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Notes on Patents, Distortions, and Development

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What are the economics of patents? What problems arise in implementing a patent system? How much do distortions in developing countries affect the benefits and costs of a patent system? And what are the policies that would increase the likelihood of patents benefiting a developing country?

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This paper — a product of the International Trade Division, International Economics Department — is part of a larger effort in PPR to increase the understanding of the impact of patent protection on developing economies. Copies are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Please contact Maria Teresa Sanchez, room S8-039, extension 33833 (30 pages with figures and tables).

The idea behind patent policies is to increase the output of commercially useful innovations by creating a transitory property right that allows the inventor to appropriate part of the returns from his invention.

In practice, the issue is so complex that after evaluating the U.S. patent system in 1958 Fritz Machlup concluded, "If we did not have a patent system, it would be irresponsible, on the basis of our present knowledge of its economic consequences, to recommend instituting one. But since we have had a patent system for a long time, it would be irresponsible, on the basis of our present knowledge, to recommend abolishing it." Empirical research done in the 30 years since Machlup's study suggests that the patent system has benefited competitive industrial countries in important ways.

In developing countries, two types of considerations need to be addressed. First, there are issues of designing an appropriate patent system. This includes considerations of administrative efficiency, the impact on government expenditures, and the legal administration of intellectual property rights.

Second and more fundamentally, the investments that patent incentives trigger in research and development are one of many uses for scarce savings. Returns to investments protected by patents depend on the productivity of the inventive process and the industrial applicability of innovations. For several reasons — including the paucity of experience in research and development — the productivity of inventive and innovative processes might be low in some developing countries. In such situations care should be taken that scarce investment resources are not wasted in unproductive research and development endeavors.

The paper also argues that in unstable and protected economies, the social returns of patented innovations might be low. One reason for this is that innovations that are appropriate for a given productive structure might not be applicable when a shift in policies induces a new economic structure. If so, the analysis suggests a sequencing of policies where patent protection should be strengthened once developing countries have achieved a level of savings compatible with investments in risky research and development projects, relative economic stability and competition through open market policies.

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by
Julio Nogués

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NOTES ON PATENTS, DISTORTIONS AND DEVELOPMENT*

Julio Nogués

I. Introduction

What are the simple economics of patents? What are some of the problems of implementing a patent system? To what extent do the distortions of developing countries affect the social benefits and costs of a patent system? Finally, what policy suggestions can be made for increasing the likelihood that patents will enhance welfare in developing countries? These are the questions addressed in this paper.

The topic of patents is a complex one involving several fields including economic, technological, sociological and legal issues. The purpose of the paper is essentially to offer a survey of the questions posed and not to provide a definite answer to them. I should also mention that the focus of the paper is on process and not product innovations.

The paper is arranged in the following way. Sections II and III provide a discussion of the patent system much of it based on the existing literature. Section II summarizes a simple model that is useful to analyze the economic impact of patents including the optimal level of private investment in research and development (RD), the optimal length of a patent, and the efficiency of patents. Section III provides a discussion of the social costs and benefits of patents in competitive economies.

This background leads to a discussion in Section IV on how the characteristics of developing countries might affect patent policies. I argue

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*/ I appreciate extensive comments received from Bela Balassa and Paul Meo.

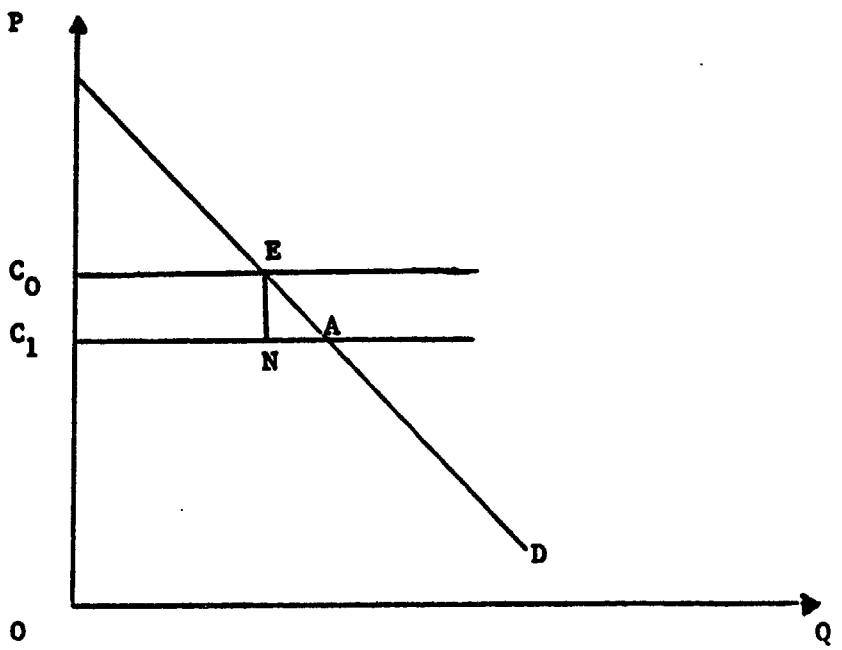
that in these countries, distortions and instabilities could imply low social rates of return to patents. This Section also includes a discussion of the sequencing of patent policies in economies that are highly distorted and unstable.

II. A Simple Model of Investment in Research and Optimal Patent Life

The purpose of this section is to summarize a simple model on the economics of patents. This model was developed twenty years ago, but it is still often used as the basis for further theoretical developments. The discussion will be made graphically and the reader is referred to the original mathematical development by Nordhaus (1969).

Figure 1 portrays the case of a process innovation in a firm located in a competitive industry. It will be assumed that the industry faces a

Figure 1



linear demand curve and has constant costs. The process innovation results in a downward shift of the cost function from C_0 to C_1. A patent will allow the innovating firm to choose between two strategies. On the one hand, the firm can license its innovation or sell it to other firms. Given the competitive nature of the industry, the maximum royalty per unit of output that the innovating firm can charge to its competitors is C_0C_1.

The firm can also choose to displace its competitors and supply the market demand making a profit equivalent to the area C_0ENC_1. It will be noted, that the innovating firm will alter its pre-invention profit-maximizing price-output decision only in the case of inventions which imply major cost reductions.

The social benefit of the patent is represented by the area of the rectangle C_0ENC_1 during the life of the patent and this area plus the consumer surplus triangle EAN (or C_0EAC_1), from the moment the patent expires to infinity or until a new innovation becomes more cost effective. On the other hand, the social cost is given by the consumer surplus loss during the life of the patent, or the area EAN plus the resources used in RD triggered by the patent system. Given these considerations, what is the optimal level of RD? What is the optimal life of a patent? What is the efficiency of the patent system?

1. Optimal level of RD 1/

The answer to the first question is facilitated by the introduction of Figure 2. Here, the vertical axis shows percentage cost reductions. The

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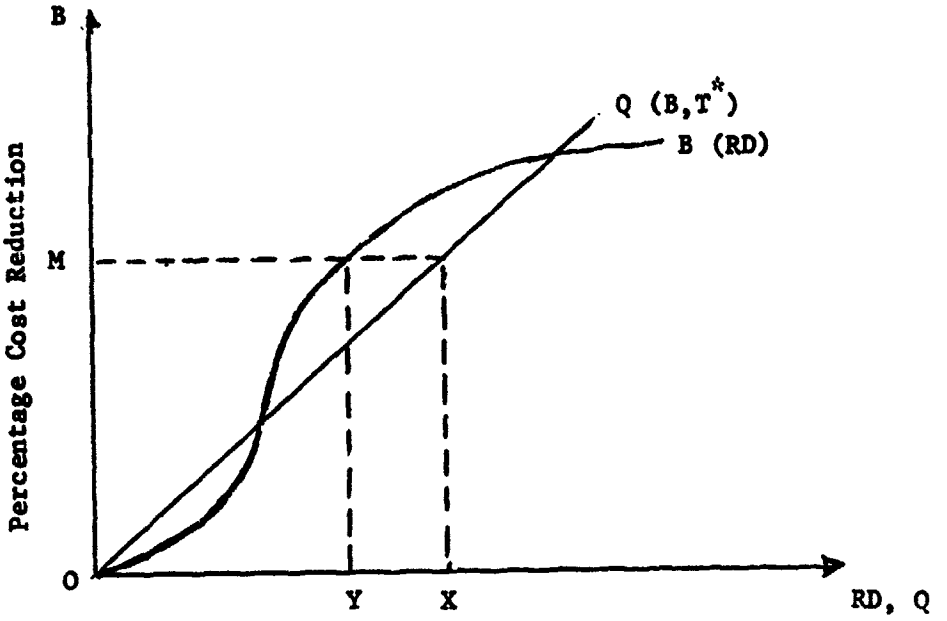
1/ The graphs that follows are taken from Scherer (1972).

horizontal axis indicates RD costs and the private discounted rents from the innovation (Q).

Figure 2



It is assumed that the productivity of RD can be approximated by B(RD) function which eventually has decreasing returns. Whether there is a segment of increasing returns in the B(RD) function is not clear from the empirical literature. As a matter of fact, Nordhaus developed his model based on empirical research, which showed continous decreasing returns to RD (Nordhaus, 1969, p. 80). It is also noted that RD is an activity whose output is very uncertain but as I will note below, recent developments have incorporated this feature into the model.

On the other hand, under the assumption of linear demand and cost functions, the rent schedule Q(B,T) is also linear and is a function of the cost reduction and the length (T) of the patent. As the patent life increases, the Q function rotates to the right but because additional benefits

from longer patents are discounted more heavily, the extent of rightward shift of the Q function diminishes as T increases. It is noted that what determines the position of the Q(B,T) function is not the legal duration of patents, but the effective market protection that they provide. Thus, it is possible for the legal length of patents to be changed while at the same time not affecting the industry or even the economy-wide level of RD.

The location of the rent function also depends on the private rate of discount. Given the cost reduction of the innovation and the length of the patent, a reduction in the rate of discount will rotate the Q function clockwise.

Figure 2 provides an answer to the optimal level of RD by the innovating firm which is determined by the profit maximization condition. In Figure 2 this occurs at point Y where the horizontal difference between the B(RD) function and Q(B,T) function is maximum. In this case, the innovating firm will invest OY in RD for a total profit of YX.

2. Optimal life of a patent

Given these considerations, what length of patents maximizes society's welfare? To answer this question we need to introduce the social costs of innovations. The price society pays for an innovation that reduces costs from C_0 to C_1 is given by the welfare triangle EAN during the life of the patent, plus the inventor's RD costs. 1/ As the patent life increases, society must wait longer to gain the surplus EAN. At the same time, the diminishing returns to RD implies that after some point, a longer patent life might result in proportionately less inventions. Scherer (1972) has concluded

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1/ Other costs of patents will be discussed in the next section.

that "...sooner or later, these diminishing return effects overpower society's interest in stimulating additional cost reductions by extending the patent life. Therefore, in all but some special limiting cases there exists a finite socially optimal patent life ..."[1/]

To be more explicit, Nordhaus (1969) assumed that:

$$B(RD) = \beta RD^{\alpha}$$

With this assumption and using a social discount rate of 20%, he determined the optimal life of a patent. The figures are shown in Table 1.

Table 1: OPTIMAL LIFE OF A PATENT
(In number of years)

Demand Elasticity	Value of B 0.001	0.01	0.02	0.05	0.10
0.25	34.0	22.5	19.1	14.7	11.6
0.50	30.5	19.1	15.8	11.6	8.6
0.75	28.5	17.1	13.9	9.8	7.2
1.0	27.0	15.8	12.6	8.7	6.2
1.5	25.0	13.9	10.8	7.2	5.0
2.0	23.6	12.6	9.6	6.2	4.2
4.0	20.2	9.6	6.9	4.2	2.9
10.0	15.8	6.2	4.2	2.6	1.8

Source: Abridged from Table 5.1. in Nordhaus (1969).

Based on this simple model, the following conclusions can be made:

- First, for a given percentage cost reduction, the welfare cost paid by society for the innovation (EAN) is higher the higher is the price elasticity of demand. Thus, ceteris paribus, a high

1/ For a discussion of the productivity of RD and of patents in the U.S., see Griliches (1989).

price elasticity of product demand implies a lower optimal patent life.

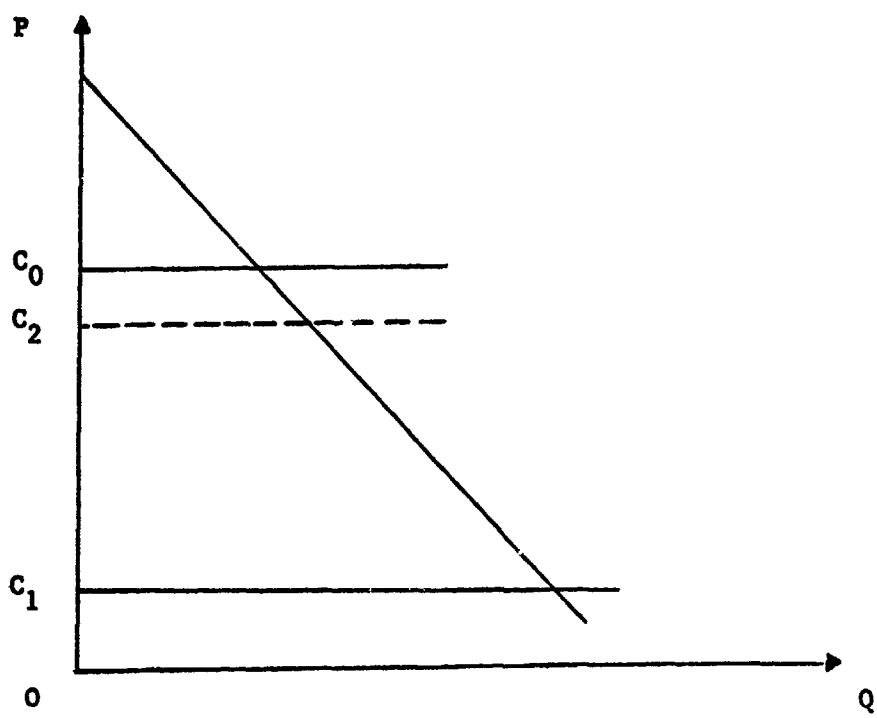
- Second, the easier "...it is to achieve a given cost reduction, the shorter the optimal patent life will be ...". This is so because for given B and Q functions, bigger cost reduction innovations imply larger welfare losses, which society wants to avoid.

- Third, the more pronounced the decreasing returns to RD, the shorter the optimal patent life is. A lengthening of the patent life that induces RD leading to small cost reduction innovations must be weighted by the higher welfare loss incurred by society. Thus in general, a shorter patent life is likely to be optimal when RD expenditures are characterized by strong decreasing returns.

- Fourth, a reduction in the social rate of discount increases the optimal patent life. This also occurs when inventors are risk averse and their discount rate is higher than the social discount rate. In Figure 2, an increase in the rate of discount can be depicted as a leftward rotation in the Q function. The negative impact of a high discount rate on RD can be compensated with longer patent protection which as said, is equivalent to a rightward rotation of the Q function.

- Fifth, for big innovations, i.e., innovations which reduce costs substantially, the optimal patent life should be longer. Why this should be the case can be seen in Figure 3, where a major innovation reduces costs from C_0 to C_1. The new cost schedule allows the innovating firm to monopoly price at OC_2. Given that this price is below OC_0, the consumer obtains immediate gains from the innovation. Thus, longer patents are socially beneficial when innovations provide important welfare gains.

Figure 3



In practice, the length of patents varies greatly among countries and between industries. In the U.S., patents last for 17 years from date of approval. Although it is not clear how this length was determined, it is worth quoting Machlup on the determination of the patent length in England: "The 14-year term of the English patents after 1624 was based on the idea that

2 sets of apprentices should, in 7 years each, be trained in the new techniques, though a prolongation by another 7 years was to be allowed in exceptional cases" (Machlup [1958], p. 9). Nordhaus adds sarcastically that after "...some further compromise it was decided for the United States that 2.43 apprentices, or 17 years, would be the proper length..." (Nordhaus, 1969, p. 82).

Note also, that in many countries the length of patents is uniform across industries. Nevertheless, the simple economics of patents suggests that to the extent that elasticities of product demand and cost and productivity of research and development varies across industries, optimal patent lengths should differ between industries.

But probably because these functions cannot be estimated with great precision at the industry and product level, policymakers have opted for uniform patent lengths. One theoretical justification for this is that in the previous model, beyond a certain number of years--usually ten or less--the welfare provided by the patent system cannot be altered significantly.

3. Efficiency of patents

Given that the patent system implies a welfare loss from the monopoly position, what proportion of the maximum welfare is achieved by it? Assuming an elasticity of demand of 2.0 and a cost reduction innovation of 10%, the patent system achieves 66% of the maximum welfare (Nordhaus, 1969, Table 5.4).

The issue of efficiency of the patent system is important. Policymakers should make an effort to "...determine when the patent system has so low a level of efficiency that other mechanisms for encouraging technological change should be substituted for it ..." (Nordhaus, 1969, p. 86). For example, it has been shown that under certain conditions other

policies such as prizes and research contracts, are superior to patents (Wright, 1972). It is not at all clear why these alternative policies have been left out of the policy debate.

III. Social Benefits and Costs of the Patent System in Competitive Economies

The previous section discussed the simple economics of the patent system. The purpose here is to introduce further issues and make some general comments on the benefits and costs of patents. These comments are based on the experience of the U.S. As will become clear in the next section, the relative importance of costs and benefits in developing countries might be quite different.

1. The social benefits of patents

In a thorough review of the US patent system published more than thirty years ago, Machlup concluded that the profession is confronted with conflicting theories. "...On the basis of the theory of the 'competitive compulsion to keep ahead' one might think that firms would invent and innovate even without patent protection. But on the basis of the theory of the 'competitive elimination of profits' one might think that without patent protection it would not pay to invent and to innovate, and that firms could not afford to invest in research and development. On the strength of the theory of the 'sufficiency of the innovator's headstart' one might think that many innovators would have enough time to recover their costs of innovation. But on the strength of the theory of the 'nearly perfect competition from imitators' one might think that few innovators would get away without losses..." Furthermore, no "... conclusive empirical evidence is available to decide this conflict of theories..." and therefore none "... of the empirical

evidence at our disposal and none of the theoretical arguments presented either confirms or confutes the belief that the patent system has promoted the progress of the technical arts and the productivity of the economy..." (Machlup, 1958, p. 79).

Research undertaken since then has thrown light on some of Machlup's considerations and of the benefits of the patent system. For example, in the simple model of Section II, patents which pass the market test can be expected in general to provide a net social benefit. Empirically, it has been proved that for some industries, patents are a powerful incentive to innovations (Levin, et. al., 1986).

Also, because patents--unlike trade secrets--make public the basic principles of an invention, they facilitate further innovations and permit their faster diffusion.

But how much do these benefits add? An educated guess has recently been provided by Griliches. In discussing the residual of an aggregate production function for the U.S., he states that "... not all productivity growth is due to invention and only some fraction of the latter arises from patented inventions. If one takes 1.5 to 2.0 percent as the approximate growth rate per year in total factor productivity, at least half of it is likely to be due to the growth in the quality of the labor force, economies of scale, and various reallocations of capital between assets and industries. Moreover, it is unlikely that patented inventions would account for more than half of all the relevant advances in knowledge. This leaves us with at most a quarter of total productivity growth, and an unknown fraction of its fluctuations, to be attributed to patented inventions..." (Griliches, 1989, p. 220). For 1982--the year that Griliches was looking at--this amounted to approximately US$12 billion.

2. Social cost of the patents

Griliches has provided a rough estimate of the net social gains of patents. But the approach does not throw light on the extent to which greater gains could be achieved. Some insights can be gained by looking at the cost side of patents.

In addition to the RD expenditures and the monopoly welfare loss, other social costs of the patent system arise from losses from uniform patent protection, the value of resources used in its administration and the cost of producing non-used patented innovations. Going a step further, some observers have argued that patents have been involved in legal harassment cases, and that restrictive licensing have at times been abusive.

The analysis in the previous section suggests that optimal patent duration varies between industries and over time. But because these adjustments should be based on information that is usually not available, or if available of dubious reliance, policymakers have enacted uniform patent protection across broad group of industries. This second best policy entails a loss which to my knowledge has not been estimated.

The value of resources used for administration is a social cost of the patent system. In many countries, the patent offices appear to be understaffed and for example in the US, it has been found that the number of patent examiners is a significant variable for explaining the number of patents processed and granted (Griliches, 1989, p. 5). Given the administrative costs of increasing the number of patent examiners, it has been suggested that payment of a non-trivial fee at the time of patent application could serve as an impersonal preliminary screening of potentially profitable new inventions.

Also, sometimes patents push resources to be engaged in useless innovations. Unfortunately, not much evidence appears to be available in this area, but one quotation from "The Economist" is of interest "...Of all the drugs brought to market during 1988 by the 25 largest companies, 84% were considered by the Food and Drug Administration to have little or no contribution to make to existing medical therapies..." ("The Economist", 1989). More generally, whether an invention passes the patent test and represents a "significant technological advance," is not determined by economic but by scientific and technological considerations. Therefore, it comes as no surprise to observe that a great majority of patents never become marketed. For example, Machlup (1958) cites work by Meinhardt (1950, p. 66) who argued that uneconomic exploitation is the main reason why 80% to 90% of patents were not produced.

Mention should also be made of the fact that market power can be enhanced, or the security of patent rights affected, by means of legal harassment. For example, "...Between 1900 and 1941, 684 radio patents were involved in a total of 1,567 infringement suits. Inventors like Lee de Forest and Edwin Armstrong were forced to sell out their rights in key patents because, as Armstrong later lamented, he was 'in danger of being litigated to death.' A single lawsuit over petroleum cracking patents lasted fifteen years, piling up court costs and legal fees exceeding $3 million" (Scherer, 1970, p. 391). Many of these court patent cases have piled up over the years, but there is no global analysis of how much they have reinforced patent protection and how often they have been used to abuse it.

More generally, given that the patent system provides monopoly rights, it often leads to restrictive licensing. These restrictions include territorial limitations on manufacture; limitations on licensees export

quantities; limitations on licensees export price; export through designated agents; tie-in sales; grantbacks from licensees and quality controls on material inputs and output. Grant back provisions according to which a licensee cannot develop improvements of the technology he is licensing is another way by which the patent system can reduce competition and innovation.

It must be said, that not all restrictive licensing must necessarily imply a greater welfare loss than is implied by the original patent. In fact, it has been argued that many restrictive practices are used as a means to appropriate the returns of patents while at the same time allowing a greater diffusion of innovations (Hindley,1971). Recently among industrial countries, the attitude towards restrictive licensing has shifted from one of condemnation to neutrality if not sympathy. In the U.S. for example, there has been a proposal (S. 438, H.R. 557, cited by Levin, et.al., 1987) that patent license agreements "... shall not be deemed illegal per se under any of the antitrust laws." A recent OECD report also holds a similar view. Some quotations from it are useful. For example, "...The belief that permitting innovators to capture the full returns inherent in their innovations leads to a long term efficient use of resources, thus benefitting the consumer, is basic to the analysis of this report." Also, "... the report argues that long-standing notions of conflict between intellectual property rights and competition policy should be reconsidered." (OECD, 1989, pp. 101-102).

In any case, the logic of the shift in attitude by industrial countries is simple to understand. If for whatever reasons policymakers favor the patent system, then there should not be too much concern with the way by which the inventor reaps the reward from his patent monopoly. This is so because in a competitive economy, the maximum that an inventor can gain by whatever means including restrictive licensing is given by the characteristics

of the market and the importance of the invention. In contrast, when the mood used to be one of suspicion of the patent system, policy recommendations in favor of compulsory licensing were often made and in some cases, patents were even abolished (Machlup, 1958). In fact, in many countries including industrial, compulsory licensing has been enforced from time to time.

This recent debate shows that a general case against restrictive licensing cannot be made, and that "... a case by case treatment (is) more appropriate ..."(OECD, 1989, pp. 101-102).

Summing up this section, it appears that there are several characteristics of the patent system that results in social costs over and above those discussed in Section II. The extent to which policy can reduce these costs is part of the ongoing debate.

IV. Patents in a Distorted Economy

It is at this stage useful to introduce some stylized characteristics of developing countries and assess the extent to which the simple model of Section II helps to throw light on patent policies. The following issues will be discussed: administrative difficulties, distributive effects, productivity of RD trade protection, macroeconomic considerations, property rights in trade secrets, the sequencing of patent policies, and patent policies in presence of trade retaliation. The analysis in this section also provides some guidance on the timing within an overall policy reform process at which patent protection should be strengthened.

1. Administrative problems

In principle a patent should be granted to a significant

technological advance with a clear industrial applicability. An important question in the administration of the patent system arises in connection with the interpretation of "significant technological advance." This is not a trivial matter. The crucial question here is when to so classify an invention. This takes us to the stringency of the patent test. In the U.S., the stringency has varied over time. For example, the test used to be quite severe in the free trade, anti-monopoly environment of the 1850s. In contrast, "...the judicial and political climate in the late 1930s became more hostile to corporate patenting ..." (Griliches, 1989, p. 8). More recently in industrial countries, there has been a trend in favor of patents and more generally of intellectual property rights (see, for example, OECD, 1989).

The basic administrative problem of deciding when an innovation represents a "significant technological advance," appears to be more difficult in developing than in industrial countries. A serious analysis of inventions often requires highly qualified people. But can the public sector attract such scientists into its patent office? Given budgetary problems, does it make sense to pull scientists into their public sectors or are other expenditures more urgent? Given the international role of patents and the increasing sophistication of investors, can small developing countries afford to open a full-services patent office? In any case, how will the decision on significant technological advances be taken? These are some of the questions that arise when thinking about the creation of efficiently managed patent offices in developing countries.

2. Distributive effects of patents

The model in Section II implicitly assumed that the benefits of

inventions were captured by the nationals of the inventing country. This is not always the case. Long ago Penrose (1951) concluded that "...any country must lose if it grants moncpoly privileges in the domestic market which neither improve nor cheapen the goods available, develop its own productive capacity nor obtain for its producers at least equivalent privileges in other markets..."

When the welfare of nationals are given greater weight than that of foreigners, the optimal patent policy is modified. For example, in the extreme case that only multinationals do research and transfer their license royalties abroad, the rectangle C_0ENC_1 in Figure 1 now represents social costs during the life of the patent and no benefits accrue to nationals.

In the case where the profits of innovations are transferred abroad, patents might still be justified when it can be argued that innovations made by multinationals which provide specific benefits to the country--such as a new drug against a local disease-- would otherwise not be forthcoming. In this case, the social benefits to the country at the expiration of the patents could be greater than the social costs, thus supporting a patent.

Table 2 shows the pattern of international patenting. The figures show that as a group, industrial countries are by far the most important innovators. These are followed by planned economies. In contrast, between 1969 and 1979, developing countries share in international patenting was a mere 0.4 percent. Clearly, developing countries are net importers of patented innovations. The extent to which they make a net social benefit from these acquisitions depends not only on the extent to which additional benefits are transferred abroad, but also whether the innovations can be used efficiently.

3. Productivity of RD

It is likely that in developing countries the productivity of RD is lower than in industrial countries. Several reasons could be listed including skill deficiencies, poor research equipment, poor quality of inputs, etc. Also, industrial countries having a richer experience with RD have accumulated experience which likely enhance their productivity of RD.

Table 2: INTERNATIONAL DATA: PATENTING AND RELATED INDICATORS (Percent)

	Industrial Economies		Semi-industrialized Economies		Developing Economies	Planned Economies
	USA	Other	Rapid Growth	Slow Growth		
Share of inventions						
1969-71	31.6	36.1	2.6	1.7	0.4	27.7
1976-79	23.3	38.5	3.3	1.0	0.4	33.6
Proportion national						
1967-71	75	33	25	17	11	76
1976-79	62	45	27	20	12	84
Ratio: R&D/GDP						
1967-71	2.7	2.0	0.8	0.4	0.6	3.1
1976-79	2.0	1.7	0.5	0.4	0.4	3.3

Source: Evenson and Putnam (1987).

If the productivity of RD in developing countries is low, then increasing patent protection will not have a significant impact on innovations, but will imply higher prices for the technology they acquire.

4. Uncertainty

So far, the discussion has been carried out under the assumption of

certainty. Nevertheless, it is reasonable to presume that the RD process is surrounded with uncertainty. This uncertainty might refer to several factors. One that has been worked out in the literature refers to uncertainty surrounding the extent of cost reduction of the innovation. In this regard, Rafiquzzaman (1987) has shown that when the extent of cost reduction is uncertain and the innovator is risk neutral, the optimal patent life is shorter than in the perfect certainty case.

It might be reasonable to presume that uncertainty surrounding the RD is higher in developing countries. One reason for this is that the quality of the inputs of the RD process might be more variable. Another reason is that government policies are often unstable. Thus, in order to reduce uncertainty and increase the productivity of domestic investments in RD, it is important to assure that government policies are supportive.

5. The macroeconomy

Consider the situation of an economy characterized by high fiscal deficits, growing inflation, increasing real interest rates and growing currency overvaluation. In this economy, it is likely that investment is declining, the trade surplus (if any) is narrowing, protectionism is increasing, the residual productivity of the economy is declining, growth is faltering and unemployment is increasing. Among developing countries, and in particular among the highly indebted ones, it is not uncommon to find that during the 1980s, per capita income and real wages declined by 10-20% and 50%, respectively. Also, the investment and savings ratios of these economies have declined significantly; in some cases by as much as 50%.

There is no empirical basis to support the notion that the productivity problems of these economies are primarily associated with lack of

local innovation in much the same way that it would be erroneous to use the Griliches methodology and conclude that the decline in total factor productivity of many developing countries in recent years could be attributed in part to whatever patents and innovations developing countries have produced.

On the other hand, there is evidence to suggest that the poor productivity growth of many developing countries is associated with high debt-service, price instability, resource misallocation and lack of competitive pressures. For example, in a recent contribution Mundlak, et. al. (1989), concluded that if in 1930 the Argentine economy would had liberalized its trade regime and remained stabilized, by 1984 real GNP would had been 46% higher than what it actually was, thus implying a faster rate of growth. More generally, the phenomenal growth rates of several developing countries is also illustrative of the effects of competition in spite of weak patent protection.

6. Property rights in trade secrets

Property rights derive from the existence of scarcity of goods and services. The economic justification for private property rights is that in a competitive economy these rights will allocate scarce resources efficiently.

In sharp contrast to property rights in goods and services, intellectual property rights do not stem from the need to allocate something scarce. In fact, an idea does not lose its properties with the number of people acquiring it; property rights granted to ideas create scarcity (Usher, 1964).

The fundamental justification for intellectual property rights stems from the fact that in the absence of an appropriate reward system, the output

of new productive ideas would diminish. 1/ These rights permit the inventor to appropriate part of the economic return associated with the development of a new idea. In the absence of intellectual property rights the return to new ideas would diminish and so would their output. 2/

From a development perspective, some questions arise including: how strong is the institution of property rights in developing countries? to what extent these countries' legal institutions--including the courts--are appropriate for sustaining the patent system?

Another question is related to the trade-off between patents and trade secrets. It has been observed that lower patent protection can imply more reliance on trade secrets. The extent to which substitution between patents and trade secrets will affect the rate of innovation would appear to depend on the strength of property rights in trade secrets and their enforcement. It should be noted that very few countries protect trade secrets, and the U.S. is one of these countries (Benko, 1988). In general, developing countries do not protect property rights in trade secrets but some observers argue that this should be a priority area that needs closer attention (Frischtak, 1989). The reason is that in developing countries, enterprises usually make small improvements --in general believed to be non-patentable-- to productive process. These innovations are lost to competition when employees move to competing firms. Thus, it is argued, the protection of trade secrets would provide an important incentive for the type of adaptative RD which is usually performed in developing economies.

1/ In the case of patents, other justifications are discussed in Machlup (1958).

2/ Historically, this has also been a point of debate (Machlup, 1958).

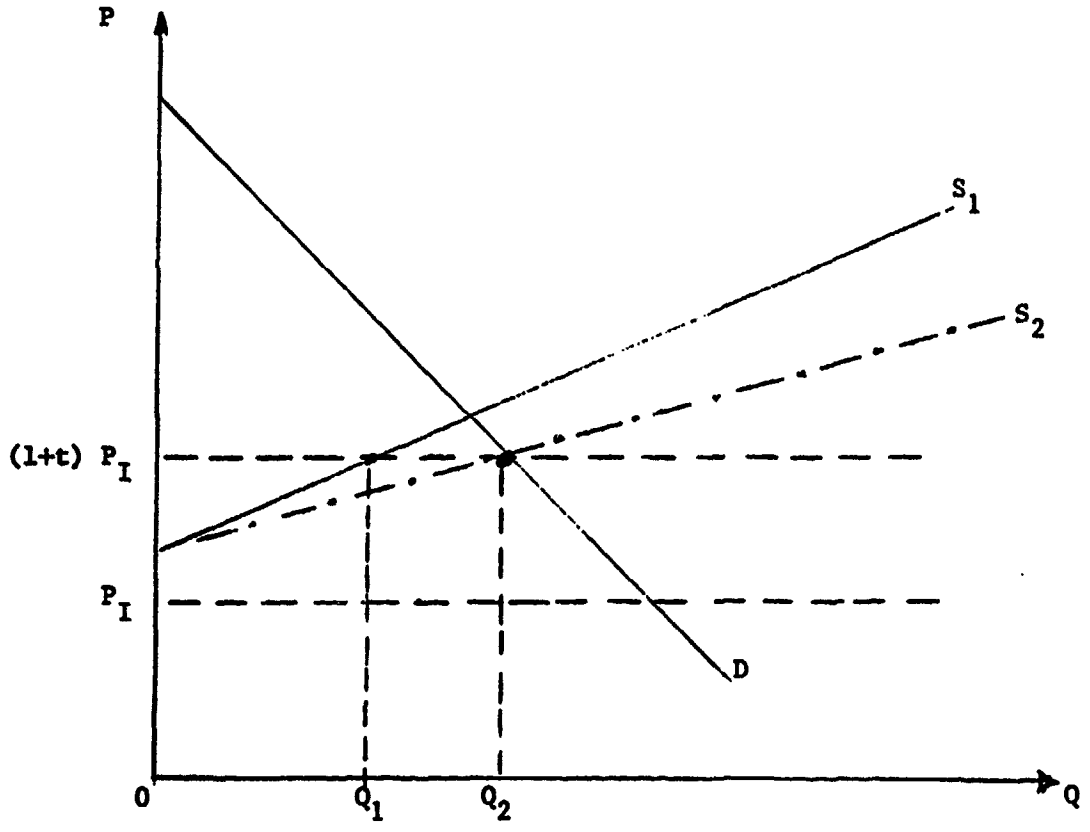
7. The sequencing of patent policies

The set of policies--in this case patent policies--which are best suited for a country, depends on whether a country's own policies are independent or interact with that of other countries. In the case of patents this distinction appears to be crucial. I will first discuss a general suggestion for the sequencing of patent policies and then introduce the case of trade retaliation against countries with weak patent protection.

Let me assume--and this is an assumption on which more light needs to be thrown--that in developing countries patents are an inducement to innovations in much the same way as they are in industrial countries. The previous analysis suggests that the relation between distortions and the pattern of innovations appears to be crucial for assessing the direction of the likely welfare effect of patent policies. These arguments are static. The risks of welfare losses get compounded when patents interact with product and factor market policies in an unstable and unpredictable way. Take the situation of tariff protection. An extreme case could be that depicted in Figure 4. Here P_I indicates international domestic prices and the domestic price is $(1+t)P_I$ where t is the ad-valorem tariff rate. Initially the industry produces OQ_1 and imports $Q_1 Q_2$. Investment in RD results in a new invention that reduces costs and shifts the supply curve to S_2 where domestic supply equals demand. Now assume a trade liberalization program is introduced and tariffs are dismantled. At the new price of P_I, the local industry is unprofitable and only imports satisfy domestic demand. Clearly, in those cases where a local innovation has no impact on international prices, the RD efforts made by an internationally unprofitable industry implies a net social

loss. Again, the loss does not stem from the invention but from the interaction between invention and changes in other policies.

Figure 4



Is this an extreme case? This is difficult to tell, but tariff rates in excess of 100% and extensive quantitative restrictions are not uncommon in developing countries. Clearly in these situations, ambitious trade liberalization programs are likely to result in some industries and/or some products, and/or some lines of production becoming unprofitable. In recent years ambitious and fast liberalization policies have not been uncommon (Laird and Nogués, 1989), and certainly trade regimes of many developing countries remain unstable.

Furthermore, the instability of microeconomic policies is compounded by acute macroeconomic instability. As said, real exchange rate and real wage rate fluctuations of 50% have not been uncommon during the 80s. All this suggest that innovations whose benefits remain in the country might be good in stable policy environments and will quite likely be good in a fully liberalized competitive economy. Thus, it would appear that from a development perspective, a strong patent system would be appropriate once developing countries have secured a competitive and stable economy; a position some NICs have achieved. In many other countries, however, the road to travel before arriving at this stage appears to be long. In this regard, it is illustrative to note that several industrial and some newly industrializing countries (NICs), only moved late in their development process to increase patent protection. When they did so, their economies were characterized by open markets, competition, an important physical and human capital base, and high savings and investment ratios. By that time, they had all the necessary base to become efficient innovators.

8. Patents and retaliation

Many developing countries have long instituted patent regimes. For those who do have one and are enforcing it, the previous discussion should be cast in terms of changes to the system. Changes on which the previous analyses throw some light include modifications in the duration of patents expansion in the number of industries falling under the patent system, enhancing the efficiency of the patent office, etc.

Policy analysis is complicated by the fact that industrial countries have started to implement retaliatory measures against countries not complying with a minimum level of patent protection. The policy sequencing just

discussed can be fundamentally altered in the presence of retaliation or threats of retaliation.

For example, one common exclusion from the patent system is that of pharmaceutical processes and products. There are 49 countries which exclude patents in pharmaceutical products (WIPO, 1988). Pressed by several factors, industrial countries are requesting many of these countries to include pharmaceutical and other products under their patent laws. For those countries not accepting these demands, industrial countries have threatened and in some cases effectively retaliated against them.

In the presence of retaliation, the main economic consideration is whether the net social benefit of low patent protection--assuming there is a social benefit--to pharmaceutical products is higher or lower than the social costs of retaliation. When this cost is higher than the net social benefits, then from an economic point of view, patents should be introduced.

For example, let me assume that the U.S. would have implemented retaliation for the full value of the loss of US$ 84 million per year reported by U.S. affiliates in their 301 petition against Argentina for lack of patent protection in pharmaceutical products 1/. Then, on a narrowly focused economic evaluation, for Argentina to decide not to introduce patents in pharmaceutical products, it should conclude that the social benefits of the status quo is at least equal to US$84 million per year.

This consideration assumes that it does not matter on which industry the retaliation falls against. In recent cases, the U.S. has retaliated by imposing 100% ad-valorem tariffs on selected imports from the infringing

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1/ On Section 301 see Grinols (1988). While this article was being revised, the Government of Argentina announced that it plans to send to Congress a new patent law that would include pharmaceutical products.

country. If the U.S. did this against Argentina, then further considerations should be made. For example, it could be that some promising fast growth export industries resulted seriously damaged by the retaliation measures. Given the value of retaliation, this is not unlikely. For example, in 1987, Argentina's manufactured exports--the type of products against which retaliation would most likely fall--to the U.S. were in the order of US$ 600 million. Thus, if the retaliatory threats were to be enforced, it would mean that in terms of 1987 figures, manufactured exports would decline by a relatively important amount. This is a high enough figure so as to fear that the export prospects of several industries could be seriously damaged by the introduction of retaliatory measures.

It should be said that because of their protectionist effect, retaliatory actions will always hurt the U.S. Thus, for example, the trade sanctions against Brazil in another 301 case in pharmaceutical patents has hurt not only Brazil but also the U.S.

So far the analysis has been cast in terms of an all or nothing situation. Clearly, negotiations including bilateral trade negotiations on patents, are not always undertaken in this situation. There could be middle of the row solutions which can be satisfactory to both parties. Finding this middle of the row is the task of good negotiators. It is clear nevertheless, that in presence of policy interactions, the difficulties of searching for good patent policies are more serious than in the case where these interactions are absent.

V. Final Remarks

Patent policies seek to increase the output of commercially useful innovations by creating a transitory property right which allow the inventor

to appropriate part of the returns from his invention. But in practice, the issues appear to be so complex that after a close evaluation of the U.S. patent system published more than thirty years ago, Machlup recommended that "... if one does not know whether a system as a whole (in contrast to certain features of it) is good or bad, the safest 'policy conclusion' is to "muddle through"--either with it, if one has long lived with it, or without it, if one has lived without it. If we did not have a patent system, it would be irresponsible, on the basis of our present knowledge of its economic consequences, to recommend instituting one. But since we have had a patent system for a long time, it would be irresponsible, on the basis of our present knowledge, to recommend abolishing it" (Machlup, 1958, p. 80).

Much empirical research has been done since Machlup's conclusions were made 30 years ago, and today there is more evidence that the patent system has entailed important benefits to competitive industrial countries. But it should be noted that these benefits have been enhanced by the relative stability, openness and competitive nature of these economies. In contrast, developing countries' macro and micro policy instability suggests that more care should be exercised. For example, low productivity of RD suggests that patent protection should not necessarily be as strong as in high productivity competitive economies. Likewise, even if the productivity of investments in RD is similar across countries, it could very well be the case that commercial and industrial policy shifts could force--for example, as a consequence of an adjustment program--the closing of some industries. For those industries, past investments in RD will no longer yield benefits and might had provided a low social rate of return. This suggests that patents should be strengthened once economies have stabilized and restructured.

In addition to these basic resource allocation considerations, it appears that more analysis is needed on the efficiency of management and costs of administering patent offices in developing countries. Also, little is known as to how the courts of these countries administer patent cases.

In light of these considerations, it is not surprising to see that several industrial economies and some of the more advanced of the NICs only moved late in their development process to strengthen patent protection. When they did so, these economies were characterized by competition, a significant human capital stock and high saving ratios, i.e., they were ready to become efficient innovators and exporters of technology.

References

Benko, Robert, "Intellectual Property Rights and the Uruguay Round", The World Economy, June 1988.

Evenson, Robert and Jonathan Putnam, "Institutional Change in Intellectual Property Rights", American Journal of Agricultural Economics, May 1987.

Frischtak, Claudio, "The Protection of Intellectual Property Rights and Industrial Technology Development in Brazil," The World Bank, (mimeo), 1989.

Griliches, Zvi, "Patents: Recent Trends and Puzzles", National Bureau of Economic Research, Working Paper No. 2922, 1989.

Grinols, Earl, "Procedural Protectionism: The American Trade Bill and the New Protectionist Mode" (Mimeo), 1988.

Hindley, Brian, "The Economic Theory of Patents, Copyrights and Registered Industrial Designs", Economic Council of Canada, 1971.

Laird, Sam and Julio Nogués, "Trade Policies and the Debt Crisis", World Bank Economic Review, May 1989.

Levin, Richard, Alvin Klevorick, Richard Nelson, and Sidney Winter, "Appropriating the Returns from Industrial Research and Development," Brookings Paper on Economic Activity, No. 3, 1987.

Machlup, Fritz, "An Economic Review of the Patent System", Study No. 15 of the U.S. Senate Subcommittee on Patents, Trademarks and Copyrights, 1958.

Meinhardt, Peter, "Inventions, Patents and Monopoly," London (Second Edition), 1950.

Mundlak, Yair, Domingo Cavallo and Roberto Domenech, "El Sector Agropecuario y el Crecimiento Económico. La Experiencia Argentina, 1913-84". Estudios, January-March, 1989.

Nordhaus, William D., "Invention, Growth and Welfare," Cambridge, MIT Press, 1969.

OECD, "Competition Policy and Intellectual Property Rights", OECD, Paris, 1989.

Penrose, Edith, "The Economics of the International Patent System", The Johns Hopkins University Press, 1971.

Rafiquzzaman, M., "The Optimal Patent Term Under Uncertainty", International Journal of Industrial Organization, No.5, 1987.

Scherer, Frederick M., Industrial Market Structure and Economic Performance", Rand Mc Nally, Chicago 1970.

Scherer, Frederick M., "Nordhaus' Theory of Optimal Patent Life: A Geometric Reinterpretation" The American Economic Review, June 1972.

The Economist, "The Food and Drug Administration Under Siege", The Economist, August 12, 1989.

Usher, Dan, "The Welfare Economics of Invention", Economica, August 1964.

World Intellectual Property Organization (WIPO), "Existence Scope and Form of Generally Internationally Accepted and Applied Standard/Norms for the Protection of Intellectual Property Rights" WIPO, WO/INF/29, 1988.

Wright, Brian C., "The Economics of Invention Incentives: Patents, Prizes, and Research Contracts", The American Economic Review, June 1972.

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