of which dumping arises.

One of the centerpieces of Finger's book is the Swedish stainless steel industry. The author of this case study, which is entitled "Antidumping Attacks Responsible International Citizenship," portrays the Swedish specialty steel industry in glowing terms as "an industry following good economic principles" and that receives little support from "a government demonstrating good international citizenship."[110] A series of U.S. trade actions have been brought over time against Swedish stainless steel products,[111] and the lesson, according to the author is

> that good economics, international competitiveness, private ownership, and limited support from a government demonstrating good international citizenship are not enough to defend an industry against the application of antidumping or other import restricting policy. . . . [T]he Swedish government, in its compliance with OECD criteria guiding national steel policy, demonstrated better international citizenship than either the United States or the European Community.[112]

Mr. Finger, commenting on this case study, concludes that

> Antidumping is anticompetition policy, not procompetition. . . . [T]he U.S. industry used antidumping and other unfair trade remedies to attack (Swedish) producers who had started out in the same situation as the U.S. producers but had fought their way through a disciplined, market-accommodating restructuring and downsizing to restore their profitability.[113]

Given such a presentation of the facts, the reader might well conclude that the U.S. antidumping law served as little more than a mechanism employed by U.S. protectionists to harass market-oriented, pro-competitive Swedish entrepreneurs.

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[109]J. Michael Finger, *Antidumping: How It Works and Who Gets Hurt* (Ann Arbor: University of Michigan Press, 1993).

[110]Fors in Finger (1993), *op. cit.*, p. 138.

[111]Antidumping actions have been brought against Swedish stainless steel plate and seamless and welded tubes. Stainless steel sheet and strip, plate, bar, wire rod, and drawn wire have been the subject of import relief (safeguards) actions. Section 301 actions have been brought against stainless steel drawn wire and tubes.

[112]Fors in Finger (1993), *op. cit*., p. 158.

[113]Finger (1993), *op. cit*., pp. 53–54.

An objective reader of the Swedish specialty steel case study might have been interested to know—but wasn't told anywhere in Finger's book—that on July 18, 1990, Avesta, one of Sweden's leading stainless steel producers and a centerpiece of his case study, was found by the EC Competition Directorate to have been a participant in the so-called Sendzimir Club or Z-mill club, a secret cartel of stainless steel sheet producers that, in the words of the Commission,

> prevented, restricted and distorted normal competition in the common market by controlling production, by sharing markets and customers, and by providing the basis for concerted practices on prices. . . . [These actions] inevitably had a significant effect on conditions in the Community market.[114]

The details of Avesta's participation in the Sendzimir Club were set forth in detail in the EC Commission's public findings. Basically, Avesta was a signatory to a secret agreement signed in Dusseldorf on May 16, 1986, that divided up the European market for stainless steel sheet [meaning the EC and EFTA (European Free Trade Association) countries] among the participating producers, establishing a system of delivery quotas for each market, together with arrangements for fines for deliveries to any market exceeding the quotas set. A sophisticated administrative structure was set up to run the cartel, characterized by frequent meetings and periodic adjustments of the quotas.

This episode, to be sure, could be dismissed as an anomaly; it might be argued that, notwithstanding this apparent lapse by Avesta, Swedish steel producers embrace "good economic principles" *most* of the time. But there is more. On February 16, 1994, the EC Commission's Competition Directorate published a decision imposing sanctions on the members of a secret European cartel in the steel beams (structurals) industry, and again, Swedish steel firms were found to be deeply involved, including SSAB, the largest producer in Sweden; Ovako Profiler AB, a Swedish producer of specialty and carbon steel products; and Fundia Steel AB. The Commission's finding set forth the details of an extraordinarily complex set of arrangements involving price fixing and market division on a country-by-country basis for the EC and Scandinavia; exchange of information between producers; harmonization of charges for "extras"; and the imposition of fines on companies violating these accords.[115] EC Competition Commissioner Van Miert stated that

> Everything that could have been infringed was infringed. It was a serious cartel involving all of the firms in the sector. It was flagrant and prolonged.[116]

It might be argued that European competition authorities acted against the Sendzimir and Beams cartels, thus demonstrating that national competition rules

[114]Commission Decision of 18 July 1990, *Official Journal* No. L 220/28 (August 15, 1990). The details of the cartel's administration, rules, procedures, and operations are set forth by the Commission in this order.

[115]Commission Decision of 16 February 1994, *Official Journal* No. L.116 (May 6, 1994).

[116]*European Report* No. 1927 (February 19, 1994).

are in fact disciplining such activity. However, the Sendzimir group was let off with small fines, reflecting, in part, the complicity of government officials in the activity concerned. The decision in the Beams case made clear that cartel activity in other product areas, and other markets, was known to the Commission but was not subject to sanctions. Public documents filed by at least one participant indicated that, notwithstanding the Commission's actions, it would take a wait-and-see attitude rather than withdrawing from other, similar arrangements in other product areas and in other international markets.[117]

The nexus between such anticompetitive arrangements and dumping is the same one that British critics of dumping cited at the turn of the century. Groupings such as the Sendzimir Club seek to stabilize prices in their home markets by creating an artificial constraint on supply. At the same time, they can maintain high operating rates, reduce unit costs, and enhance profitability as long as outlets exist in external markets where surpluses can be disposed of without disturbing the market order at home—that is, they are dumped.[118]

Although none of the activities of the Sendzimir Club or the Beams cartel found its way into Finger's analysis of antidumping and the Swedish steel industry, his omissions were not unique—they are virtually universal in critiques of antidumping policy. The existence of anticompetitive groupings that restrain supply within their own markets and dump surpluses in external markets is either not known, or if known, not reported to readers. But until such activities and their implications are fully understood and directly addressed, it is difficult to see how a meaningful public discussion of the continuing relevance of antidumping measures can go forward.

The Sendzimir and Beams cartels were operating in the European Union, which has one of the world's most rigorous competition regimes. If such activity remains common in the EU, it is not unreasonable to suppose that it occurs with equal or greater frequency in markets where competition rules are less stringent,

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[117]Following the decision in the steel beams case, British Steel's (BS's) annual report noted the fines involved in the beams decision and warned its shareholders of "industry groups" other than the beam cartel, to which BS belongs and which cover, among other things, "market conditions and various aspects of the sale and marketing of steel products..." Although British Steel does not say how membership in these groups might constitute a contingent liability, the clear inference is that they are involved in dealings similar to those that were found to be illegal in the Beams case" (*Metal Bulletin*, July 11, 1994). Moreover, the company disclosed in its 1993 Form 20-F filing with the U.S. Securities and Exchange Commission that its continued participation in such groups depends on the enforcement policies of the European Commission and of "authorities in other jurisdictions," indicating that the sphere of influence of these "industry groups" extends beyond the boundaries of the EU.

[118]Some cartels have regarded dumping as so essential to their success that they have adopted rules to spread the costs associated with dumping on an equitable basis among their members. One example is South Africa's "Iron/Steel Export Promoting Scheme" of the 1980s, pursuant to which producers paid money from domestic sales into a fund that was used to provide rebates on exported steel (typically about 20 percent of the f.o.b. value of exported steel products) to compensate exporters for the lower international prices obtained.

to the extent they exist at all. Japan, where weak enforcement of the Antimonopoly Law has been a subject of widespread comment and criticism, is characterized by highly cartelized industries that differ little in basic structure or competitive dynamics from the German kartells of a century ago.[119] And numerous newly industrializing and developing countries either have no competition laws or are only now beginning to implement them. It is surely no coincidence that the incidence of antidumping actions around the world still tends to cluster in sectors where anticompetitive arrangements are known or frequently reported to exist.

TECHNOLOGICAL CHANGE

Even if the persistence of current market access barriers and restrictive private practices is acknowledged, it might be argued that because of such practices dumping remains a problem in traditional capital-intensive sectors such as cement, steel, and paper. The world economy is increasingly dominated by technology-intensive industries in which the competitive dynamics are quite different than those of a century ago. In these sectors, dumping may not be a significant problem. In fact, experience has demonstrated that dumping can be, if anything, even more destructive in its impact. It has had a devastating effect in several technology-intensive sectors, notably consumer electronics, microelectronics, and telecommunications equipment. Because at least some of these industries are as integral to national defense as steel once was, dumping can pose national security concerns as serious today as those at the turn of the century.

In high-technology manufacturing industries, research and development, and capital investment requirements are extremely high—a single semiconductor wafer fabrication facility, for example, can cost in excess of $1 billion. At the same time, in contrast to steel, product life cycles are extremely short, with the result that these investments must be entirely recovered within a very short time, typically three to four years. In this setting, intensive dumping can literally destroy an industry in a matter of months, as happened to much of the U.S. dynamic random access memory (DRAM) sector in 1984–1985. The massive losses incurred in such episodes may preclude investment in the next generation technology for that product, with the result that, from a commercial perspective, a firm is permanently driven out of a sector.

Competition in high-technology sectors is rendered more intense by "learning curve" pricing tactics, pursuant to which producers seek to maximize production volume early in a product life cycle because production costs decline in a predictable fashion based on cumulative production experience. Firms that achieve high volumes in the early stages of the product cycle achieve a cost ad-

[119]See Mark Tilton, *Restrained Trade: Cartels in Japan's Basic Industries* (Ithaca, N.Y: Cornell University Press, 1996); Office of the U.S. Trade Representative, *1997 National Trade Estimate Report on Foreign Trade Barriers* (Washington, D.C.: U.S. Trade Representative, 1997).

vantage that may well prove to be commanding. However, playing this game requires massive investments accompanied by aggressive initial pricing, a high-risk approach that can culminate in market dominance, or, conversely, disastrous losses and even the destruction of the firm. "Learning curve" competition, while brutally Darwinian in its implications, is arguably consistent with market-based economics unless one or more of the competitors is operating from a protected "sanctuary" market. In that case, a company can move down the learning curve at relatively low risk through sales in the protected market. Such cost advantages and profits from the sanctuary can then be used to subsidize attacks on rival firms outside the sanctuary. The net result of diminished risk for the protected firms and exacerbated risk for other firms is familiar—disinvestment by firms adversely affected by dumping which cannot respond in kind in their rival's sanctuary.

The Japanese electronics industry, for example, is dominated by large, diversified industrial groups that have limited competition among themselves in the Japanese market in a number of product areas, with the result that prices are higher than world prices in many product lines. Profits from these "sanctuary" sectors have been used to finance aggressive entry into contested areas, selling at a loss, if necessary, for a sustained period. This dynamic has been observable in semiconductors, telecommunications equipment, and a number of other technology-intensive product areas. The high volumes that have been achieved as rivals were marginalized have eventually translated into a cost advantage and, as investment by rivals is deterred, a long-run technological advantage—in effect, the same dynamic observable in steel competition at the turn of the century.

The gradual shift in competitive advantage that took place between the British and German steel industries has close parallels in electronics. Twenty-five years ago U.S. consumer electronic firms were the world leaders in sales and technology. They sought to establish a competitive position in Japan, but were blocked by a combination of formal and informal market barriers as the Japanese government worked to foster an indigenous consumer electronics industry.[120] Government restrictions included a prohibition on the establishment of local subsidiaries, foreign exchange controls, import quotas (particularly with respect to replacement and repair parts), and a 30 percent tariff.[121] Although these restrictions were largely phased out in the early 1970s, an even more effective market barrier was the arrangements made by the Japanese producers themselves to restrict market penetration. Japanese consumer electronics retail outlets and service facilities were usually owned or controlled by large *keiretsu*-affiliated elec-

[120]For a comprehensive account of the promotional measures employed by the Japanese government in consumer electronics, see Developing World Industry and Technology, Inc., Office of Technology Assessment, *Sources of Japan's International Competitiveness in the Consumer Electronics Industry: An Examination of Selected Issues* (Washington, D.C.: Office of Technology Assessment, 1980).

[121]General Accounting Office, *United States-Japan Trade: Issues and Problems* Washington, D.C.: General Accounting Office, 1979).

tronics firms. These firms enjoyed enormous leverage over the small retailers because of the dependency of the latter on the former for capital and because of a system of rebates given by the manufacturer to retailers for factors such as "loyalty" and "cooperation."[122] Because the retail price was the same at all retail outlets, manufacturers could also reward or punish individual retailers by varying the wholesale price of merchandise. This leverage was used to prevent retailers from handling foreign merchandise.[123] U.S. consumer electronics firms might have in theory set up their own dealer networks, but they were prevented from doing so by a welter of official restrictions.[124]

But the restrictive practices in the Japanese consumer electronics sector went far beyond such garden-variety vertical restraints. For decades a number of the major electronics producers were involved in an extraordinarily elaborate system of clandestine and semi-clandestine arrangements to regulate various aspects of market competition in consumer electronics.[125] They operated a network of working groups[126] that met monthly from 1964 through at least 1974 to agree on future

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[122]Kozo Yamamura and Jan Vandenburg, "Japan's Rapid Growth Policy on Trial," in Kozo Yamamura, ed., *Policy and Law Issues of the Japanese Economy* (Seattle: University of Washington,, 1987), p. 244.

[123]Japanese consumer electronics retail outlets committed to provide a minimum of 80 percent of their floor space to their franchisor. The General Accounting Office observed in 1979 that the "Japanese industry representatives expressed doubt that any retailer would refuse to sell a product, but from our fieldwork we find this difficult to believe" (General Accounting Office, 1979, *op. cit.*, p. 90). This system still exists in its essential aspects, despite some moves toward reform (*Shukan Daiyamondo*, July 3, 1993).

[124]In the 1960s and 1970s, foreign ownership of a 50 percent share in ten or more retail outlets required special approval by the national government; foreign firms were prohibited from underwriting consumer purchase installment loans; and they could not enter into restrictive distribution arrangements with their own retail outlets comparable to those employed by Japanese firms. Although some independent dealers existed that theoretically might have handled U.S. products, selling through such outlets was impeded by government restrictions on the import of replacement and repair parts, which limited after-sales service (General Accounting Office, 1979, *op.cit.*, p. 90).

[125]From the 1950s through at least the 1970s, Hitachi, Mitsubishi, Toshiba, Sharp, Sanyo, and Matsushita maintained a joint arrangement known as the Market Stabilization Group, whose purpose was to control the retail prices of television sets in the domestic market. According to the Japanese Fair Trade Commission (JFTC), these firms engaged in "concerted activities" to "fix, maintain, or enhance prices, or to limit production. . . .thereby causing, contrary to public interest, a substantial restraint of trade." The companies agreed on "the bottom prices, margin rates, and distributors' prices for both color and black and white televisions. . . ." These findings, however, did not result in any significant policy actions (JFTC, *Kosei Torihiki Iinkai Nenji Hokoku* [1979], cited in Yamamura and Vandenberg [1987], *op. cit.*).

[126]The Tenth Day Group was limited to mid-level executives from the television divisions of the largest producers. The Tenth Day Group consisted of representatives of the seven large producers as well as smaller producers. The Palace Preparatory Group digested data assembled by the Tenth Day Group for consideration by the so-called Palace Group, consisting of senior managing directors who met to consider more important unresolved matters at the Tokyo Palace Hotel. From there, the decision went to the highest executives of the major companies, who met monthly at the Hotel Okura (Yamamura and Vandenburg [1987], *op. cit.*, p. 25).

production and shipment levels for televisions. The JFTC did not impose sanctions for any of the anticompetitive activities engaged in by the Japanese companies,[127] and its relative passivity was essential to the continued functioning of the cartel:

> Regular, frequent meetings, at which manufacturers' representatives negotiated outputs and prices at the retail, wholesale, and manufacturers' levels were an important element of [the cartel's] success. . . . The story of the cartel shows that it would have been an impossible venture had the JFTC possessed more power. The members were continuously renegotiating complex, detailed agreements at numerous meetings, which did not escape notice by the JFTC.[128]

But it is unclear that a series of warnings and recommendations by the JFTC to the Japanese electronics firms, spanning over 30 years, has done much to curb anticompetitive behavior.[129]

In 1984, "evidence suggesting anticompetitive behavior in the marketing of office computers and other final products utilizing microchips" [was] uncovered by the JFTC;[130] the JFTC noted the increasing "capture" of wholesalers by manufacturers, increasing producer shareholding in distributors, and transfer of management personnel between manufactures and sellers, and found that contracts signed between producers and dealers contained "restrictions regarding retail prices, sales area, retailers to whom the products could be sold, and other matters, [and] restrictions which conflict with the intent of the Antimonopoly

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[127]The Electronics Industry Association of Japan (EIAJ) collected sensitive data from each producer on television production volume, shipments, and inventories, broken down by screen size and tube type, and disseminated this information to all other manufacturers on a monthly basis through at least 1975. Documents seized by the JFTC indicated that the primary goal of this "welter of clandestine groups and overt cooperative activity" was price fixing and the cooperative control of distributors. These groups openly discussed and agreed on bottom prices for each type of television as well as wholesale and retail profit margins and rebate levels to distributors. The same producers participated in export cartel arrangements that divided the U.S. market among these companies (to avoid interfirm rivalry among Japanese producers) and that facilitated a massive wave of dumping which virtually destroyed the U.S. television industry during the 1970s. For a detailed account of this activity see Yamamura and Vandenburg (1987), *op. cit.*

[128]David Schwartzman, *The Japanese Television Cartel* (Ann Arbor: University of Michigan Press, 1993), pp. 75–76.

[129]See, generally, Marcel F. Van Marion, *Liberal Trade and Japan: The Incompatibility Issue in Electronics* (Groningen, Netherlands: Rijksuniversiteit Groningen, 1992), pp. 77–101. In 1957 the JFTC issued a report describing anticompetitive practices of the Japanese television manufacturers in the domestic market, including price fixing and resale price maintenance with respect to distributors, and it issued an order prohibiting the firms in question from carrying out their agreement, but the order did not prohibit a new agreement dated subsequently to the order. In 1966, in the six-company case, the JFTC again found that six Japanese television manufacturers had violated the Antimonopoly Law, but it concluded that the violations had ceased. The cartel continued to operate after this decision (Schwarzman, 1993, *op. cit.*, p. 28).

[130]Yamamura and Vandenburg (1987), *op. cit.*, p. 270.

Act."[131] In 1992 the JFTC and Ministry of International Trade and Industry (MITI) began investigations into allegations of illegal price fixing of audio-visual appliances by Matsushita, Sony, Hitachi, and Toshiba.[132] In 1993 the JFTC was reportedly investigating allegations of *dango* (bid rigging) in connection with the sale of large-scale display screens manufactured by Sony, Matsushita, and Mitsubishi.[133] A recent German study found that 80–90 percent of the retail sales of consumer electronics products in Japan involved retailers' sales of items made by "their" domestic manufacturer, and that "the tied retailers do not usually carry directly competing products. . . . Japanese manufacturers of domestic electrical appliances have broad control over the marketing chain right down to the consumer. . . . [T]his means that the tied retailer sector, which also has service facilities, is in general not accessible to non-Japanese manufacturers and their direct marketing partner (importers)."[134]

Eventually, the anticompetitive practices that were endemic in the Japanese domestic electronics market spilled over into the international arena—with devastating effects. As one recent study observed, the

> facts demonstrate that the seven [Japanese electronics] firms carefully coordinated their export plans; they notified one another of the intended quantity of shipments and prices, allocated U.S. customers among themselves, and cooperatively concealed a web of illegal, covert activity while charging prices low enough to suddenly and decisively gain a large share of the American market.[135]

In the television case, although numerous legal remedies were invoked by U.S. producers, no real answer was found either to dumping itself or to the Japanese market barriers and cartel practices that had made dumping possible. Instead, the U.S. television industry largely disappeared, foreclosing not only U.S. participation in this sector in the future, but in succeeding generations of products such as VCRs.

The problems that "downstream" British industries faced at the turn of the century as the effects of dumping gradually made them dependent on their Ger-

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[131]JFTC, *Office Computer no ryutsu jittai chosa ni tsuite* (September 28, 1984), cited in Yamamura and Vandenburg, 1987, *op. cit.*, p. 278n.

[132]*Nihon Keizai Shimbun* (March 27, 1992).

[133]*Asahi Shimbun* (November 16, 1993).

[134]Erich Batzer and Helmut Laumer, *Deutsche Unternehmen in Japangeschaft* (Munich, Germany: IFO Institute for Economic Research, 1989).

[135]Yamamura and Vandenberg (1987), *op. cit.*, p. 259. The Japanese firms devised the so-called "Five Company Rule," which required each exporter to specify five U.S. companies as its only and exclusive customers. No firm could sell to another company's U.S. customer without prior approval of a committee made up of executives from each company, "including, of course, any would-be Japanese competitor." Violations were punished by the Committee through fines equal to one-third of the value of a transgressing shipment. The purpose of these arrangements was to ensure that U.S. buyers did not play off one Japanese firm against another, and that any "increases in sales would be at the expense of American competitors." *Ibid.*

man competitors for key inputs has been paralleled, to a degree, in electronics. Both U.S. and European firms have repeatedly been placed in competitive difficulty as a result of their dependency on the Japanese electronics producers' group for components and tools. The most dramatic instance was the "chip shortage" of 1987–1990.[136]

Japanese semiconductor production is dominated by the same large electronics firms that comprised the television cartel described above—semiconductors are a basic component used in the end products manufactured by these firms, not only televisions but other computers, telecommunications equipment, robots, and factory automation systems. Beginning in the 1960s, these firms were organized by MITI into a series of research and development consortia for the purpose of catching up with the United States in semiconductor technology. Foreign sales in Japan were severely restricted through a ban on foreign investment, import restrictions, and local content requirements.[137] Under U.S. pressure, Japan committed to eliminate these formal market barriers by 1974, and MITI undertook an urgent program of "liberalization countermeasures" designed to offset the effect of liberalization when it was implemented. Japanese semiconductor and computer firms were encouraged to form tie-ups for the production, marketing, and sales of semiconductors and computers after liberalization.[138] Perhaps not surprisingly, after elimination of formal barriers to market entry in 1975, there was no increase in the foreign share of the Japanese market. U.S. firms were able to sell semiconductor products in Japan when a competing Japanese alternative did not exist, but when Japanese devices became available (often simply copies of U.S. devices), U.S. sales fell dramatically, in some cases resulting in a total loss of market.[139]

In the early and mid-1980s, Japanese semiconductor companies used their protected home market to pursue an aggressive trade strategy characterized by periodic episodes of dumping in the United States.[140] In the 1980s, Japanese companies repeatedly dumped DRAM and erasable programmable read-only

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[136]See Semiconductor Industry Association, *Creating Advantage* (Santa Clara, Calif.: Semiconductor Industry Association, 1992), pp. 120–126.

[137]*Nikkan Kogyo* (December 12, 1974); Japan Information Processing Development Center *Computer White Paper* (1975); *Japan Economic Journal* (January 14, 1969).

[138]*Nihon Kogyo Shimbun* (February 19, 1974); *Nihon Keizai Shimbun* (January 24, 1974); *Nikkan Kogyo Shimbun* (March 20, 1974).

[139]The Japanese press characterized this phenomenon as the "extinction of the market" (*Nikkan Kogyo* [July 28, 1982]). For a number of case studies see Semiconductor Industry Association, *The Effect of Government Targeting on World Semiconductor Competition* (Santa Clara, Calif.: Semiconductor Industry Association, 1983).

[140]The best account of this episode is Kenneth Flamm, *Mismanaged Trade? Strategic Policy and the Semiconductor Industry Association* (Washington, D.C.: The Brookings Institution, 1996). See also Semiconductor Industry Association (1983), *op. cit*. and (1992), *op. cit*.

memory (EPROM) chips in the United States, which in the case of DRAMs, succeeded in driving virtually all U.S. firms from the market.[141]

Most U.S. DRAM producers withdrew from the market in mid-1985, and the Japanese DRAM producers were left with a virtual world monopoly of this strategic product. At this point, the Japanese DRAM producers began jointly curtailing their production so as to raise prices.[142] In 1986 MITI announced a system of production "guideposts" (indicative production limits) designed to create a state of tight supply and higher prices.[143] By 1987, the market power of the Japanese producers was so great that a "chip shortage" occurred; they exercised concerted production restraint in the face of strong demand, resulting in worldwide shortages, skyrocketing prices, and economic dislocation for foreign firms dependent on Japanese components—and enormous profits for Japanese DRAM makers.[144] The Japanese firms continued to supply their own end users with DRAMs during this period, giving them a competitive advantage internationally. In addition to price manipulation through coordinated production controls, Japanese DRAM producers reportedly attempted to leverage their dominant position in the DRAM market into other markets by "tying" DRAM sales to sales of other unwanted custom chips such as application-specific integrated circuits [ASICs].[145] Significantly, none of these experiences was replicated in EPROMs, where U.S. producers retained a much more substantial presence in the market and served as a check on the market power of the Japanese firms.

The strategic implications of U.S.-Japanese competition in electronics are not particularly difficult to discern. This competition occurred between the industries of two close allies between whom armed conflict is unlikely under any foreseeable circumstance. However, the Gulf War underscored the extent to which advanced electronic systems are likely to dominate future wars and to which U.S. forces will depend on foreign companies and systems. As other advanced electronics industries are emerging around the world, the competitive dynamics that characterized U.S.-Japanese rivalry in the 1970s and 1980s are likely to manifest themselves again, perhaps in a strategic context that is considerably less benign.

Although the character of strategic industries has shifted from sectors such as steel and dyestuffs to technology-intensive industries such as advanced electronics, new materials, and aviation, dumping poses a problem little different from that which Britain faced a century ago. The loss of strategic industries, and the resulting dependency on foreign sources for defense-related supplies, inevitably poses security risks that cannot readily be remedied once a conflict actually breaks out. Even if the foreign source of supply is a close ally, access may be

[141]The margins of dumping in EPROMs ranged from 60 to 188 percent (Federal Register, *Erasable Programmable Read Only Memories from Japan*, 51 Fed. Reg. 29,708 (U.S. Department of Commerce, 1986); *64 Kilobit Dynamic Random Access Memories from Japan*, No. 731-TA-300 (final). U.S. International Trade Commission, Washington, D.C.

foreclosed through enemy occupation or interdiction, competing demands on the products in question, or a foreign decision to withhold supply for a variety of policy reasons.

BELOW-COST DUMPING

Antidumping measures have evolved over time that have offset not only "classic" dumping (e.g., price discrimination between markets) but export sales below the cost of production.[146] Commentators on antidumping frequently acknowledge that sustained below-cost export sales can be indicative of a predatory export strategy designed to drive rivals out of the market. However, it is argued that predatory schemes are rare and that assessing antidumping duties against below-cost exports penalizes certain legitimate economic activities, such as inventory clearance, "forward pricing" of new products whose average costs are initially high but decline rapidly as cumulative output increases, and export sales during recessions. In fact, predatory export strategies do appear to be extremely rare in the real world, at least as the term "predatory" is defined by contemporary economists and court decisions, and the need to protect industries against predation does not, by itself, appear to justify most of the cost-of-production antidumping duties that have been applied in recent decades.[147] It is also probably true that

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[142]*Sankei Shimbun* reported that "semiconductor industry circles, which were forced to take rigid measures for the coordination of production because of the decline of the market prices of their products, have at last begun to show signs of recovery" (*Sankei Shimbun*, December 5, 1985).

[143]*Nihon Keizai Shimbun* (April 24, 1986).

[144]*Nihon Keizai Shimbun* (October 10, 1987; June 28, 1989); *Wall Street Journal* (February 19, 1987).

[145]See U.S. General Accounting Office, *U.S. Business Access to Certain Foreign State-of-the-Art Technology* (Washington, D.C.: U.S. General Accounting Office, 1991), pp. 43–44.

[146]The U.S. Department of Commerce (DoC), for example, normally determines dumping margins by comparing home market prices with export prices. However, in calculating the appropriate domestic price, the DoC disregards sales made at below the cost of production if they are made "in substantial quantities," "over an extended period of time," and "not at prices which permit recovery of all costs within a reasonable period of time in the normal course of trade." If over 90 percent of domestic sales are disregarded as below cost, the DoC moves to a "constructed value" approach, in which it determines the "fair market value" for the domestic market by examining the exporter's costs (19 U.S.C. § 1677b[a][2], [b][c]).

[147]When the antidumping laws were enacted the term "predatory" was one of a number of "loose catchwords" (such as "cutthroat competition," "chiseling," and the like) used to describe a broad range of commercial abuses, such as "putting a crimp in one's competitors, punitively or destructively attacking other firms, and acting vindictively with punitive effect" (*International Air Industries* v. *American Excelsior Company* [517 F.2d 722, 5th Cir. 1975]). However, economists and recent U.S. court decisions have so narrowed the concept that "predatory pricing," as so defined, almost never occurs. Judge Bork has gone so far as to say that predatory conduct "probably does not exist" in the real world (Robert H. Bork, *The Antitrust Paradox: A Policy at War With Itself* (New York: Free Press, 1978), p. 154. See in particular *Matsushita Electrical Industrial Co., Ltd. et.al* v. *Zenith Radio Corp.* 475 U.S. 574 [1986]).

the scope of below-cost antidumping measures permitted under the GATT and national legislation has resulted in the application of duties in specific cases in which little policy justification exists to support the measures taken, although refinements in the GATT Antidumping Agreement limit the extent to which this can occur. It does not follow, however, that below-cost antidumping measures should be abolished or even substantially curtailed.

In a market-based economy, below-cost sales generally cannot occur indefinitely, since eventually the seller will be required to exit the market. Sustained sales at below cost are thus indicative of abnormal business behavior, and a variety of types of market distortion can give rise to sustained below-cost export sales. For example, a number of instances of below-cost dumping appear to involve the cross-subsidization of the exported product with profits generated from a domestic sanctuary market in which competition is restrained. This situation is simply a variant of Viner's "classic" dumping and is harmful for the same reasons.

Some normal commercial practices, such as inventory clearance sales, involve sales below cost for a limited time, but under current GATT rules and most national legislation, such short-term sales do not constitute a basis for imposition of antidumping measures. Although "forward pricing" of exports based on anticipated profits is cited as a legitimate rationale for below-cost export sales, this rationale could be used to justify any below-cost export sales—a product's life cycle cannot be predicted accurately, and there is no way of knowing whether it is reasonable to expect that full costs will ever be recovered. Finally, while it is certainly true that below-cost exports occur during recessions, the vast majority of these are not subject to antidumping measures. Moreover, a serious question is presented as to

> whether it is welfare-maximizing for the country of import to absorb, on a sectoral basis, somebody else's homemade recession. I dread to hear some people argue that, prima facie, this would be a good thing because it would result in low prices for consumers. If this were true, maybe we should not wait for recessions to be imported, but we should rush and ask our central banks to severely deflate so as to generate lots of low prices for consumers.[148]

In fact, it is unlikely that a multilateral regime that permitted unrestricted below-cost export sales—whether generated by recessions, anticompetitive syndicates, or some other factor inconsistent with market-based economies—could long endure the political pressures that would be engendered.

ANTIDUMPING AND TRADE LIBERALIZATION

For a century the concern that dumping by foreign syndicates might destroy key industries has been used by advocates of protectionism as a rationale for

[148]Miranda (1996), *op. cit.*, p. 6.

restricting imports in general, whether through a high tariff wall, quantitative restrictions, tariff, or other means. A variant on this argument has been used in developing countries as a justification for protectionist measures to defend against the feared depredations of multinational corporations. And yet despite the persistence of anticompetitive business groupings in international trade, and of dumping, the world trading order has been progressively liberalized since mid-century. The positive role played by antidumping—commonly castigated as nothing but a protectionist tool in this process—should be recognized.

The enactment and refinement of antidumping measures worldwide is almost always an element in a broader program of trade liberalization or a mechanism for defusing protectionist pressures. Typically, proponents of liberalization argue that the danger of dumping in specific sectors should be addressed through administrative measures limited to the sectors where dumping actually occurs and should not stand in the way of a more general reduction in trade barriers. The world's first antidumping legislation was enacted by Canada in 1904 by the Liberal party to neutralize domestic manufacturers' opposition to a more general reduction in import duties.[149] Similarly, the first U.S. antidumping legislation, the Antidumping Act of 1916, was supported by the Wilson administration which, "while showing itself wholly sympathetic with the desire for adequate protection against unfair foreign competition, was determined that it should not be employed to build up sentiment for an upward revision of the existing tariff act."[150] In the modern era, congressional political support has been sustained for the ratification of a successive road of multilateral tariff reductions, in part because the implementing legislation has incorporated refinements in U.S. antidumping procedures. A similar process is now observable in newly industrializing countries such as Mexico, Korea, and Chile, which are making greater use of antidumping measures, and strengthening their antidumping procedures, as they move to make their markets more open.

One of the most pervasive charges against antidumping policy is that it is spreading to newly industrialized countries like a sort of plague, threatening the liberal world trading order. But this reasoning implies that these countries' markets were previously open, and that a shadow is falling across this happy state of affairs as free-trading nations imitate the United States and begin to put in place antidumping regimes, a regression to a more protectionist policy. In fact, with the exception of a few special cases such as Hong Kong, virtually all newly industrializing and developing countries have been highly protectionist in the postwar era, even countries such as Taiwan and Korea, which were sometimes touted

[149]"[T]he government found an ingenious escape in the enactment of the antidumping law, which gave the manufacturers the specific type of protection which they claimed they needed without antagonizing farmers by an increase in the rates of duty of the ordinary tariff" (Viner [1923], *op. cit.*, p. 193).

[150]*Ibid.*, p. 242.

as liberal. The market barriers in these countries were not particularly easy to identify because they consisted, typically, of opaque practices such as import licensing and prior approval requirements and the grant of import monopolies to domestic producers of the imported product.[151] This situation began to change at the end of the 1980s as many newly industrialized countries and developing countries began scrapping their systems of administered protection in favor of transparent, GATT-based import regimes. The adoption of antidumping measures is part of that process of trade liberalization, and, as such, their advent should be welcomed, not condemned, provided that transparent and fair procedures are adopted. A member of the World Trade Organization Secretariat recently observed on this point that

> The literature on the effects of anti-dumping duties assumes that no alternative protection would have been put in place. This assumption, however, is highly debatable. All the countries that have undergone substantial trade liberalization understand how difficult it may be to implement this policy, especially when the groups adversely affected are (politically) visible while the groups benefitting are (politically) dispersed. It is more than likely that, at least on occasion, the country of import would have let some of the steam pressuring trade reform come out in the form of additional protection.[152]

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[151]Professor Robert Wade of Princeton recently published a study of Taiwan's industrial policy that sets forth a detailed description of Taiwan's discreet system of import protection as it existed through the mid-1980s. Typically, issuance of an import license might require an import to secure approval from a bank to see whether or not the item was on the "Secret List" of restricted items promulgated by the Board of Foreign Trade. In other cases issuance of a license would require a domestic association representing domestic producers of competing products to give their assent to the import—a requirement that, according to one source cited by Wade, covered fully half of Taiwan's imports in 1984 (Robert Wade, *Governing the Market: Economic Theory and the Role of the Government in East Asia Industrialization* (Princeton, N.J.: Princeton University Press, 1990). This system was virtually invisible and enabled Taiwan to win kudos from U.S. economists as a dynamic outward-oriented economy, while Taiwan simultaneously restricted and controlled imports that threatened the development of key industries such as steel, petrochemicals, chemicals, machine tools, and bearings. It is perversely ironic that as Taiwan and other newly industrialized countries have moved to phase out their systems of clandestine protection, and have adopted transparent rule-based antidumping regimes, they are now coming under criticism from American economists for doing so.

[152]Miranda (1996), *op. cit.*, p. 8. A European Union official commented in 1989 that "there are of course those who argue that the whole principle of applying antidumping remedies is flawed and that market forces should be allowed to function unhindered. . . . This laissez-faire approach is, in the author's view, not only naive but also ignores the fundamental precept for open markets (i.e., open markets themselves). Everyone, in principle, is for free and open trade; however free trade is not possible if ones partners' exporters are not trading fairly. This is all the more true when the hidden hand of government creates the conditions facilitating the pursuit of price discriminatory policies. To blandly assume that, somewhere down the road, a liberalized world trading order will resume whilst ignoring the real potential for economic hardship during the 'adjustment' period seems to this author devoid of any practical, economic, or political reality" (Richard Wright, "Validity of Antidumping Remedies—Some Thoughts," in John H. Jackson and Edwin A. Vermulst, eds., *Antidumping Law and Practice: A Comparative Study* [Ann Arbor: University of Michigan Press, 1989], p. 421).

It might be argued, of course, that even if some form of antidumping rules is needed as a transitional political concession to certain constituencies to facilitate the transition to liberal trade, this is a second-best solution, and that over the longer term, as the political base for open markets becomes stronger, antidumping should be phased out. The flaw in this reasoning is that if dumping really is a harmful commercial practice, foregoing its regulation will generally tend to undermine the political base for a liberal trade policy.

It is worth returning to the case of Britain in this connection. Britain did adopt antidumping regulation in the 1920s, but the rules enacted were so cumbersome as to be unusable, so that for practical purposes, dumping was permitted to continue unrestricted through the 1920s. With the onset of a world economic crisis at the end of the 1920s, Britain's 80-year consensus in support of free trade collapsed dramatically, and a wall of tariffs was erected around the Empire. Although the precise causes of this seismic shift in British economic policy have been the subject of some disagreement, it is clear that "the speed and completeness with which the remaining free trade support collapsed in 1930 can only be understood in the context of growing disillusion with trade liberalism in the late 1920s."[153] Underlying this disenchantment was the persistence of an old problem—barriers in foreign markets, coupled with dumping in Britain's own. Farmers were "shocked by the intensive dumping of foreign fruits and vegetables which had destroyed markets before smallholders were able to dispose of their crops,"[154] and a 1930 manifesto by British banks—long supporters of free trade—proclaimed that

> Bitter experience has taught Great Britain that the hopes expressed four years ago in a plan for removal of the restrictions upon European trade have failed to be realized. The restrictions have materially increased, and the sale of surplus foreign products in the British market has steadily grown.[155]

The world trading system may never again confront stresses of the magnitude of those of the early 1930s, which saw an extraordinary regression into protection worldwide. But the current political consensus in support of liberal trade should not be taken for granted, if only because it ultimately rests on its members' continuing assessment of where their self-interest lies. Antidumping measures are a safety mechanism not only for defusing protectionist pressures, but for the wholly legitimate purpose of limiting a harmful commercial practice that, left unchecked, could undermine support for the current system.

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[153]Tim Rooth, *British Protectionism and the International Economy: Overseas Commercial Policy in the 1930s*. (Cambridge: Cambridge University Press, 1991), p. 70.

[154]Rooth (1991), *op. cit.*, p. 58.

[155]*The Times* (July 10, 1930), cited in Rooth (1991) *op. cit.*, p. 46.

Antidumping as an Interface Mechanism

Antidumping measures have become controversial, in significant part, because they have been assigned, by default, an impossible task—to reconcile the economic and strategic contradictions that arise out of the sharp divergences that exist between national markets with respect to competition policy. The fact that some markets are open and others are highly cartelized gives rise to distortions in trade and economic dislocations for which national antitrust policies and the multilateral system have no apparent answers. Antidumping measures are invoked by beleaguered industries because nothing else works, including improvements in their own efficiency and productivity. The application of duties at the border in a given instance may prevent the destruction of an industry by dumping, but it does not resolve the market distortions that gave rise to dumping in the first place.

Virtually all of the extant literature on antidumping measures emphasizes the problems that such measures allegedly create, rather than on whether or not they are actually effective in addressing the problem at which they are directed—dumping. Thus, specific instances are raised in which antidumping measures are said to have been applied to inappropriate situations, or in a way that is unnecessarily burdensome or that results in margins of dumping that are too high. In some cases the criticism is valid and provides the basis for future reforms both at the national and the multilateral level. At the same time, however, antidumping measures do not always prevent serious injury to affected industries.[156] Margins are not always high enough to fully offset the injurious effects of dumping, and antidumping orders can be circumvented through a wide variety of commercial tactics. In high-technology industries the sector may be largely destroyed even before preliminary relief is available. Antidumping actions are burdensome to petitioners as well as respondents and the cost of such proceedings has mounted as the information required of petitioners has increased.[157]

If dumping itself remains a "problem in international trade," then true "reform" of antidumping policy does not simply entail weakening or eliminating national antidumping laws, but the shaping of those laws to rectify, to the fullest extent possible, the problem of dumping itself. Antidumping measures cannot, by themselves, open foreign markets or break up cartels, but they can form one element in a broader program aimed at such objectives. Antidumping should not disrupt exporters that are not engaging in anticompetitive practices (as now occurs), but it should offer the most efficient and complete relief possible to industries genuinely injured by dumping. Such reform is unlikely to emerge from a debate cast in the simplistic free-trade versus protectionism terms which charac-

[156]For case studies in the failure of antidumping measures in the European Union, see Van Marion (1992), *op. cit*.

[157]On this point see Office of Technology Assessment, "An Unfiled Dumping Case" in *Competing Economies: America, Europe and the Pacific Rim* (Washington, D.C.: U.S. Office of Technology Assessment, 1991), pp. 146–148.

terized the British policy debates at the turn of the century. Effective pragmatic reform requires a far more informed and dispassionate examination of dumping itself and the closed markets and cartels that foster it. Only such a comprehensive approach, rooted in the realities of commercial practice, will make possible reforms necessary to enable the multilateral trading system to adjust to the challenges of the next century.

Dumping: Still a Problem in International Trade

Thomas R. Howell
Dewey Ballantine

SUMMARY

Dumping is the export of products at less than "normal value," often defined as the price at which those products are sold in the home market. Since its inception, the General Agreement on Tariffs and Trade (GATT) has authorized signatories to apply duties to offset dumping when it causes, or threatens to cause, material injury to an industry in the territory of a GATT member.[1] National antidumping legislation dates from well before the GATT. For example, the United States passed its first antidumping statutes in 1921.

Despite their longevity, antidumping measures are frequently subject to sharp criticism, especially from academic economists. Indeed, some observers advocate their complete elimination, raising the question whether dumping itself is a problem sufficiently serious to warrant retention of the antidumping regime provided for under the GATT. This paper notes that antidumping measures, like any complex regulatory regime, may give rise to anomalous or undesirable results in some cases, but argues that dumping itself remains a "problem in international trade," as described by Jacob Viner in his seminal 1923 study of the subject. As such, dumping requires continued regulation, especially for countries with relatively open national markets.

[1]As noted in the Recommendations and Findings of this project, dumping and antidumping are subjects that elicit strongly divergent views. As a result, no consensus could be reached on dumping and antidumping issues. See Recommendation 21 in the summary report of the study, *Conflict and Cooperation in National Competition for High-Technology Industry.* This paper outlines why some practitioners believe antidumping measures should be retained as an integral part of national trade policy. For a contrary view, see Section V, pp. 223–233, of *Conflict and Cooperation.* For a summary discussion of the issue, see Box G. *Ibid,* pp. 82–84.

The existence of price discrimination between domestic and export markets generally indicates the presence of a market distortion in the home market, such as import barriers, a monopoly or cartel, or some combination of these factors that gives domestic producers the ability to maintain domestic prices at a level higher than export prices. Under such circumstances, dumping is a mechanism through which competitive outcomes are determined, in effect by the distortion itself, not the relative competitiveness of individual producers. In the short run, dumping enables protected firms to run their facilities at higher utilization rates than would be economically feasible in an open market, giving them a major cost advantage unrelated to their comparative cost competitiveness. Over the long run, dumping can deter investment in the market where it is occurring and, conversely, may well foster increased investment in the protected market. Over time, through such dynamics, dumping may permit an initially less efficient (but protected and cartelized) industry to displace an equally or efficient competitor, that is, not benefiting from a protected home market.

Because dumping can result in the erosion or destruction of national industries for reasons unrelated to normal market competition, simply permitting dumping to occur without any regulation could endanger the political consensus which supports the current liberal multilateral trading system. Friction arising out of dumping can become particularly acute when dumping injures or destroys industries regarded as vital to national economic well-being and national security, a phenomenon which has been observable at a number of points in this century.

Fundamentally, the controversy surrounding antidumping is a symptom of a larger phenomenon, the divergence which exists between various national markets with respect to competition policy and which has frustrated all attempts at consensus for at least half a century. Antidumping measures have been assigned, more or less by default, the task of addressing specific problems created by this divergence. They are admittedly an imperfect tool. But until broader national differences with respect to competition policy are reconciled, these measures remain essential to the world trading system, acting, in the words of John Jackson, as an "interface mechanism. . . necessary to allow different trade systems to trade harmoniously."

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Today's open multilateral trading system stands as one of the greatest achievements of the generation of statesmen that laid the foundations of the postwar world order. The legal underpinning of this system is provided by the General Agreement on Tariffs and Trade (GATT) and its ancillary agreements and codes, currently administered by the newly formed World Trade Organization. The GATT has made possible the progressive liberalization of world trade through the basic mechanism of binding commitments by signatories to reduce trade barriers on a most-favored-nation basis. The GATT has survived, however, in significant part, because its framers were wise enough to recognize that the system would not be sustainable in the absence of certain exceptions to the general com-

mitments undertaken by the signatories. These exceptions, which include "escape clause" provisions, special rules for developing countries, and antidumping and countervailing duty measures, have functioned as interface mechanisms to soften the dislocations that have occurred as the reduction in border restrictions has brought differing national economic systems into progressively closer competitive contact. Without the existence of these mechanisms, given

> the politically sensitive subject of international trade . . . the General Agreement might never have been concluded or might never have endured in the face of the pressures that have buffeted it.[2]

One of the most significant exceptions to the basic GATT principle for most favored nation treatment authorizes contracting parties to apply duties "in order to offset or prevent dumping." GATT Article VI provides that

> **dumping**, by which products of one country are introduced into the commerce of another country at less than the normal value of the products, is to be condemned if it causes or threatens material injury to an established industry in the territory of a contracting party or materially retards the establishment of a domestic industry.[3]

The right to apply antidumping measures was an important element in the original consensus that made the formation of the GATT possible, and the contracting parties to the GATT subsequently elaborated a complex system of rules and procedures pursuant to which members may apply antidumping duties in appropriate cases.[4] Within these parameters, most major trading nations have enacted antidumping rules. It is often overlooked that the most active users of antidumping measures have been GATT members with the more open markets—countries such as Australia, Canada, the European Union, and the United States. As a number of newly industrializing nations liberalize their trade regimes, they are becoming more active in applying antidumping measures.

Antidumping policy is now the subject of scathing attacks from many quarters, including prominent figures in law, business, and academia.[5] *Forbes* characterizes the antidumping laws as tools that U.S. firms use to push foreign firms into "a quick descent into legal hell" as they "lustfully anticipat[e] a price hike" for domestic consumers.[6] Claude Barfield of the American Enterprise Institute calls antidumping measures "the chemical weapons of the trade wars," a "system

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[2]John H. Jackson, *World Trade and the Law of GATT* (Charlottesville, Va.: Michie Company, 1969), p. 536.

[3]GATT Article VI(1).

[4]"There was general consent among the majority of countries in the discussion on Antidumping and Countervailing Duties, that circumstances might arise in which such duties might properly be applied" (U.N. Doc. EPCT/C.II/SY at II [1946], cited in Jackson [1969], *op. cit.*, at 404n).

[5]See, for example, the essays in Richard Boltuck and Robert E. Litan (eds.) *Down in the Dumps: Administration of the Unfair Trade Laws* (Washington, D.C.: The Brookings Institution, 1991).

[6]David Frum, "Dump It," *Forbes* (September 28, 1992).

of price-fixing cartelization . . . that stacks the deck in favor of local producers against their foreign competitors."[7] In a 1993 *Wall Street Journal* commentary, James Bovard branded the U.S. antidumping laws as a "fraud," castigating the laws for their "hypocrisy and absurdity," which enable "a few greedy producers" to invoke remedies that cause the U.S. government "to inflict unlimited amounts of unfairness in the name of fair trade."[8] Although academic critics are usually less colorful in their choice of words, the sheer number of eminent economists who have attacked antidumping is impressive. One might ask why laws so odious have not been quickly repealed. This has not occurred in the United States at least, according to some critics, because of "lobbying" by "protected U.S. producers,"[9] because of "bureaucrats" at the Department of Commerce seeking "to flaunt the fact that there are few restraints on [their] power over foreign companies,"[10] and, perhaps inevitably, because of the baneful influence of "lawyers."[11]

Curiously, there has been little response to the rising chorus of criticism of antidumping policy. Apart from a few obscure monographs and articles, little has been published defending the rationale for antidumping policy since Professor Jacob Viner, one of the draftsmen of the original U.S. antidumping laws, produced what remains the seminal work on the subject in 1923.[12]

The purpose of antidumping measures is to offset economic injury caused by the commercial practice of dumping. Although antidumping measures can be, and sometimes are, applied in an arbitrary, irrational, or unnecessarily burdensome manner, the same can be said of any major regulatory program or system of legal redress, and such problems do not, by themselves, constitute a basis for

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[7]Claude Barfield, "Dumping Know-Nothingism," *Journal of Commerce* (March 18, 1993).

[8]James Bovard, "Commerce's Latest Fair Trade Fraud," *Wall Street Journal* (January 28, 1993).

[9]Hans Mueller "Backdoor Protection for Steel," *Journal of Commerce* (February 5, 1993).

[10]James Bovard, *The Fair Trade Fraud: How Congress Pillages the Consumer and Decimates American Competitiveness* (New York: St. Martin's Press, 1991), p. 48.

[11]According to one recent monograph, the antidumping law "benefits a powerful lobby in Washington, D.C.—the international trade bar. Eliminating antidumping law would dramatically reduce the business of international trade lawyers" (Raj Bhala, "Rethinking Antidumping Law," *George Washington Journal of International Law & Economics* 29(1), 1995, p. 20). By far the majority of practitioners of antidumping law in Washington represent foreign firms seeking to avoid the imposition of antidumping duties. Many of them have been vocal in criticizing the antidumping law, and if the "international trade bar" were polled on the subject, it is likely that a majority would support repeal of the law. Prominent international trade lawyers who have sharply criticized antidumping include N. David Palmeter and Gary O. Horlick.

[12]Viner was the author of *Dumping: A Problem in International Trade* (Chicago: University of Chicago Press, 1923) and helped draft the Antidumping Act of 1921. Noteworthy exceptions to the general lack of academic work supporting antidumping include Jorge Miranda, "Should Antidumping Laws Be Dumped?," a monograph presented at a conference on "Antidumping and Competition Policy: Complementary or Supplementary," Center for Applied Studies in International Negotiations, Geneva (July 11–12, 1996) and Clarisse Morgan, "Competition Policy and Antidumping: Is It Time for a Reality Check?" *Journal of World Trade* 30(5) (1996).

scrapping an entire system. The real issue is whether *dumping* itself is a practice that warrants continuing restriction by national governments. The common strand that unites most critiques of antidumping is the extent to which they avoid that question, tending to minimize or dismiss altogether the phenomenon of dumping itself as not warranting serious examination. In the thousands of pages that have been written attacking antidumping, it is a challenge to find any detailed case study of an actual episode of dumping or an examination of its problematic aspects and implications. Were such inquiries more common, it would be evident that dumping remains "a problem in international trade" that warrants the continued existence of workable regulatory constraints on the practice.

The term "dumping" has enjoyed a casual business use for at least two centuries and is still loosely applied in a lay context to a variety of export practices involving low pricing. Jacob Viner's groundbreaking 1923 work proposed a precise definition, "price discrimination between national markets," that has gained general acceptance as the definition of "classic" dumping and is now embodied in the GATT and national antidumping legislation. Under classic dumping, a seller charges higher prices in the home market than in export markets, or, much less commonly, charges higher prices in one export market than in another. The dumper is able to maintain a price differential because some factor or combination of factors separates the two markets—generally either the sheer distance between the markets or a protective barrier around the market where the higher price is charged, coupled with restraints on competition in the latter market.[13] The first antidumping statutes, which were enacted between the end of the nineteenth century and the early 1920s, were directed against classic dumping only, but during the postwar era, their scope has been expanded, in effect, to embrace some types of export sales that are made below the cost of production, notwithstanding the absence of price discrimination between national markets.

THE EFFECTS OF DUMPING

Dumping leads to the erosion and in some cases the disappearance of industries in markets where dumping is occurring for reasons unrelated to the relative competitiveness of those industries—put most simply, dumping enables less efficient firms to prevail over more efficient firms in international competition. Competitive outcomes are determined by market distortions, that is, the factors that make dumping possible, rather than the relative competitiveness of individual producers. This occurs for two reasons:

[13]Viner recognized that in his time businessmen also tended to use term "dumping" to apply to the practice of export sales below the cost of production, which, although "closely related" to dumping in its nature and "in its economic objectives or consequences," was not strictly speaking, classic dumping.

- **Capacity utilization.** Over the short run, other things being equal, dumping firms tend to enjoy lower unit costs than comparable firms in markets where dumping is occurring because dumpers can operate their plants at higher rates of capacity utilization—a factor that often has a far greater impact on cost than any other consideration. Firms in the market where dumping is occurring cannot respond in kind if the market of the dumper is closed to them. In this way, a relatively inefficient plant run at 100 percent utilization rates may well enjoy lower unit costs than a state-of-the-art facility run at a 50 percent rate.
- **Investment deterrent.** Over the longer term, dumping discourages investment in markets where dumping is occurring, and, at the same time, encourages higher levels of investment in the protected markets from which dumping is taking place. This occurs because investment risks are higher, and returns lower, in markets where dumping is taking place, and risks are lower, and returns higher, in the protected market from which dumping is taking place. The short-run cost advantage that dumping firms enjoy is thus eventually translated into a capital and technological advantage as investment dries up in the one market and intensifies in the other.

The fact that unconstrained dumping can gradually lead to a shift in competitive advantage has implications that extend beyond the firms directly affected. A given nation's economic well-being, standard of living, and security are all determined in significant part by the composition of its industrial base. The ultimate implication of the competitive dynamics of dumping is that the industrial base can be altered in deleterious ways as a result of market distortions abroad, such as protected markets and cartels, that make dumping feasible. Because such distortions can be deliberately created and manipulated, whether by governments or by private syndicates enjoying the toleration or tacit encouragement of state authorities, the decision to permit unrestricted dumping is a decision to allow a national economy to be shaped by anticompetitive strategies and market distortions that are engineered in other countries. Although experience has shown that GATT signatories will accept, as part of the price of an open trading system, the need for adjustment by domestic industries that have lost international competitiveness, it is quite another matter to expect signatories to accept the burdens of adjustment that arise out of anticompetitive practices in other countries. It is unlikely that many nations would accept such a result for any sustained period. It is equally unlikely that a political consensus could be sustained for any multilateral regime that attempted to enforce it through proscriptions on national antidumping measures.

DUMPING UNRESTRICTED: THE BRITISH CASE

Would the world trading system as a whole, and its members individually, be better off if all antidumping measures were eliminated and dumping allowed to

occur without interference? A distinguished contemporary critic of antidumping policy, J. Michael Finger of The World Bank, argues that

> The most appealing option is to get rid of antidumping laws and to put nothing in their place. Then all of the evils of such policy—its power politics, its bad economics, and its corrupted law–would be eliminated.[14]

Is Finger's proposal a sound one? Fortunately, this question is not altogether speculative, since trade between industrialized nations did occur for at least half a century before the widespread adoption of antidumping measures in the 1920s. Dumping was pervasive and its dynamics and effects widely reported and discussed. While many countries (including the United States) were relatively unaffected by dumping because high tariff walls severely limited import competition, Britain offers an example of a major, fully industrialized country that elected to avoid any policy action against dumping and to remain, in effect, an open "dumping ground" for a protracted period. Britain's rationale for adhering to free trade in the face of widespread dumping in her domestic and overseas markets was based on many of the lines of reasoning that are used today by those who urge the complete elimination of antidumping measures. Britain's disheartening industrial and commercial performance during this period, which saw the precipitous competitive decline of the industries most severely affected by dumping and a disastrous (and very near fatal) erosion of the country's strategic industrial base, is now an established historical fact. Although the "British disease" was the product of an extraordinarily complex tangle of economic and social problems of which dumping comprised only one strand, the historical record yields enough evidence of the harmful effect of unrestricted dumping on British industry to cast serious doubt on the wisdom of the policy that was followed.

In 1870 Britain accounted for more of the world's manufacturing output than any other nation, its industries boasted the lowest costs and the most advanced production technologies, and its banks and shipping firms dominated world commerce. Britain's prosperity and commercial dominance appeared to validate the philosophy of the Free Trade movement that, after a series of intense political battles, had in the 1840s succeeded in clearing away most of Britain's import restrictions.[15] In retrospect, however, it is evident that Britain's success prior to 1870 was attributable, in substantial part, simply to the fact that the country had industrialized before any other nation. Beginning in the 1870s, and growing in intensity thereafter, the rapidly growing manufacturing industries of Germany and the United States mounted a commercial assault on traditional British mar-

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[14]J. Michael Finger, "Reform" in J. Michael Finger, ed., *Antidumping: How It Works and Who Gets Hurt* (Ann Arbor: University of Michigan Press, 1993), p. 57.

[15]See generally W. Cunningham, *The Rise and Decline of the Free Trade Movement* (Cambridge, England: Cambridge University Press, 1912).

kets. In contrast to Britain, both the United States and Germany were avowedly protectionist; by 1880 both national markets were surrounded by high tariff walls. In addition, in both of these countries, highly organized and sophisticated anti-competitive industrial combinations were formed for the purpose of reducing competition and exploiting their partial or complete monopoly power. In the United States, so-called "trusts" regulated output and prices in many major manufacturing industries, and in Germany, manufacturing was dominated by *kartells* (cartels) in which price and output restrictions were maintained through legally enforceable contractual commitments.[16] It was the standard practice of both the American trusts and the German kartells to engage in large-scale dumping as a deliberate export strategy.[17]

British industries did not exist in a competitive milieu that permitted them to respond in kind to this challenge. They could do nothing to reopen the American or German markets that had been lost to them, and they lacked both the protected home market and the organized character needed to engage in dumping on an American or German scale.[18] American and German firms not only captured sales from British firms, but began surpassing British industry in the level of industrial technology, productivity, and economies of scale. British producers confronted a strategic dilemma for which the Free Trade doctrine offered no obvious answers. Britain's Tariff Commission summarized this quandary in 1904 as follows:

> [I]t is the control of the home market which their tariffs give to foreign countries, combined with the facilities for exportation which they secure through their trusts and kartells, and the free access to the British market, which is the condition of their rapid progress relative to the United Kingdom. These tariffs were, in many instances, deliberately adopted to shut out British products which came into competition with home manufacturers. Their adoption has been followed by (i.) the extinction or diminution of British competition in the foreign protected markets; (ii.) the closing of British works or of departments of British works which depended on these markets; (iii.) the rapid growth of the foreign

[16]See generally J.H. Clapham, *The Economic Development of France and Germany, 1815–1914.* (Cambridge, England: University Press, 1928); Robert Brady, *The Rationalization Movement in German Industry*. (New York: Howard Fertig, 1974); Hans B. Thorelli, *The Federal Antitrust Policy: Origination of an American Tradition* (Baltimore, Md.: The Johns University Hopkins Press, 1955).

[17]Witness No. 11, *Report of the Tariff Commission*, Vol. I (London: P.S. King & Son, 1904), pars. 795, 806.

[18]Episodes of dumping by British manufacturers were reported throughout the nineteenth century, but they were precisely that—episodic, and generally poorly documented as well. Jacob Viner catalogs an anecdotal history of alleged dumping by English manufacturers in the late eighteenth and early nineteenth centuries. He concludes that most of the allegations were poorly supported, if not altogether unfounded, and that there was no evidence of predatory dumping by British manufacturers. There was "less reason to doubt that there were occasional instances of the practice of dumping in less objectionable form, especially as such branches of English industry as were in the control of relatively few individuals or combinations of producers" (Viner, [1923], *op. cit.*, pp. 35–50).

> competing industry; (iv.) the appearance in the British market of the products of that industry at prices which the British manufacturer cannot touch. Thus, the positions of the United Kingdom and its most powerful competitors have been reversed.[19]

Britain's eroding competitive position relative to two dynamic protectionist powers began to foster dissent from the prevailing free trade orthodoxy, and in 1895, the issue was moved to the center of the nation's political arena by the governing Conservative Unionist party.[20] In that year, Joseph Chamberlain, the government's Colonial Secretary and an avowed imperialist, began a crusade against free trade in favor of an imperial customs union that would establish a wall of protective tariffs around Britain and the Empire. Conservative Unionist Prime Ministers Lord Salisbury (1895–1902) and Arthur Balfour (1902–1906) shared Chamberlain's skepticism about free trade and were concerned over mounting evidence of Britain's economic decline relative to Germany and America, but were ultimately unwilling to commit their party and their country to a renunciation of free trade. Instead, Balfour sought a middle ground, the selective imposition of retaliatory tariffs against trading partners that practiced restrictive trade which hurt British industry.

The British debate over dumping at the turn of the century closely parallels the current controversy in the United States at the century's end. The Chamberlain and Balfour factions singled out "dumping" by foreign "trust system[s] working behind tariffs"[21] and argued that dumping was injuring or destroying key industries on which Britain's economy and security rested.[22] Dumping, it was argued, placed domestic industries at a cost disadvantage, eroded producers' profits, and jeopardized "the provision of adequate capital for carrying on great modern industries."[23] Nonsense, responded the Free Traders. British industry was still faring well under free trade.[24] The industries complaining of dumping were

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[19]*Report of the Tariff Commission* (1904), Vol. I, par. 58.

[20]See, generally, Aaron L. Friedberg, *The Weary Titan: Britain and the Experience of Relative Decline, 1895–1905* (Princeton, N.J.: Princeton University Press, 1988), pp. 45–79.

[21]Speech by Prime Minister Balfour in House of Commons, May 28, 1903, cited in Friedberg (1988), *op. cit.*, p. 63.

[22]Joseph Chamberlain used the example of the sugar industry: "Free imports have destroyed sugar refining . . . one of the great staple industries of the country, which it ought always to have remained. . . . Sugar has gone; let us not weep for it; jam and pickles remain." Cited in William Smart, *Return to Protection: Being a Re-Statement of the Case for Free Trade* (London: MacMillan and Co. Ltd, 1906), p. 154.

[23]Speech by Prime Minister Arthur Balfour, June 26, 1903, cited in Friedberg (1988) *op. cit.*, p. 63.

[24]The Free Traders drew considerable support from a substantial study by Sir Robert Giffen, which contended that the trade data showed trends that were quite favorable, Britain's exports were growing faster than those of Germany, the British trade position was sound, and there was "no weakening in the hold of the United Kingdom upon either the import or export trade of the world." Giffen reached these conclusions by using statistics for Germany for only the period 1890–1892, thereby producing distorted results when the country was in a recession; nevertheless, Giffen was a "high authority," and

seeking to blame imports for problems that were really of their own making. Dumping was actually a positive good, not only because it provided a stimulus to such firms to reform their ways, but because it provided cheap inputs for many other industries, lowering their costs.[25] The alleged threat to "staple" industries was brushed off as exaggerated; moreover, it was pointed out, the disappearance of staple industries was more than offset by the appearance of new industries utilizing dumped inputs.

The arguments against antidumping measures carried the day in turn-of-the-century Britain, and the Conservative Unionist assault on free trade served only to bring an electoral debacle upon the governing party.[26] Britain took no measures to restrict dumping until a number of years after World War I. But while the Free Traders won the political debate, what were the consequences? Did Britain ultimately fare better or worse for having allowed itself to exist as a "dumping ground" until well after World War I?

Dumping and the Erosion of British Competitiveness

From the perspective of the late twentieth century it is evident that in the period 1880–1914 British industry was moving on a path of decline relative to the industries of the United States and Germany, a trend that would become increas-

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his study was seized on by the defenders of the status quo and widely cited. One historian writing from the perspective of three decades later characterized it as an "excellent example of official optimism, Cobdenite certainty that nothing could be basically wrong with a nation adhering to free trade principles, and the misleading possibilities of statistics" (J.S. Ross, *Great Britain and the German Trade Rivalry 1875–1914.* (Philadelphia, University of Pennsylvania Press, 1933), p. 231., citing Sir Robert Giffen, *Foreign Trade: Statistical Tables Relating to the Progress of the Foreign Trade of the United Kingdom, and of other Foreign Countries, with Report to the Board of Trade Thereon.* [C-7349, 1894]).

[25]By dumping in Britain, "the Germans are in this way our benefactors, and last year supplied to us sugar to the extent of nearly £9,400,000 at less than its cost, not to speak of other articles outside the class of food products . . . " (*Manchester Guardian* [July 27, 1896], cited in Hoffman [1933], *op. cit.*, p. 253).

[26]Following months of internal debate, Chamberlain and several like-minded ministers, who felt that Balfour's "selective retaliation" proposals did not go far enough in the direction of protection, quit the Cabinet to wage a campaign of public education against free trade. At the same time, despite Balfour's comparative moderation, his party was identified in the public's eye with protectionism, which, it was believed, would result in higher food prices for consumers (the so-called "dear loaf"). His attempt to find a middle ground between the extremes of free trade and protection satisfied neither camp; instead, his government entered its "death agony," a protracted and bitter public controversy over trade policy that culminated in the election of 1906, in which Balfour's party suffered one of the worst electoral defeats in British history. The trade issue played the major role in the Conservative Unionist defeat. "All the evidence suggests that nothing was more disastrous to [Balfour's] party than Joseph Chamberlain's campaign for tariff reform" (Robert Blake, *The Conservative Party from Peel to Churchill* [London: Eyre and Spottswood, 1970], p. 180, cited in Friedberg [1988], *op. cit.*, p. 77).

ingly obvious as the twentieth century progressed.[27] Britain's decline from the zenith of the mid-1800s has been extensively examined, but its causes remain something of an enigma.[28] Dumping in British markets by foreign cartels was not the sole or even the primary proximate cause of Britain's relative industrial decline, but it does not follow that dumping played no role, or that Britain was, on the whole, better off for having permitted unrestricted dumping. Dumping *was* identified by many contemporary partisans in the trade debate as a significant factor contributing to both the erosion of British cost competitiveness and the inadequate levels of British capital investment.[29] Both of these factors have been cited by subsequent generations of scholars as important, if not central, elements underlying British industrial decline.[30]

The British iron and steel industry was the centerpiece of the British debate over dumping, and its particular experience with dumping in this industry is probably of greatest relevance to the current dumping controversy because dumping in this industry was more pervasive in its extent and effects than in most other sectors, and because of steel's central importance to Britain's economy and national defense. The slump in Britain's position as a steel producer in the 1890s "was particularly alarming,"[31] given steel's status at the time as the most important of all strategic industries, and it was addressed and analyzed by virtually all of the partisans on both sides of the trade controversy. While Free Traders argued that there was insufficient evidence that dumping was substantially injuring domestic producers,[32] the weight of evidence from the period makes it clear that by the mid-1890s, British steelmakers were under attack from low-priced Ger-

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[27]Between 1880 and 1913 Britain's share of total world manufacturing output fell from 22.9 to 13.6 percent. Britain's competitive position eroded in basic industries such as iron, coal, and textiles, where it had led the world in 1880; more seriously, British industry failed to invest adequately in the new industries that made possible the so-called "second industrial revolution"—electrical products, steel, specialty steel, mass-produced machinery, industrial chemicals, and pharmaceuticals (Paul Kennedy, *The Rise and Fall of the Great Powers* [New York: Random House, 1987], p. 228; Alfred D. Chandler, Jr., *Scale and Scope: The Dynamics of Industrial Capitalism* [Cambridge, Mass.: Belknap Press, Harvard University, 1990], pp. 12, 62–67).

[28]Paul Kennedy writes that "[t]he slowdown of British productivity and the decrease in competitiveness in the late nineteenth century has been one of the most investigated issues in economic history. It involved such complex issues as national character, generational differences, the social ethos, and the educational system as well as more specific economic reasons like low investment, out-of-date plant, bad labor relations, poor salesmanship, and the rest" (Kennedy [1987], *op. cit.*, p. 228).

[29]In general, see the materials appended to the *Report of the Tariff Commission* (1904), Vol. I, "The Iron and Steel Trades."

[30]Chandler (1990), *op. cit.*, p. 330; Peter Temin, "The Relative Decline of the British Steel Industry, 1880–1913," in Henry Rosovsky, ed., *Industrialization in Two Systems: Essays in Honor of Alexander Gerschenkran* (New York: John Wiley & Sons, 1966).

[31]Peter Cain, "Political Economy in Edwardian England: The Tariff-Reform Controversy," in Alan O'Day, ed., *The Edwardian Age: Conflict and Stability, 1900–1914* (Hampden, Conn.: Acchon Books, 1979), p. 35.

[32]See Smart (1906), *op. cit.*, p. 156.

man and American steel across a broad product range in both overseas and domestic markets, and that they were being badly hurt by the loss of business.[33]

The mere loss of sales described in contemporary reports does not by itself necessarily indicate the existence of a problem that would have warranted a change in government trade policy. The American-German onslaught might, for example, simply have reflected the emergence of more efficient competitors abroad, confronting British producers with the choice of adapting to remain competitive or getting out of the business, a point that was in fact made many times during the debate over dumping. However, a close examination of the situation confronting British steelmakers at the turn of the century suggests that there was more at work than simply shifting comparative advantage. The combination of high tariffs, cartels, and the incentive to sell products below average cost had powerful effects both on immediate commercial positions and long-term relative competitiveness. Specifically:

1. The tariff-cartel dumping systems of America and Germany operated in a way that lowered American and German unit costs and raised British unit costs, facilitating constant undercutting of British prices and erosion of British market-share.

2. The short-run cost disadvantage of the British mills was progressively translated into a long-run loss of competitiveness as American and German mills maintained higher levels of capital investment. Dumping affected this process directly by increasing British investment risk and diminishing American and German investment risk.

Dumping Lowers Cost

The aspect of dumping that most engaged the attention of contemporary steel producers was its effects on the relative unit costs of dumping firms, on the one hand, and of firms in whose markets dumping was occurring, on the other hand. It was the consensus of British, American, and German industrialists that dumping lowered the unit costs of the dumpers and raised the unit costs of the "dumpees." The reason was quite simple—the dumpers could engage in the practice known then as "continuous running" or "rapid driving," that is, running their mills at high operating rates, which resulted in progressively lower per unit pro-

[33]In addition to the contemporary testimony of many British businessmen, a 1916 study by the U.S. Federal Trade Commission supports this conclusion. It noted that in steel, "the [British] home market may at any time be made a dumping ground by foreign producers. . . . The iron and steel bar manufacturers of England have had to contend with a great deal of dumping on both home and foreign markets. . . ." Through the use of export bounties paid by the *Stählwerksverband* (German steel cartel), "German iron and steel goods have gained a foothold in the markets previously regarded as British preserves, and have materially affected British trade" (Federal Trade Commission, *Cooperation in American Export Trade* [Washington, D.C.: Federal Trade Commission, 1916], pp. 215, 219, 222).

duction costs for each additional unit of output. Because of high tariffs, they could dispose of surpluses abroad without spoiling domestic prices, and in fact could maintain high domestic prices by limiting the available supply within the home market. British "dumpees" generally could not do this; foreign markets were increasingly closed to their exports, and continuous running for purposes of serving only the home market tended simply to further depress prices in that market, without necessarily increasing sales volume.[34] "Continuous running" had a particularly dramatic impact in capital-intensive industries with high fixed costs, that is, sunk costs incurred whether or not goods were actually produced. In such industries (steel, chemicals, machinery) in competition between two facilities of equal efficiency, the producer able to operate at the highest rate would enjoy the lower costs, and hence, the competitive edge. The most modern and efficient production equipment carried with it very high fixed costs. While such facilities, if run "flat out," could produce goods at a lower cost per unit than those of any competitor, if the utilization rate dropped and the works were put on half-time or quarter-time, the cost per unit could easily be higher than that of older, less efficient facilities.[35] This dynamic could thus enable a less efficient producer to operate at lower unit costs than a more efficient firm.

The ability to run plants "flat out" was one of the principal policy justifications offered for a high tariff and the "trust" form of combination that was offered by Carnegie, Schwab, and other U.S. industrialists of the time.[36] The German

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[34]*Report of the Tariff Commission* (1904), *op. cit.*, pars. 62, 64–65.

[35]A British steelmaker testified in 1904 that "I should say that, generally speaking, British works are fully up to date. Some of our modern plants would be as much up to date as any foreign works. The disadvantages which we are under I attribute chiefly to our not running full time. . . . The reason why we are unable to work full time, as compared with the Germans, is that the Germans have a protected market at home at a high price and can afford to sell their surplus production at a much lower price than we can make it, and even than they can make it" (Witness No. 8, *Report of the Tariff Commission* [1904], *op. cit.*, Vol. I, pars. 726–727). Another testified that "I have worked out before my own works, the difference between the cost of production at its present rate of output, and at its maximum rate, and if we could produce to the full extent of our capacity, we could sell the extra quantity at 10 percent less than our present cost price, and should make, on the whole, an increased output twice our present profit. These figures are very startling, even to myself, when I worked them out" (Testimony of Witness No. 3, *Report of the Tariff Commission* [1904], *op. cit.*, Vol. I, pars. 626–627). Another observed that "[t]he additional output for their works caused by their foreign sales enables them to reduce their export price for all the additional quantity, the establishment charges having been borne by the lesser produce for their home market. A huge output is of first importance in reducing cost and this is never lost sight of by American and German manufacturers" (Testimony of Firm No. 1,512, *Report of the Tariff Commission* [1904], Vol. I, par. 300).

[36]Testimony of Andrew Carnegie before the House Ways and Means Committee, December 21, 1908, pp. 1853–1855. President Schwab of the U.S. Steel Corporation testified as follows before the U.S. Industrial Commission in 1901: "It is quite true . . . that export prices are made at a very much lower rate than those here; but there is no one who has been a manufacturer for any length of time who will not tell you that the reason he sold, even at a loss, was to run his works full and steady." United States Industrial Commission *Report,* (1901), Vol. XIII, p. 455.

Stählwerksverband (steel cartel) likewise justified its dumping policy primarily in terms of the beneficial effect on operating rates.[37] For the British, the inability to match the American-German practice of "continuous running" produced a vicious circle—loss of sales volume effectively raised British mills' unit costs, making them vulnerable to still further loss of sales and additional increases in costs.[38] A British scholar, noting this phenomenon, observes that

> The importance of 'dumping' in any explanation of Britain's difficulties [in steel] may well have been overstated in the *Report of the Tariff Commission*, but there is no question that selling below average cost gave both German and American exporters a very real competitive advantage in world markets. The constant refrain of witnesses before the 1904 Tariff Commission was that British manufacturers were inhibited from pursuing a like policy because of 'the openness' of the home market, in which American, German, and Belgian manufacturers were making growing inroads by 'unfairly' undercutting domestic producers. If the home market—relatively stagnant though it was—wasn't reserved for native manufacturers, it was no wonder that they were slowly demoralized by being placed in a disadvantageous position in overseas trade.[39]

Dumping and Capital Investment

In 1870 Britain possessed the most modern, competitive iron and steel industry in the world, but by 1914 it had fallen behind its rivals by virtually every standard used to measure international competitiveness.[40] Subsequent generations of scholars have concluded that a decisive element in this competitive rever-

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[37]The U.S. Consul General in Berlin reported in 1916 that "the Steel Verband believes in dumping. They justify their position as follows: Large steel plants must work at a certain maximum capacity without interruption if they are to remain efficient and produce at a minimum cost. It is impossible for the home market of any plant in any country to absorb a large output without interruption in the flow of orders due to periods of depression, from economic causes outside the influence of the steel industry. Also, the increased complication of the coal, iron, and steel industries, the increased use of furnace gases for industrial purposes (gas engines), for running lighting plants for neighboring towns, also the concentration of all stages of production in a few large mills, have made it increasingly difficult to reduce production in any one line of all the allied processes, without causing grave losses and disorganization in other lines. The Steel Verband therefore maintains that it is better for the entire economic life of the country in slack years at home to dispose of surplus products abroad at prices which may even cause a loss, inasmuch as the loss incurred by dumping abroad is in no comparison to the losses which would be incurred if production were reduced at home. Also, if production were reduced at home, the cost of production would rise in mills running at half the time. . . ." (Special Report of Consul General Julius G. Lay, Berlin, November 2–16, 1915, reproduced as Exhibit I in Federal Trade Commission [1916], *op. cit.*).

[38]See testimony of Witness No. 1, *Report of the Tariff Commission* (1904), *op. cit.*, Vol. I, par. 490.

[39]P.L. Payne, "Iron and Steel Manufacturers," in Derek H. Aldcroft, ed., *The Development of British Industry and Foreign Competition*, 1875–1914 (London: George Allen & Unwin Ltd., 1968), pp. 79.

[40]See Temin (1996), *op. cit.* In the mid-1870s Britain produced roughly 36 percent of the world's iron and steel, compared with 26 percent for the United States and 17 percent for Germany; by 1886 the United States surpassed Britain, and in 1893, so did Germany. By 1914, Britain produced less

sal was the fact that the British iron and steel industry did not make the capital investments prior to 1914 that would have enabled it to remain competitive in subsequent decades.[41]

In fact, at the turn of the century British steelmakers were quite aware that their competitive edge was slipping away due to their own failure to invest in state-of-the-art technology, and they said that dumping was a principal cause of that failure. One of them testified as follows in 1904:

> I state emphatically that, in my opinion, some fiscal provision for meeting dumping is essential to the maintenance of the trade of this country. . . . I may explain the above statement further—continual changes and improvements are being made in the manufacture of steel. I know of no trade which of late years has been subject to so many changes and improvements in the mode of manufacture. All these changes involve enormous outlays. If the manufacturers in this country are unable, from the instability of their market and from the liability of being overwhelmed from the stuff being dumped upon them at prices with which neither they nor anybody else can compete, if they are deterred from making the necessary improvements from availing themselves of new inventions, and if the foreigners, by reason of their protected market and of the certain large returns which they get from their home trade, are enabled to make these outlays, they will place themselves in such a position that, even if we got a free market and a free interchange, we should be some years before we could overcome them. I fear that if this state of things goes on for a considerable time longer, we never shall get on equal terms; they will attain so much superiority, and, when we are driven out of the market, our competitors would raise their prices to us.[42]

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than half the volume of steel that Germany produced and less than one-fourth that of the United States. With respect to efficiency and productivity, the British industry was regarded universally as the world leader in the last quarter of the nineteenth century, but by the outbreak of World War I had fallen behind Germany, the United States, and possibly Belgium (Payne [1968], *op. cit.*, p. 72–75).

[41]Alfred Chandler writes of the British iron and steel industry in the 1920s that it is "clear why the British steelmakers were unable to carry out the plans that all agreed were needed to modernize their industry and make it competitive in international markets. Essentially they were paying the price [in the 1920s] for the earlier failure to make an investment large enough and to recruit a management organization large and effective enough to exploit fully the new technologies of mass-producing steel" (Chandler [1990], *op. cit.*, p. 330).

[42]Testimony of Witness No. 2, *Report of the Tariff Commission* (1904), *op. cit.*, Vol. I, par. 547. Another manufacturer made a similar observation: "Taking the whole of this country, I do not consider the plant and equipment of British works are, as a whole, as up to date as those of the United States and Germany. This is due to the Americans having made very rapid strides in recent years, and having never been burdened with much original plant, such as existed in this country. They have been compelled to introduce many improved economical labour-saving machines, whereas this country could not apply similar methods to existing machinery; consequently, we have been unable to adapt ourselves to these new conditions, but the advantage, which is slight, is only a temporary one; there is certainly some truth in the statement that a sense of insecurity with the British manufacturer prevents him from laying down new plant. We are so alarmed and disheartened at the approaching foreign competition that we fear to spend money" (Testimony of Witness No. 6, *Report of the Tariff Commission* [1904], *op. cit.*, par. 678).

For British entrepreneurs, the decision as to whether to invest in the latest steel-making technologies turned, in large degree, on their assessment—and that of the capital markets—of the risks involved. Although large new mills could produce goods at lower average costs than a collection of smaller facilities, because of the higher fixed costs of the biggest facility, its losses were potentially larger if demand fell and it could not be utilized adequately. If demand were sharply and continuously cyclical, the biggest facility might not have the lowest average costs even over the long run because its unit fixed costs would be so high in each recession. Alternatively, if cyclicality were somewhat less sharp, the biggest facility might suffer higher losses in recessions, but enjoy lower average costs over the long run, and thus be more profitable.[43] Whether this prospect was sufficient to entice a given entrepreneur into committing the massive sums of capital needed to establish the largest facilities depended on the entrepreneur's assessment of the risks involved:

> [T]he rational choice depends upon the entrepreneur's attitude toward risk and his ability to insure himself against it. In either case greater variability in demand can make it rational to invest in less capital-intensive plants, even if those plants are less efficient in terms of minimum average cost. Only if demand fluctuations were reduced would the most efficient, capital-intensive technologies always be the most attractive.[44]

Dumping—or rather the protection/cartel system to which dumping was integral—affected this equation in several ways. First, for the Germans and Americans, by reducing competition and enhancing profitability in the home market, dumping diminished cyclicality and reduced investment risk, making it less hazardous for entrepreneurs to invest in the most advanced capital facilities.[45] Many German scholars concluded that the tariff-cartel system enabled German industry to achieve higher levels of technological advance and production efficiency than could have occurred under laissez faire:[46]

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[43]The foregoing argument was summarized by Stevan B. Webb, "Tariffs, Cartels, Technology and Growth in the German Steel Industry, 1879 to 1914" in *Journal of Economic History, vol. XL, No. 2* (June 1980), pp. 323–324.

[44]Webb (1980), *op. cit.*, p. 324.

[45][D]umping contributed to the growth of the German iron and steel industry—and hence to Britain's long-run differences . . . because German manufacturers knew that if demand fell off in their guaranteed home markets they could always export surpluses by undercutting competitors" (Payne [1968], *op. cit.*, p. 79).

[46]German scholars conceded that cartels and high tariffs protected some inefficient firms from competitive pressure, but argue that this was more than offset by the role played by protection and restraints on competition in reducing investment risks for the most modern equipment, thus fostering the rapid growth of large, efficient firms (Max Krawinkel, *Die Verbandsbildung in der Deutschen Drahtindustrie* [Cologne, Germany, 1968], p. 10; Robert Liefman, *Kartelle und Trusts und die Weiterbildung der Volkwirtschaftlichen Organization*, 2nd ed. [Stuttgart, Germany, 1924], p. 47; Franz Rips, *Die Stellung der Deutschen Eisenindustrie in der Aussenhandelspolitik* 1870 bis 1914 [Jena,

> The tariff-cartel system could keep domestic prices high enough to cover fixed costs, while firms added to their profits by selling at marginal cost on the depressed world market. . . . In ten of the years between 1876 and 1896 the average cost (Selbskosten) of rails from the Krupp firm exceeded the average export price, the world price with which the British had to contend. The domestic price, on the other hand, always exceeded average cost by over 10 marks per ton. Thus, the tariff-cartel system kept the German mills like Krupp profitable through times of recession. The national statistics also reflect such a pattern. In 1886, 1891, 1901, and 1908, when international trade crisis struck, British pig iron output declined 10 percent on average from the previous year, and the number of furnaces in blast fell 14 percent. German pig iron output fell only 6 percent, and the number of furnaces in blast dropped only 5 percent. Given the greater riskiness of their market environment, British steelmakers may have been rational to use less capital-intensive techniques, even if that meant slightly higher average costs.[47]

Second, the British confronted not only the loss of sales in protected foreign markets, but more violent cyclical swings in their own market as a result of intermittent incursions of dumped products, which exacerbated the intensity of recessions. This was the nub of the British strategic dilemma—investment risk was higher for them than for the Germans or the Americans. "In England there is not the same security for capital," as one steel tubemaker put it.[48] Prime Minister Balfour explained the problem at the height of the British trade policy debate in 1903:

> Now, there is no reason to expect that the plant erected to meet an average demand would reach the exact size most conducive to economy of manufacture. . . . Neither is it practicable to arrange that the plant shall always be kept working full time. If it is, there must evidently be recurrent period, during which over-production . . . must inevitably take place. Such is the ordinary position of the manufacturer under free trade. Compare it with the position of his protected rival, who controls his home markets. He is not haunted by the fear of overproduction. . . . [S]o long as other countries are good enough to offer him open markets, he can dispose of his surplus abroad, at prices no doubt lower, often

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Germany, 1941], pp. 40–46). "Thus, taken as a whole, the development of German industry is inconceivable [ist . . . nicht . . . zu dencken] without the high tariff rates, which were repeatedly raised" (Friedrich Lütge, *Deutsche Sozial-und Wirtschaftsgeschichte* [Berlin, Germany, 1966]. "[T]he pig iron duty was the foundation of our iron and steel industry and whoever destroyed this foundation would ruin the whole industry" (Reichsant des Innern, *Kontradiktorische Verhandlungen über Deutsche Kartelle* [Berlin, Germany, 1904–1905], Vol. 3, p. 196). All references in this note are cited in Webb (1980), *op. cit.*, p. 314.

[47]Webb (1980), *op cit.*, p. 324–325.

[48]Testimony of Witness No. 14, *Report of the Tariff Commission* (1904), *op. cit.*, par. 863. Another steelmaker commented that, "Owing to insecurity of trade at home, we do not spend as much money on plant as we would. [sic] is not the same inducement in this country to go and spend money" (Testimony of Witness No. 1, *Report of the Tariff Commission* [1904], *op. cit.*, par. 515).

> very much lower, than the price which his quasi-monopoly enables him to obtain at home, but at prices which nevertheless make the double transaction, domestic and foreign, remunerative as a whole. . . . The manufacturing capitalist [in the free trade country], when investing his money in costly plants has, in any case, many risks to run—new inventions, new discoveries, new fashions. Add to these his loss, actual or anticipated, through the operation of foreign protection, and his burden becomes insensibly increased. But add yet again the further uncertainty and the further loss due to the system [of protection/cartels/dumping] and he is overweighed indeed. Will the hostile combination keep together long enough to ruin him? Can his credit stand the strain? Is it worthwhile holding on in the face of certain loss and possible ruin? These are questions which the lenders of the threatened industry cannot but ask. And surely the mere fact that they have to be asked must shatter the buoyant energy which is the very soul of successful enterprise.[49]

Balfour's diagnosis was corroborated by the contemporary testimony of many British steelmakers.[50] But the cure was never found. No action was taken to curtail dumping or to open the foreign markets from which dumping was occurring. The immediate cost disadvantages and loss of sales confronting British steelmakers as a result of dumping were gradually translated into a loss of competitiveness that would, in the years to come, prove to be irremediable.

Dumping and Consuming Industries

During the British dumping debate, free trade advocates argued persuasively that dumping of intermediate products had actually enhanced the international competitiveness of British industries that used those products as inputs. Thus, although dumped sugar may have weakened England's sugar refining industry, cheap imported sugar fostered new food processing industries—jam, confectionery, biscuits, condensed milk—that employed far more people than the sugar refining industry had ever utilized. British shipbuilders reported that they bought dumped German castings and forgings, "built them into ships and machines, and sent them back to Germany."[51] Even within the British iron and steel industry

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[49]Arthur James Balfour, *Economic Notes on Insular Free Trade* (London: Langmans, Green & Co., 1903), pp. 26–27.

[50]As one British steelmaker summarized his situation, "companies hitherto prosperous can keep a certain measure of trade by enlarging their works, and thereby reducing the cost of production, but it is becoming more and more difficult to entice the requisite capital into the trade, either for that, or for introducing more labour-saving appliances. My company, as I have stated, largely increased their works recently, and, speaking personally, I should be exceedingly chary of investing anything more in extensions, unless we get some measure of security against the foreign dumper." Report of the Tariff Commission; Witness No. 6, pp. 628–629.

[51]Smart (1906), *op. cit.*, pp. 154–157. "America makes her own tin plates excessively dear, and spoils her own trade in canned goods. At the same time she dumps steel into South Wales. Our tinplate manufacturers, in consequence, send out cheap tin plates to German, Russia, Australia and

itself—the principal source of alarm over dumping—many manufacturers benefited, at least in the short run, by purchasing low-priced German and American iron and semifinished steel and said as much.[52] Dumped imported steel not only fostered a price advantage, but occasionally offset domestic shortages or attempts by domestic iron and semifinished producers to "boycott" downstream steelmakers.[53] But even the firms that gained apparent short-run advantages from buying dumped inputs expressed misgivings about their growing dependency for inputs on foreign syndicates that were beginning to move into areas further downstream in the production process. Switching to a foreign source was not always a discretionary option; the price advantages associated with buying dumped inputs in some cases forced British manufacturers to abandon their own internal production of those inputs[54] and in other cases, to switch from domestic suppliers to foreign sources so as to remain competitive, despite certain troubling long-run implications.[55] Reflecting this concern, a pattern that emerges from contempo-

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Canada, and give them a hold of the canned fruit and meat trade which otherwise America might have kept from them. It reminds one of a besieging army smuggling ammunition and food into the beleaguered town." *Ibid.*

[52]"This German steel found its way to every steel-making centre. . . . Many sheet mills would have had to have stopped in consequence of the high price of pig iron if it had not been for German steel, and it cannot be said that the late advent of German steel has done any harm, but that it has actually supplied a want. . . . Black sheet makers are helped very considerably by using German steel sheet bars, which are so cheap comparatively" (*Ryland's* [December 28, 1901 and December 13, 1902], cited in *German and American Iron and Steel in the British Market* [Appendix II to *Great Britain, Board of Trade, memorandum on the Export Policy of Trusts, 1903 (cd. 1761)*], pp. 348, 350).

[53]Testimony of Witness No. 1, *Report of the Tariff Commission*, (1904), *op. cit.*, par. 490.

[54]"Wire rods we formerly made ourselves, until we found it quite impossible to make them at the price at which we could buy them. The same applies to sheet bars. This has thrown idle three Siemens-Martin steel furnaces, a cogging mill and a wire rod mill, in all, about £20,0000 worth of plant, and dispensed with the labour of about 250 men" (Firm No. 1,003, *Report of the Tariff Commission* [1904], *op. cit.*, Vol. I, par. 236).

[55]"We used at one time to buy all English wire rods, but of latter years the English firms would not compete at the price the Germans were prepared to take. Consequently, we had to buy German, in order to compete with our competitors who did so, much against our wish" (Firm No. 1276, *Report of the Tariff Commission* [1904], *op. cit.*, Vol I, par. 238). One British barmaker, who had experienced difficulties procuring billets (semifinished steel from which bars are made) from domestic suppliers, indicated that it was turning to German sources, but only reluctantly: "The billets which are being purchased in the West of Scotland from Germany has [sic] now become an established business between us. It has grown within the last year or two, and now they have really won the whole trade. . . . The Germans are now taking the next stage in producing iron bars. In Düsseldorf there are large works. I saw them doing so at the Essen works. At the moment it is an advantage to us to have this free importation of German stuff at so cheap a rate, but it is a fact that we cannot depend upon a continuation of cheap prices from abroad when they happen to have a great demand of their own. At those times we have to buy at home. The basis of our present working is a very unsound one. There is no dependence on it, and unless we can encourage the production of raw material at home, our position is a very unstable one" (Testimony of Witness No. 1, *Report of the Tariff Commission* [1904], *op. cit*., pars. 500, 502).

rary surveys is the intermittent and unpredictable character of the German and American sales; they occurred in waves that surged and receded, discomfiting competing British producers in the former case and British consuming industries in the latter.[56]

German steelmakers recognized that their dumping abroad created serious competitive problems for their domestic steel-consuming customers, who had to compete with foreign firms that were able to buy dumped German steel. Thus, for example, Dutch producers of barges for river transport were able to capture most of this business from their German rivals at the end of the nineteenth century because they could buy dumped German plate, while their German competitors paid the higher domestic price set by the German steel cartel.[57] The German syndicates counteracted this problem, however, by developing a sophisticated system of "export bonuses" or "bonifications"—payments to domestic customers who could demonstrate that their inputs would be utilized for producing products for export.[58] This system underwent continual refinement that served to strengthen the vertical and horizontal cohesion of German industry even as German dumping was weakening and in some cases breaking the vertical relationships between British producers. Thus, German export bounties were paid only to downstream exporters who brought exclusively from the upstream cartels, and only downstream firms that were themselves members of cartels in their own industries could qualify for export premiums from upstream cartels.

With the advent of the system of export bonuses, the focus of German dumping began shifting from intermediate industrial products toward finished products and higher value-added products. The Germans found that under the new system, the purchasing power of the home market was increased because downstream firms could, in effect, buy semifinished materials for use in production for export at "dumping" prices and expand their export sales of finished products through

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[56]Typically, following months of reports of widespread sales of low-priced German steel in various parts of the United Kingdom, *Ryland's* reported that "Germans are declining to quote owing to the improvement of their home market. The withdrawal of cheap German steel has caused home sheet makers some inconvenience [February 21, 1903]. . . . We understand that the German Wire Rod Syndicate have withdrawn all quotations for steel wire rods. . . . Swansea reports that German offers of steel tin-plate bars are off the market" ([March 21, 1903], cited in Great Britain, Board of Trade, *German and American Iron and Steel in the British Market, op. cit.,* p. 351).

[57]Great Britain Board of Trade, "Memorandum on the Export Policy of Trusts in Certain Foreign Countries," in *Report on British and Foreign Trade and Industrial Combinations, 1903*, p. 4.

[58]At the turn of the century the German Union of Sheet Manufacturers was paying an export bounty to customers who incorporated sheets in export products of 15 DM per ton. The Wire Syndicate's bylaws stipulated that the organization's "main object is to promote export by granting premiums." The Rhenisch-Westphalian Coal Syndicate, the Westphalian Coke Syndicate, and the various pig iron, structural steel, and semifinished steel syndicates established the *Düsseldorfer Abrechnungsstelle für die Ausfuhur*, a joint "Clearinghouse for Export" where the complex task of sorting out the various export premiums owed by the syndicates to their customers was performed (see Board of Trade [1903], *op. cit.*, p. 303).

price reductions. The U.S. Consul General in Berlin, commenting on this phenomenon in 1916, observed that through the new selling policy

> [t]he Steel Verband therefore shifted the entire movement of half-finished materials, and the ultimate result was the struggle for supremacy in finished manufactured products in South America and the colonies.[59]

A number of British manufacturers abandoned intermediate production processes in the face of German dumping, retreating into production activities further "downstream," in many cases becoming dependent on dumped German products as inputs. This was rationalized on the grounds that the downstream product areas were more specialized and remunerative, and that it therefore made sense to allow the Germans to supply the commodity-grade inputs while concentrating on areas requiring the greatest craftsmanship. But British industrialists soon found that they had not only lost control of the upstream part of the production process, but confronted German dumping in the downstream product lines as well. One British steelmaker testified in 1904:

> Our profits dropped from £30,000 in 1899, to about £2,600 in 1900. The following year, there was a loss of nearly £10,000, and it became obvious to those interested, that the cause of this sudden and alarming change in the prosperity was due to the heavy dumping of steel from Germany and America, at a price sold in this country considerably below the cost price at which the steel could be made here. . . . The alternatives we had before us were either to wait in the hope of a change in the conditions of trade or to put down fresh plant and get into a higher class of manufacture. We settled to do the latter, and by large expenditure gradually got into a different trade. . . . Then the proceeding was this. First, we began to make rails, sheet bars, & c., then the Germans, by dumping, stopped the trade in bars, blooms and billets. We then went into the tram rails and electric rails, and they are now beginning to dump those articles; finally, we were driven into a general trade in which we also suffered from German competition. There is no part of our trade in which they are not to some extent dumping, only this is not so acute as when we were confined to the lower grade of material worth from £3 15s to £5 per ton. . . . Then again, if we get into a still higher class of trade where wages per ton are greater still, they cannot touch us—at all events at present—but I think they are bound in time to touch us in higher products. We are beginning to feel it already.[60]

National Security Implications

British imperialists noted that dumping was destroying certain "primary" and "staple" industries and warned that foreign competition could weaken or eliminate industries that were essential to national security. The Free Traders ques-

[59]Special Report of Consul General Lucius G. Lay, Berlin, November 2–16, 1915, in Federal Trade Commission (1916), *op. cit.*, Exhibit I, p. 18.

[60]Testimony of Witness No. 4, *Report of The Tariff Commission* (1904), Vol. I, pars. 579, 581.

tioned whether, in light of their poor competitive performance, such industries were, in any event, "one[s] which we could expect to keep." The loss of "staple" industries was more than offset, they argued, by the advent of specialized downstream industries processing the cheaper imported inputs formerly produced by the supposedly vital basic industries.[61] Others made the point that rapid strides in human technological progress and global economic and financial integration had made war virtually unthinkable; the advent of technological breakthroughs in communications and transportation and growing foreign direct investment were bringing about the very international "division of labor" envisioned by Adam Smith. Commenting on globalization in 1910, one observer noted that there now existed

> a financial interdependence of the capitals of the world so complex that disturbance in New York involves financial and commercial disturbance in London, and, if sufficiently grave, compels financiers of London to co-operate with those of New York to put an end to the crisis, not as a matter of altruism, but as a matter of commercial self-protection. . . . [T]his complexity of the international division of labor tends to render futile the . . . contrivances of conquest. . . .[62]

The Surprise of 1914

Such ruminations were abruptly removed from the realm of abstract argument on the morning of August 4, 1914, when thousands of German troops crossed the Belgian frontier and began an assault on the fortress city of Liège, the beginning of an onslaught by 1.5 million men against the eastern boundaries of Belgium and France. A few hours later, to the considerable surprise, if not outright disbelief, of most of its citizens, Britain found itself at war with Imperial Germany. Five days later, on August 9, 1914, 80,000 men of the British Expeditionary Force, representing virtually all of Britain's professional army that could be gathered in the home islands, began embarking for the continent, and within days its "tiny numbers were sucked inexorably into the military planning of the great continental powers."[63] On August 13, 1914, the Germans began bombarding the forts defending Liège—which had been expected to hold out for months—with terrifying new weapons that the British did not know existed—huge 420-mm howitzers, the "Big Berthas"—that had been developed secretly at the Krupp steelworks in Essen. Smashed to pieces by these guns, all of the forts fell within four days; the German armies passed through Liège and began a sweep across Belgium. Brussels fell on August 20. On August 21, 400 German guns, includ-

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[61]Smart (1906), *op. cit*., pp. 154–155.

[62]Sir Newman Angell, *The Great Illusion: A Study of the Relation of Military Power to National Advantage* (New York: G.P. Putnam's Sons, 1910), pp. 53–67.

[63]Trevor Wilson, *The Myriad Faces of War: Britain and the Great War, 1914–1918* (Cambridge, England: Polity Press, 1986), p. 38.

ing the Big Berthas, began bombarding the Belgian fortress city of Namur; the city fell two days later, unhinging the whole Franco-Belgian line and forcing the French army into a general retreat along its entire front.[64] The same day, a little further to the west, the British Expeditionary Force, which had advanced into Belgium and taken up positions along the Mons Canal, came under attack by greatly superior German forces. Outnumbered, out of contact with the French, and threatened with envelopment on both flanks, the British began a fighting retreat that did not end until they reached the Aisne River, 250 miles to the south.

The stunning events of this fortnight in August 1914, which catapulted Britain into a major war on the continent and saw the unravelling of pre-war allied strategy, brought only the first of a succession of unpleasant surprises to the nation. The military had expected that if war came, it would be short and sharp, resolved with a few decisive battles, such as the Franco-Prussian contest of 1870. British marksmanship, pluck, and military professionalism would carry the day. There was no reserve army to call up, no store of munitions to sustain a long war, and no arrangement for industrial production to support a continental-scale army in the field.[65] Instead, after the first engagements in Belgium and Northern France, the war degenerated into the ghastly deadlock of trench warfare, in which, as was quickly demonstrated, sheer weight of munitions and numbers counted most.[66] Less than three months after the outbreak of the war, the Germans launched a massive attack on British positions in front of Ypres, concentrating what was at that time the greatest weight of artillery that had ever been brought to bear on a British force in the field and mounting successive, massive infantry assaults with a numerical superiority of between four and seven to one. This continued for four weeks. The British held their ground, but by mid-November, 1914, the original British Expeditionary Force had largely ceased to exist; a third

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[64]Sir Winston Churchill wrote later of the impact of this event: "Namur fallen! Namur taken in a single day. . . . We were evidently in the presence of new facts and of a new standard of values. If strong fortresses were to melt like wisps of vapour in a morning sun, many judgments would have to be revised. The foundations of thought were quaking" (Churchill, *The World Crisis* [New York: Charles Scribner's Sons, 1923], Vol. I, pp. 289–290).

[65]The British Expeditionary Force consisted of six regular infantry divisions and a cavalry division, which were augmented later by two divisions withdrawn from India. Behind these forces stood 14 lightly armed "territorial" divisions and 13 Mounted Brigades with little if any organic artillery. By way of comparison, the Germans committed 70 combat-ready infantry divisions and 3 cavalry divisions to the invasion of Belgium and France in August 1914 (Churchill [1923], *op. cit.*, Vol. I, pp. 252–253).

[66]A British officer on the scene who witnessed the onset of the trench war observed that "[t]he growing resemblance of this battle to siege warfare has already been pointed out. . . . [W]e at all times suffered from the great preponderance of the Germans in artillery, especially in heavy field howitzers. As, however, we had not got the material means with which to counter this disadvantage, we could only try to mislead the enemy as to the damage he was doing us" (Sir Ernest D. Swinton, *Eyewitness: Being Personal Reminiscences of Certain Phases of the Great War, Including the Genesis of the Tank* [New York: Arno Press, 1972], pp. 42–43).

of its original members had been killed outright, and many others were wounded; "the British regular army no longer had the capacity to fight a major battle."[67] Thereafter, Britain, like the other belligerents, had no choice but to mobilize its civilian population and its economy to fight a protracted war of attrition.

The unexpected development of a stalemate on the Western Front brought in its wake other, even more fundamental surprises. One was the extent to which Britain's principal strategic asset, its fleet, was neutralized by German industrial power. The British blockade against Napoleon had played an important role in bringing him down; but the British blockade against Imperial Germany was countered, to a considerable degree, by German industrial science and technology. German manufacturing concerns quickly converted to the mass production of munitions, spewing out guns, shells, and bullets at an incredible rate.[68] Chemical companies churned out not only high explosives but a vast range of *ersatz* products to replace items that had been cut off by the British blockade. German railroads shifted huge armies rapidly around the interior of Europe, whereas the British fleet operated more or less ineffectually around the periphery. Indeed, Britain soon found itself under partial blockade as German U-boats began sinking the merchant ships that constituted the country's lifeline.

But the most appalling surprise—known to Britain's leaders but not the public—was the sheer extent to which the country's industrial base had decayed. In the wars against Napoleon, the "workshop of the world" had outfitted not only the British fleet and army, but also the large armies of its continental allies—Prussia, Russia, Austria, and Spain. But, by 1914, so many industries had disappeared or fallen behind technologically that Britain could not sustain her own army and navy, much less those of her allies:

> [T]he first two years of the Great War showed England to be incapable of fighting a major war from her own industrial resources.[69]

The Ammunition Shortage

An early and continuing manifestation of British industrial weakness was the ammunition shortage, a scandal that erupted several months after the outbreak of the war. In the midst of the Ypres battle, the British commander on the scene warned London that unless he received large quantities of ammunition, he would

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[67]Wilson (1986), *op. cit.*, p. 48.

[68]When the German army began its assault on Verdun in February 1916, it began with a 12-hour barrage of 100,000 shells per hour fired from 1,200 guns. By the third year of the war the Krupp works at Essen was turning out 9 million shells and 3,000 artillery pieces a month (William Manchester, *Arms of Krupp*. Bantam Books, New York, 1981, p. 326.

[69]Correlli Barnett, *The Collapse of British Power* (Atlantic Highlands, N.J.: Humanities Press International, Inc., 1986), p. 83.

be forced to fight without artillery support. He was told to economize.[70] Several months later, in March 1915, Douglas Haig, in command of Britain's First Army in Flanders, proposed a major assault on German positions along Aubers Ridge, but there was a problem:

> I went out to Hazebrouck about 10:00 am and saw Sir John French. He approved my plan of operations but **there was no ammunition**. . . . This lack of ammunition seems serious. It effectually prevents us from profiting by our recent success and pressing the enemy before he can reorganize and strengthen his position [original emphasis][71]

The British army lacked, in particular, large numbers of high-explosive artillery shells of the type needed to make an impression on the Germans' well-engineered and deeply dug trench systems; for the most part, the British possessed only airburst shrapnel shells that made little impression on an entrenched foe. Over the next four years, the British army paid dearly for this deficiency, which was never wholly made good; the shell shortage limited the army's ability to sustain offensive action, or, if an attack was made, greatly increased the cost to the attackers, since the German trench systems were seldom adequately softened up by preliminary artillery fire.[72] On May 15, 1915, a British offensive at Festubert was broken off because the British forces had expended their ammunition along the entire front.[73] In the fall of 1915, compelled to take the attack at Loos to relieve German pressure on their Russian allies, the British assaulted the German trenches despite the fact that the shell shortage left them without adequate artillery support—"all we wanted was ammunition." They suffered 60,000 casualties, making no appreciable dent in the German lines.[74] In Britain the shell shortage fueled

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[70]John Terraine, *Douglas Haig: The Educated Soldier* (London: Hutchinson & Co., 1963), p. 107.

[71]Douglas Haig, Diary entry for March 16, 1915, in Robert Blake, ed., *The Private Papers of Douglas Haig* (London: Eyre and Spottiswoode, 1952), p. 88.

[72]For an eyewitness account of a disastrous, and all too typical, British assault on German trenches, supported only by shrapnel, in May 1915, see Swinton (1972), *op. cit*., p. 92–93. "As soon as our short bombardment of the German position—almost entirely with field-gun shrapnel—ceased, our infantry went over the top. As they clambered up, the Germans in their dug-outs, unhurt and hardly shaken by our shrapnel, swarmed up and manned their parapets. . . . [They] poured on a steady hail of bullets into our advancing infantry, their machine guns firing from emplacements fitted with loopholes just clear of the ground. Some of our men got as far as the German wire; but in most cases our assault was stopped dead on the top of our parapets or a few yards in front, where the ground was strewn with bodies."

[73]Later in 1915, the British command decided against further offensive action in Flanders for the remainder of the year because British forces were "gravely short of the war's most important implements, heavy artillery and shells"; the most they could do was offer to take over portions of the French defensive lines to free up French troops for the offensive (Haig, Diary entries and editors' notes for May 9, 1915 [1952], *op. cit*.).

[74]Much of the British-made ammunition that was produced was "of such poor quality that it might have been saved the trip to the battlefield."

public outrage, and much angry finger-pointing took place over who bore the blame; partly as a result, Prime Minister Asquith was compelled to ask the resignations of all of his ministers in 1915 and to form a coalition government.[75]

The Steel Shortage

The ammunition shortage was, in part, a function of poor planning and bureaucratic bungling, but it was much more fundamentally a reflection of the fact that Britain's industrial base could not meet the demands that were being placed on it. It was evident in 1915 that the British steel industry could not even begin to produce enough shell-quality steel; the three firms that could make such steel had a combined output of 5,000 tons per week, while the government was asking for 35,700 tons per week.[76] The shortfall was slightly alleviated by reducing the quality requirements for shell steel and by attempts to import shell steel from the United States, but Britain's shortage of shell steel "remained acute until the end of the war."[77] In 1918 Britain's ability to go on the offensive on the Western Front was still constrained by a shortage of artillery shells, with respect to which "steel [was] the limiting factor."[78] The Ministry of Munitions concluded at war's end that

> It was only the ability of the Allies to import shell and shell steel from America and iron ore from neutral Spain that averted the decisive victory of the enemy.[79]

The ammunition shortage was only one symptom of a broader problem, the inability of the nation's steel industry to produce the quantity and quality of steel needed by the nation's armed forces to fight the war. It was a "steel war," in the words of Sir Winston Churchill, the Minister of Munitions. Steel was needed, most critically, to produce the merchant ships that constituted Britain's supply lifeline; after that, steel was needed for naval vessels, shells, artillery pieces, rails, construction of fortifications, and later, for tanks. The demand could not be met

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[75]Britain's commander-in-chief, Lord Kitchener, blamed the army in Flanders for its profligate expenditure of bullets and shells. The War Office was faulted for not paying earlier attention to munitions production. Many in the government blamed the work force for its sluggish response to exhortations to produce more guns, bullets and shells (see Churchill [1923], Vol. II, pp. 319, 365; Wilson [19xx], *op. cit*., p. 141).

[76]*History of the Ministry of Munitions*, Vol. X, "The Supply of Munitions" HMSO, London, 1922, pp. 79–81. Shell steel required precise percentages of sulphur and phosphorus in the metal to prevent it from becoming brittle in extremes of temperature.

[77]*History of Ministry of Munitions*, Vol. X (1922), *op. cit*., p. 87.

[78]Churchill, Memorandum of October 21, 1917, reproduced in *The World Crisis*, Vol. IV (1923), *op. cit*, p. 303; see also Churchill to Mr. Layton (undated memorandum, late 1917) reproduced in *The World Crisis*, Vol. IV (1923), *op. cit*., p. 290.

[79]*History of Ministry of Munitions*, Vol II (1922), *op. cit.*, p. 58.

from the domestic production base that was, moreover, heavily dependent on imported ore and semifinished steel that had to be brought in through U-boat-infested waters. The Germans identified Britain's steel dependency as one of its greatest strategic vulnerabilities and made the overseas steel lifeline the primary target of its policy of unrestricted submarine warfare.[80] Moreover, even leaving aside the U-boat problem, the overseas sources of ore and semifinished and finished steel were precarious at best. Germany, the principal source of imported semifinished steel, was now the enemy; Belgium, another source of steel, was occupied, as were most of the iron ore fields of France.[81] Britain's allies, Italy and France, were utterly unable to meet their own steel needs and looked to Britain to do so. Sweden, a primary source of iron ore, was an unfriendly neutral. The United States proved to be an important, but erratic source of supply.[82]

These problems were never overcome. The shortage of steel meant that it had to be rationed between competing demands; Churchill identified steel as one of the four limiting factors of production (the others being labor, shipping, and money) confronting the Ministry of Munitions.[83] The country's annual wartime needs were estimated at 10 million tons; it could only produce 8.5 million tons, and "out of this, every requirement must be met, and if through shipping shrinkage the total production is reduced, all programmes will be affected."[84] Because of the shortage, a constant tug of war raged within the British war effort to secure supplies of steel. In 1917, Churchill wrote to Haig and observed that

> there are many difficulties here, both with labour and materials, especially steel, and at this stage of the war, it will often become necessary to choose between desirable things and to throw special emphasis on this or that branch of production.[85]

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[80]When Chancellor Dr. Bethmann-Hollweg announced the policy of unlimited submarine warfare on January 31, 1917, he gave "as his first object the cutting off of British ore imports, putting this on the same level of importance as his other object, namely, depriving the country of food imports" (*History of the Ministry of Munitions*, Vol. II [1922], *op. cit*., p. 58).

[81]"The importance of steel as one of the essential materials for the supply of munitions seems to have been ignored to a remarkable extent by the military and naval authorities of the Allied Powers . . . [a]pparently no cognizance was ever taken [by the French] that the Briey ore fields, which produced 80 percent of French iron ore, were commanded by the enemy fortress of Metz. Italy, with practically no natural resources of iron ore or fuel, had maintained military forces beyond her financial powers, depending on her Allies of the Triple Alliance for steel and coal" (*History of the Ministry of Munitions*, Vol. VII [1922], *op. cit*., pp. 4–5).

[82]British attempts to buy American shell steel drove up the price of that commodity, and the quality of American steel did not satisfy British requirements. French and Italian efforts to buy their own shell steel in America resulted in "the steel works . . . becoming congested with orders as far forward as 1917" (*History of the Ministry of Munitions*, Vol. VII [1922], *op cit*., pp. 68–69).

[83]Churchill (1923), *op.cit.*, Vol. IV, p. 4.

[84]*Provisional Munitions Budget for 1918*, to the War Cabinet (November 1, 1917), reproduced in Churchill (1923), *op. cit*., Vol. IV, p. 25.

[85]Churchill to Haig, July 26, 1917, reproduced in Churchill (1923), *op. cit.*, Vol. IV, p. 285.

Britain, which a few years earlier had debated whether it should worry at all about the erosion of its steel industry, now frantically attempted to expand that industry and make good the many deficiencies that the war had revealed. "It was . . . urgently necessary to increase the capacity of the British steel works at once." The government appealed to the steelmakers to expand their capacity, but the British mills replied that capital expenditures on the scale needed were too risky. They expressed concern about the international competitive environment they would face after the war. The government advanced much of the capital required, but the expansions of existing mills proceeded much more slowly than hoped, due to the recalcitrance of the steelmakers to expand and shortages of supplies and labor, which were "urgently needed for war purposes." Most of the steel works "extensions" were still incomplete when the war ended in 1918.[86]

The Sluggish Production of Tanks

Because the steel shortage touched every aspect of Britain's war effort, major and minor, it is impossible to assess its full effect. In a myriad of specific cases, the shortage meant that there was not enough merchant tonnage, not enough shells, or not enough artillery pieces to perform the task at hand.[87] Often, the deficit was made up in additional lives lost, the most dramatic example of which was Britain's sluggish deployment of tanks, the weapon that ultimately broke the deadlock in the trenches. The idea of armored caterpillar-tracked vehicles as a way out of the trench stalemate was conceived at the very beginning of the trench deadlock in late 1914 and early 1915.[88] But it took over three years to develop this idea from a prototype stage to that of a weapon capable of being employed on a mass basis in the field; only small batches of tanks were available before late 1917, not enough to achieve any decisive result. During this interval, from early 1915 to late 1917, the British army launched repeated mass infantry offensives against the German trenches at the Somme (1916) and Passchendaele (1917), suffering truly horrific losses without achieving any significant result.[89]

Britain's tardiness in employing tanks on a mass scale was due to several

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[86]*Ibid*., Vol. VII, pp. 55–63.

[87]*Ibid.*, p. 84. Aircraft production was hampered by the inability to produce sufficient quantities of alloy steel. The British fleet's narrow (and costly) victory at Jutland may have been attributable, in part, to the fact British battleships were shielded by superior-quality German plate procured from Krupp before the war (Manchester [1981], *op. cit*., p. 327).

[88]Colonel Maurice Hankey and Lieutenant Colonel Henry Swinton advanced proposals to the government during this period for the development of armored vehicles to assault enemy trenches. The idea was seized on by Winston Churchill, then First Lord of the Admiralty, who played a key role in advancing it through the bureaucracy (see, generally, Swinton [1972], *op. cit*., pp. 71–81).

[89]All told, Britain suffered 2.5 million casualties on the Western Front (Terraine [1963], *op. cit.*, p. 480).

factors, including resistance by some elements of the military, labor shortages, training bottlenecks, and disputes over design issues.[90] But material shortages and shortcomings played a crucial limiting role. The Admiralty engaged in a continuous struggle with the tank program over the supply of steel plates, and the Admiralty usually came out on top.[91] Perhaps more seriously, the British steel industry experienced great difficulty producing adequate numbers of castings that would join together the links of the tanks' caterpillar tracks. Until mid-1917 British steel manufacturers could not make adequate numbers of track links at the tensile strength required. As a result,

> the production of track links proved a limiting factor in the output of tanks and contributed considerably to the accumulation of arrears, since it was always some six months from the time of placing a contract before a new foundry could produce satisfactory links in considerable quantities.[92]

What might have been achieved, and the losses that could have been avoided, had tanks been employed en masse at an earlier date, was revealed when the first mass tank assault was undertaken by the British at Cambrai on November 20, 1917, in the last year of the war. Four hundred seventy-six tanks, backed by infantry, broke a six-mile wide hole through the vaunted German Hindenberg Line, penetrating four and one-half miles through the German positions in a single day. Winston Churchill commented as follows:

> Accusing as I do without exception all the great ally offensives of 1915, 1916 and 1917, as needless and wrongly conceived operations of infinite cost, I am bound to reply to the question, What else could be done? And I answer it, pointing to the Battle of Cambrai, 'This could have been done.' This in many variants, this in larger and better forms ought to have been done. . . .[93]

A later author points out that Churchill was wrong insofar as he implied British leaders were at fault for the delay; the real problem was with the production base:

> [O]f greatest significance was the fact that only now [late 1917] had tank production reached a level at which this weapon had the weight of numbers largely to affect a military operation. This matter of numbers, depending on the painful development of a productive capacity, needs to be stressed.[94]

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[90]See, generally, Swinton (1972), *op. cit.*; *History of the Ministry of Munitions* (1922), *op. cit.*, Vol. XII, Part III.

[91]"Each of the armed services was fighting to obtain every ton of steel and freight for itself in a free-for-all in which the Royal Navy seemed to come off best" (Bryan Cooper, *The Battle of Cambrai* [New York: Stein and Day, 1967], pp. 52–53).

[92]The problem was "blowholes and segregation of sulphur and phosphorus at the parts of the link where soundness was particularly essential" (*History of the Ministry of Munitions* [1922], *op. cit.*, Vol. XII, p. 48).

[93]Churchill (1923), *op. cit.*, Vol. IV, p. 61.

[94]Wilson (1986), *op. cit.*, p. 487.

Consequences of a Weakened Industrial Base

Although the problems of the steel industry posed the greatest difficulties for Britain in World War I, the nation's industrial shortcomings went far beyond this industry or any of the industries normally associated with munitions production. The domestic industrial base producing consumer goods had also eroded, and therefore could not be converted to war production on the scale required. Before the war, Britain's clockmaking and mechanical toy industries had been displaced by imported clocks and toys; when war came there was no precision clock or toymaking industry that could be converted to the production of accurate shell fuses. Britain had to create a light engineering industry to fill this gap, but the effort to do so revealed another hole in the nation's industrial fabric: the lack of a modern machine–tool industry that could make the machines needed to run the production lines. The nation had become dependent on imported machines, and only the importation of machine tools from America, Switzerland, and Sweden "prevented a total breakdown of the British effort to create new industries between 1914 and 1916."[95]

Britain had become dependent on Germany, now her enemy, for many of the industrial products needed to wage a modern war. At the outbreak of the war, Britain looked to Germany for 90 percent of the optical glass used for precision instruments, for 75 percent of its glass for electric lights, and even most of the laboratory instruments used by British scientists. Britain was dependent on Germany for chemicals needed for explosives and even drugs such as aspirin; during the war it "had no alternative but to continue importing German drugs via neutral countries." Britain was dependent on Germany for precision bearings and magnetos, both of which were indispensable for every type of motorized equipment—aircraft, tanks, trucks, cars. Britain tried, but never succeeded, in making up for this shortcoming by imports from Sweden and Switzerland; in fact, Britain was never able to produce the number of engines needed to fight the war and had to rely on its allies to make good at least part of the difference.[96]

Although the decline of Britain's strategic industrial base that had occurred by 1914 had multiple causes, dumping was an important contributing factor. The stagnation of investment by the British steelmakers in the years prior to the war, and indeed, through the war years themselves, reflected the demoralization that had set in as the British confronted a competitive dilemma for which they had no solution. While it is impossible to state with certainty that the qualitative problems revealed by the war, such as the difficulties in making track links for tanks, could have been resolved more readily by a larger and more robust steel industry, it is reasonable to assume that a bigger and a more vibrant industry would have grappled with such challenges more successfully.

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[95]*History of Ministry of Munitions*, *op. cit.*, Vol. XII, p. 110, cited in Barnett (1986), *op. cit.*, p. 85.
[96]Barnett (1986), *op. cit.*, pp. 86–87.

Britain's experience allowing unrestricted dumping a century ago is obviously subject to varying interpretations, but on balance its experience can hardly be held up as a ringing testimonial to the wholly passive policy that was actually followed. Dumping in the markets of the British Empire by cartels operating behind high tariff walls placed a number of key British industrial sectors at a permanent competitive disadvantage. Over time, this led to declining relative competitiveness and, ultimately, disinvestment. This erosion of the British industry left the Empire dangerously vulnerable when it was unexpectedly plunged into a major war in 1914. Although it was argued contemporaneously that dumping of industrial inputs such as steel enhanced the competitiveness of downstream industries that consumed these inputs, it was also noted at the time that the downstream industries themselves suffered from the erratic availability of dumped inputs, the growing dependency on their direct competitors for key inputs, and ultimately by dumping in their own downstream markets—and it was not merely the steel industry, but British industry *as a whole* that had declined dramatically by 1914. Finally, unrestricted dumping surely gave rise to short-run benefits to consumers of dumped products, a fact that was recognized and played a major role in the electoral victory of the Free Traders in 1906. However, seven hundred thousand of those same British "consumers" were killed several years later in the war, and millions more wounded, a toll far higher than it would have been but for the erosion of Britain's industrial base.

DUMPING TODAY: STILL A PROBLEM?

In the decades following World War I, many countries enacted antidumping rules that provided for the imposition of duties at the border on imports that were being sold at "less than fair value" and injured a domestic industry.[97] The "problem" of dumping was recognized in many bilateral trade agreements in which treaty partners agreed to the mutual use of antidumping measures to offset dumping. When the GATT was negotiated in 1947, Article VI provided that contracting parties could use antidumping duties to offset dumping that caused material injury. In subsequent rounds of multilateral trade negotiations, the contracting parties have adopted and refined a succession of antidumping codes that prescribe detailed procedural and methodological rules for the application of antidumping duties.

[97]These measures defined dumping by reference to the domestic price in the market of the dumper and calculated the margin of dumping as the difference between the home market price and the export price. If goods were not sold in the home market, or if too few were sold to use as the basis of a valid home market price, the rules required reference to other measures of "normal value," such as export prices in third country markets or a "constructed" price based on an evaluation of cost plus a reasonable profit. Under some systems, home market prices that did not represent full recovery of cost plus a reasonable profit were excluded from the calculation of home market average prices.

Notwithstanding the proliferation and refinement of antidumping rules, antidumping measures remain controversial. As a leading GATT scholar observes, "central to the whole subject is the perplexing question whether antidumping law and policy, as related to international trade, makes any real policy sense today at all."[98] A chorus of academic commentary answers that question in the negative.

The British experience at the turn of the century would suggest that unrestricted dumping, at least in that era, was harmful. The question remains whether the events of that earlier era have any relevance today. It might well be argued that the widespread adoption of liberal trade and competition policies worldwide has changed the international commercial environment so profoundly that the dilemma which Britain once confronted does not and could not exist today. In addition, it may be that technological change has rendered obsolete the competitive dynamics that existed at the turn of the century. In fact however, while the world has undergone revolutionary political and technological change since that time, the factors that made dumping harmful remain with us today.

Dumping and Cartels: the Evolution of Trade and Competition Regimes

Superficially little remains of the international trading order that existed in the early twentieth century. The world is no longer clearly bifurcated between a single, major free-trading empire and a group of protectionist states and empires. Since the inception of the GATT in the late 1940s, quantitative import restraints have been phased out and tariff walls have been progressively dismantled. In the United States, an antitrust movement fostered enactment of strong antitrust laws and the breakup of many American business trusts. Following World War II, U.S. antitrust thinking was widely (albeit not universally) embraced abroad and some large industrial groups were dismantled by U.S. occupation authorities in Germany and Japan. National competition authorities were established, under U.S. prodding and tutelage, to curtail anticompetitive business behavior. On the basis of such changes, many observers concluded that the types of problems once posed by German cartels and American trusts had become marginal issues in the world economy.

In fact, a significant portion of the debate over the need for antidumping measures turns on the question whether the market barriers and cartels of an earlier time have really been banished from the world economy to the extent assumed by many, or whether they have simply been driven underground by the evolution of national and multilateral competition rules. Numerous critics of antidumping measures concede that dumping from protected "sanctuary" mar-

[98]John J. Jackson, "Dumping in International Trade: Its Meaning and Context," in John J. Jackson and Edwin A. Vermulst, eds., *Antidumping Law and Practice: A Comparative Study* (Ann Arbor: University of Michigan Press, 1989), p.16.

kets by cartels or monopolies may well be a potential problem, were it to occur, but that such practices are rare today:

> The world has changed somewhat in the last eighty years. The operations of foreign cartels are likely to be a smaller problem today than in 1900, in part, at least, because of the operation of national competition laws. Accordingly, even if a persuasive argument that dumping of this type creates economic losses for the receiver of the dumped goods was available, the relevance of the argument to the modern world might be doubted.[99]

There is no question that markets are more open today and that restrictive private arrangements have much less effect on trade today than was the case in the first half of this century. However, the dismantling of tariff walls has not necessarily resulted in open markets, and it does not follow that because national antitrust laws and enforcement agencies now exist, anticompetitive business behavior has ceased or been reduced to marginal importance.[100]

Although "national competition laws" are cited reassuringly by antidumping's critics as a latter-day bulwark against cartels, the assumption that such laws have largely eliminated cartels does not withstand scrutiny. It is true that following World War II many countries enacted competition laws that incorporated elements of U.S. antitrust doctrine, including proscriptions against price fixing, joint restraints on output, and the like. But these laws were grafted onto political systems whose industrial traditions were quite different from those of the United States, and in which antipathy toward joint industrial action, and even cartels, was far less. Following the immediate postwar era—a sort of high water mark for U.S. antitrust ideals—some national competition laws were amended to permit the formation of cartels as industrial policy tools. In other cases the laws were simply not enforced, with governments either tacitly consenting to cartel activity or, in some cases, actually encouraging and directing it.[101] The U.S. government gradually acceded to such arrangements, initially reflecting practical foreign policy considerations (e.g., the onset of the Cold War) but increasingly because it lacked the ability to do anything about the problem without incurring

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[99]Brian Hindley, "The Economics of Dumping and Anti-Dumping Action: Is There a Baby in the Bathwater?" in P.K.M. Thoradan, ed., *Policy Implications of Antidumping Measures* (Amsterdam: North-Holland, 1991).

[100]It should not be forgotten that the American trusts did not disappear or even alter their behavior very substantially for the generation after the Sherman Act and other antitrust legislation were enacted; they continued to thrive alongside laws and enforcement agencies that were supposed to break them up, and even briefly emerged as an element of U.S. industrial policy during the early stages of the New Deal (see Ellis W. Hawley, *The New Deal and the Problem of Monopoly* [Princeton, N.J.: Princeton University Press, 1966]).

[101]See, for example, with respect to Japan, Kiyoshi Humakawa, "Industrial Policy Law Regime," *Jurisuto* No. 1073, 8/01–15/1995, pp. 244–250. With respect to Germany, see Peter J. Katzenstein, *Policy and Politics in West Germany: The Growth of a Semisovereign State* (Philadelphia, Pa.: Temple University Press, 1987).

political costs that were unacceptably high.[102] Over time, a rough modus vivendi emerged in which many countries' governments and competition authorities paid obeisance to U.S.-type antitrust principles, while at the same time cartels and cartel-type arrangements were allowed to regulate a substantial volume of world trade.[103]

THE FACTUAL DEFICIT

Public discussion of the persistence of a "cartel problem" is hampered by the deficit of readily available hard information on the subject. Although at one time the U.S. government and the academic community possessed a wealth of information about national and international cartels, that information base has largely disappeared. The U.S. government agencies that once gathered information on this subject no longer do so and do not possess the capability that once existed. The U.S. economics profession has largely abandoned empirical study of such practices in favor of theoretical mathematical modeling exercises, and this approach has come to dominate the thinking of U.S. antitrust enforcement agencies. As a result, apart from the piecemeal facts that may emerge from a particular episode of civil litigation or as a result of sectoral studies by individual scholars, very little of a practical nature is known about the extent and pervasiveness of restrictive business practices outside of the borders of the United States.

The factual void with respect to anticompetitive business practices in international markets plays a central role in the present debate over antidumping. Critics of antidumping policy are able to ignore or downplay the notion that cartels, monopolies, and similar entities exist abroad that foster dumping because there is little empirical information on the subject that offers a contrary perspective. The result, typically, is a steady stream of highly visible, authoritative pronouncements by prominent scholars on the subject of dumping, which, when juxtaposed against market realities, serves simply to underscore the surreal character of the debate.

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[102]For an account of how U.S. "decartelization" efforts in Germany were brought to halt by political factors, see James Steward Murthin, *All Honorable Men.* Little, Brown, and Co., Boston, Mass., 1950.

[103]In 1994 a gathering of antitrust officials from many OECD countries was presented with a detailed description of a vast web of cartels in flat-rolled steel products, linking the principal mills of the European Union, Japan, Korea, and a number of newly industrializing countries. These arrangements, conducted in a relatively open manner which was sometimes reported in the press, included agreed floor prices, division of world markets into spheres of influence, and delivery quotas into various markets. No competition official from any country denied the essential accuracy of the information presented on this occasion or afterward. Yet at this writing, nearly three years later, these arrangements continue and do not appear to have been the subject of any action by national competition authority within the OECD (see remarks of Alan Wm. Wolff before the OECD Market Access Roundtable, "The Problems of Market Access in the Global Economy: Trade and Competition Policy" [Paris: presented June 30, 1994]).

Several examples of how the factual deficit colors the antidumping debate were provided by the investigation conducted by the U.S. International Trade Commission in 1994–1995 with respect to the rationale for antidumping and countervailing duty laws.[104] The Commission's staff chose to approach this question through a mathematical modeling exercise, and its factual inquiry was largely limited to the gathering of quantitative duty for use in its models. The existence, extent, and implications of anticompetitive combinations abroad giving rise to dumping was not considered relevant to the exercise. A number of prominent academic witnesses who testified similarly ignored or downplayed the role of anticompetitive practices in fostering dumping. Based on this approach, the academic witnesses and the Commission staff tended to reach similar conclusions—that antidumping measures are unwarranted, at least in most cases. But a fleshing out of the facts surrounding cases presented in the investigation calls into question the soundness of the conclusions reached.[105]

One prominent witness before the U.S. International Trade Commission, Professor Robert Willig of Princeton, concluded that so-called "strategic dumping," involving aggressive pricing of exports in combination with protection of the home markets of the exporter, "may, in the long run, harm consumers in the country that receives the exports," as well as domestic industries in those countries. So-called predatory dumping (designed to drive competitors out of business) posed similar concerns. That said, however, he reported that a study conducted by one of his colleagues, Dr. Hyun Ju Shin, had concluded that almost all recent U.S. antidumping cases with a non-negative outcome did not involve either strategic dumping or predatory dumping. The approach suggested by Willig was sensible—that is, to examine the central question of how truly prevalent are the anticompetitive arrangements that supposedly give rise to problematic dumping. However, the examination itself was flawed because of the lack of factual information available. The conclusion was based on Dr. Shin's assumptions rather than on empirical study.

Dr. Shin examined 282 non-negative outcome antidumping cases, "screened out" all cases that did not involve a threat to competition in the United States (e.g., "strategic" or "predatory" dumping), and found that only 20 to 30 cases

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[104]U.S. International Trade Commission, *The Economic Effects of Antidumping and Countervailing Duty Orders and Suspension Agreements* (Investigation No. 332-344) (Washington, D.C.: U.S. International Trade Commission, June 1995).

[105]Two of the International Trade Commission's six Commissioners voted to disapprove the staff study, citing the theoretical nature of the exercise: "Although economic modeling is a useful tool, it cannot substitute for `real world' experience" (views of Commissioner Bragg). Two other Commissioners voted to approve the report to enable the Commission to comply with the deadline set by the Office of the U.S. Trade Representative when it requested the study, while expressing "reservations . . . about the adequacy of this report in presenting a balanced and comprehensive discussion of the issues" (views of Vice Chairman Nuzum and Commissioner Rohr). Two Commissioners approved the study without reservation.

involved actual threats to competition in the United States. This would appear to be a fairly serious indictment of the entire antidumping regime. But the standards that Dr. Shin used to eliminate cases were not based on empirical sectoral case studies, but on her own *assumptions* concerning what seemed logical to include or exclude (e.g., "fairly sensible screens"). Although her reasoning is quite defensible, in an abstract sense, at least one of her most important assumptions was sharply at odds with commercial reality. She surmised that

> [i]f the imports that were challenged were coming from five or more different countries, then it seemed implausible that even if U.S. suppliers were eliminated from the market place, that importers from five different countries could form a cartel—although I am interested in checking this out with other panelists—and thereby participate in a monopolizing episode of the U.S. market.[106]

The assumption that producers from five or more countries could not form a cartel is inaccurate with respect to most cases involving steel products, which in turn comprise the largest single group of antidumping cases.[107] It is also erroneous with respect to a number of other industries.[108] It is, in other words, a factual error of sufficient magnitude to throw into question the validity of the study's

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[106]Transcript of hearing at 443–444 (September 30, 1994).

[107]Virtually all steel cases against the European Community (EC) between 1978 and 1988 involved products that were subject to the Davignon Plan and ancillary market-regulating measures implemented by Eurofer, the European integrated steel producers' association. The Davignon-Eurofer regime was a system of production and delivery quotas, recommended and mandatory minimum prices, fines for violations, and allocation of market shares among Eurofer's members. The EC cartel was linked to a similar cartel in Japan throughout the 1970s, 1980s, and 1990s pursuant to which shipments were limited in both directions and third-country export markets were divided, allocated, and subject to agreements on price and volume. Producers in Sweden, Finland, Korea, and other countries also coordinated their sales with the EC and Japanese groups. The Davignon Plan has been followed by other market-regulating schemes designed to stabilize prices through production restraints (see *Official Journal C.* 83/6, April 21, 1993). In other words, the preponderance of U.S. antidumping cases brought between the late 1970s and the present in the steel sector involved exporting firms that were parties to multinational cartel arrangements. A rough count from Fed-Track turns up a total of 43 U.S. antidumping actions after 1980 that involved EC carbon steel products that were concurrently subject to cartel restrictions under the Davignon Plan or its subsequent (and illegal) descendants. This count does not include numerous cases involving Japan, Korea, Sweden, and Finland. Detailed accounts of the EC steel cartel are set forth in Yves Meny and Vincent Wright, eds. *The Politics of Steel: Western Europe and the Steel Industry in the Crisis Years* (1974–1984) (Berlin, Germany: De Gruyter, 1987); Thomas R. Howell, William A. Noellert, Jesse G. Kreier and Alan Wm. Wolff, *Steel and the State: Government Intervention and Steel's Structural Crisis.* (Boulder and London: Westview Press, 1988), pp. 72–108.

[108]In 1994, for example, the EC Competition Directorate disclosed that ten European producers of carton board from nine European countries had operated a "pernicious. . . high tech cartel operation" involving price fixing and marketshare allocation. The cartel's activities involved "flagrant violation" of EC competition rules and "reveals once again a disturbing level of sophisticated cartel activity in a major industrial sector" (*European Report* No. 1967 [July 16, 1994]).

basic conclusion, which is that truly problematic dumping (strategic) is relatively rare.

Another example is offered by the work of one of antidumping's harshest critics, J. Michael Finger of The World Bank, who also testified in the 1994 U.S. International Trade Commission proceeding. His book, *Antidumping: How It Works and Who Gets Hurt*, denounces antidumping measures based on a series of case studies of the application of U.S. antidumping measures.[109] The case studies are less interesting for what they contain—a series of accounts of the difficulties experienced by foreign firms subject to antidumping measures—than for what is omitted, that is, any description whatsoever of the cartelized milieu out of which dumping arises.

One of the centerpieces of Finger's book is the Swedish stainless steel industry. The author of this case study, which is entitled "Antidumping Attacks Responsible International Citizenship," portrays the Swedish specialty steel industry in glowing terms as "an industry following good economic principles" and that receives little support from "a government demonstrating good international citizenship."[110] A series of U.S. trade actions have been brought over time against Swedish stainless steel products,[111] and the lesson, according to the author is

> that good economics, international competitiveness, private ownership, and limited support from a government demonstrating good international citizenship are not enough to defend an industry against the application of antidumping or other import restricting policy. . . . [T]he Swedish government, in its compliance with OECD criteria guiding national steel policy, demonstrated better international citizenship than either the United States or the European Community.[112]

Mr. Finger, commenting on this case study, concludes that

> Antidumping is anticompetition policy, not procompetition. . . . [T]he U.S. industry used antidumping and other unfair trade remedies to attack (Swedish) producers who had started out in the same situation as the U.S. producers but had fought their way through a disciplined, market-accommodating restructuring and downsizing to restore their profitability.[113]

Given such a presentation of the facts, the reader might well conclude that the U.S. antidumping law served as little more than a mechanism employed by U.S. protectionists to harass market-oriented, pro-competitive Swedish entrepreneurs.

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[109]J. Michael Finger, *Antidumping: How It Works and Who Gets Hurt* (Ann Arbor: University of Michigan Press, 1993).

[110]Fors in Finger (1993), *op. cit.*, p. 138.

[111]Antidumping actions have been brought against Swedish stainless steel plate and seamless and welded tubes. Stainless steel sheet and strip, plate, bar, wire rod, and drawn wire have been the subject of import relief (safeguards) actions. Section 301 actions have been brought against stainless steel drawn wire and tubes.

[112]Fors in Finger (1993), *op. cit*., p. 158.

[113]Finger (1993), *op. cit*., pp. 53–54.

An objective reader of the Swedish specialty steel case study might have been interested to know—but wasn't told anywhere in Finger's book—that on July 18, 1990, Avesta, one of Sweden's leading stainless steel producers and a centerpiece of his case study, was found by the EC Competition Directorate to have been a participant in the so-called Sendzimir Club or Z-mill club, a secret cartel of stainless steel sheet producers that, in the words of the Commission,

> prevented, restricted and distorted normal competition in the common market by controlling production, by sharing markets and customers, and by providing the basis for concerted practices on prices. . . . [These actions] inevitably had a significant effect on conditions in the Community market.[114]

The details of Avesta's participation in the Sendzimir Club were set forth in detail in the EC Commission's public findings. Basically, Avesta was a signatory to a secret agreement signed in Dusseldorf on May 16, 1986, that divided up the European market for stainless steel sheet [meaning the EC and EFTA (European Free Trade Association) countries] among the participating producers, establishing a system of delivery quotas for each market, together with arrangements for fines for deliveries to any market exceeding the quotas set. A sophisticated administrative structure was set up to run the cartel, characterized by frequent meetings and periodic adjustments of the quotas.

This episode, to be sure, could be dismissed as an anomaly; it might be argued that, notwithstanding this apparent lapse by Avesta, Swedish steel producers embrace "good economic principles" *most* of the time. But there is more. On February 16, 1994, the EC Commission's Competition Directorate published a decision imposing sanctions on the members of a secret European cartel in the steel beams (structurals) industry, and again, Swedish steel firms were found to be deeply involved, including SSAB, the largest producer in Sweden; Ovako Profiler AB, a Swedish producer of specialty and carbon steel products; and Fundia Steel AB. The Commission's finding set forth the details of an extraordinarily complex set of arrangements involving price fixing and market division on a country-by-country basis for the EC and Scandinavia; exchange of information between producers; harmonization of charges for "extras"; and the imposition of fines on companies violating these accords.[115] EC Competition Commissioner Van Miert stated that

> Everything that could have been infringed was infringed. It was a serious cartel involving all of the firms in the sector. It was flagrant and prolonged.[116]

It might be argued that European competition authorities acted against the Sendzimir and Beams cartels, thus demonstrating that national competition rules

[114]Commission Decision of 18 July 1990, *Official Journal* No. L 220/28 (August 15, 1990). The details of the cartel's administration, rules, procedures, and operations are set forth by the Commission in this order.

[115]Commission Decision of 16 February 1994, *Official Journal* No. L.116 (May 6, 1994).

[116]*European Report* No. 1927 (February 19, 1994).

are in fact disciplining such activity. However, the Sendzimir group was let off with small fines, reflecting, in part, the complicity of government officials in the activity concerned. The decision in the Beams case made clear that cartel activity in other product areas, and other markets, was known to the Commission but was not subject to sanctions. Public documents filed by at least one participant indicated that, notwithstanding the Commission's actions, it would take a wait-and-see attitude rather than withdrawing from other, similar arrangements in other product areas and in other international markets.[117]

The nexus between such anticompetitive arrangements and dumping is the same one that British critics of dumping cited at the turn of the century. Groupings such as the Sendzimir Club seek to stabilize prices in their home markets by creating an artificial constraint on supply. At the same time, they can maintain high operating rates, reduce unit costs, and enhance profitability as long as outlets exist in external markets where surpluses can be disposed of without disturbing the market order at home—that is, they are dumped.[118]

Although none of the activities of the Sendzimir Club or the Beams cartel found its way into Finger's analysis of antidumping and the Swedish steel industry, his omissions were not unique—they are virtually universal in critiques of antidumping policy. The existence of anticompetitive groupings that restrain supply within their own markets and dump surpluses in external markets is either not known, or if known, not reported to readers. But until such activities and their implications are fully understood and directly addressed, it is difficult to see how a meaningful public discussion of the continuing relevance of antidumping measures can go forward.

The Sendzimir and Beams cartels were operating in the European Union, which has one of the world's most rigorous competition regimes. If such activity remains common in the EU, it is not unreasonable to suppose that it occurs with equal or greater frequency in markets where competition rules are less stringent,

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[117]Following the decision in the steel beams case, British Steel's (BS's) annual report noted the fines involved in the beams decision and warned its shareholders of "industry groups" other than the beam cartel, to which BS belongs and which cover, among other things, "market conditions and various aspects of the sale and marketing of steel products..." Although British Steel does not say how membership in these groups might constitute a contingent liability, the clear inference is that they are involved in dealings similar to those that were found to be illegal in the Beams case" (*Metal Bulletin*, July 11, 1994). Moreover, the company disclosed in its 1993 Form 20-F filing with the U.S. Securities and Exchange Commission that its continued participation in such groups depends on the enforcement policies of the European Commission and of "authorities in other jurisdictions," indicating that the sphere of influence of these "industry groups" extends beyond the boundaries of the EU.

[118]Some cartels have regarded dumping as so essential to their success that they have adopted rules to spread the costs associated with dumping on an equitable basis among their members. One example is South Africa's "Iron/Steel Export Promoting Scheme" of the 1980s, pursuant to which producers paid money from domestic sales into a fund that was used to provide rebates on exported steel (typically about 20 percent of the f.o.b. value of exported steel products) to compensate exporters for the lower international prices obtained.

to the extent they exist at all. Japan, where weak enforcement of the Antimonopoly Law has been a subject of widespread comment and criticism, is characterized by highly cartelized industries that differ little in basic structure or competitive dynamics from the German kartells of a century ago.[119] And numerous newly industrializing and developing countries either have no competition laws or are only now beginning to implement them. It is surely no coincidence that the incidence of antidumping actions around the world still tends to cluster in sectors where anticompetitive arrangements are known or frequently reported to exist.

TECHNOLOGICAL CHANGE

Even if the persistence of current market access barriers and restrictive private practices is acknowledged, it might be argued that because of such practices dumping remains a problem in traditional capital-intensive sectors such as cement, steel, and paper. The world economy is increasingly dominated by technology-intensive industries in which the competitive dynamics are quite different than those of a century ago. In these sectors, dumping may not be a significant problem. In fact, experience has demonstrated that dumping can be, if anything, even more destructive in its impact. It has had a devastating effect in several technology-intensive sectors, notably consumer electronics, microelectronics, and telecommunications equipment. Because at least some of these industries are as integral to national defense as steel once was, dumping can pose national security concerns as serious today as those at the turn of the century.

In high-technology manufacturing industries, research and development, and capital investment requirements are extremely high—a single semiconductor wafer fabrication facility, for example, can cost in excess of $1 billion. At the same time, in contrast to steel, product life cycles are extremely short, with the result that these investments must be entirely recovered within a very short time, typically three to four years. In this setting, intensive dumping can literally destroy an industry in a matter of months, as happened to much of the U.S. dynamic random access memory (DRAM) sector in 1984–1985. The massive losses incurred in such episodes may preclude investment in the next generation technology for that product, with the result that, from a commercial perspective, a firm is permanently driven out of a sector.

Competition in high-technology sectors is rendered more intense by "learning curve" pricing tactics, pursuant to which producers seek to maximize production volume early in a product life cycle because production costs decline in a predictable fashion based on cumulative production experience. Firms that achieve high volumes in the early stages of the product cycle achieve a cost ad-

[119]See Mark Tilton, *Restrained Trade: Cartels in Japan's Basic Industries* (Ithaca, N.Y: Cornell University Press, 1996); Office of the U.S. Trade Representative, *1997 National Trade Estimate Report on Foreign Trade Barriers* (Washington, D.C.: U.S. Trade Representative, 1997).

vantage that may well prove to be commanding. However, playing this game requires massive investments accompanied by aggressive initial pricing, a high-risk approach that can culminate in market dominance, or, conversely, disastrous losses and even the destruction of the firm. "Learning curve" competition, while brutally Darwinian in its implications, is arguably consistent with market-based economics unless one or more of the competitors is operating from a protected "sanctuary" market. In that case, a company can move down the learning curve at relatively low risk through sales in the protected market. Such cost advantages and profits from the sanctuary can then be used to subsidize attacks on rival firms outside the sanctuary. The net result of diminished risk for the protected firms and exacerbated risk for other firms is familiar—disinvestment by firms adversely affected by dumping which cannot respond in kind in their rival's sanctuary.

The Japanese electronics industry, for example, is dominated by large, diversified industrial groups that have limited competition among themselves in the Japanese market in a number of product areas, with the result that prices are higher than world prices in many product lines. Profits from these "sanctuary" sectors have been used to finance aggressive entry into contested areas, selling at a loss, if necessary, for a sustained period. This dynamic has been observable in semiconductors, telecommunications equipment, and a number of other technology-intensive product areas. The high volumes that have been achieved as rivals were marginalized have eventually translated into a cost advantage and, as investment by rivals is deterred, a long-run technological advantage—in effect, the same dynamic observable in steel competition at the turn of the century.

The gradual shift in competitive advantage that took place between the British and German steel industries has close parallels in electronics. Twenty-five years ago U.S. consumer electronic firms were the world leaders in sales and technology. They sought to establish a competitive position in Japan, but were blocked by a combination of formal and informal market barriers as the Japanese government worked to foster an indigenous consumer electronics industry.[120] Government restrictions included a prohibition on the establishment of local subsidiaries, foreign exchange controls, import quotas (particularly with respect to replacement and repair parts), and a 30 percent tariff.[121] Although these restrictions were largely phased out in the early 1970s, an even more effective market barrier was the arrangements made by the Japanese producers themselves to restrict market penetration. Japanese consumer electronics retail outlets and service facilities were usually owned or controlled by large *keiretsu*-affiliated elec-

[120]For a comprehensive account of the promotional measures employed by the Japanese government in consumer electronics, see Developing World Industry and Technology, Inc., Office of Technology Assessment, *Sources of Japan's International Competitiveness in the Consumer Electronics Industry: An Examination of Selected Issues* (Washington, D.C.: Office of Technology Assessment, 1980).

[121]General Accounting Office, *United States-Japan Trade: Issues and Problems* Washington, D.C.: General Accounting Office, 1979).

tronics firms. These firms enjoyed enormous leverage over the small retailers because of the dependency of the latter on the former for capital and because of a system of rebates given by the manufacturer to retailers for factors such as "loyalty" and "cooperation."[122] Because the retail price was the same at all retail outlets, manufacturers could also reward or punish individual retailers by varying the wholesale price of merchandise. This leverage was used to prevent retailers from handling foreign merchandise.[123] U.S. consumer electronics firms might have in theory set up their own dealer networks, but they were prevented from doing so by a welter of official restrictions.[124]

But the restrictive practices in the Japanese consumer electronics sector went far beyond such garden-variety vertical restraints. For decades a number of the major electronics producers were involved in an extraordinarily elaborate system of clandestine and semi-clandestine arrangements to regulate various aspects of market competition in consumer electronics.[125] They operated a network of working groups[126] that met monthly from 1964 through at least 1974 to agree on future

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[122]Kozo Yamamura and Jan Vandenburg, "Japan's Rapid Growth Policy on Trial," in Kozo Yamamura, ed., *Policy and Law Issues of the Japanese Economy* (Seattle: University of Washington,, 1987), p. 244.

[123]Japanese consumer electronics retail outlets committed to provide a minimum of 80 percent of their floor space to their franchisor. The General Accounting Office observed in 1979 that the "Japanese industry representatives expressed doubt that any retailer would refuse to sell a product, but from our fieldwork we find this difficult to believe" (General Accounting Office, 1979, *op. cit.*, p. 90). This system still exists in its essential aspects, despite some moves toward reform (*Shukan Daiyamondo*, July 3, 1993).

[124]In the 1960s and 1970s, foreign ownership of a 50 percent share in ten or more retail outlets required special approval by the national government; foreign firms were prohibited from underwriting consumer purchase installment loans; and they could not enter into restrictive distribution arrangements with their own retail outlets comparable to those employed by Japanese firms. Although some independent dealers existed that theoretically might have handled U.S. products, selling through such outlets was impeded by government restrictions on the import of replacement and repair parts, which limited after-sales service (General Accounting Office, 1979, *op.cit.*, p. 90).

[125]From the 1950s through at least the 1970s, Hitachi, Mitsubishi, Toshiba, Sharp, Sanyo, and Matsushita maintained a joint arrangement known as the Market Stabilization Group, whose purpose was to control the retail prices of television sets in the domestic market. According to the Japanese Fair Trade Commission (JFTC), these firms engaged in "concerted activities" to "fix, maintain, or enhance prices, or to limit production. . . .thereby causing, contrary to public interest, a substantial restraint of trade." The companies agreed on "the bottom prices, margin rates, and distributors' prices for both color and black and white televisions. . . ." These findings, however, did not result in any significant policy actions (JFTC, *Kosei Torihiki Iinkai Nenji Hokoku* [1979], cited in Yamamura and Vandenberg [1987], *op. cit.*).

[126]The Tenth Day Group was limited to mid-level executives from the television divisions of the largest producers. The Tenth Day Group consisted of representatives of the seven large producers as well as smaller producers. The Palace Preparatory Group digested data assembled by the Tenth Day Group for consideration by the so-called Palace Group, consisting of senior managing directors who met to consider more important unresolved matters at the Tokyo Palace Hotel. From there, the decision went to the highest executives of the major companies, who met monthly at the Hotel Okura (Yamamura and Vandenburg [1987], *op. cit.*, p. 25).

production and shipment levels for televisions. The JFTC did not impose sanctions for any of the anticompetitive activities engaged in by the Japanese companies,[127] and its relative passivity was essential to the continued functioning of the cartel:

> Regular, frequent meetings, at which manufacturers' representatives negotiated outputs and prices at the retail, wholesale, and manufacturers' levels were an important element of [the cartel's] success. . . . The story of the cartel shows that it would have been an impossible venture had the JFTC possessed more power. The members were continuously renegotiating complex, detailed agreements at numerous meetings, which did not escape notice by the JFTC.[128]

But it is unclear that a series of warnings and recommendations by the JFTC to the Japanese electronics firms, spanning over 30 years, has done much to curb anticompetitive behavior.[129]

In 1984, "evidence suggesting anticompetitive behavior in the marketing of office computers and other final products utilizing microchips" [was] uncovered by the JFTC;[130] the JFTC noted the increasing "capture" of wholesalers by manufacturers, increasing producer shareholding in distributors, and transfer of management personnel between manufactures and sellers, and found that contracts signed between producers and dealers contained "restrictions regarding retail prices, sales area, retailers to whom the products could be sold, and other matters, [and] restrictions which conflict with the intent of the Antimonopoly

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[127]The Electronics Industry Association of Japan (EIAJ) collected sensitive data from each producer on television production volume, shipments, and inventories, broken down by screen size and tube type, and disseminated this information to all other manufacturers on a monthly basis through at least 1975. Documents seized by the JFTC indicated that the primary goal of this "welter of clandestine groups and overt cooperative activity" was price fixing and the cooperative control of distributors. These groups openly discussed and agreed on bottom prices for each type of television as well as wholesale and retail profit margins and rebate levels to distributors. The same producers participated in export cartel arrangements that divided the U.S. market among these companies (to avoid interfirm rivalry among Japanese producers) and that facilitated a massive wave of dumping which virtually destroyed the U.S. television industry during the 1970s. For a detailed account of this activity see Yamamura and Vandenburg (1987), *op. cit.*

[128]David Schwartzman, *The Japanese Television Cartel* (Ann Arbor: University of Michigan Press, 1993), pp. 75–76.

[129]See, generally, Marcel F. Van Marion, *Liberal Trade and Japan: The Incompatibility Issue in Electronics* (Groningen, Netherlands: Rijksuniversiteit Groningen, 1992), pp. 77–101. In 1957 the JFTC issued a report describing anticompetitive practices of the Japanese television manufacturers in the domestic market, including price fixing and resale price maintenance with respect to distributors, and it issued an order prohibiting the firms in question from carrying out their agreement, but the order did not prohibit a new agreement dated subsequently to the order. In 1966, in the six-company case, the JFTC again found that six Japanese television manufacturers had violated the Antimonopoly Law, but it concluded that the violations had ceased. The cartel continued to operate after this decision (Schwarzman, 1993, *op. cit.*, p. 28).

[130]Yamamura and Vandenburg (1987), *op. cit.*, p. 270.

Act."[131] In 1992 the JFTC and Ministry of International Trade and Industry (MITI) began investigations into allegations of illegal price fixing of audio-visual appliances by Matsushita, Sony, Hitachi, and Toshiba.[132] In 1993 the JFTC was reportedly investigating allegations of *dango* (bid rigging) in connection with the sale of large-scale display screens manufactured by Sony, Matsushita, and Mitsubishi.[133] A recent German study found that 80–90 percent of the retail sales of consumer electronics products in Japan involved retailers' sales of items made by "their" domestic manufacturer, and that "the tied retailers do not usually carry directly competing products. . . . Japanese manufacturers of domestic electrical appliances have broad control over the marketing chain right down to the consumer. . . . [T]his means that the tied retailer sector, which also has service facilities, is in general not accessible to non-Japanese manufacturers and their direct marketing partner (importers)."[134]

Eventually, the anticompetitive practices that were endemic in the Japanese domestic electronics market spilled over into the international arena—with devastating effects. As one recent study observed, the

> facts demonstrate that the seven [Japanese electronics] firms carefully coordinated their export plans; they notified one another of the intended quantity of shipments and prices, allocated U.S. customers among themselves, and cooperatively concealed a web of illegal, covert activity while charging prices low enough to suddenly and decisively gain a large share of the American market.[135]

In the television case, although numerous legal remedies were invoked by U.S. producers, no real answer was found either to dumping itself or to the Japanese market barriers and cartel practices that had made dumping possible. Instead, the U.S. television industry largely disappeared, foreclosing not only U.S. participation in this sector in the future, but in succeeding generations of products such as VCRs.

The problems that "downstream" British industries faced at the turn of the century as the effects of dumping gradually made them dependent on their Ger-

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[131]JFTC, *Office Computer no ryutsu jittai chosa ni tsuite* (September 28, 1984), cited in Yamamura and Vandenburg, 1987, *op. cit.*, p. 278n.

[132]*Nihon Keizai Shimbun* (March 27, 1992).

[133]*Asahi Shimbun* (November 16, 1993).

[134]Erich Batzer and Helmut Laumer, *Deutsche Unternehmen in Japangeschaft* (Munich, Germany: IFO Institute for Economic Research, 1989).

[135]Yamamura and Vandenberg (1987), *op. cit.*, p. 259. The Japanese firms devised the so-called "Five Company Rule," which required each exporter to specify five U.S. companies as its only and exclusive customers. No firm could sell to another company's U.S. customer without prior approval of a committee made up of executives from each company, "including, of course, any would-be Japanese competitor." Violations were punished by the Committee through fines equal to one-third of the value of a transgressing shipment. The purpose of these arrangements was to ensure that U.S. buyers did not play off one Japanese firm against another, and that any "increases in sales would be at the expense of American competitors." *Ibid.*

man competitors for key inputs has been paralleled, to a degree, in electronics. Both U.S. and European firms have repeatedly been placed in competitive difficulty as a result of their dependency on the Japanese electronics producers' group for components and tools. The most dramatic instance was the "chip shortage" of 1987–1990.[136]

Japanese semiconductor production is dominated by the same large electronics firms that comprised the television cartel described above—semiconductors are a basic component used in the end products manufactured by these firms, not only televisions but other computers, telecommunications equipment, robots, and factory automation systems. Beginning in the 1960s, these firms were organized by MITI into a series of research and development consortia for the purpose of catching up with the United States in semiconductor technology. Foreign sales in Japan were severely restricted through a ban on foreign investment, import restrictions, and local content requirements.[137] Under U.S. pressure, Japan committed to eliminate these formal market barriers by 1974, and MITI undertook an urgent program of "liberalization countermeasures" designed to offset the effect of liberalization when it was implemented. Japanese semiconductor and computer firms were encouraged to form tie-ups for the production, marketing, and sales of semiconductors and computers after liberalization.[138] Perhaps not surprisingly, after elimination of formal barriers to market entry in 1975, there was no increase in the foreign share of the Japanese market. U.S. firms were able to sell semiconductor products in Japan when a competing Japanese alternative did not exist, but when Japanese devices became available (often simply copies of U.S. devices), U.S. sales fell dramatically, in some cases resulting in a total loss of market.[139]

In the early and mid-1980s, Japanese semiconductor companies used their protected home market to pursue an aggressive trade strategy characterized by periodic episodes of dumping in the United States.[140] In the 1980s, Japanese companies repeatedly dumped DRAM and erasable programmable read-only

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[136]See Semiconductor Industry Association, *Creating Advantage* (Santa Clara, Calif.: Semiconductor Industry Association, 1992), pp. 120–126.

[137]*Nikkan Kogyo* (December 12, 1974); Japan Information Processing Development Center *Computer White Paper* (1975); *Japan Economic Journal* (January 14, 1969).

[138]*Nihon Kogyo Shimbun* (February 19, 1974); *Nihon Keizai Shimbun* (January 24, 1974); *Nikkan Kogyo Shimbun* (March 20, 1974).

[139]The Japanese press characterized this phenomenon as the "extinction of the market" (*Nikkan Kogyo* [July 28, 1982]). For a number of case studies see Semiconductor Industry Association, *The Effect of Government Targeting on World Semiconductor Competition* (Santa Clara, Calif.: Semiconductor Industry Association, 1983).

[140]The best account of this episode is Kenneth Flamm, *Mismanaged Trade? Strategic Policy and the Semiconductor Industry Association* (Washington, D.C.: The Brookings Institution, 1996). See also Semiconductor Industry Association (1983), *op. cit*. and (1992), *op. cit*.

memory (EPROM) chips in the United States, which in the case of DRAMs, succeeded in driving virtually all U.S. firms from the market.[141]

Most U.S. DRAM producers withdrew from the market in mid-1985, and the Japanese DRAM producers were left with a virtual world monopoly of this strategic product. At this point, the Japanese DRAM producers began jointly curtailing their production so as to raise prices.[142] In 1986 MITI announced a system of production "guideposts" (indicative production limits) designed to create a state of tight supply and higher prices.[143] By 1987, the market power of the Japanese producers was so great that a "chip shortage" occurred; they exercised concerted production restraint in the face of strong demand, resulting in worldwide shortages, skyrocketing prices, and economic dislocation for foreign firms dependent on Japanese components—and enormous profits for Japanese DRAM makers.[144] The Japanese firms continued to supply their own end users with DRAMs during this period, giving them a competitive advantage internationally. In addition to price manipulation through coordinated production controls, Japanese DRAM producers reportedly attempted to leverage their dominant position in the DRAM market into other markets by "tying" DRAM sales to sales of other unwanted custom chips such as application-specific integrated circuits [ASICs].[145] Significantly, none of these experiences was replicated in EPROMs, where U.S. producers retained a much more substantial presence in the market and served as a check on the market power of the Japanese firms.

The strategic implications of U.S.-Japanese competition in electronics are not particularly difficult to discern. This competition occurred between the industries of two close allies between whom armed conflict is unlikely under any foreseeable circumstance. However, the Gulf War underscored the extent to which advanced electronic systems are likely to dominate future wars and to which U.S. forces will depend on foreign companies and systems. As other advanced electronics industries are emerging around the world, the competitive dynamics that characterized U.S.-Japanese rivalry in the 1970s and 1980s are likely to manifest themselves again, perhaps in a strategic context that is considerably less benign.

Although the character of strategic industries has shifted from sectors such as steel and dyestuffs to technology-intensive industries such as advanced electronics, new materials, and aviation, dumping poses a problem little different from that which Britain faced a century ago. The loss of strategic industries, and the resulting dependency on foreign sources for defense-related supplies, inevitably poses security risks that cannot readily be remedied once a conflict actually breaks out. Even if the foreign source of supply is a close ally, access may be

[141]The margins of dumping in EPROMs ranged from 60 to 188 percent (Federal Register, *Erasable Programmable Read Only Memories from Japan*, 51 Fed. Reg. 29,708 (U.S. Department of Commerce, 1986); *64 Kilobit Dynamic Random Access Memories from Japan*, No. 731-TA-300 (final). U.S. International Trade Commission, Washington, D.C.

foreclosed through enemy occupation or interdiction, competing demands on the products in question, or a foreign decision to withhold supply for a variety of policy reasons.

BELOW-COST DUMPING

Antidumping measures have evolved over time that have offset not only "classic" dumping (e.g., price discrimination between markets) but export sales below the cost of production.[146] Commentators on antidumping frequently acknowledge that sustained below-cost export sales can be indicative of a predatory export strategy designed to drive rivals out of the market. However, it is argued that predatory schemes are rare and that assessing antidumping duties against below-cost exports penalizes certain legitimate economic activities, such as inventory clearance, "forward pricing" of new products whose average costs are initially high but decline rapidly as cumulative output increases, and export sales during recessions. In fact, predatory export strategies do appear to be extremely rare in the real world, at least as the term "predatory" is defined by contemporary economists and court decisions, and the need to protect industries against predation does not, by itself, appear to justify most of the cost-of-production antidumping duties that have been applied in recent decades.[147] It is also probably true that

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[142]*Sankei Shimbun* reported that "semiconductor industry circles, which were forced to take rigid measures for the coordination of production because of the decline of the market prices of their products, have at last begun to show signs of recovery" (*Sankei Shimbun*, December 5, 1985).

[143]*Nihon Keizai Shimbun* (April 24, 1986).

[144]*Nihon Keizai Shimbun* (October 10, 1987; June 28, 1989); *Wall Street Journal* (February 19, 1987).

[145]See U.S. General Accounting Office, *U.S. Business Access to Certain Foreign State-of-the-Art Technology* (Washington, D.C.: U.S. General Accounting Office, 1991), pp. 43–44.

[146]The U.S. Department of Commerce (DoC), for example, normally determines dumping margins by comparing home market prices with export prices. However, in calculating the appropriate domestic price, the DoC disregards sales made at below the cost of production if they are made "in substantial quantities," "over an extended period of time," and "not at prices which permit recovery of all costs within a reasonable period of time in the normal course of trade." If over 90 percent of domestic sales are disregarded as below cost, the DoC moves to a "constructed value" approach, in which it determines the "fair market value" for the domestic market by examining the exporter's costs (19 U.S.C. § 1677b[a][2], [b][c]).

[147]When the antidumping laws were enacted the term "predatory" was one of a number of "loose catchwords" (such as "cutthroat competition," "chiseling," and the like) used to describe a broad range of commercial abuses, such as "putting a crimp in one's competitors, punitively or destructively attacking other firms, and acting vindictively with punitive effect" (*International Air Industries* v. *American Excelsior Company* [517 F.2d 722, 5th Cir. 1975]). However, economists and recent U.S. court decisions have so narrowed the concept that "predatory pricing," as so defined, almost never occurs. Judge Bork has gone so far as to say that predatory conduct "probably does not exist" in the real world (Robert H. Bork, *The Antitrust Paradox: A Policy at War With Itself* (New York: Free Press, 1978), p. 154. See in particular *Matsushita Electrical Industrial Co., Ltd. et.al* v. *Zenith Radio Corp.* 475 U.S. 574 [1986]).

the scope of below-cost antidumping measures permitted under the GATT and national legislation has resulted in the application of duties in specific cases in which little policy justification exists to support the measures taken, although refinements in the GATT Antidumping Agreement limit the extent to which this can occur. It does not follow, however, that below-cost antidumping measures should be abolished or even substantially curtailed.

In a market-based economy, below-cost sales generally cannot occur indefinitely, since eventually the seller will be required to exit the market. Sustained sales at below cost are thus indicative of abnormal business behavior, and a variety of types of market distortion can give rise to sustained below-cost export sales. For example, a number of instances of below-cost dumping appear to involve the cross-subsidization of the exported product with profits generated from a domestic sanctuary market in which competition is restrained. This situation is simply a variant of Viner's "classic" dumping and is harmful for the same reasons.

Some normal commercial practices, such as inventory clearance sales, involve sales below cost for a limited time, but under current GATT rules and most national legislation, such short-term sales do not constitute a basis for imposition of antidumping measures. Although "forward pricing" of exports based on anticipated profits is cited as a legitimate rationale for below-cost export sales, this rationale could be used to justify any below-cost export sales—a product's life cycle cannot be predicted accurately, and there is no way of knowing whether it is reasonable to expect that full costs will ever be recovered. Finally, while it is certainly true that below-cost exports occur during recessions, the vast majority of these are not subject to antidumping measures. Moreover, a serious question is presented as to

> whether it is welfare-maximizing for the country of import to absorb, on a sectoral basis, somebody else's homemade recession. I dread to hear some people argue that, prima facie, this would be a good thing because it would result in low prices for consumers. If this were true, maybe we should not wait for recessions to be imported, but we should rush and ask our central banks to severely deflate so as to generate lots of low prices for consumers.[148]

In fact, it is unlikely that a multilateral regime that permitted unrestricted below-cost export sales—whether generated by recessions, anticompetitive syndicates, or some other factor inconsistent with market-based economies—could long endure the political pressures that would be engendered.

ANTIDUMPING AND TRADE LIBERALIZATION

For a century the concern that dumping by foreign syndicates might destroy key industries has been used by advocates of protectionism as a rationale for

[148]Miranda (1996), *op. cit.*, p. 6.

restricting imports in general, whether through a high tariff wall, quantitative restrictions, tariff, or other means. A variant on this argument has been used in developing countries as a justification for protectionist measures to defend against the feared depredations of multinational corporations. And yet despite the persistence of anticompetitive business groupings in international trade, and of dumping, the world trading order has been progressively liberalized since mid-century. The positive role played by antidumping—commonly castigated as nothing but a protectionist tool in this process—should be recognized.

The enactment and refinement of antidumping measures worldwide is almost always an element in a broader program of trade liberalization or a mechanism for defusing protectionist pressures. Typically, proponents of liberalization argue that the danger of dumping in specific sectors should be addressed through administrative measures limited to the sectors where dumping actually occurs and should not stand in the way of a more general reduction in trade barriers. The world's first antidumping legislation was enacted by Canada in 1904 by the Liberal party to neutralize domestic manufacturers' opposition to a more general reduction in import duties.[149] Similarly, the first U.S. antidumping legislation, the Antidumping Act of 1916, was supported by the Wilson administration which, "while showing itself wholly sympathetic with the desire for adequate protection against unfair foreign competition, was determined that it should not be employed to build up sentiment for an upward revision of the existing tariff act."[150] In the modern era, congressional political support has been sustained for the ratification of a successive road of multilateral tariff reductions, in part because the implementing legislation has incorporated refinements in U.S. antidumping procedures. A similar process is now observable in newly industrializing countries such as Mexico, Korea, and Chile, which are making greater use of antidumping measures, and strengthening their antidumping procedures, as they move to make their markets more open.

One of the most pervasive charges against antidumping policy is that it is spreading to newly industrialized countries like a sort of plague, threatening the liberal world trading order. But this reasoning implies that these countries' markets were previously open, and that a shadow is falling across this happy state of affairs as free-trading nations imitate the United States and begin to put in place antidumping regimes, a regression to a more protectionist policy. In fact, with the exception of a few special cases such as Hong Kong, virtually all newly industrializing and developing countries have been highly protectionist in the postwar era, even countries such as Taiwan and Korea, which were sometimes touted

[149]"[T]he government found an ingenious escape in the enactment of the antidumping law, which gave the manufacturers the specific type of protection which they claimed they needed without antagonizing farmers by an increase in the rates of duty of the ordinary tariff" (Viner [1923], *op. cit.*, p. 193).

[150]*Ibid.*, p. 242.

as liberal. The market barriers in these countries were not particularly easy to identify because they consisted, typically, of opaque practices such as import licensing and prior approval requirements and the grant of import monopolies to domestic producers of the imported product.[151] This situation began to change at the end of the 1980s as many newly industrialized countries and developing countries began scrapping their systems of administered protection in favor of transparent, GATT-based import regimes. The adoption of antidumping measures is part of that process of trade liberalization, and, as such, their advent should be welcomed, not condemned, provided that transparent and fair procedures are adopted. A member of the World Trade Organization Secretariat recently observed on this point that

> The literature on the effects of anti-dumping duties assumes that no alternative protection would have been put in place. This assumption, however, is highly debatable. All the countries that have undergone substantial trade liberalization understand how difficult it may be to implement this policy, especially when the groups adversely affected are (politically) visible while the groups benefitting are (politically) dispersed. It is more than likely that, at least on occasion, the country of import would have let some of the steam pressuring trade reform come out in the form of additional protection.[152]

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[151]Professor Robert Wade of Princeton recently published a study of Taiwan's industrial policy that sets forth a detailed description of Taiwan's discreet system of import protection as it existed through the mid-1980s. Typically, issuance of an import license might require an import to secure approval from a bank to see whether or not the item was on the "Secret List" of restricted items promulgated by the Board of Foreign Trade. In other cases issuance of a license would require a domestic association representing domestic producers of competing products to give their assent to the import—a requirement that, according to one source cited by Wade, covered fully half of Taiwan's imports in 1984 (Robert Wade, *Governing the Market: Economic Theory and the Role of the Government in East Asia Industrialization* (Princeton, N.J.: Princeton University Press, 1990). This system was virtually invisible and enabled Taiwan to win kudos from U.S. economists as a dynamic outward-oriented economy, while Taiwan simultaneously restricted and controlled imports that threatened the development of key industries such as steel, petrochemicals, chemicals, machine tools, and bearings. It is perversely ironic that as Taiwan and other newly industrialized countries have moved to phase out their systems of clandestine protection, and have adopted transparent rule-based antidumping regimes, they are now coming under criticism from American economists for doing so.

[152]Miranda (1996), *op. cit.*, p. 8. A European Union official commented in 1989 that "there are of course those who argue that the whole principle of applying antidumping remedies is flawed and that market forces should be allowed to function unhindered. . . . This laissez-faire approach is, in the author's view, not only naive but also ignores the fundamental precept for open markets (i.e., open markets themselves). Everyone, in principle, is for free and open trade; however free trade is not possible if ones partners' exporters are not trading fairly. This is all the more true when the hidden hand of government creates the conditions facilitating the pursuit of price discriminatory policies. To blandly assume that, somewhere down the road, a liberalized world trading order will resume whilst ignoring the real potential for economic hardship during the 'adjustment' period seems to this author devoid of any practical, economic, or political reality" (Richard Wright, "Validity of Antidumping Remedies—Some Thoughts," in John H. Jackson and Edwin A. Vermulst, eds., *Antidumping Law and Practice: A Comparative Study* [Ann Arbor: University of Michigan Press, 1989], p. 421).

It might be argued, of course, that even if some form of antidumping rules is needed as a transitional political concession to certain constituencies to facilitate the transition to liberal trade, this is a second-best solution, and that over the longer term, as the political base for open markets becomes stronger, antidumping should be phased out. The flaw in this reasoning is that if dumping really is a harmful commercial practice, foregoing its regulation will generally tend to undermine the political base for a liberal trade policy.

It is worth returning to the case of Britain in this connection. Britain did adopt antidumping regulation in the 1920s, but the rules enacted were so cumbersome as to be unusable, so that for practical purposes, dumping was permitted to continue unrestricted through the 1920s. With the onset of a world economic crisis at the end of the 1920s, Britain's 80-year consensus in support of free trade collapsed dramatically, and a wall of tariffs was erected around the Empire. Although the precise causes of this seismic shift in British economic policy have been the subject of some disagreement, it is clear that "the speed and completeness with which the remaining free trade support collapsed in 1930 can only be understood in the context of growing disillusion with trade liberalism in the late 1920s."[153] Underlying this disenchantment was the persistence of an old problem—barriers in foreign markets, coupled with dumping in Britain's own. Farmers were "shocked by the intensive dumping of foreign fruits and vegetables which had destroyed markets before smallholders were able to dispose of their crops,"[154] and a 1930 manifesto by British banks—long supporters of free trade—proclaimed that

> Bitter experience has taught Great Britain that the hopes expressed four years ago in a plan for removal of the restrictions upon European trade have failed to be realized. The restrictions have materially increased, and the sale of surplus foreign products in the British market has steadily grown.[155]

The world trading system may never again confront stresses of the magnitude of those of the early 1930s, which saw an extraordinary regression into protection worldwide. But the current political consensus in support of liberal trade should not be taken for granted, if only because it ultimately rests on its members' continuing assessment of where their self-interest lies. Antidumping measures are a safety mechanism not only for defusing protectionist pressures, but for the wholly legitimate purpose of limiting a harmful commercial practice that, left unchecked, could undermine support for the current system.

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[153]Tim Rooth, *British Protectionism and the International Economy: Overseas Commercial Policy in the 1930s*. (Cambridge: Cambridge University Press, 1991), p. 70.

[154]Rooth (1991), *op. cit.*, p. 58.

[155]*The Times* (July 10, 1930), cited in Rooth (1991) *op. cit.*, p. 46.

Antidumping as an Interface Mechanism

Antidumping measures have become controversial, in significant part, because they have been assigned, by default, an impossible task—to reconcile the economic and strategic contradictions that arise out of the sharp divergences that exist between national markets with respect to competition policy. The fact that some markets are open and others are highly cartelized gives rise to distortions in trade and economic dislocations for which national antitrust policies and the multilateral system have no apparent answers. Antidumping measures are invoked by beleaguered industries because nothing else works, including improvements in their own efficiency and productivity. The application of duties at the border in a given instance may prevent the destruction of an industry by dumping, but it does not resolve the market distortions that gave rise to dumping in the first place.

Virtually all of the extant literature on antidumping measures emphasizes the problems that such measures allegedly create, rather than on whether or not they are actually effective in addressing the problem at which they are directed—dumping. Thus, specific instances are raised in which antidumping measures are said to have been applied to inappropriate situations, or in a way that is unnecessarily burdensome or that results in margins of dumping that are too high. In some cases the criticism is valid and provides the basis for future reforms both at the national and the multilateral level. At the same time, however, antidumping measures do not always prevent serious injury to affected industries.[156] Margins are not always high enough to fully offset the injurious effects of dumping, and antidumping orders can be circumvented through a wide variety of commercial tactics. In high-technology industries the sector may be largely destroyed even before preliminary relief is available. Antidumping actions are burdensome to petitioners as well as respondents and the cost of such proceedings has mounted as the information required of petitioners has increased.[157]

If dumping itself remains a "problem in international trade," then true "reform" of antidumping policy does not simply entail weakening or eliminating national antidumping laws, but the shaping of those laws to rectify, to the fullest extent possible, the problem of dumping itself. Antidumping measures cannot, by themselves, open foreign markets or break up cartels, but they can form one element in a broader program aimed at such objectives. Antidumping should not disrupt exporters that are not engaging in anticompetitive practices (as now occurs), but it should offer the most efficient and complete relief possible to industries genuinely injured by dumping. Such reform is unlikely to emerge from a debate cast in the simplistic free-trade versus protectionism terms which charac-

[156]For case studies in the failure of antidumping measures in the European Union, see Van Marion (1992), *op. cit*.

[157]On this point see Office of Technology Assessment, "An Unfiled Dumping Case" in *Competing Economies: America, Europe and the Pacific Rim* (Washington, D.C.: U.S. Office of Technology Assessment, 1991), pp. 146–148.

terized the British policy debates at the turn of the century. Effective pragmatic reform requires a far more informed and dispassionate examination of dumping itself and the closed markets and cartels that foster it. Only such a comprehensive approach, rooted in the realities of commercial practice, will make possible reforms necessary to enable the multilateral trading system to adjust to the challenges of the next century.