6 Are New Global Rules Needed for High-Tech?

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The topic of globalization is one that sends chills down my spine because of the broad expanse of potential approaches. So I have narrowed the focus to ask and try to answer this question: Are new rules for high-technology trade needed? Within this question are four other questions:

- Why should we be concerned about high-technology trade?
- Why should we be concerned about trade rules?
- Why are current trade rules a problem or, to put it another way, are there problems with current trade rules that are affecting high-technology goods?
- Finally, if we have problems what should we do about them?

First, why should we be concerned about high-technology trade? The most obvious answer is that it is important. High-technology made up about ten percent of U.S. manufacturing in 1980. By 1995, it made up about 15 percent of U.S. manufacturing. Over the course of 15 years it increased by roughly 50 percent. And this is not just a U.S. phenomenon. If you take all the countries you can easily get statistics for, lump them together, and look at it on a global basis you come up with roughly the same rate of increase. In 1980, high-technology made up about 7.6 percent of global production. By 1995 that had grown to about 12 percent. We see about a 50 percent growth as a share of world output.

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In 1980, high-tech products, calculated with respect to either imports or exports, were about nine percent of world trade. In 1995, 15 years later, it doubled to about 18 percent. Clearly, it is growing about twice as fast as trade in manufactures in general.

What we cannot easily talk about, of course, are high-tech services. It is very difficult to try to measure them. However, one generalization, which seems obvious, is that the growth rate in services is probably even greater than in manufacturing. Although, of course, that is debatable. (Not having numbers puts that conclusion at risk).

Is this a quantitative phenomenon that we have to worry about or is there something about trade that is critical to high-technology industries? The answer, of course, is the latter. The reason trade is critical here goes back to the economic structure of these industries. By definition, a high-tech industry is an industry that spends a lot relative to other industries on research and development (R&D). To a first approximation, the amount you spend on research and development does not vary with the amount of output you produce making use of that research and development. Therefore, the wider your market the more you sell. This makes your unit of cost lower and you get a higher rate of return on your investment in technology.

These economies of scale in the use of research and development have made virtually all high-technology industries unremittingly global in outlook right back to their beginnings. Consider the semiconductor industry, for example. Within ten or fifteen years after their invention 50 percent or more of their sales were in global markets. That is no accident. It is critical to a high-technology industry that you reach out to the widest possible market.

So high-technology is something to be concerned about and high-tech trade is something to be concerned about, but what is the problem? What is wrong with the trade rules? We must begin by asking what exactly these trade rules are that affect high-technology industry.

First, trade rules govern what we can and cannot do when we go out to international markets and try to sell our goods to others and consider buying their goods. These rules are a recent innovation. We did not have a system of trade rules before World War II. The trade rules of the General Agreement on Tariffs and Trade (GATT) system, which we take for granted today, are a post-war innovation. In coming up with the basic principles for the GATT system after World War II four fundamental principles were embedded.

The first and perhaps most striking was the principle that we should progressively lower taxes on trade (that is, tariffs). A process of continual negotiation under the aegis of trade rules has tried to get countries to agree to irrevocable and negotiated declines in the level of taxes they place on trade. These negotiations have been largely successful over the years.

Second, countries agreed to eliminate less transparent barriers (other than taxes) to trade. These include non-tariff barriers and restrictions like quotas. Countries also agreed to reduce or eliminate distortions like subsidies to trade and subsidies to individual industries.

The third principle that was embedded in GATT was the idea of most-favored nation. That is, whatever concessions you make to one country you have to automatically offer to other countries. You cannot play favorites and discriminate in the way you deal with countries in trading with them.

The fourth principle, not to be underestimated, was the idea that when we have disputes we should have consultation and negotiation rather than simply taking unilateral action without consultation. These principles seem innocuous enough but they have been a great success.

However, rules were not made about some things, or rules were not enacted. One of those issues is antitrust, which was put off-limits when GATT was negotiated. There were attempts to put it on the table, but basically it was decided that it was too difficult a problem and would be postponed. One of the consequences of this postponement was that antitrust became one of the loopholes in GATT. Countries had to lower formal barriers, quotas, and tariffs, but nothing was said about private barriers to trade. For example, you could tolerate or you could even encourage private companies to engage in various kinds of anticompetitive conduct, which might have the effect of making imports more difficult. Without pointing fingers it suffices to say that, in certain situations, it could be argued that that sort of creative exercise did take place and it was relatively successful. As a result, today we increasingly see antitrust on the table.

The second issue not addressed by GATT was the rise of so-called antidumping policy, which is related to antitrust in terms of its theoretical basis. Without getting into details of what this policy covers, essentially rules on fair-pricing policy were enacted in various countries. Limits were placed on how you could price your products when selling in international markets. This is extremely relevant to high-technology industries because these industries have a very peculiar cost structure. They have a cost structure with a lot of R&D before they even start selling a

product. The R&D is a fixed, sunk cost before they ever get to market. When you start selling products there will be many times when the economically rational thing to do is to price it at your variable cost of production. You try to recover your costs over the life cycle, but you do not necessarily try to recover your full life-cycle cost at every moment in time. Antidumping issues and arguments about how we should price these things have repeatedly occurred in the high-tech industry.

Finally, intellectual property rights are obviously important in a high-technology industry, but this is another issue that was never directly addressed during the GATT negotiations. Their importance was not clear back in the late 1940s, when the modern high-tech economy was just beginning. You would have had to have been very far-sighted to understand that this was going to become a critical issue in international trade. But it did.

What exactly are the problems with the current rules? I will focus on the critical issues for high-technology products. My main point is complicated and focuses on the rules for subsidies. There are very few countries in which the government does not play some role in funding R&D. At what point do these subsidies start to overlap on the GATT disciplines on subsidies to individual industries? There are a lot of points of intersection. This is something that will be an increasing concern. The rules that currently govern high-technology products in terms of subsidies are a highly imperfect, compromise solution to a couple of fundamental economic problems.

The main economic issue deals with what we call spillovers, or appropriability. The basic idea is this: An inventor producing a new innovation basically creates information. Information is very difficult to control or capture. In many ways it is often difficult for an inventor, innovator, or discoverer of a new scientific algorithm, theorem, or whatever to build a fence around that concept that prevents others from making at least partial use of it in some way. When you develop information, others can observe what you are doing. Thus there are spillovers beyond the boundaries of the organization or individual that is doing the inventing. The consequence from an economic perspective is that in many situations you have a social rate of return to an invention or investment that is greater than the private return. Very few things are as widely accepted within the economics profession as this, although defining this becomes an opportunity for hot and often hostile debate. But as a general principle most would agree that in cases where social return exceeds private return some reasonable argument exists for the govern-

ment to step in and play some role in promoting, subsidizing, or in other ways stimulating those kinds of investments because the market tends toward underinvestment (from the social perspective) in these areas. This argument has absolutely nothing to do with trade.

A second argument that is commonly recognized today (and again it is a hot argument about its practical import) is that strategic trade policy can at times be in a nation's interest. Basically, strategic trade policy argues that in imperfectly competitive industries where economic profits are being generated it is possible under ideal circumstances for a government to engage in policies that give its own companies, rather than foreign companies, market power in world markets, which are generating these monopoly returns. If nothing else, you have to have at least a temporary monopoly on technology for investment to be worthwhile. Therefore, you can transfer profits out of the pockets of foreign companies and into your own companies' pockets.

This argument for taking steps to make sure that your firms succeed in world high-tech markets does depend on trade. If you were not engaging in international trade this argument would not exist. You would just be transferring from the pockets of your consumers into the pockets of your corporations. You would see no net gain nationally. But dipping into the pockets of foreign consumers is a different story.

There is a noble motivation: a social return greater than private return. And there is the ignoble motivation: dipping into the pockets of foreign consumers and grabbing monopoly profits. That is the ignoble motive for engaging in an activist government intervention or a technology policy.

How do the rules deal with this? The obvious social motive for engaging in investment in R&D, which has been recognized since the end of World War II, suggests that the government is going to want to intervene. But there is always the possibility of ignoble action for zero-sum gain, where you are basically transferring from the other guy and you are not creating necessarily something that benefits all. How do the rules deal with this? The rules really did not deal with this in a very articulate way until 1994, when the latest round of GATT was negotiated. We now basically deal with it by classifying the problem.

The National Science Foundation and most science and technology organizations basically define different categories of research and development. The standard categories are basic research and applied research. Basic research typically has been defined as research undertaken with no material objective in mind other than pushing knowledge forward.

Applied research is research for which you have a practical application in mind. It is somehow "less pure." Then, of course, there is development that takes research and translates it into products. This is, of course, a crude approximation. Typically, economists and policymakers have assumed that these classifications are correlated with the spectrum of appropriability. Basic research is the least appropriable, or the least prone to capture. Development is the most appropriable and the most prone to capture. Empirical economic studies have tended to support at least in a gross way this general correlation.

If you took arrows and linked basic to applied to development you have the familiar and now discredited linear model of technology development. But the arrows do not matter. The point is the appropriability. You can have arrows going in all directions. You can parse basic research into basic research that is oriented toward pure knowledge (understanding of phenomena) and basic research that is oriented toward trying to get a handle on practical problems that may be soluble somewhere down the line. The most elegant articulation of this is Donald Stokes' quadrant model of scientific research where he argues that you have to distinguish between pure basic research and use-inspired basic research.

Whichever way you look at this, you still come up with a rough categorization of appropriability. It seems logical that pure basic research will have the least degree of appropriability. The use-oriented research might be hard to capture, but there is a notion of capture somewhere. In pure applied research you care only if something works. You will expend a lot of effort to make sure you are working on things that will give you a commercial return, that is, things that are more capture-able.

The key issues here are appropriability and capture. That is one way to categorize research (from basic to development). You can run the appropriability or capture scale in that direction. You can even argue that there are other important factors.

Within these different categories of effort there are incremental gains. There are radical innovations when you are exploring totally new territory. It is inevitable that others can observe these innovations. To put it in economic terms, you are looking for a demand function that people know nothing about when you start working on something. If you have just invented the first automobile, do you know that it will replace horseless carriages? You do not. But if you are going from one model of automobile to another model of automobile with a different type of engine, you are making an incremental innovation. You have at least a rough

idea of what the demand curve is going to look like. But if you are going from horse-pulled carriages to autos you are leaping into the unknown. Others, simply by observing your success or failure, will get information about the demand curve. Inevitably, with a radical innovation, information will be generated that is going to be very difficult to capture.

If you want to take a two-dimensional approach to the appropriability issue, you can think of it as a wedge. The upper part—basic research or radical innovation—is the logical place for the government to focus its resources if you are looking for appropriability or capture as a criterion for subsidy.

In 1994, when the rules on subsidies were revised, the final result was a line drawn at the first prototype (basically). That is, up until the first prototype of a new product or process you are permitted government subsidies of up to 50 percent of the R&D. After that first prototype, you can do whatever you want, but it is a countervailable subsidy.

These rules have not been in operation very long. They are obviously a compromise attempt to deal with this appropriability issue. The people who pushed the rules through in the government were aware of this appropriability issue and that is why they pushed them. The rules seem to be working, but they have not really been tested yet. The reason they have not been tested is because of the blossoming of issues and cases in the operations of the World Trade Organization, which came into existence in 1994. We are seeing an incredible growth industry in trade cases.

Governments are going to try to structure their programs in a way that they do not cross that green line of 50 percent on subsidies. But what are the incentives? The incentives are to favor programs that can be captured. They are not going to favor programs that will create benefits that everybody gets. If you look at our own technology programs you will see we are financing R&D, as well as development projects, within private companies. People are going to try to cheat and people are going to do things anyway that seem to benefit their private companies in development and capture.

It is only a matter of time before we start getting trade cases on this issue. We will be taken to court because that little company we funded to develop this, which is now a huge success in world markets, crossed that green line. And we subsidized it. What do we do about this?

The problem that I see with the way we are dealing with the subsidy issue right now is that with the globalization of the economy the inappropriable, least-captured elements of research and development are speeding about the globe ever more rapidly. Governments are going to

get more and more pressure to take a free-rider approach. (That is, let other people do the work that we are all going to get anyway. We will focus on work that will help our people). Governments will give in to the inevitable temptation to back off from the pure seed-corn type of research. If everyone is going to get the benefit why should we pay the bill? For that reason I predict that the programs are inevitably going to be pushed by purely economic incentives. How do we deal with this?

One way to deal with this is some kind of international cooperation on the least appropriable elements of research and development. That same process of globalization makes international operations cheaper and more feasible to do. We can have international cooperation among different companies or countries even on basic research. We will need some kind of agreement, at least among countries doing the major R&D work. We are going to have to fund the basic seed-corn type of research that everybody has difficulty capturing. And we will have to maintain resources for that kind of effort. Of course, we also have to find a way to permit countries to subsidize technology programs while at the same time rendering them immune from the temptation to make them strategic-trade oriented, or rent or profit-transferring programs rather than programs that focus on inappropriable elements of technology.

I think the answer is to negotiate reciprocal access to national technology programs. We will open our firms (or programs) to your firms that are resident in the United States if you will open your programs of roughly equal value to our firms that are resident in your market.

I will conclude with three problems. The first concerns antitrust. Slowly but surely minimum international standards on antitrust are going to evolve. We are already down that road. A good example is the recent European Union review of the Boeing-McDonnell merger. Their Justice Department opened a dialogue with our Justice Department, which is very informal at present. But I predict it will ultimately become the basis for a new trans-Atlantic antitrust standard.

Second, I predict the dumping rules are ultimately going to be revisited when our people start getting hit with dumping suits from their countries. We are starting to see dumping cases, for example Japanese cases against the Koreans. It is only a matter of time before we see a Japanese dumping case against the United States. We will have to start discussions on what correct pricing standards in high-technology industries look like.

Finally, intellectual property is the most difficult of the trade rule issues that have not been resolved yet. This is basically a "have" versus

"have-not" issue, a north-south issue. The whole existence of a system of intellectual property in a developed economy is a trade-off between two divergent sets of interests. On the one hand, from a static efficiency viewpoint, once technology is created the most efficient thing society can do is diffuse that technology as widely as possible. The problem with that, however, is that if you give it away (which often is the marginal cost of diffusing technology), nobody has an incentive to create new technology for the future. So we give a temporary monopoly. That is a patent system.

We can work those trade-offs on a national scale because we have both technology producers and technology consumers. But on a global scale some nations are almost exclusively technology consumers. They are not going to be technology producers of any significance, at least in the very near future. It is clearly not in their interest to go with a system that impedes diffusion. Their interest is not the same as the advanced industrial countries that are developing the technology. This is a tough issue because there are very different interests between different groups of countries. A clear solution is not feasible.

For example, the European Union has moved toward a single European-wide patent system. You can now get a European patent in Europe. The problem with that, however, is that these patents are still being enforced by national patent courts. You can get a European patent, but it is very difficult, and costly, to enforce. You have to go into all these national markets and do things differently in each one. This is a very simple illustration of the kinds of difficulties we are going to face if we try to determine the logical solution to the patent issue, which is a world patent system. That seems very, very difficult and very unattainable. It is a very tough bargaining issue because of these divergent interests.