R&D Subsidies in the European Union - A Competitiveness Issue for U.S. Firms?

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ABSTRACT

This paper examines European public research and development (R&D) subsidies that support precompetitive development (PCD), which is R&D up to and including a prototype. The research seeks to determine How effective these subsidies have been and whether European practice has been influenced by the recent change in GATT (General Agreement on Tariffs and Trade) subsidy language and by the current controversy over R&D subsidies in the U.S. The paper examines the European Union (EU) Framework Programs, the EUREKA program, and the French and German programs of direct subsidy to industries. The conclusion of this preliminary examination is that there is little evidence that current European support to PCD threatens American competitiveness. With very few exceptions, European programs do not go beyond prototype, and there is no evidence of a change in policy as a result of the recent GATT agreement on subsidies signed last year. Budget constraints prevent the EU and member states from supporting the expensive prototype-to-commercialization stage of the innovation process. While European programs have generally not been successful at bringing new products to market, they have provided numerous secondary benefits. These benefits include diffusion of knowledge, development of cross-border and vertical collaborations, and improvement of university-industry links. The U.S. could learn some useful lessons from the European experience.

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Introduction - Background and Focus of Inquiry

The Final Act of the Uruguay Round, agreed on in December 1993, made many improvements in world trading rules. Among the most important was the consensus on clearer language governing subsidies and countervailing measures. Under the old rules, the GATT did not clearly define a subsidy nor did it identify which types of subsidies were either unacceptable or countervailable. This led to serious and costly disputes and injury to domestic producers. The Uruguay Round language establishes three categories of subsidies: prohibited, actionable, and non-actionable. The focus of this paper is on non-actionable subsidies for research and development (R&D).

The language on R&D subsidies, which more closely reflects existing European R&D subsidy practices than the U.S. model, was actively opposed by the U.S. until late in the negotiations. It permits three types of non-actionable R&D subsidies. Even before the completion of the Uruguay Round, however, the Clinton Administration moved to introduce programs modeled on the European effort and consistent with the types of R&D subsidies now permitted by the GATT (General Agreement on Tariffs and Trade). Now several of these Clinton Administration programs are under attack in the Republican Congress. At the same time, those who oppose strong government support for development of new technologies are also expressing concern about the possible effect of the changes in GATT language on future European R&D programs. They argue that the new provisions will encourage the Europeans to push their R&D support closer to the market and perhaps beyond the somewhat fuzzy limits prescribed in the GATT.

The focus of this inquiry is on those European R&D programs that support product development up to and including the prototype stage. This type of support is generally known as "precompetitive development" (PCD) because at this stage in the innovation process, no one partner in a cooperative project is able to appropriate the gains from the development effort. Only a few projects in Europe have provided support beyond the prototype stage (e.g., the Airbus and JESSI programs).

My research centers on the effectiveness of PCD-type support and the impact of the new GATT language on future PCD-type programs in Europe. This paper describes an effort to determine whether there have been any discernable changes since the GATT agreement in the amount and nature of support to programs that go to prototype or beyond. The areas searched for evidence are the EU Framework Program, the Pan European EUREKA Program, and selected national programs (France and Germany). National programs in Italy, the Netherlands, and the UK provide much less PCD support to industry.

The question for American business is whether there is any evidence that recent trends in EU R&D subsidy programs constitute a threat to U.S. competitiveness. The answer is that the European programs do not seem to have become more interventionist as a result of the new GATT subsidy rules. European support to PCD to date has rarely been successful in commercialization of technology, but the projects have provided important secondary benefits. European support to PCD has not come under ideological attack and funding levels have not changed much.

The Commercialization Process

Opponents of PCD-type subsidies argue that government should not "pick winners" by attempting to stimulate development of commercial products in specific sectors. Supporters of government aid to PCD argue that in certain high-tech areas with high development costs, government aid is necessary to stimulate private investment in commercialization.

For those technologies in which basic and applied research represent the bulk of the costs (e.g., chemicals and pharmaceuticals and other products that benefit from technological "breakthroughs"), government support for basic and applied research may be sufficient to stimulate commercialization. These products fit a simple linear model of innovation (following a sequence of basic research to applied research to development of prototype to commercialization). For many products, especially those involving complex technologies, a non-linear approach appears more appropriate. Innovation is depicted as a series of iterative feedback loops, and continuous incremental innovation is increasingly considered to be a key element in maintaining comparative advantage.[1] PCD support appears to be more necessary to stimulate private investment in commercialization of these products.

A growing amount of innovation research concentrates on the gap between prototype and commercial product. Many observers believe that the post-prototype commercialization of certain complex advanced technologies represents 90 percent of total innovation costs.[2] In these cases, only about 10 percent of these costs are devoted to PCD. The implications of that finding are that governments would be hard pressed to support commercialization of many of these advanced products; the public sector can fund only a limited number of airbus-type programs. This gives rise to an important public policy question: can governments, through limited assistance to PCD, stimulate firms to make the large investments needed for successful commercialization of prototypes? European PCD support and many of the Clinton Administration programs are based on the belief that government can "leverage" its limited assets to stimulate private investment in commercialization. The GATT subsidy language appears to provide cover for PCD programs.

Changes in the GATT Subsidy Rules

Under the old GATT rules, a contracting party could take countervailing action against an import alleged to be unfairly subsidized if 1) the existence of the subsidy was proven and 2) imports of the subsidized product caused injury to domestic producers of that product. The Uruguay Round adopted a "traffic light" approach, establishing three categories of subsidies:

Prohibited - those contingent on export performance or on use of domestic vs. imported goods

Actionable - non-prohibited subsidies that cause harm to other contracting parties. The parties alleging injury may countervail such subsidies. If the subsidy in question is greater than 5 percent ad valorem, there is a rebuttable presumption that it seriously prejudices the injured party

Non-Actionable - these must not be specific to a particular product and are permitted for R&D, for aid to underdeveloped or distressed regions, and to assist in improving environmental protection

Non-actionable subsidies for R&D are categorized as follows:

Fundamental research - ("enlargement of scientific/technical knowledge not linked to industrial or commercial objectives")
There is no limit to the extent of government support to such activities conducted by higher education or research establishments.

Industrial research - ("discovery of new knowledge...useful in developing new products...or in bringing about...improvement to existing products...") This is described as an amalgam of basic and applied research. Government assistance may not cover more than 75 percent of costs.

Precompetitive development activity (PCD) - ("translation of industrial research findings into a...design for new, modified, or improved products...including the creation of a first prototype...not capable of commercial use") PCD does not include routine alterations to products. Government assistance is limited to 50 percent of costs.

While these two taxonomies are a great improvement over the previous subsidies language, the new formula raises many questions.
Critics of the GATT consensus point out that one member's "green light" R&D subsidy that causes injury in another member state is not legally countervailable. Allegations of injury from permitted subsidies must be handled in a special procedure that sets a high injury standard. The definition of PCD is also open to many interpretations. Critics of the agreement contend that while the U.S. views the PCD rule as a limit, other countries including

European members, may view it as an invitation to make even bolder interventions in the innovation process.

Supporters of the GATT language point out that the rules apply to all GATT (now World Trade Organization--WTO) members instead of just members of the Tokyo Round Subsidies code. In addition, each subsidy program must be notified in advance to the WTO in order to receive green light status. Supporters argue that the new procedures for settlement of disputes over green light subsidies that cause injury will be an effective remedy.

EU Subsidy Policy

European countries have for years used subsidies for stimulation of new technologies, assistance to disadvantaged regions, R&D, "bail outs," and help to small and medium firms. Article 92 of the Treaty of Rome forbids any subsidy "that distorts or threatens to distort competition by favoring certain undertakings or the production of certain goods." At the beginning of the implementation of the 1992 Internal Market Program (EC 1992), the Commission made it clear that many of the industrial subsidies that had been granted by member states in the past were inconsistent with economic integration. Subsidies designed to prop up inefficient "national champions," the Commission argued, delayed the opening of European industry to the benefits of competition. R&D subsidies by themselves have generally not been the target of Brussels efforts to reduce distortive national "state aids."3

The Commission takes a more favorable view of Europe-wide subsidies that do not benefit any one member or industry at the expense of others. The Airbus subsidy program, a powerful example of post-prototype development assistance, is deemed acceptable using this criterion. Airbus aid has been the subject of trade conflict between Europe and the U.S. for years. The recent settlement of the dispute requires the EU to cap development subsidies. Airbus has become a very successful commercial product, but the cost of the program precludes many more similar projects. JESSI, the attempt through EUREKA to develop a European 64-megabyte chip, is generally acknowledged to be a hugely expensive failure.

"Successes" in Past European R&D Programs

The goals of European technology programs have been 1) to advance the process of economic integration and 2) to improve the competitiveness of European firms. The EU program (Framework) and the pan-European Eureka program concentrate on precompetitive generic technologies and encourage cross-border collaborative research. Measuring success of government supported R&D programs is difficult, if not impossible. Some writers suggest patent awards as a proxy for success, but this does not get at the question of commercialization. Many patented items are never commercialized. If a product is commercialized after benefiting

from a PCD subsidy, there is still a question of whether the subsidy was a direct cause of successful commercialization or whether the industry would have achieved commercialization without the stimulus of the subsidy.

Evaluations of EU projects tend to be weak and of little use in measuring success, especially in terms of increased competitiveness. Much supranational and national aid in Europe has been focused on the electronics sector, particularly telecommunications and information technology. After more than a decade of support, this sector is still weak. The Esprit Program, started in 1984 to improve the competitiveness of Europe's 12 major electronics companies, has been refocused. Today only six of the 12 companies are still in business, and Europe's large electronics trade deficit persists.

Since the EU projects mainly involve generic research and not product development, it is not surprising that there have been few commercial results. The European programs have been very successful, however, in terms of facilitating technology diffusion, getting firms to work together, improving links between universities and industry, promoting vertical integration, and supporting efforts of small firms. In short, these programs have been good "conveners," but it is not clear that they have stimulated much innovation, especially in the commercialization phase of the cycle.

Two Multinational and Two National Programs - Implications for U.S. Competitiveness

I The Framework Programs

These programs are administered by the European Commission. They were initiated to help restore European competitiveness vis a vis the U.S. and Japan. Framework provides approximately $2 billion per year in funding for collaborative projects in basic and applied research and precompetitive R&D. Typical Framework projects tend to be closer to the basic research end of the spectrum than the EUREKA programs. Commissioner Antonio Ruberti seeks to devote the bulk of Framework support to the development of "generic" technologies that will benefit a wide range of industries and meet other EU social and economic integration objectives. The EU support is matched at least 50 - 50 by European firms. The Framework funds represent only about 4 percent of total annual R&D spending at all levels in Europe and about 4 percent of the EU budget. Brussels sees its support to PCD as having a catalytic effect far larger than its small share would suggest.

Recent changes in Framework policies

The Fourth Framework program, negotiated in 1993 and covering 1994 to 1998, is almost twice as large as the third program. This figure is misleading, however, because as a result of the ratification of the Maastricht treaty in 1993, several outside R&D programs (agriculture, energy, and environment valued at about 2 billion ECU) were added to the Fourth Framework.

Several changes in the focus of the Fourth Framework program stem from frustration at member state and community levels over the lack of commercial results after 10 years and $20 billion of public support for R&D. The need to deal with recession in Europe and the growing importance of the social implications of R&D have also influenced R&D policy formulation.4 The following are some of the major differences between the Third and Fourth Framework programs:

o The main concentration is on development of "generic technologies" not product-specific, that will aid the growth and competitiveness of industry. Funding areas are designed to stimulate proposals that will bring more of the results of R&D to the market.

o Basic research will be left increasingly to the member states.

o The social component of R&D gets more stress. Funds are increased for R&D in environmental protection and health care. Framework will now support R&D in transport, especially improvement of inter-country road and rail networks.

o The program puts increased emphasis on cooperation with other international R&D programs, including those of Central and Eastern Europe, developing countries, and other industrialized countries.

o Funds are provided to promote increased dissemination and utilization of research results. Evidence shows that participants still have difficulties in sharing the information developed in the projects.

o Framework Four calls for better coordination with member state R&D programs.

Although the new Framework program is very large, it still reflects only about 4 percent of total R&D spending in Europe. The Commission insists that, in the spirit of subsidiarity reflected in the Maastricht treaty, primary responsibility for R&D remains with the member states and private industry.

Evaluation of the impact of Framework programs

It has proven difficult to evaluate the benefits of community R&D programs. First, there is the general problem of "metrics." How do you measure "success" in a given public R&D effort? No one has devised a foolproof yardstick. Second, the lags from project start to technology gestation and from gestation to application are generally long -- 10 years or more. Even for the earliest projects, the Commission is only able to look at short-term effects. Third, it is hard to sort out the impacts of community support in particular sectors such as electronics from the effects of national programs.

The Commission has sought to begin the evaluation process with a series of national studies that attempt to measure the impact of EU R&D on the research landscape in each member state.5 These studies, carried out in 1993 and 1994, focused on the Second Framework program. Using a uniform questionnaire, the Commission sought information on:

o Financial impact, i.e., EU aid as a percentage of the total R&D budget of participants and percentage of projects that would have been done without EU support

o Impact on transnational collaboration and the nature of collaborations

o Impact on human resources, including recruitment, retention, and training of personnel

o Impact on competitiveness, including increases in industry market share and improvements in balance of trade

The financial impact results varied widely across countries. Smaller firms and industries in less developed regions reported a fairly large percentage of EU contribution to R&D budgets. Developed countries and large firms reported smaller figures. There was also wide variability in the percentage of projects that would have been undertaken without EU support, but many responses demonstrated that EU aid, while not essential, tended to affect the scale and speed of research.6

Impacts on the nature and extent of collaboration and on human resources were more consistent and demonstrated short-term positive results. Industry competitiveness proved harder to measure, but the results show a significant amount of participant optimism about possibilities for commercialization. Thirty to 40 percent of participants believe that their projects will lead to commercially applicable products; 50 to 60 percent expect to develop commercially applicable manufacturing processes or methods.

It is particularly difficult to establish a clear causal link between the competitiveness of an individual company and a particular research effort. At company level it may only be possible to measure whether the assistance has helped a firm to improve research skills and innovative capabilities and to cooperate more effectively with partners. EU research priorities have shifted a bit to be more responsive to company needs. The Commission, however, has not changed its view that it should avoid pushing specific products to market because of the danger of market distortion. The view in Brussels is that the best way for companies to achieve and maintain competitive advantage is by sustaining an appropriate momentum of technological change.7

An examination of major Framework initiatives does not produce encouraging evidence of effectiveness. Independent studies have shown that the information technology program (ESPRIT) allocated close to $10 billion over 915 projects from 1984 through 1994. Participants reported that less than half of the projects have had any market impact. A similar result was reported for Advanced

Materials (BRITE - 1100 projects and $3.2 billion through 1994). The communications technology (RACE) program, with $2.8 billion earmarked, has been plagued by delays.8

Political dynamics - stronger industry influence and growing centralization

Major policy milestones - The 1991 industrial policy paper sought to enhance the competitiveness of European firms in the international market. The Commission signaled that it was rejecting the top-down, dirigiste national policies of the 1980s. The new role of government was to be as catalyst and path breaker and as provider of the stable macroeconomic climate needed for innovation.

A second document, "Research after Maastricht," issued by the Commission in 19929 criticizes the lack of input from industry in formulating R&D policy. The document also notes the lack of coordination and complementarity between EU programs and national R&D programs and urges a new policy similar to the Japanese "vision setting" of the 1970s.

Tom Lawton of Essex University argues that the so-called liberal middle way approach advocated in the 1991 policy paper never really happened. In an analysis of policy formulation for the electronics sector, he contends that large electronics firms and the Commission established a policy partnership.10 The firms struck a bargain, Lawton argues, in which they offered to promote the ESPRIT program with member state governments in return for a promise of vigorous Commission use of trade policy tools to augment R&D and ensure competitiveness. ESPRIT got bigger, reinforcing the Commission's vision of a strong, federal Europe, and the firms benefitted from powerful trade remedy rules (dumping, rules of origin, procurement provisions).

This "protective partnership," as Lawton calls it, helps explain why EU support for electronics remained strong, even in the absence of commercial results. The irony is that the result of the partnership was indeed a stronger European electronics industry, but not one based on the enhanced competitiveness of European firms. The stars of European electronics are the foreign firms that have invested in Europe to get around the trade barriers.

Other observers put more stress on intra-Commission rivalries and "panic reactions" within the Commission to perceived threats from Japan (the auto trade agreement) and the U.S. to explain EU policies. They point, for example, to the influence that U.S. information superhighway activities appear to have had on the information technology priorities of the Fourth Framework program.
The Framework programs cannot be considered a threat to U.S. competitiveness. The Commission, backed by several member states, has insisted that these programs should not go beyond precompetitive research. There does not seem to be much pressure from members to scale up the programs. Framework is considered to be beneficial even though the link to commercial results is tenuous.

II The EUREKA Program

The Pan European EUREKA program, established as a counterweight to the U.S. Strategic Defense Initiative, has 18 members including the European Commission. EUREKA has no appreciable bureaucracy and operates on the basis of a set of understandings between governments. Its contribution is in matching cross-border research partners and in helping them seek national government support. Funding of about $2 billion annually comes from member governments and occasionally from the EU.

The projects supported by EUREKA are closer to the market than Framework projects. There are no set rules on sharing of support between government and industry, but industry tends to make the majority contribution. Projects have been focused in the areas of information technology, telecommunications, and infrastructure. In practice, Framework and EUREKA seem to complement each other. Projects that have benefitted from generic research under Framework are not discouraged from applying for more market-oriented support from EUREKA.11

Under EUREKA, the Prometheus Program (smart car technology) is a promising effort, as are many of the smaller projects. At this point no EUREKA project appears to be the subject of controversy under the new GATT subsidy rules. As Robin Gaster points out, the PCD portion of the projects tends to run 4-5 years, to which must be added an equal length of time for commercialization. Therefore, it is probably a bit early to judge whether EUREKA has been successful as a catalyst.12

Adding together all pan-European programs, including EUREKA, European Space Agency, CERN particle research, and atomic energy, the share of multinational programs is still only 10 percent. The EU money is more clearly focused on rising industries, however. An analysis of the 90 percent share covered by national programs shows that a large proportion of the state aid continues to be devoted to senescent industries.13

III NATIONAL PROGRAMS

EU member states before the recent enlargement

Information on national R&D programs collected by the Commission shows that, from 1983 to 1990, average EU member R&D expenditures remained relatively stable at 3.4 percent of total current and capital expenditures. Expenditures in France and Germany are well above the EU average (4.5 percent and 5.7 percent, respectively), and several countries are well below the average.

From 1991 through 1993 there is a noticeable drop in most countries, reflecting recession in Europe, and this drop reportedly continued in 1994 and is reflected in forecasts for 1995.14 At national levels, considerable "soul searching" occurred over R&D programs, not because of right-wing ideological concerns but based on the impact of recession, competing social policy requirements, and the lack of measurable commercial payoff.

Among the objectives of Science and Technology policies common to a large majority of members are: a boost in economic competitiveness, maintenance of high-quality basic research, and increased participation in international R&D programs. Newer objectives in the more advanced countries include health, environment, and safety; and in the "catch up" countries, the need to improve R&D infrastructures.

The increasing importance of regions in R&D is also an important new trend in member state activity. France and Italy are moving to decentralize their R&D activities. In Germany and Belgium, which have regions with extensive powers under federal arrangements, the regions provide half or more of national R&D support.

Looking at composition of R&D support, France and the UK provide the largest percentage of funding for defense, while in other member states general university funding accounts for the largest proportion of public support. Interestingly, support for research in industrial productivity and production technologies is declining or stagnating in most countries.

R&D in the EFTA Countries

Trends in the EFTA countries (three of which are now EU members) generally follow those of the EU 12. Sweden and Switzerland have the highest R&D expenditures as a percentage of GDP. There is wide variability in the extent to which government subsidizes business and the extent of business finance of R&D.

IIIa French R&D Subsidies to Industry

An analysis of the French technology support systems shows that, although spending levels are the highest in Europe (about $15 billion annually), very little money goes directly to private companies in the civilian sector.15 Of the total assistance, 30 percent is concentrated on military R&D, a very high figure for a European country. Sixty percent of non-defense French funding is directed to universities, government ministries, and research establishments.

Another 30 percent supports French participation in "big" technological support programs or GPTs (airbus, space, nuclear energy). The U.S. counterpart would be the R&D programs of NASA, the Department of Energy, and the Department of Defense's Advanced Research Projects Agency. Only 10 percent of funding is directly available for industrial R&D, but firms also benefit from collaborating on GPT activities with the universities and labs.

In 1993, France spent approximately $1 billion on industrial research. This money is divided into support for small and medium enterprises (SMEs) and bigger projects not covered by the GPTs (including high-speed rail technology, clean cars, ultrasound, and water purification). Public support is limited to the initial phases of R&D and does not exceed 50 percent of the total project investment.

France has devised several interesting "bottom up" projects as well. These projects pay the salaries of industrial company researchers and support promising PhD. candidates. The Erasmus study notes that 6 percent of French companies do 63 percent of the research and get 79 percent of the public funding.

Provincial governments in France do not have significant industrial R&D programs. Foreign firms have not been successful in gaining access to GPT or industrial research programs. The focus in GPT is on French firms in sectors considered strategically important to the nation. In the SME programs, limits on company size prevent U.S. firms with a European presence (generally larger companies) from qualifying for support.

Given the growing predominance of relatively small projects in the structure of French industrial subsidy programs (other than Airbus), there do not appear to be any serious causes for U.S. business concern. It is still too early to tell whether France will change its R&D policies as a result of the GATT agreement or in response to the current soul-searching in the U.S. over government R&D support. Funding levels for 1994 and 1995 do not appear to have dropped. French government officials project a 2 percent annual growth rate in R&D subsidies.

IIIb German Support Programs

Eighteen percent of Germany's $11 billion of annual federal technology support goes to defense industries. Direct aid to the civilian industrial sector is about $2 billion, but about 30 percent of this is support to the German Airbus partners. There is an even greater emphasis on SMEs than in France. The $1 billion or so of assistance actually available for general research (the Fachprogramme) is meant to serve as a catalyst, "helping firms help themselves."16

Government support is limited to 50 percent of the project budget. Projects in the former German Democratic Republic (GDR) are eligible for 60 percent public support. The Fachprogramme is currently supporting R&D in microprocessing, information technology, materials, laser technology, and manufacturing techniques.

German indirect support programs include measures to increase technology diffusion, share in payment of salaries of researchers, and facilitate collaboration. In addition, the federal government has introduced a number of programs earmarked for use in the former GDR. Foreign firms seeking to invest in eastern Germany have had easy access to these funds.

Unlike the situation in France, the German states provide extensive R&D support (about $20 billion in 1992). Of this amount, $1 billion (about the same amount as the federal direct program) is provided directly to companies at a regional level.

Given the focus on support of SMEs and of R&D in eastern Germany, current German programs do not appear to pose a competitiveness threat to U.S. firms. There is some indication of attempts to reduce the scope of federal funding, but state efforts could well increase to offset any federal cuts.

Conclusion

After this preliminary look at major public PCD programs Europe-wide and in France and Germany, it is hard to accept the view that Europe is actively trying to push the envelope on the GATT R&D subsidy language. The Commission remains allergic to use of R&D as a blatant industrial policy tool. EUREKA programs have not reached the point where they could be considered a threat. There are some interventionist programs at state level, but these are focused on SMEs and are not big enough to pose a competitiveness threat to the U.S. In Germany at least, foreign firms have been encouraged to participate in PCD programs that benefit national priorities. Among the Europe-wide programs, only Airbus has been successful, but at great cost. JESSI has failed to meet its objectives.

An area of potential concern to U.S. business is the use of other measures such as tax breaks, regional aid, and aggressive government procurement programs to complement R&D support to particular industries. The Commission to date has been very active in discouraging this type of "hot house" treatment in support of national industries.

Far from being threatened by the current European R&D schemes, U.S. firms can learn some useful lessons from the European PCD experience.

o Money is a necessary but not sufficient condition to stimulate commercial development. The secondary benefits (diffusion of knowledge, development of vertical collaborations, improvement of university-industry links) are important. U.S. firms are weak in these areas. Companies must be more willing to share information.

o Small firms have their own special problems. They need help tailored to their circumstances. In most cases, government aid to large firms is not big enough to make a difference.

REFERENCES