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Website: http://www.pitt.edu/~wesnews

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Technology, MNE's and Convergence in US and European Industrial and Technology Policies

Steven McGuire
Assistant Professor
In International Management
At Royal Holloway College
University of London

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Steven McGuire is Assistant Professor in international management at Royal Holloway College, University of London. His research examines the relationship between firms and governments in the development of technology and trade policies and on the role of the WTO. He takes a special interest in the aerospace industry. His current research includes work on the commercial satellite industry and on regional economic development in North America. His publications include: *Airbus Industrie: Conflict and Cooperation in EC-US Trade Relations*, Macmillan (1997), and "National Policies for Internationalized Industries: Neo-liberal Interventionism and the UK Aerospace Sector, *Journal of European Public Policy*, 4 (2), 1997. He has also written several book chapters on EU trade policy and firm government relations, and is co-editor (with Brian Hocking) of a forthcoming book, *International Trade Politics: Actors, Issues and Processes* (Routledge, 1999).

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Desislava Jordanoff
Center for West European Studies
European Union Center
4E01 Forbes Quadrangle
University of Pittsburgh
Pittsburgh, PA 15260, USA

Tel: (412) 648-7405
Fax: (412) 648-2199
E-mail: <wesp+@pitt.edu>

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"Technology, MNE's and Convergence in US and European Industrial and Technology Policies."

Steven McGuire

Abstract

This paper argues that both the EU and the US are evolving largely similar industrial policy mixes in response to change in the international political economy. These competitiveness policies blend liberal deregulation with a renewed commitment to government subsidy and support in 'key' industrial sectors - especially high-technology industries. The US has thus retreated from the 'laissez-faire' policies long associated with it. Europe, long more comfortable with the involvement of the state in economic life, has undertaken deregulation while seeking to develop technology policies.

"Technology, MNE's and Convergence in US and European Industrial and Technology Policies."[1]

Steven McGuire

Introduction

Does the internationalization of high-technology industries lead to a convergence in industrial policies? Convergence is once again appearing in politics journals after a period of relative neglect.[2] Convergence - the process by which economic activity in states is gradually homogenized - is an economically deterministic concept. That is, the process occurs naturally due to the playing out of commercial forces. Firms are expected to adopt best practices in the search for survival in global competition; diffusion of an optimum model for international production is expected.[3]

Technology has an important role to play. It changes the nature of international business - the related industrial and trade politics - in various ways. Technological change and growth can render national systems of production obsolete. Modern electronic communications have eroded the ability of governments to prevent leakage of technology into the international system. In any event, national scientific communities find that international exchange is vital for innovation in national systems. A 'go-it-alone' approach to high-technology R&D may be self-defeating as it could cut off firms and scientists from important technological developments occurring elsewhere.

Both the US and the EU are evolving relatively similar policy mixes - but not necessarily institutions - in response to changes in the International Political Economy. These influences include the intellectual and political hegemony of liberalism; growing internationalization of business; and the increasing salience of technology as a motor of economic growth. Policies designed to cope with these pressures emphasize the state's role as an active supporter of home firms in international competition. The changing nature of competition in high technology goods such as telecommunications, aerospace and computers has exerted pressures on political establishments in both the EU and the USA.

These industries have distinctive characteristics. First, on the production side, they are increasingly characterized by international strategic alliances, as opposed to simple oligopoly. Second, their products rely on an international-scale marketing effort to recoup their costs. Those that are 'intellectual' in nature - software, film and music production - also benefit from broadly internationalized standards for transmission.

Politically, it is the nature of these industries to produce harmonization pressures on government. In the US, this has resulted in a greater acceptance of selected government support for industry. In Europe, the same pressure has produced a more liberal and nuanced industrial policy. The increase in 'functionally convergent' multinational enterprises (MNEs) has put pressure on European and American states to harmonize their regulatory regimes. It also places Europe and America on the same side of the negotiating table on issues such as telecoms liberalization in the WTO.

The changing nature of MNE activity

The demands that MNEs make on their home governments are crucially shaped by two characteristics of the international political economy: economic liberalism and Schumpeterian competition (competition driven by technological innovation) The difficulty for MNEs and states alike is that these two features of the global economy are in some tension with each other. Thus, MNE-state relationships are likely to be marked by a considerable degree of inconsistency on matters of trade, industrial and technology policies as firms attempt to deal with situations of great uncertainty.[4] Indeed, the notion of 'complexity' is at the heart of recent work on the international political economy.[5] This complexity is seen in the often highly sector-specific nature of firm - government relations.

The triumph of capitalism over communism in the Cold War has led to the hegemony of liberalism and free trade over - not merely communism - but virtually all forms of social democracy. Deregulation and market openness have become the hallmarks of the 1990s. Firms - even small and medium size companies not typically associated with internationalization - find that turning to overseas markets has considerable attractions. Thus foreign direct investment (FDI) regimes have been steadily liberalized. State-owned enterprises are now privatized on the grounds that state ownership is antithetical to the new, fast-moving era of private, internationalized commerce.

The triumph of neoliberalism is usually credited to the collapse of the Soviet Union and the consequent elimination of the socialist alternative to capitalism. However, another explanation may lie within the capitalist world itself: the clear resurgence of the United States as the world's leading economy. Throughout the 1970s and 1980s, the Japanese and German economic miracles eroded American economic predominance - especially in medium to high technology sectors. A virtual cottage industry grew up in American political economy trying to understand the nature of US decline and the catch-up strategies of other states.[6] Yet by the mid-1990s the talk was of an American economy so dominant in some key technologies that the word 'unipolarism' could again be used to understand the American relationship with the rest of the world.[7] One of the explanations advanced for this resurgence is that an essentially entrepreneurial American culture has been mated to a fluid, risk-accepting financial system where venture capital willingly backs speculative forays into high-technology products.

As neo-liberalism has eroded the boundaries between states, it has done more than expand the opportunities for exporters. It has also exposed the domestic political economy to the full force of global competition. This injection of the international into the domestic explains in part the increasing emphasis on technology in both the US and Europe. Some observers have argued that, faced with low- wage competition, advanced industrialized economies must move up the value chain and stop competing in labor-intensive markets. Quite apart from the effect of international competition, technical change appears to be driving an increased technological intensity in industrialized states. The OECD noted a long term trend for the proportion of all manufacturing exports accounted for by high-technology industries to increase from 18 per cent in 1980 to 26 per cent in 1993.[8] Hence the renewed interest in technology as an economic driver. Paradoxically, it is the liberalization of trade which has provided firms in Europe and America with the justification for renewed government intervention in the economy.

The rise of so-called Schumpeterian competition in high-technology sectors has arguably increased the salience of government intervention in support of home firms. In an increasing number of sectors, economic advantage is created by human effort and choice rather than being conferred by natural endowments. The process of creative destruction requires not the possession of mineral reserves or vast tracts of land, but active, intelligent and creative people. Industries such as computers, telecommunications equipment, advanced materials and aerospace, place an emphasis on globalized firms with deep R&D and production competencies. Often these sectors tend toward oligopoly; firms have a vital interest then in first mover advantages and short product cycle times, as both are designed to pre-empt entry by competitors.

Schumpeterian competition, with its emphasis on technology intensive industries and the advantages that innovation can confer on home economies in the form of economic rents and skilled jobs, invites government intervention to ensure that domestic firms are able to appropriate some of the benefits of this type of economic activity. Essentially, the job of the state is to preserve and promote the international competitiveness of home firms in global competition. States are responsible for adding value to international production through providing an infrastructure capable of supporting home firms in the global marketplace.[9] Infrastructure also ensures that a country's firms remain attractive partners for the growing number of alliances and networks which characterize international business in knowledge-intensive sectors.[10] Thus, states are pressured to lower transaction costs associated with international production by a combination of intervention and deregulation. Drache argues that this type of policy mix represents a middle ground between the surrender to market forces represented by free trade and the discredited policy of protectionism.[11]

Structure of competitiveness policies	Thrust of policy
role of government	regulation rather than intervention, acts as salesman for home MNEs
financial system	decline of universal banks in favor of US-style investment banking; advocacy of venture capital and 'alternative' stock markets for entrepreneurs
favored sectors	knowledge-based industries: IT, pharmaceuticals, financial services, telecoms, aerospace
nature of state R&D policy	support for commercialization of scientific knowledge rather than curiosity-driven research; emphasis on knowledge-based sectors

However, while the discussion above suggests the development of a type of techno-national policy implying discrimination against foreign firms, the reality is more complex. For technology, even as it places pressures on government to help home firms, also increases the need for these firms to access foreign technological capability. The trans-Atlantic business relationship is characterized not only by FDI flows, but by expansion of the number of strategic alliances concluded between US and European firms.

Alliances are a relatively new and important development in corporate strategy. The term itself has been defined in numerous ways and is best viewed as an umbrella term for a variety of joint-ventures concluded between firms. However, at one end of the scale are international strategic alliances (ISAs) - corporate relationships which engage the participating firms in substantial commitments of assets (capital, technology, personnel) in the pursuit of a long-term strategic goal.[12] These ISAs can often endure for years and, indeed, often take on the appearance of a separate company. For instance, CFM International (the aero-engine alliance between General Electric of the US and the French firm, Snecma), has its own staff, corporate headquarters and production and marketing arms specifically dedicated to a line of small jet engines. In short, it has a corporate identity quite separate from the parent firms. As an Office of Technology Assessment report points out, such autonomous and long term alliances blur the nationality of MNEs involved making them, "increasingly 'multi' and less 'national'".[13] Less far-reaching alliance relationships can include joint ventures or merely developing a network of firms for the development of a given product.

In a variety of sectors, the pace of technological change has quickened; product life cycle times in the computer industry, for instance, are often less than two years. Technology has a varying impact on manufacturing. In some industries, it increases productivity, but in others, it complicates life for the firm as the increasing complexity of production overwhelms the firm's organizational capacity. In this circumstance, the firm cannot remain a master of all aspects of its product; increasing specialization requires a greater reliance on expert subcontractors and suppliers. Increasing technological sophistication has meant that product

development is now a process of negotiation among several firms.

Such negotiation reflects a paradox in the political economy of high-technology industries. In the very sectors where states are preparing their firms for neo-mercantilist economic warfare, technology makes autarkic strategies very problematic. Technological sophistication places a premium on the innovative capacity of firms. This innovative capacity includes not merely the ability to generate new technologies internally, but also the willingness to augment proprietary technologies with those of other firms. Increasing specialization makes it improbable that a given company can master the various and discrete technologies that go into a given product, for it implies an increase in the size and scale of research departments that would not be cost effective. Thus technologies develop in networks of firms. One firm may be central to the development of products - a type of core firm - and is surrounded by smaller, specialist firms.[14] The core firm may own the smaller ones, or prefer to maintain an independent existence. Either way, the process of innovation is similar: a type of craft-industry structure where groups of specialists engage in a process of cooperation over time.

The civil aircraft industry provides a good example of this phenomenon. Major firms like Boeing, Airbus or even smaller players like Bombardier find that while they are supposed to build the plane, the process is rather different. Modern civil aircraft contain highly sophisticated sub-systems such as computerized flight controls and cockpits. Moreover, the modern plane is composed of numerous materials, including aluminum and carbon fibre. Faced with developing an increasingly complex product, these firms are in essence brokers or chief negotiators who, in addition to adding their own technological assets, essentially co-ordinate a design and construction effort involving dozens of firms. Indeed, the program management skills implied in this role are themselves a valuable competitive asset in modern defense contracting.

The computer and biotechnology industries present similar phenomenon. Here products are the result of co-operation among a network of firms even if the product is branded as one company's work. These specialist networks are developing across the Atlantic. In the biotechnology field, European firms have been anxious to tap into the American market. The US is considered to be ahead of Europe in most areas of biotechnology. European pharmaceutical firms are anxious to build a portfolio of biotechnology products to augment conventional drugs. The result has been a spate of takeovers or alliances involving American and European firms. Not all such tie-ups occur between large European MNEs and American start-up companies. Recently, a young and growing British biotechnology company purchased two, small US firms. The company, Oxford Molecular, purchased the two because of their expertise in the area of computer software designed to assist in drugs development[15].

Technological developments also 'spill over' into other fields. Networks can arise when one company develops a technology that has applications in sectors different from its own. This type of complementary technology can lead to the innovating firm becoming the center of a dense network of co-operative arrangements. Corning Glass is an example. Its development

of fibre optic glass led to telecommunications companies seeking the firm out as an alliance partner.[16] The same may happen in telecommunications and biotechnology where methods of using biotechnology products to carry signals may be developed.[17] In another instance, the pharmaceutical industry has become interested in the implications of ever more sophisticated semiconductor chips for its own drug development processes. New chips are able - because of their power and small size - to dramatically increase the number and intricacy of experiments that can be conducted. The promise of this spillover is reflected in the stake taken by the Swiss group Roche in a US firm pioneering the relevant chip technology, Caliper Technologies.[18]

In sum, the complex international economy that confronts firms and states places conflicting pressures on policy: to remain supportive of home industries yet open to the opportunities offered by foreign firms. The resulting policy mix is thus equally complex. In characterizing this mix, I suggest that the United States has 'tacked back' toward a policy stance seen from 1930-1950: close government support for the innovative activity of firms. The EU has, in a virtual mirror image, continued to liberalize aspects of its innovation-linked policies, while not abandoning government subsidy and support programs.

American policies

The United States has in recent years rediscovered industrial and technology policies. "Re-discovered" is the vital word here, for during the American industrialization of the 1800s the US political economy looked very much like the German social-market or Japanese developmental state.[19] The American government intervened extensively in industrial development by sanctioning market-sharing practices, aiding industrial research via direct grants and through an expanding university sector, and otherwise funding infrastructure such as railways and roads.[20] However, this interventionist trajectory was successfully and spectacularly altered in the early years of the twentieth century. In a number of industries, the government reversed its policy bias toward business in favor of one oriented toward the consumer. The Standard Oil Trust was broken up in response to a public campaign. Banks were offered the choice of operating as either investment or retail banks, thus destroying the American version of the German universal bank.

However, this shift of trajectory did not impede US economic advance; indeed, it may have been vital to it. As Mowery and Rosenberg argue, anti-trust legislation made it difficult for firms to abuse market positions and stifle innovation. Firms also chose to merge with rivals rather than attempt to form cartels. Thus, American firms gained economies of scale and scope which formed the basis of their global dominance after 1945.[21] It also reinforced characteristics of US firms even before the Sherman Act; American firms tended to rely more for on their in-house laboratories for R & D and less on government funding than their European counterparts.

That said, early American interest in using the state to establish the infrastructure for a

technologically advanced economy remains a signal feature of that country's development. As US firms emerged from the Second World War dominant in their industries, it was easy to forget the early role of the state and ascribe American success to free market economics. Thus was born the myth that the US lacked an industrial policy. The benign environment in which US firms found themselves after 1945 made it easy for them to believe in the superiority of this arm's-length relationship with the state. Non-Americans too, came to regard America's success as a confirmation of the value of *laissez-faire*, non-interventionist government.

By the mid-1980s, however, American faith in the arm's-length relationship between state and firm was being shaken. The principal agent of this loss of faith was Japan which was succeeding in using a type of state-led capitalism to erode American dominance in sector after sector. In American eyes, the Japanese succeeded in assaulting sectors of traditional US dominance - cars being the prime example - as well as newer, knowledge-intensive sectors such as semiconductors. This success owed a lot to the Japanese adaptation of American innovations and the application of the latter to successful products. Thus US firms and policymakers became concerned at the inability of the US to apply technological advances to products in a timely and effective manner.

Americans were also concerned that their industries were not merely the victims of successful competitors, but were being targeted by foreign firms operating with the express support of their home governments. Japan's entry into segments of the computer chip market looked like a predatory effort to drive out all American firms. "[A] classic strategy of infant-industry protection 'worked' to create a competitive Japanese industry capable of challenging American supremacy."[22] The European aircraft maker *Airbus Industrie* was likewise seen as mounting a direct attack on an industry in which American firms enjoyed overwhelming dominance. This perception that international trade was better understood in terms of economic warfare than through the traditional view that trade was mutually beneficial was bolstered by new work in economics which had a significant impact on American public policy in the 1980s and 1990s.

High-technology industries are not sectors where traditional tenets of free trade apply. High barriers to entry exist in the form of massive R&D costs and steep learning curves which make learning-by-doing a necessary, but expensive requirement. Thus, the industries tend towards oligopoly and firms operating in these sectors can expect rents, or super-normal profits, to accrue to them. Moreover, these knowledge-intensive industries have significant spillover effects for the rest of the economy. Their demand for high-technology components and materials has the effect of driving large sections of the economy up the technological ladder. In short, these, industries positively demand government intervention to secure benefits for the national economy.

Such economic work is bitterly contested by neo-classical economists. However, the intellectual case is not the issue: the fact is that large sections of American policymaking and business circles used "new trade theory" to argue that US policy should, once again, utilize

interventionist policies to bolster the competitive position of US firms ("New trade theory" emphasizes the role of government in shaping comparitive advantage, where traditional trade theory emphasizes natural endowments). As Milner and Yoffie[23] show, the trade preferences of US firms shifted in the 1980s away from traditional concerns about market access and toward the creation of level playing fields. The US state responded by weakening anti-trust policies toward firm co-operation in research and development and by developing a more visible salesmanship role for the Department of Commerce department.

Elements of this renewed interest in industrial policy surfaced in the early 1980s when the American semiconductor industry succeeded in convincing the state that industrial collaboration should, in certain circumstances, be allowed in the face of competition rules. The case for collaboration was based on the belief that Japanese success rested on a judicious blending of competition and cooperation among firms.[24] Co-operation eliminated the problem of firms wastefully duplicating research efforts. From the perspective of an individual firm, co-operation also reduced the risks associated with R&D intensive industries. Single, undercapitalized firms would not or could not bring new products to market, but co-operative ventures could.

The 1984 National Co-operative Research Act allowed firms to engage in industrial co-operative ventures in research and development without fear that such collaboration would result in anti-trust actions being brought. One of the most famous ventures developed under this legislative framework, Sematech, combined the resources of several of the most competitive American semiconductor firms. The aim of Sematech was to develop new generations of semiconductors that could compete with the Japanese products that US firms claimed were being dumped in the US market in a deliberate effort to drive US firms out of the sector.[25] It was also designed to improve linkages between firms which made chips and those which supplied the equipment for their fabrication. The separation of innovation from process technologies was seen as a weakness in the American industry: advanced designs cannot be built if enabling process technologies do not exist.[26]

The late 1980s and early 1990s saw the US continue to develop an industrial policy that sought to improve the competitive position of US firms. One thrust of these policies was to lesson the grip that military applications had on the national system of innovation. Critics pointed out that, while the US military had provided funding for a large number of knowledge-intensive products that underpinned US competitiveness, military R&D was no longer as useful to civilian applications as it had once been. Military applications required that products have properties that were simply not relevant to the civilian economy. Stealth technology may be very useful for military aircraft, but has no relevance to civil aircraft design. Jay Stowsky, for example, blamed the over-specific demands of military production for the decline of the US numerically-controlled machine tool industry.[27] Demands were made that the share of US government R&D accounted for by the military decline from over 50 percent of the total. By 1994, however, evidence of a decline was not clear. According to one estimate, defense R&D accounted for 55.3 percent of government funding in 1994.[28]

The Clinton administration strengthened the US state's commitment to an active industrial policy.[29] This policy was manifested in the creation of a National Economic Council to oversee the competitiveness of the economy. The Council was deliberately modeled on the existing National Security Council and was meant to convey the message that 'economic security' was as important as conventional military issues.[30] The appointment of Laura Tyson as chairman of the Council of Economic Advisors was also seen as a manifestation of the new interventionist mood. Tyson herself had long advocated industrial policy measures as a means of countering the unfair trade practices of Japan, the European Union and some LDCs.

Perhaps the most dramatic illustration of the new, interventionist attitude was seen in the American *volte-face* in the Uruguay Round on the matter of state subsidies. Here, longstanding American opposition to the very principle of state funding gave way to an acceptance, indeed an embracing, of the idea. European negotiators did not know quite what to make of the Clinton administration's eagerness to accept state subsidies. Commerce Undersecretary Garten proposed a subsidy regime that was considerably more *lax* than that under consideration at the talks, with an extremely generous ceiling on government support for all types of research.[31] US negotiators in the GATT Uruguay Round talks sought exemptions for research and development subsidies from the proposed WTO subsidy agreement; the exemption was fought for so as to 'accommodate planned new [R&D] programs by the Clinton Administration'.[32]

Gourevitch's suggestion that the US has rediscovered the Hamiltonian tradition of political economy seems well founded.[33] However, as noted above, the nature of high-technology sectors cautions against the adoption of nationally-based industrial policies. In the United States, the sheer size and technological depth of the economy allow the country to develop discriminatory policies to a greater extent than others. However, even in the American case, the highly internationalized nature of business places *de facto* restraints on the prosecution of such policies. As Ham and Mowery argue, "[for] many US firms, access to *foreign* science and technology is increasingly important to their competitive future."[34] While Sematech was an all-American grouping, numerous members of the organization concluded co-operation agreements with European and Japanese firms.[35] UNCTAD reports that strategic alliance formation is becoming a crucial corporate strategy, in some respects supplanting FDI. "[C]ooperative agreements between United States firms and foreign firms outweigh the number of fully owned foreign affiliates by a factor of four."[36] In the 1980s, the number of US - European alliances increased by 140 percent in automobiles; 114 percent in biotechnology; 62 percent in information technology and 63 percent in new materials. Only in chemicals did the number of alliances decline.[37] Notice that this increase in alliances happens at exactly the same time as the US is developing its new industrial policy initiative.

The long running Airbus-Boeing dispute illustrates the tensions between techno-nationalism and technological interdependence contained within current industrial policies. For the better part of twenty years, a trans-Atlantic trade war has threatened to erupt over the issue of subsidies paid by European states to Airbus Industrie. In 1992, an agreement was reached that specified the nature and level of permitted subsidy. Shortly after taking office, President Clinton indicated American unhappiness with the agreement and briefly threatened to provoke

a trade conflict. More recently, the EU has requested that the agreement be reopened for negotiation. This desire stems from the belief that the accord does not adequately discipline the provision of indirect subsidy for airline production via defense contracts and other R&D activities.[38]

Yet this renewed talk of a trade war is occurring at the same time as European and American aerospace firms seek further collaboration. Lockheed Martin, America's largest defense aerospace firm, actively sought talks with Airbus Industrie in the wake of Boeing's merger with McDonnell-Douglas. That merger threatened the company's position in military aerospace as it would allow Boeing to cross-subsidize its military production with revenues from civil aircraft sales. In a cooperative arrangement, Lockheed Martin's competitive position vis-a-vis Boeing in the defense field would be enhanced if *Airbus Industrie* remained a viable civilian producer. For its part, Airbus' plans for a large, 500-seat aircraft would benefit from Lockheed Martin's vast experience in large military transports.[39] This last point once again underlines the potential benefits of eschewing technological autarky in favor of aligning with foreign firms possessing specific technologies.

The US has moved away from the free market orientation that characterized its public policy during the early post-war period. The US government has reacted to perceptions that its partners were trading unfairly, especially in sectors characterized by Schumpeterian competition (competition based on technological advance). The reaction was to try and develop a more interventionist and discriminatory industrial policy. However, the nature of technology also restrains this nationally-orientated policy. US firms continue to explore and develop links with European firms. Such links are vital to the continued competitiveness of American companies.

European Initiatives

The recent history of European technology and industrial policy has witnessed a shift in that policy away from state ownership and "national champion" strategies and toward a type of sponsorship model that emphasizes government support for R&D and infrastructure such as education and transport. This policy shift was brought about by two events: the obvious failure of national champion strategies, and the successful penetration of the European market, especially in electronics, by Japanese firms. The current policy mix is consistent with our theme: it displays a mix of liberal deregulation with Schumpeterian support for innovation by firms.

European industrial and technology policies have long been framed by the perception that Europe was falling behind the US and the Japanese in technology. One early attempted solution was to create national champions. These firms, usually created by the government-sponsored merger of smaller firms, would enjoy a dominant position in a given national market and thus reap economies of scale benefits. However, the protection afforded these firms gave the wrong series of incentives: the policy produced inefficient, non-innovative

firms which were unable to cope with the dynamism of Japanese or American competitors. By the early 1980s, American computer producers held 80 per cent of the European market.[40] Policy failure highlighted the need to expose European firms to greater competition: this could be achieved in the first instance by creating a proper European market. The Single Market Program was the liberal response to the poor competitiveness of European firms. Creation of the unified market would allow European firms to reap the same scale economies that the American market provided for US firms decades earlier.

However, the Japanese challenge in both automobiles and electronics sent a different set of signals. Industrial policy for knowledge-intensive sectors could be a successful policy and should not be discarded. What was needed was a commitment to the support of so-called sunrise industries in preference to traditional sectors such as steel and a greater emphasis on developing infrastructure for knowledge-intensive sectors. [41] Thus, at both the national and EU level, new policies designed to bolster the competitiveness of European firms were developed. Among the most active supporters of a new industrial policy for the European Union were major European multinationals - especially those in the fields of computers, office equipment and electronics. These firms organized the European Roundtable, in a high profile effort to press the Commission for a more integrated and effective industrial and technology policy.

The Community's response was to create the Framework Programs which sought to encourage collaboration among European Union firms. As in the US, the aim of programs was to lower the risk of innovation for a given firm and to aid in the diffusion of new technologies and knowledge. The EU "has [the Commission argues] an excellent scientific base but it is less successful than others in converting its competence into new products and market shares; this is especially true in high-technology sectors."[42]

In 1990, the Commission articulated its 'new approach' to industrial policy matters.[43] Its paper formally signaled the Commission's embrace of innovation policy as the centrepiece of future initiatives. As Jovanovic notes, the 1990 initiative signaled the embrace of a policy designed to assist firms in coping with change rather than trying to preserve their existing competitive status; the aim, in short, was for an 'adjustment friendly' program.[44]

The Maastricht Treaty granted the Commission the power under a revised Article 130(h) to act in 'strengthening the scientific and technological bases of Community industry and encouraging it to *become more competitive at the international level*'.[45] This signaled a shift in emphasis in public funding away from curiosity-driven research and toward applied work. The initial Commission proposals for the Fifth Framework Program, due to run from 1999 - 2002, called for funding to be aimed at 'initiatives focused on industry that will help boost competitiveness and jobs'.[46] At least some member states agreed with this new approach. The UK's early submission in the consultation stage of Framework Five called for the program to enhance the competitiveness of European firms by addressing the 'medium-term technological needs' of EU firms.[47]

In the area of finance, recent developments in the EU indicate a greater willingness - indeed, desire in some quarters - for the development of an American-style venture capital industry to support European high-technology firms. As some economists have argued, high levels of European unemployment may reflect not only labor market rigidities, but also a lack of demand for labor due to the relative absence of entrepreneurial activity.[48] Two related factors may be cited as contributing to this lack of demand-side 'pull' for new labor. First, excessive regulation, including restrictive zoning practices and punitive taxation, hamper the development of new businesses. Perhaps as a result of this, a second factor has arisen: the unwillingness of European-based finance capital to act as venture capitalists. As the OECD notes, California alone raised more venture-capital finance in 1996 ($3.7 billion) than the UK, France and Germany combined ($ 3.2 billion).[49]

Consistent with our argument, recent European efforts seek to emulate American success in supporting risky investments in start-up companies and new technologies. The Commission's 1995 Green Paper called for greater risk-taking by financiers: a firm acknowledgment that new industrial policy is tightly linked to the financial system. While the Commission noted that Europe's venture capital industry had made great improvements during the 1990's, much more needed to be done. Barriers to further venture-capital investment needed to be removed. Further, the conservative nature of many investments must be shifted in favor of investment in new, unproven firms. The paper noted that in 1994, only 10 per cent of investment was in high-technology sectors and that start-ups were eschewed in favor of existing firms, often in medium or low-technology areas.[50] In November 1997, European finance ministers agreed to develop a £284 million fund for SME development. One aim of the fund is to act as a venture capitalist for small and medium enterprises.[51] In Europe's biggest economy, a growing lobby developed arguing for a more deregulated, American-style financial system. Roman Herzog, the German president, stated that the cure to Germany's employment malaise might lie in adopting aspects of the US financial system.[52]

In another shift toward a deregulated capital market supportive of innovative activity, European stock markets have shown a greater willingness to act as financiers for SME's via public flotations. In the biotechnology sector, for example, the London Stock Exchange eased listing rules in a deliberate effort to attract new firms on to the exchange.[53] Easdaq, a new European exchange modeled on the Nasdaq, is also providing an avenue for new biotechnology - as well as other - firms.

Tensions remain between the stated policy of fostering European competitiveness and globalization. The 'Europeanization' of industrial policy has not led to the abandonment of internationalizing strategies by MNEs; indeed, such strategies are central to their success. Archibugi and Michie point out that in three technological areas, European firms show a higher propensity to cooperate with American partners than European.[54] In the fields of biotechnology, new materials, and information technology, "intra-European joint-ventures amount to 19 percent [of collaborative arrangements concluded world-wide] while European-

US ones amount to 21 percent."[55] Technology has again played a role here. European firms find that they must access the US technological base via collaborative agreements with US firms.

In the early stages of the construction of EU-level policies, the Roundtable firms accepted that a degree of discrimination against foreign firms would be necessary.[56] However, van Apeldoorn argues that this European orientation within the Roundtable has been superseded by a globalist perspective which sees neoliberal deregulation as the solution to Europe's competitiveness problem.[57] But why would firms prefer this solution? They prefer it because in knowledge-intensive industries the cost of developing your own technology may be prohibitive compared to acquiring it through international strategic alliances. Liberalism ensures that firms continue to have access to foreign technology. Thus, there is no necessary contradiction between the pursuit of a European industrial policy and neoliberalism. Indeed, foreign technology, accessed through alliances, can enhance European competitiveness. The same need for access also places limits on the ability of the Commission or member states to close off foreigners from research and development programs. In the UK, foreign-owned aerospace firms such as Short Brothers are not barred from participation in UK programs.[58] Similarly, the Framework Programs are able to accommodate foreign research partners, subject to some limitations. Edith Cresson has recently emphasized the need for European research efforts to be open to greater involvement of non-member states - although preference may be given to the Central and Eastern European Countries.[59]

Conclusion

This paper has argued that changes in the international business environment have presented the US and the EU with the same problem: how to ensure the competitiveness of national firms in high-technology sectors. Firms in these sectors offer states the promise of high-paying jobs, a vibrant research base and, if new trade theory is to be believed, the accumulation of economic rents. These attractions offer states powerful incentives to develop discriminatory industrial policies designed to favor home firms. Both the US and the EU have developed such programs.

However, these same industries also place a premium on non-discriminatory policy regimes. The enormous costs of research and development push firms to co-operate as a means of spreading the cost - and the risk - of R&D. Increasing complexity also means that firms are incapable of developing all the requisite technologies for certain products. Thus, products are developed by networks of firms with each company bringing some technology or other asset to the group. In this circumstance, firms are attractive because they possess specialist knowledge. In this situation, the worst outcome for a firm is to be cut off from technology, even foreign technology. As Ham and Mowery point out, technological interdependence is now well established and unwinding it is both improbable and damaging.[60] Thus, an open international business environment is the preferred option.

NOTES

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2. Suzanne Berger "Introduction" in Berger and Dore (eds), *National Diversity and Global Capitalism* (Ithaca, NY: Cornell University Press, 1996), p.5.
3. Ibid.
4. Jonathan Crystal, "International Firms, Strategic Trade, and Reciprocity", paper presented at the International Studies Association annual meeting, Toronto, 18-22 March, 1997)
5. John de la Monthe and Gilles Pacquet, "Evolution and Inter-Creation: The Government-Business-Society Nexus", in John de la Monthe and Gilles Pacquet (eds), *Evolutionary Economics and the New International Political Economy* (London: Routledge, 1996), pp. 31-61.
6. Robert Gilpin, *The Political Economy of International Relations* (Princeton: Princeton University Press, 1987); John Zysman, *Markets and Growth* (Ithaca: Cornell University Press, 1983); Paul Kennedy, *The Rise and Fall of the Great Powers* (New York: Harper Collins, 1988).
7. Jens Van Scherpenberg, "Transatlantic Competition and European Defense Industries: A New Look at the trade - defense linkage", *International Affairs*, Vol.73, No.1, Winter 1997, p.118.
8. OECD, "Technology and Industrial Performance", *OECD Observer*, No.204, March 1997, pp.6-10, figure 5.
9. Margaret Sharp, "Technology, Globalization and Industrial Policy", in M. Talalay, C. Farrands, and R. Tooze (eds.), *Technology, Culture and Competitiveness: Change and the World Political Economy* (London: Routledge, 1997), p.101; Tony Buxton, Paul Chapman and Paul Temple (eds), *Britain's Economic Performance*, 2nd Edition (London: Routledge, 1998).
10. Steven McGuire, "National Policy for Internationalized Industries: Neo-liberal Interventionism and the UK Aerospace Industry", *Journal of European Public Policy*, Vol.4, No.2, June 1997, pp.190-205.
11. Daniel Drache, "From Keynes to K-Mart: Competitiveness in a Corporate Age", in Robert Boyer and Daniel Drache (eds), *States Against Markets: The Limits of Globalization*, (London: Routledge, 1996) pp.31-61.
12. Office of Technology Assessment, *Multinationals and the National Interest: Playing by Different Rules* (Washington: USGPO, 1993), p.117.
13. Ibid.
14. W. Ruigrok and R. van Tulder, *The Logic of Global Restructuring* (London: Routledge, 1995).
15. *Financial Times*, 9 May, 1997, p. 21.
16. Robert Van Tulder and Gerd Junne, *European Multinationals in Core Technologies* (London: John Wiley & Sons, 1988), pp.218-219.
17. Ibid.
17. *Financial Times*, 25 March 1997, www.ft.com.
18. Peter Gourevitch, "The Macro Politics of Micro Institutional Differences in the Analysis of Comparative Capitalism" , Suzanne Berger and Ronald Dore (eds.), *National Diversity and Global Capitalism* (Ithaca: Cornell University Press, 1996), pp. 239-240.
19. Ibid.
20. David Mowery and Nathan Rosenberg, *Technology and the Pursuit of Economic Growth* (Cambridge: Cambridge University Press, 1989), p.106.
21. Laura D'Andrea Tyson, *Who is Bashing Whom? Trade Conflict in High Technology Sectors*, (Washington: Washington Institute for International Economics, 1992), p.86.
22. Helen Milner and David Yoffie, "Between Free Trade and Protectionism: Strategic Trade Policy and a Theory of Corporate Trade Demands", *International Organization*, Vol.43, No. 2, Spring 1989, pp.239-272.

23. Mark Lieberman, "The Importance of Technology Transfer and Commercialization to US Competitiveness" , Gibson and Smilor, (eds), *Technology Transfer in Consortia and Strategic Alliances* (Lanham, MA: Rowman & Littlefield, 1992), p. 3.
24. Laura D'Andrea Tyson, *Who is Bashing Whom? Trade Conflict in High Technology Sectors*, (Washington: Washington Institute for International Economics, 1992), p.108.
25. Ibid., p.153; Gary Pisano and Steven Wheelwright, "High-Tech R&D", *Harvard Business Review*, Vol.73, No.5, September-October 1995, pp.93-105.
26. Jay Stowsky, "From Spin-Off to Spin-On: Redefining the Military's Role in American Technology Development" in Wayne Sandholtz et al., *The Highest Stakes: The Economic Foundations of the Next Security System* (Oxford: Oxford University Press, 1992).
27. Office of National Statistics, "Research and Experimental Development (R&D) Statistics 1994", *Economic trends*, No.514, August, 1996, table 21.
28. Lewis Branscomb, (ed.), *Empowering Technology: Implementing* a US Strategy (Cambridge, MA: MIT Press, 1993).
29. John Peterson, *Europe and America: The Prospects for Partnership*, (2nd edition), (London: Routledge, 1996), p. 81.
30. Hugo Paeman and Alexandra Bensch, *From the GATT to the WTO: The European Community in the Uruguay Round* (Leuven: University of Leuven Press, 1995), p.160.
31. Sylvia Ostry, *The Post-Cold War Trading System: Who's on First?* (Chicago: University of Chicago Press, 1997), p.182.
32. Peter A. Gourevitch, "Political and Institutional Differences in Comparative Capitalism", in Berger and Dore (eds), *National Diversity and Global Capitalism* (Ithaca, NY: Cornell University Press, 1996), p.256.
33. Rose Marie Ham and David Mowery, "Enduring Dilemmas in US Technology Policy", *California Management Review*, Vol.37, No.4 Summer 1995, p. 92, emphasis added.
34. Ibid.
35. UNCTAD, *World Investment Report* (Geneva and New York: United Nations, 1994), p.140.
36. Ibid., Table III.12.
37. *Financial Times*, 3 May 1997: www.ft.com.
38. *Aviation Week and Space Technology*, 5 May 1997, pp. 20-21.
39. "Research and Development Policy" in Kassim, Hussein and Anand Menon (eds.), *The European Union and National Industrial Policy* (London: Routledge, 1996), p. 228).
40. Margaret Sharp and Keith Pavitt, "Technology Policy in the 1990s: Old Trends and New Realities", *Journal of Common Market Studies*, Vol.31, No.2, June 1993, p.135.
41. European Commission, *Green Paper on Innovation*, Supplement 5, 1995 (Luxembourg: Office for Official Publications of the European Communities, 1996).
42. Miroslav Jovanovic, *European Economic Integration: Limits and Prospects* (London: Routledge, 1997), p.190.
43. Jovanovic, 1997, p.190.
44. Christopher Dent, *The European Economy: The Global Context* (London: Routledge, 1997), p.328, my emphasis.
45. *Financial Times*, 31 July 1997, p.2.
46. European Commission, *Green Paper on Innovation*, Supplement 5, 1995 (Luxembourg: Office for Official Publications of the European Communities), p.5.
47. Alan Krueger and Jorn-Steffen Pischke, "Observations and Conjectures on the US Employment Miracle", *Working Paper 6146* (National Bureau of Economic Research, 1997); *Financial Times*, 13 October 1997, p.21.
48. *Economist*, 6 December 1997, p.159.
49. European Commission, 1995, p.39, see also, CE, "Capital for Exploiting Research Results", Innovation and Technology Transfer, Brussels, DGXII, April 1997, p.11).
50. *Financial Times*, 7 November 1997, p.2.
51. *Financial Times*, 10 November, 1997, p.3.

52. *Financial Times*, 15 May 1997, p.21.
53. D. Archibugi and J. Michie, "The Globalization of Technology: a New Taxonomy" in D. Archibugi and J. Michie (eds.), *Technology, Globalization and Economic Performance* (Cambridge: Cambridge University Press, 1997, p.183.
54. Ibid.
55. Bastiaan van Apeldoorn, "Transnationalism and European Transformation: Contending Social Forces in the Construction of 'Embedded Liberalism'", paper presented at the International Studies Association annual meeting, Toronto, 18-22 March 1997, p. 22.
56. Ibid., p.23.
57. Steven McGuire, "National Policy for Internationalized Industries: Neo-liberal Interventionism and the UK Aerospace Industry", *Journal of European Public Policy*, Vol.43, No.2, June 1997, pp.190-205.
58. European Commission, 1996.
59. Rose Marie Ham and David Mowery, "Enduring Dilemmas in US Technology Policy", *California Management Review*, Vol. 37, No.4, Summer 1995, p. 92.