GLOBAL WELFARE IN PHARMACEUTICAL PATENTING

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ABSTRACT

This paper revisits the question of whether global welfare is higher under a uniform world-wide system of pharmaceutical product patents or with international rules allowing low-income nations to free-ride on the discoveries of firms in rich nations. Key variables include the extent to which free-riding reduces the discovery of new drugs, the rent potential of rich as compared to poor nations, the ratio of the marginal utility of income in poor as compared to rich nations, and the competitive environment within which R&D decisions are made. Global welfare is found to be higher with free-riding across plausible discovery impairment and income utility combinations, especially when rent-seeking behavior leads to an expansion of R&D outlays exhausting appropriable rents.

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The Uruguay Round TRIPS[1] provisions requiring the extension of first-world patent protection standards to third world nations, including especially the mandate that patents be granted on pharmaceutical products, have been enormously controversial. The ensuing debate led among other things to a decision at the Doha WTO conference to delay the requirement that the least-developed nations grant pharmaceutical product patents by at least a decade, to the year 2016.

It is reasonably well established in the economics literature that, especially in a world of AIDS and resistant tuberculosis epidemics, low-income nations enjoy higher economic welfare when they can free-ride on pharmaceutical innovations made and patented in the first world than when they must pay monopolistic prices for the newest and most effective drugs.[2] Less settled is the question of whether total world welfare is higher under uniform pharmaceutical patent standards or with free-riding. This paper provides what I believe are some fresh insights into the global welfare problem.

A foundation is laid by revisiting diagrams used in my 1996 analysis of the pharmaceutical patent question,[3] which in turn was based in part upon an analysis by Alan Deardorff (1990, 1992). Figure 1 views the welfare implications from the perspective of an LDC, whose demand curve for a particular drug is given by D. If the LDC grants patents, the drug is assumed to be sold at the monopoly profit-maximizing price OP_M. In that case, rectangle H measures the producers' surplus realized by the drug's patent holder, presumably, a multinational company, and consumers' surplus triangle B is realized by the citizens of the LDC. If however patents are not granted and the drug is supplied to the LDC's citizens competitively (a strong assumption not questioned here[4]), the citizens of the LDC consume more at the

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1. Trade-related aspects of intellectual property rights.

2. See e.g. Commission on Intellectual Property Rights (2002), Maskus (2000, Chapter 5), and Scherer and Watal (2002).

3. Scherer (1996, Chapter 9).

4. The post-Doha resolution allowing drug exports to least-developed nations under compulsory licenses is likely to facilitate world-wide generic competition that will help make

lower price OP_C and gain the much larger consumers' surplus of B + H + A. Given the linearity of demand and cost assumed in my example, B + H + A is four times as large as consumers' surplus B under monopoly. I argue that the LDC is better off only if granting patent rights increases the development and supply of comparable new drugs by at least three times.

Figure 2 asks whether such an increase in the number of new drugs is likely. Extending concepts originally articulated by William Nordhaus (1969), the solid line RD(NCE) shows how the number of new chemical entities (NCEs) developed on average per year (vertical axis) can be expected to vary with the amount spent on research and development (horizontal axis). Broken lines Q_1 and Q_2 show how appropriately discounted quasi-rents captured by innovators (horizontal axis) vary with the number of NCEs introduced into the market. Both have curvature reflecting diminishing marginal returns; the most lucrative and/or least costly possibilities are explored first.[5] Both are hypothetical but with intuitively plausible values. Econometric estimates are unavailable, but much to be desired. Q_2 is shifted to the right by 20 percent relative to Q_1 to reflect my assumption that extending patent protection to LDCs would increase rents by 20 percent, or low-income nations' approximate share of world GDP. Given these functions and the profit maximization approach postulated by Nordhaus, which I question in my book and will question later but accept tentatively, the equilibrium number of new chemical entities is found by maximizing the horizontal distance between RD(NCE) and a quasi-rent function, leading to the development of 21.5 new chemical entities per year on average if LDCs do not offer patent rights and 24.5 if they do. The 14 percent change falls far short of the three-fold increase required to render LDCs better off in granting patents.

Analyzing the global welfare question requires a more complex model. The one presented here is deliberately austere, attempting to focus on three fundamental variables: the relative increase in producer's surplus achieved through patented pharmaceutical sales in the third world, the number of additional pharmaceutical NCE products induced (each assumed tentatively to have identical demand functions), and -- a key variable that cannot be ignored in comparative welfare analyses -- the average difference in the marginal utility of income for third world as compared to first world consumers. Another variable will be held constant for the sake of simplicity -- the number of consumers in the third world relative to the number in the first world. The relevant data suggest setting the first- and third-world population shares at $\underline{S}_1 = \underline{S}_3 = 0.5$. Complications such as time patterns and discounting, price controls, parallel trade,

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reality approximate the assumption.

5. The diminishing returns are roughly quadratic. Specific functions used in constructing Figure 2 were $RD(NCE) = (.205\ N)^{1.8}$ (for convenience, the inverse of the likely causal relation) and $Q_1 = (100\ N)^{.51}$.

information lags, non-patent barriers to entry, and demand nonlinearities are for the most part neglected; other caveats are introduced in a final section.

Figures 3(a) and 3(b), which are conceptually identical to demand curves used by Jayashree Watal and myself to illustrate the benefits of Ramsey-Baumol-Bradford discrimination for the pricing of pharmaceutical products in the first and third worlds,[6] assume that at a zero price, the same number of prescriptions (13.5 million) would be demanded monthly in the first world and in the third world.[7] However, income effects cause the demand function to be flatter in poor nations than in rich nations. Long-run marginal production and distribution cost (excluding R&D outlays) is assumed to be $3 per Rx. As the diagram is drawn, a firm enjoying patent protection in both the rich and poor nations will set a price of about $16.50 per Rx in the rich countries, realizing a contribution to profits and the recoupment of R&D costs (quasi-rents) of roughly $91 million per month there. In the poor nations its price will be $6.50 and its contribution to profits will be approximately $18.4 million, or roughly 20 percent of first-world profits and 16.8 percent of first plus third world quasi-rent potential with universal patent protection.

To keep the numbers simpler and more memorable, we recalibrate the rich-nation producer's surplus to be 100. Using the welfare gain notation of Figure 1, and assuming linearity of demand functions, the initial tally of surpluses per new product for these two cases, assuming patent protection in both jurisdictions, is as follows:

		Rich Nations	Poor Nations
H	Producer's surplus	100	20
B	Consumers' surplus	50	10

It will be subjected in a moment to sensitivity analysis. The producer's surplus in third-world nations, it should be noted, is assumed provisionally to accrue to rich-nation shareholders of multinational corporations. If on the other hand the third world nations offer no patent protection and free-ride at competitive prices on pharmaceutical products that would be developed in any event in response to rich nation consumers' demand, the welfare gain to poor (i.e., third world) nation consumers is $H_3 + B_3 + A_3 = 40$ and producers forego a surplus of 20.

A common assumption in benefit/cost analysis is that one party's surplus of given magnitude in some numeraire currency is

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6. Watal and Scherer (2002), and Scherer and Watal (2002).

7. The demand equation is $P = 30 - 2Q$ for the rich nations and $P = 10 - 0.667\ Q$ for the poor nations.

equivalent to another party's surplus. To accept that assumption would be to miss much of what the debate over pharmaceutical product patent rights in the third world is all about. Roughly half of the world's population live in nations where income per capita is less than one-tenth that of the United States or western Europe. If one accepts the notion dating back at least to Alfred Marshall that "the richer a man becomes the less is the marginal utility of money to him,"[8] one needs to assign greater weight to the benefits realized by poor nation citizens than to those of rich nation inhabitants. I do this through the weighting factor U, which measures the ratio of the marginal utility of income for the median poor nation inhabitant to that of the median rich nation citizen.[9]

We must now tally the appropriately weighted sum of surplus for two different intellectual property regimes: Case 1, in which pharmaceutical products receive full patent protection in all nations, and Case 2, in which patent rights are only conferred in the first world and LDCs free-ride on the inventions made in the first world.[10] Plainly, with larger producer rents in Case 1, there will be more inventions, as implied by Figure 2. How many more successful new chemical entities there are is a key variable. We assume in base Case 1 that with worldwide patent rights, the average number of new chemical entities approved and introduced into the market per year, each with the same demand characteristics, is 25. In Case 2, the number is a variable N whose value is less than 25.

The question is, over what configurations of variables U and N is worldwide welfare higher under Case 1, and when is it higher under Case 2? Disaggregating the accounts so that the benefits in the first world are presented in the first set of brackets, the producer's surpluses realized by first world firms in third world markets in the second set of brackets, and benefits to third world consumers in the third set of brackets, and using the notation of Figure 1, the accounting is as follows:

Case 1: $[25S_1\ (B_1+H_1)] + [25S_3\ H_3] + [25S_3\ B_3U] = 1875 + 250 + 125U.$

Case 2: $[N\ S_1\ (B_1+H_1)] + [0] + [N\ S_3\ (A_3+B_3+H_3)\ U] = 75\ N + 20\ N$

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8. Marshall (1948), p. 96. An even older source is the widow's mite parable in the Gospel according to Mark 12: 41-44.

9. When new drug products must be imported in bulk or finished form, U might alternatively or in addition reflect the higher Lagrangian multiplier on foreign exchange budgets in less affluent nations.

10. We ignore welfare increments following the expiration of patents, which are likely to be heavily discounted. Their increase is slightly greater in Case 1 than in Case 2.

U.

When these two equations are set equal, global welfare is identical under either policy; equality identifies the breakeven case. The solid line marked "Poor = 20% of Rich" in Figure 4 shows the breakeven line for the assumptions accepted thus far. Variable pairs above (north of) the solid line show situations in which global welfare is higher under Case 2, i.e., with LDC free-riding. If extending patent protection world-wide leads to a loss of only one NCE per year relative to the base case, global welfare is maximized under free-riding even if the marginal utility of income is the same for poor as compared to rich nation citizens. But if (ignoring the diminishing marginal returns tendency, and hence erring on the side of favoring patent protection) the sacrifice from eliminating 20 percent of rich-nation rents or 16.67 percent of the world rent potential is 16.67 percent of base Case 1 NCEs, i.e., 4.17 NCEs, global welfare is higher if the marginal utility of income in the third world exceeds that of the first world by more than a multiplier of roughly 1.91. With diminishing returns in the inducement of NCEs as the quasi-rent potential increases (see Figure 2), free-riding becomes globally optimal with even smaller utility differentials. A key implication is that strong value judgments -- on the magnitude of that utility differential -- are unavoidable in determining which policy is globally optimal.

Less-developed nations might conceivably have more than 20 percent of wealthy nations' pharmaceutical rent potential.[11] Suppose the rent potential is 40 percent rather than 20 percent -- e.g., because the poor nation demand curve's vertical intercept is raised to 15 instead of 10, or because a higher fraction of the poor nation's citizens are afflicted. Then holding the rich nation quasi-rent potential constant at 100, consumers' surplus in Case 1 rises to 20 for the poor nation and so also does avoided deadweight loss triangle A_3 in Figure 3(b). The higher surpluses in LDCs shift the breakeven curve downward (dotted line in Figure 4), increasing the likelihood that free-riding is globally optimal for any given retardation of new chemical entity development. To be sure, sacrifice of larger potential quasi-rents due to free-riding makes it likely that the number of new chemical entities will be smaller than in the 20 percent scenario. With a proportional 28.6 percent (40/140) diminution to 17.9 NCEs, breakeven occurs when the income utility ratio is 2.18. Again, diminishing marginal returns are more probable, so free-riding is globally optimal at utility differentials less than 2.18.

A third case relating to diseases especially prevalent in the third world is illustrated by the breakeven curve marked "Poor = 100% of Rich," implying that demand in the third world

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11. This criticism of my 1996 assumptions is advanced in Sykes (2002). A potential smaller than 20 percent was suggested by a referee. The implications of such a downward variation will be transparent.

yields a rent potential equal to that of the first world, or one-half of the total world potential. This enlargement of the third world's relative rent potential shifts the breakeven curve even more toward the origin. But of course, the absence of patent rights in half the world market also implies a greater sacrifice of new chemical entities -- in the proportional case, to 12.5 NCEs. Then the case for free-riding requires a first world / third world utility differential in excess of roughly 3.5.

More generally, the larger the third world rent potential is relative to the first world potential, the more the breakeven curve shifts toward the origin and the smaller is the breakeven utility differential for any given impairment of incremental NCE supply due to third world free-riding. But given the probable diminution of NCE supply, the larger is the breakeven utility ratio required for free-riding to be globally optimal. Accepting the proportional diminution assumption most favorable to third-world patent grants, the dashed line WZ in Figure 4 traces the locus of breakeven cases for diverse third- as compared to first-world quasi-rent potentials. With diminishing returns, a lower breakeven locus would apply. The limiting case in which the whole potential resides in the third world -- e.g., for drugs combatting diseases existing only in the third world -- is degenerate (with zero or negative U equilibria) for NCE impairments of 6.25 or more. But in that circumstance, quasi-rents converge on zero in Case 2, which, absent inducements other than those provided by the patent system, implies that there is no incentive to perform drug R&D and hence no likely marketing of NCEs.[12] We explore those special conditions further after considering some complications.

The Rent-Seeking Alternative

In addition to the customary reluctance of economists to make the kind of income utility comparisons I have advanced, there are two broad criticisms of this model.

One questions whether the producer's surplus rectangles H in my model are in fact clear-cut welfare gains. Those surpluses are a stimulus to investment in research, development, and testing. For a complete welfare accounting, the costs of R&D must be subtracted from the quasi-rents, assumed to be discounted to present value at the same benchmark date. My service as chair of the U.S. Office of Technology Assessment advisory committee for its study of pharmaceutical profits and R&D during the early 1990s led me to wonder how quasi-rent margins in the pharmaceutical industry can be so high, stimulating R&D spending, while correctly computed returns on industry investment exceed risk-adjusted norms by only two or three percentage points on

12. But see Bond and Lean (1977) for a discussion of non-patent first mover advantages in pharmaceuticals.

average.[13] A new analysis (Scherer, 2001) suggests an answer. Extracting from U.S. Census reports data on pharmaceutical industry gross margins and from Pharmaceutical Research and Manufacturers of America reports data on R&D spending for the years 1962-96, I computed percentage deviations of those variables (adjusted to 1992 price levels) from their exponential trends. Figure 5 shows the plotted percentage deviations. When gross margins rise, so also do R&D outlays; when margins fall, R&D outlays fall virtually in tandem. Although the exact adaptive expectations structure remains uncertain, it seems probable that a competitive rent-seeking model best describes the relationship of pharmaceutical R&D spending to cash flows. That is, rising quasi-rent potentials are almost fully exhausted by the competitive escalation of costs -- for R&D, marketing, and implicit returns on R&D investment -- leaving only a small pure surplus for the stockholders of pharmaceutical companies.

One implication of this alternative behavioral model is that industry equilibrium occurs at points R_1 and R_2 rather than W and Y in Figure 2, and so, depending upon the strength of the diminishing returns phenomenon, there are far more new products forthcoming in a given year. Another implication follows from the largely forgotten insights advanced in a debate two decades ago, showing that when innovators are competing rent-seekers rather than secure Nordhaus-type profit maximizers, the welfare-maximizing life of invention patents is drastically shortened.[14]

In the model presented here, the logic of rent-seeking requires that the H rectangles cannot be counted as social welfare gains.[15] Thus, the comparison of gains when LDC quasi-rent potential is 20 percent of the rich nation potential is altered to:

Case 1: $[25\ S_1\ (B_1)] + [0] + [25\ S_3\ B_3\ U] = 625 + 125\ U.$

Case 2: $[N\ \ S_1\ (B_1)] + [0] + [N\ S_3\ (A_3+B_3+H_3)\ U] = 25\ N + 20\ N\ U.$

With this change of assumptions, the breakeven curves are shifted dramatically toward the origin. This is illustrated in Figure 6, which contains the same information as Figure 4 and assumes for ease of comparison 25 NCEs per year under world-wide patent

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13. See U.S. Office of Technology Assessment (1993).

14. McFetridge and Rafiquzzaman (1986), with a comment by Roger Beck.

15. By the same logic, R&D costs incurred under Nordhaus assumptions should be deducted from the H rectangles. With the numerical assumptions used, they amount to approximately 28 percent of the relevant quasi-rent measures. They were not deducted to simplify the analysis. If they were deducted, the breakeven lines and the proportional diminution breakeven locus WZ would be shifted downward, strengthening the case for free-riding.

rights,[16] but with rent-seeking rather than Nordhaus maximization as the framework. If a loss of LDC quasi-rent potential amounting to 20 percent of rich-nation rents in Case 2 implies a proportional 16.7 percent reduction in the number of new products to 20.8 per year, global welfare (with breakeven given by the solid line) is higher under free-riding if the ratio of LDC to rich nation income utility exceeds 0.35.[17] If the reduction in the number of new products were a much larger eight out of 25, global welfare remains higher under free-riding if the ratio of LDC to rich nation income utility exceeds 0.93! With 40 percent LDC rent potentials relative to those of the high-income nations, the downward shift of the breakeven curve (dotted line) is even more, and so global welfare is maximized under free-riding even if the number of NCEs falls by 44 percent and no distinction is made between the income utility of rich and poor consumers. And these rent-seeking assumptions, I am convinced, are more realistic than the assumption that producer's surplus is a pure social gain, accepted in my initial model. If one believes that competitive rent seeking dissipates much or all of producers' surpluses, free-riding policies become all the more justifiable, even from a global perspective.

Variable Demand Conditions

Another vulnerable point in the model presented here is the assumption that each product has the same demand curve and hence the same constellation of surpluses. This is at odds with reality in pharmaceuticals and indeed in virtually every field of technological innovation. The distribution of returns to innovation is highly skew. Blockbuster innovations always capture a share of quasi-rents or profits disproportionate to their numbers.[18]

It might be argued that consumers in less-developed countries will generate quantitatively large quasi-rents because there are vast numbers of them, they suffer from diseases not prevalent in the rich nations, and (arguably) the granting of patent rights will induce pharmaceutical companies (presumably, multinational pharmaceutical companies)[19] to do research they

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16. Multiplying by 2 to conform more nearly to the rent-seeking equilibrium of Figure 2 does not change the basic results. What matters is the ratio of N to the number of new chemical entities with full patent rights, whether 25 or 50.

17. If the relationship between quasi-rents and N were continuously proportional, no stable rent-seeking equilibrium would exist. Diminishing returns ensure equilibrium.

18. See Scherer, Harhoff, and Kukies (2000).

19. Note that to the extent quasi-rents are appropriated within third world markets, e.g., by indigenous companies, they must be multiplied by U, shifting breakeven curves in Figure 4 (but not Figure 6) outward and strengthening, all

would otherwise not undertake on diseases found mainly in poor nations and discover new drugs with blockbuster potential. This is indeed the strongest argument for extending pharmaceutical product patent rights throughout the world. Recognizing it, Jean O. Lanjouw (2001) has advocated a bifurcated patent system, letting the companies achieving pharmaceutical product innovations seek patent rights in either the first world or in the third world, but not in both. This would allow third-world nations to free-ride on drugs that would have been developed in any event for the first world but maximizes the stimulus for private investment in the development of drugs targeted solely toward third-world diseases. It is an attractive argument, but four doubts intrude.

First, in the nations where the so-called "tropical diseases" abound, most potential consumers are very poor, with annual incomes measured in the low hundreds of dollars. Those nations also tend to have at best primitive public health systems, and most drugs must be purchased with consumers' own funds, for which a myriad of life-sustaining uses compete. In other words, demand functions are pressed even closer to marginal cost functions than implied in Figure 3(b). Even when they are aggregated over hundreds of millions of consumers, it is not clear that there are quasi-rent potentials anywhere near those associated with medicines targeted toward coronary problems, common cancers, gastritis, depression, and inadequate sexual function in rich nations. If the quasi-rent potential is weak, not much rent-seeking research and testing will be induced.

Second, uncertainty abounds in predicting during R&D phases how large the market for a particular therapeutic molecule will be. Molecules often turn out to have therapeutic uses quite different from those initially contemplated. Viagra is an example of such serendipitous discovery, as was the discovery that Bayer's praziquantil is effective against schistosomiasis and that the German anti-cancer drug miltefosine is effective against black fever.[20] And at the clinical testing stage, it remains uncertain what fraction of a target audience will respond favorably to the drug's use. Even as simple a matter as the way the drug is introduced into the body -- e.g., injection, three-per-day oral delivery, or once-per-week time release delivery -- can significantly affect the extent of use in less-developed nations, where systematic care by nurses or physicians is the exception rather than the rule. Ex ante, therefore, the expected distribution of returns from innovation entails more uniformity of quasi-rents than it does after full technological and marketing experience has unfolded.[21]

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else equal, the case for third-world patents.

20. See "Drug Proves Able to Cure Disease Borne By Parasite," New York Times, Nov. 28, 2002, p. A6.

21. This is shown in simulations by Scherer, Harhoff, and Kukies (2000).

Third, interest in developing new tropical disease cures may be keener en situ than in pharmaceutical laboratories thousands of miles away from the disease locus.[22] But in the nations most afflicted by tropical diseases, the technological capabilities needed to do state-of-the-art research and product development are scarce. Advancing from incentive to breakthrough innovation is not automatic. Research by Sandy Weisburst and mentored by me showed, for example, that Italy, with a vibrant generic drug industry, did not achieve any significant increase in the discovery of innovative drugs during the first decade after the Italian Supreme Court mandated the issue of pharmaceutical product patents.[23]

If there are exceptions to the Italian experience, India, having replaced Italy as the world's leading generic drug source, is the most likely candidate. But this raises my fourth caveat. In preliminary interviews on the probable response of Indian pharmaceutical firms to a new regime in which pharmaceutical product patents can be received in India, Jean O. Lanjouw (1997) found that the leading Indian firms seemed more interested in developing new drugs that will be blockbusters in the first world than in targeting tropical disease remedies. More recent public statements convey the same implication.[24]

It is nevertheless possible that multinational pharmaceutical companies will reorient their R&D portfolios to place more emphasis on third world diseases. Certainly, in the past, that has not been the case. A study for Medicins sans Frontieres (2001) revealed that among the 1,393 new drug chemical entities introduced into world markets between 1975 and 1999, only 13 (or 15 including tuberculosis drugs) were indicated for so-called tropical diseases. Among the 26 new chemical and biological entities approved in 2002 for marketing in the United States, only one, the anti-diarrheal nitazoxanide, had a larger potential market in third world nations than in the United States, where the orphan drug's case incidence was estimated to be roughly 4,000.[25] Since the Uruguay Round intellectual property agreements have now been a reality for eight years, one might expect some results to have materialized by 2002, but again, the evidence is meager. The principal two exceptions to this gloomy prognosis involve the establishment by GlaxoSmithKline of a laboratory in Spain to seek drugs effective against tuberculosis and malaria and the creation of a Novartis

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22. Cf. note 19 supra.

23. Weisburst and Scherer (1995). See also Challu (1995).

24. "Patently Ambitious," The Economist, September 6, 2003, p. 56.

25. Pharmaceutical Research and Manufacturers of America, "New Drug Approvals in 2002," Washington: January 2003.

laboratory in Singapore to work on drugs for resistant tuberculosis and dengue fever.[26]

In the mean time, I believe, an opportunity for encouraging first-world cross-subsidization of third-world disease research has been ignored. The debate over drug patent rights under TRIPS would have provided an ideal opportunity for someone like Kofi Annan to say to the multinational pharmaceutical companies, "We will support your demand for strong patent rights throughout the world if you will commit 20 percent of your research, development, and testing budgets to diseases specific to less-developed nations." The multinational pharmaceutical companies made an analogous commitment in persuading Canada to abandon its vigorously enforced drug patent compulsory licensing laws. As a quid pro quo, the pharmaceutical companies agreed to locate in Canada R&D activities proportional to Canada's share of the companies' drug sales. If such a commitment were forthcoming, my third caveat would be less persuasive.

Finally, we must recognize a quite different rationale for third world free-riding not expressly modelled here. India's most powerful pharmaceutical companies grew from an environment in which drug product patent rights were not issued, permitting Indian companies to build their technological capabilities initially by concentrating on process innovations to produce and then export still-patented drugs to nations similarly denying product patent rights and then, after relevant patents expired, becoming first-moving generic drug suppliers to first-world nations. Similarly, the United States developed its early industrial capabilities by free-riding upon the technology pioneered in the leading European nations -- e.g., England for textiles, steam engines, and machinery and France for gunpowder. Until 1836, foreigners were not allowed to obtain U.S. patents unless they had resided at least two years in the United States and declared an intent to become U.S. citizens. After that, between 1836 and 1861, aliens paid higher registration fees than citizens. In that later period, foreigners received fewer than two percent of all U.S. patents issued. By the 1850s, English technicians visiting the United States observed with astonishment, U.S. enterprises were producing a wide range of products with methods more mechanized than those prevailing in England, the cradle of the Industrial Revolution.[27] Analogous strategies of building industrial prowess first by free-riding or cheap-riding on other nations' technology and only then strengthening patent mechanisms can be observed in the histories of Switzerland, the Netherlands, and Japan.[28] Although the issue cannot be pursued here, it is at least arguable that

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26. "Exotic Pursuits," The Economist, February 1, 2003, p. 52.

27. See Habakkuk (1962), p. 4.

28. See Schiff (1971), Ordover (1991), and Granstrand (1999).

industrial development can proceed faster when more advanced foreign technology can initially be appropriated at low cost.

Conclusion

To sum up, my analysis suggests that global welfare is maximized by letting low-income nations free-ride on the patented inventions of first-world nations over a wide range of negative new product development impacts if one accepts the reasonable premise that the marginal utility of income is appreciably higher in poor nations than in rich nations. The Doha round of negotiations appears to have gravitated toward a proper solution, deferring implementation of the TRIPS provisions on pharmaceuticals in the least-developed nations for a decade.[29] In the interim, we will be able to observe the response of pharmaceutical companies to the limited grants of exclusivity already implemented under the Treaty of Marrakech. And there will be time for commitments to be extracted that could change the conditions under which tropical medicines are supplied.

29. The U.K. Commission on Intellectual Property Rights (2002, p. 162) recommended extension of this delay for all subject matter covered by TRIPS along with flexible interpretation of its provisions after the year 2016.

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