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PATENTS, ESSENTIAL MEDICINES, AND THE INNOVATION GAME

David W. Opderbeck*

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I. INTRODUCTION

The once dusty arena of international patent law now hosts a life and death contest. Human rights activists claim patents restrict access to essential technologies in the developing world and skew research and development away from global health and welfare problems. Industrialized countries argue that innovation and development require strong patent protection. Both sides agree that much of the world lacks meaningful access to technologies that are basic to a healthy standard of living.

Current international patent rules strike an uneasy balance between these conflicting views about patents. The precarious nature of this balancing act is illustrated by the recent heated debate about compulsory licenses for certain "essential medicines" under the Trade Related Aspects of Intellectual Property ("TRIPS") agreement. Developing countries and activists argued that TRIPS should be liberally interpreted to facilitate compulsory licenses for the production and exportation of generic medicines by developing countries. Developed countries argued that any exceptions to TRIPS should be limited to a narrow list of diseases. The debate produced a procedurally complex compromise that will do little to ameliorate the essential medicines problem.

This Article argues that the recent debate was misplaced because it ignored differing price elasticities of demand in developed and developing country markets. In connection with price, demand elasticity refers to the relationship between changes in demand and changes in price. Demand is considered "elastic" if a change in price produces a relatively large change in demand and "inelastic" if a change in price has relatively little effect on demand. Demand elasticity is a primary driver of the utility of patent rules. If demand is inelastic, strong patent protection allows the patent owner to charge

1. A more formal definition of demand elasticity is presented in Part IV., infra.
a price premium, which minimalizes the social cost\(^2\) of the patent monopoly. If demand is elastic, however, the justification for strong patent protection evaporates.\(^3\) In a demand elastic market, the patent owner cannot sustain supercompetitive pricing.\(^4\)

Demand elasticities differ significantly in developed and developing country markets for many essential technologies. The essential medicines problem is an excellent illustration of this point. Demand for pharmaceutical products generally is inelastic in developed countries when the condition the product treats is prevalent in such countries. Treatments for HIV/AIDS, for example, can be priced well above marginal cost in developed countries, because the market for such drugs is relatively inelastic and the price increase will not significantly affect demand.\(^5\) However, when the product treats conditions endemic primarily to developing countries, such as malaria or river blindness, demand generally is elastic in developed countries, or the market in developed countries is so small that there effectively is no demand.\(^6\) In contrast, demand for pharmaceutical products is nearly always elastic in developing countries, where only the wealthy elite can afford brand name drugs, regardless of the condition the product treats.\(^7\)

These differences in demand elasticity in developed and developing country markets create two problems. First, treatments that are priced at above-market levels are not available to most of the affected population in developing countries. The social cost of the patent monopoly, therefore, is measured in human lives. Second, when demand is elastic or the market is very small in developed countries, as it is for treatments for tropical diseases, a firm that is focused on a "blockbuster" economic model, such as a multinational pharmaceutical company,\(^8\) will not be spurred to innovate regardless of the level of patent protection in any market.

We might reluctantly accept these costs if they were essential to the development of at least one category of new drugs. At the very least, a system of strong patent protection in both developed and

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2. As discussed in Part II.A., infra, the social cost of the patent monopoly includes the reduction in output that results when prices are set above a competitive level.
3. See infra Part IV.
4. See infra Part IV.
5. See infra Part III.C.
6. See id.
7. See id.
8. Examples of "multinational pharmaceutical companies" include many members of the Pharmaceutical Research & Manufacturers of America (PhRMA). For a list of members, see Pharmaceutical Research & Manufacturers of America, Who are We, Member Company List, Member List, at http://www.phrma.org/whoweare/members (last visited Jan. 18, 2005).
developing countries might encourage the creation of some drugs that benefit consumers in developed countries. Eventually, cheaper versions would become available in developing countries as patent protection expires and generic competitors enter the market. This would be preferable to the innovation vacuum that might exist without patent protection. Treatments for conditions endemic to developing countries could then be developed through a mixture of public subsidies and private donations. This Article argues, however, that the level of patent protection in developing countries is irrelevant as an incentive for innovation when there is inelastic demand and a relatively large market in developed countries.

The argument is supported with a game theory analysis of the essential medicines debate. Basic game theory provides a simple yet powerful model to illustrate how firms will respond to differing levels of patent protection in developing countries. The game theory analysis set forth in Part VI of this Article shows that, at least with respect to essential medicines for which there is strong demand in developed countries, the international patent system governing such products should allow greater flexibility for generic "imitator" competition in developing country markets.

With respect to diseases endemic to developing countries, the game theory analysis set forth in this Article shows that subsidies may in fact help spur innovation. However, a subsidy of any reasonable size is unlikely to make a difference by itself. Instead, it may be useful to focus the patent incentive scheme on firms that are indigenous to the region in which the problem is endemic.

A principal means of building flexibility into a patent system is to allow for compulsory licensing. Compulsory licenses, however, are seldom intended to be costless. The licensee must typically provide some remuneration to the unwilling licensor. This is the case, for example, under the compulsory licensing provisions in TRIPS. Part IV.B.3. describes a mechanism whereby the remuneration requirement would serve as an incentive for firms in developing countries to innovate with respect to local diseases. In return for a lucrative compulsory license for essential medicines produced by developed country firms, the developing country firm would agree to conduct original research and development on medicines for local diseases. The game theory analysis in Part VI.B.2.c. shows that this option may provide a more efficient and socially desirable balance of incentives.

9. See infra Part II.D., for a discussion of compulsory licensing under TRIPS.
II. THE INTERNATIONAL PATENT STRUCTURE AND THE "ESSENTIAL MEDICINES" DEBATE

A. Globalization of IPRs and the Advent of TRIPS

Intellectual Property Rights ("IPRs") are utilitarian tools designed to encourage innovation and public disclosure. Patents are a type of IPR that provide this encouragement by granting certain exclusive rights to an invention, with the resulting prospect of monopoly rents. Monopoly rents imply a reduction in output. The value of this reduction in output is the "deadweight loss" of the monopoly.

Patents, like other IPRs, are territorial. Societies that provide patent protection accept the deadweight loss associated with this incentive system as a necessary cost of the bargain struck with the inventor. Various nations balance these concerns differently, and, therefore, the substantive scope and procedural availability of

10. See KEITH E. MASKUS, INTELLECTUAL PROPERTY RIGHTS IN THE GLOBAL ECONOMY 28 (2000) (noting that "[m]ost legal systems adopt a utilitarian view, in which IPRs strike a balance between needs for invention and creation, on the one hand, and needs for diffusion and access, on the other"). As Maskus notes, however, there are some threads of natural rights theory in some intellectual property rules, reflected perhaps most directly in the European concept of "moral rights." Id. at 27-28; see also A. Samuel Oddi, The International Patent System and Third World Development: Reality or Myth?, 1987 DUKE L.J. 831, 837-65 (1987) (discussing utilitarian assumptions underlying patent systems in developed countries and the application of those assumptions).

11. Whether the incentives provided by patent laws are truly meaningful in a broad sense is a subject of intense debate. The classical view is that patent incentives are essential in research-intensive industries such as pharmaceuticals. See RICHARD POSNER, ECONOMIC ANALYSIS OF LAW 43 (5th ed. 1998) (noting that without a patent system, inventive activity would be biased in favor of inventions that could be kept secret); Statement by PhRMA President and CEO Alan F. Holmer on the Importance of Intellectual Property for Patients Worldwide (Nov. 20, 2002) ("Intellectual property protections are the answer to new cures . . ."). at http://www.phrma.org/mediaroom/press/releases/20.11.2002.628.cfm. Other commentators believe the need for patent incentives is overstated, particularly in developing countries. See Oddi, supra note 10, at 846 (suggesting the rationale for a patent system may not be equally applicable to developing countries, because of the significant social costs they may confer on those countries); MASKUS, supra note 10, at 28-32 (discussing economics of intellectual property rights and circumstances under which protections are good or bad); see also HAL R. VARIAN, INTERMEDIATE MICROECONOMICS 407-408 (1993) (discussing deadweight loss of monopoly).

12. VARIAN, supra note 11, at 407-410.

13. Id.

14. MASKUS, supra note 10, at 3.

15. Id. at 28-30; see also VARIAN, supra note 11, at 407-408 (discussing deadweight loss of monopoly); Alan O. Sykes, TRIPS, Pharmaceuticals, Developing Countries, and The Doha "Solution", 3 CHI. J. INT'L L. 47, 48-49 (2003) (discussing the effect of deadweight loss resulting from monopolies on pharmaceuticals in developing countries).
intellectual property protections can vary significantly across borders.\(^{16}\)

Although IPRs are territorial, the industries that rely on IPRs are increasingly global. As Keith Maskus has suggested, these multinational industries can be broadly divided into three IPR "complexes": the Patent Complex, which includes pharmaceuticals, biotechnology, and plant varieties; the Copyright Complex, which includes recorded entertainment, software, and internet transmissions; and the Trademark Complex, which includes status goods.\(^{17}\) The increasing importance of these multinational IPR complexes has given rise to a more coherent system of international IPR standards.

This set of international intellectual property standards is located in a number of treaties and international agreements, including the Berne Convention,\(^{18}\) the Paris Convention,\(^{19}\) and TRIPS Agreement under the General Agreement on Tariffs and Trade ("GATT").\(^{20}\) TRIPS incorporates the Paris Convention and Berne Convention and is the most comprehensive of all the international IPR regimes in terms of scope and membership.\(^{21}\)

TRIPS has been described as a "constitution-like" agreement in that it requires member nations to agree to certain overarching principles and minimum standards.\(^{22}\) Among these minimum standards is a requirement that all member nations provide patent protection for any product or process inventions in any field of

\(^{16}\) MASKUS, supra note 10, at 3.

\(^{17}\) Id. at 52-65.


\(^{21}\) See World Trade Organization, Understanding the WHO: The Organization, Members and Observers (showing that there are currently 148 members to the WTO that are obligated to follow TRIPS), at http://www.wto.org/english/thewto_e/whatis_e/tif_e/org6_e.htm (last updated Oct. 13, 2004).

\(^{22}\) See, e.g., Steve Charnovitz, The WTO and the Rights of the Individual, 36 INTERECONOMICS 98 (2001) (stating "[t]he WTO is constitution-like in reaching into the nation-state to guarantees rights to individuals").
technology that satisfy the conditions of novelty, an inventive step, and industrial applicability.

When national intellectual property laws are harmonized, as they were under TRIPS, however, problems arise when some member nations are better equipped than others to absorb the deadweight losses resulting from IPRs. These differences are most pronounced between the more developed "North" and the less developed "South." The North has been more willing to absorb the deadweight losses associated with strong IPRs in order to encourage innovation and protect existing industries. The South has been less willing to do so because "copycat" industries provide jobs and access to cheap goods so that there is little need to invest in and bear the risks of original research and development.

International IPR agreements typically include limited exceptions designed to ease some of this tension. Under TRIPS, for example, a member nation may require a compulsory license of an article or process subject to an IPR in the case of a national

23. See TRIPS art. 33(2); Paul J. Heald, Mowing The Playing Field: Addressing Information Distortion and Asymmetry in the TRIPS Game, 88 MIN. L. R. 249, 275 n. 113 (2003) (describing the TRIPS requirement of "absolute novelty" of the patent at the time of filing, in contrast to the USPTO practice of allowing the patent to be on sale or known for less than one year (35 U.S.C. §102 (b)); see also J.H. Reichman, From Free Riders to Fair Followers: Global Competition Under the TRIPS Agreement, 29 N.Y.U. J. INT'L L. & POL. 11, 30 (1997) (asserting that since the original TRIPS agreement does not supply definitions to the terms, each of the member countries relies on its own legal definition allowing member countries to choose to define "novelty" in a way that will broaden their patent protection or, conversely, narrow it based on their particular needs).

24. See TRIPS art. 33(3) (defining satisfaction of the inventive step requirement as an invention that, in light of the prior art, known prior and up to, the time of filing, would not have been obvious to a person of ordinary skill in the art). The parallel requirement of nonobviousness in the United States is codified at 35 U.S.C §103 (a). There is some debate, however, about whether the U.S. standard is consistent with TRIPS. See, e.g., Reichman, supra note 23, at 30 (noting that similar to the novelty requirement, no agreed-upon standard exists for what is nonobvious, allowing each member country to make the definition most appropriate for their needs).

25. See TRIPS art. 33(4) ("[A] claimed invention shall be considered industrially applicable if, according to its nature, it can be made or used (in the technological sense) in any kind of industry. 'Industry' shall be understood in its broadest sense, as in the Paris Convention for the Protection of Industrial Property.").

26. See e.g., Oddi, supra note 10, at 846 (noting that traditional rationales for having a patent system may not hold true for developing countries); Marney L. Cheek, The Limits of Informal Regulatory Cooperation in International Affairs: A Review of the Global Intellectual Property Regime, 33 GEO. WASH. INT'L L. REV. 277, 286 (2001) (noting that, as discussions concerning international intellectual property harmonization proceeded in the 1980s, "[d]iffering levels of protection between industrialized and developing countries more often than not reflected deep ideological divisions about the proper role of intellectual property rights in a growing economy").

27. MASKUS, supra note 10, at 4.

28. Id.
emergency or other circumstances of extreme urgency or in cases of public non-commercial use."\(^{29}\) Such compulsory licenses, however, must be "predominantly for the supply of the domestic market of the Member authorizing such use."\(^{30}\) The question of what constitutes a "national emergency" and of how the "domestic market" provision should apply underlies the current debate over whether TRIPS will impair access to "essential medicines." The next Section describes the "essential medicines" problem and how it is intertwined with the international patent system.

**B. The “Essential Medicines” Access Problem**

The World Health Organization ("WHO") defines "essential medicines" as "those that satisfy the health care needs of the majority of the population."\(^{31}\) The WHO maintains a Model List of Essential Medicines that includes medicines for a wide variety of conditions ranging from alimentary tract disorders (such as peptic ulcers) to sensory organ problems (such as eye infections).\(^{32}\) According to the WHO, over one-third of the world's population (two billion people) lacks access to many of these essential medicines.\(^{33}\) The percentage rises to over 50 percent in the poorest African and Asian countries.\(^{34}\)

Many factors affect access to essential medicines. These include lack of health care provider education, poor distribution networks, and poor patient compliance.\(^{35}\) However, one of the most

29. TRIPS art. 31(b).
30. TRIPS art. 31(f).
32. WORLD HEALTH ORGANIZATION, WHO 13TH MODEL LIST OF ESSENTIAL MEDICINES (2003), available at http://www.who.int/medicines/organization/par/edl/eml.shtml. Other categories include drugs to treat:
(1) Alimentary Tract and Metabolism; (2) Blood & Blood Forming Organs; (3) Cardiovascular System; (4) Dermatologicals; (5) Genito Urinary System & Sex Hormones; (6) Systemic Hormonal Preparations, Excl. Sex Hormones & Insulins; (7) Antimicrobials for Systemic Use; (8) Antineoplastic & Immunomodulating Agents; (10) Musculo-Skeletal System; (11) Nervous System; (12) Antiparasitic Products, Insecticides & Repellents; (13) Respiratory System; (14) Sensory Organs; (15) Various or All Other Therapeutic Products.
Id.
34. The WHO MEDICINES STRATEGY notes that only 10.3 percent of Sub-Saharan African countries and 27.3 percent of Asian countries (excluding China and India) offer health insurance coverage for drugs. Id. at 9.
35. See, e.g., WORLD HEALTH ORGANIZATION & WORLD TRADE ORGANIZATION SECRETARIATES, REPORT OF THE WORKSHOP ON DIFFERENTIAL PRICING AND FINANCING OF ESSENTIAL DRUGS (Apr. 2001) ("Locally available health services, adequately staffed, equipped, managed and financed,
significant factors is price. Indeed, price can be considered a "gateway" factor because better education, distribution and compliance are meaningless if the drugs are not affordable. In fact, the WHO Model List is underinclusive because it excludes some expensive newer treatments that remain covered by patents. Thus, the number of people who lack access to medicines that can be considered "essential" can be considered larger than the two billion cited by the WHO.

In many developing countries the costs of drugs can equal 50 percent or more of a person's annual income. In some cases, the cost of drugs is simply beyond a household's ability to bear or may present a choice between drugs and food. In Thailand, for example, prior to the entry of generic competition, Fluconazole, a drug used to treat an opportunistic infection that is particularly prevalent in Thai AIDS patients, cost $14 USD per daily dose, or approximately $434 USD per month. The typical monthly wage of a Thai office worker is equivalent to $120 USD, making the treatment prohibitively expensive. Policies that result in lower prices for pharmaceuticals in developing countries thus represent a crucial step towards increasing access to essential medicines.

and oriented to local means and priorities, as well as efficient distribution systems and tariff and tax-free treatment for drugs are some of the other factors that play an important role in enabling access on the basis of medical need.


37. Many nongovernmental organizations ("NGOs") are pressing for a broader definition of "essential" that would not include any affordability criteria. See Mediciens Sans Frontiers, The Campaign for Access to Essential Medicines, Frequently Asked Questions, Question 18 (discussing that many "essential" drugs are not included on the "off-patent" list because they are too expensive), at http://www.accessmed-msf.org/campaign/faq.shtm (last visited Jan. 20, 2005).


39. See, e.g., Sykes, supra note 15, at 47 (noting that the annual cost of advanced antiretroviral medicine in South Africa where one in eight is infected with HIV/AIDS is $12,000, far beyond the means of most South Africans).


41. Id.
C. The Essential Medicines R&D Problem and International Orphans

Another intractable problem in global health is the presence of "orphan" conditions for which private industry conducts little or no significant research and development. For example, there are no effective treatments for many tropical infectious and parasitic diseases. Between 1975 and 1999, less than 1 percent of the almost 1,400 new drugs approved by regulatory agencies in the U.S. and Europe were approved to treat such tropical diseases. The bacteria and parasites that cause these diseases are generally well understood, and effective treatments could be developed for them. In fact, old treatments exist for some of these diseases, but they often have severe side effects.

42. See Patrice Trouiller et al., Drug Development for Neglected Diseases: A Deficient Market and a Public-health Policy Failure, 359 THE LANCET 2188, 2188 (2002) (noting "tropical diseases such as malaria, leishmaniasis, lymphatic filariasis, Chagas' disease and schistosomiasis continue to cause significant morbidity and mortality, mainly in the developing world."); Centers for Disease Control, Traveler's Health, Diseases, at http://www.cdc.gov/travel/diseases.htm (last visited Jan. 20, 2005) (noting diseases such as malaria, leishmaniasis, lymphatic filariasis, Chagas' disease, schistosomiasis, and dengue). Malaria is caused by a parasite that can be transmitted to humans via the bite of a malaria-infected mosquito. Centers for Disease Control, Diseases & Conditions, Malaria, Frequently Asked Questions, at http://www.cdc.gov/malaria/faq.htm (last visited Apr. 19, 2005). Malaria may cause serious complications such as kidney failure and can be fatal if not properly treated. Id. "Leishmaniasis" is a parasitic disease transmitted by sand flies. Centers for Disease Control, Traveler's Health, Diseases, Leishmaniasis, Fact Sheet, at http://www.cdc.gov/travel/diseases.htm#leish (last visited Apr. 19, 2005). It may affect the skin or internal organs. Id. "Lymphatic Filariasis," also known as Elephantiasis, affects over 120 million people, over 40 million of whom have been seriously incapacitated and disfigured. Centers for Disease Control, Traveler's Health, Diseases, Lymphatic Filariasis, Fact Sheet, at http://www.cdc.gov/ncidod/dp/dp/lymphaticfilaria/default.htm (last visited Apr. 19, 2005). The disease primarily affects populations in India, Africa, and Asia. Id. It is caused by parasitic worms that are transmitted to humans by mosquitoes and lodge in the lymphatic system. Id. "Chagas Disease" is a parasitic infection that affects 16-18 million people. Centers for Disease Control, Traveler's Health, Diseases, Chagas Disease, Fact Sheet, at http://www.cdc.gov/ncidod/dp/dp/chagasdisease/default.htm (last visited Apr. 19, 2005). It is spread by insects that live in unsanitary housing. Id. "Schistosomiasis" is caused by flukes found in contaminated water. Chronic infections can cause liver, intestinal tract, kidney, and lung damage. Centers for Disease Control, Traveler's Health, Diseases, Schistosomiasis, Traveler's Health Information, at http://www.cdc.gov/travel/diseases/schisto.htm (last visited Apr. 19, 2005). "Dengue" and dengue hemorrhagic fevers are viral infections spread by mosquitoes. Centers for Disease Control, Diseases & Conditions, Dengue Fever, at http://www.cdc.gov/ncidod/dvbid/dengue (last visited Apr. 19, 2005).


44. See id. at 2189 (noting that the treatment for sleeping sickness, for example, is an arsenic derivative that often has lethal side effects and is ineffective in 5 percent to 40 percent of cases). Another problem is resistance where the number of available treatments is limited. The efficacy of the first-line drug for visceral leishmaniasis in Northern India, for example, has
The prevalence of these diseases makes their orphan status somewhat surprising. A 1996 sampling of tropical diseases showed that they accounted for 16.07 million deaths worldwide—30 percent of the total 52 million deaths for all causes in that year. The problem is lack of targeted research and development. While total annual worldwide drug research and development expenditures may exceed $50 billion, less than $75 million is spent on research and development each year for tropical diseases. In fact, only 10 percent of global research and development efforts are directed towards the conditions that cause 90 percent of the global disease burden.

D. The Current Balance Under TRIPS

The exceptions built into TRIPS, including the compulsory licensing provisions, reflect a balance between developed countries' concerns about incentives for innovation and the need in developing countries to make essential technology available in times of crisis. Representatives of developing countries and relief activists quickly seized on these exceptions and argued that the "national emergency" provision in TRIPS can be applied to the essential medicines problem. This proposition initially met with some resistance from some developed countries who argued that a "national emergency" implies an unusual and temporally limited incident, such as a war or drought, rather than a long-term public health issue.
The debate over the "national emergency" exception led to the Doha, Qatar Ministerial Conference in 2001.\textsuperscript{50} In what was widely seen as a triumph for developing and least developed countries ("LDCs"),\textsuperscript{51} the Declaration on the TRIPS Agreement and Public Health (commonly called the "Doha Declaration"), adopted on November 14, 2001, confirmed that members are free to determine what constitutes a "national emergency or other circumstance of extreme urgency" and that such circumstances may arise through a health crisis such as HIV/AIDS.\textsuperscript{52}

The Doha Ministerial also acknowledged that the "domestic use" limitation on compulsory licensing would limit the value of this exception for many developing countries and LDCs that do not have sufficient domestic manufacturing capacity. Paragraph 6 of the Doha Declaration instructed the WTO Council for TRIPS\textsuperscript{53} to find a solution to this problem—which came to be called the "Article 6 problem"—before the end of 2002.\textsuperscript{54}

The Article 6 problem was not solved by the end of 2002, but instead generated a debate that further polarized the North and South. Developing countries and LDCs from the South, led by a group of African nations and supported by a number of activist NGOs, seized on the broad language of Article 30 of TRIPS\textsuperscript{55} and proposed that compulsory licenses be permitted for both domestic use and for export to regional trade groups in response to any public health crisis or

\textsuperscript{50} The Ministerial Conference is the WTO's highest-level decisionmaking body. It meets at least once every two years, as required by the WTO's founding charter, the Marrakesh Agreement Establishing the World Trade Organization. World Trade Organization, Understanding the WHO: The Organization, Who's WHO Is It Anyway?, at http://www.wto.org/english/thewtoe/ministe/minist_e/minist_e.htm (last visited Apr. 19, 2005).

\textsuperscript{51} Id. (stating that an LDC is a developing country that is listed by the United Nations as "least developed" because of a very low level of economic development). Of the forty-five designated LDCs on the United Nation list, thirty are WTO members, committed to the TRIPS agreements. Id.

\textsuperscript{52} Id. The text states that "[e]ach member has the right to determine what constitutes a national emergency or other circumstances of extreme urgency, it being understood that public health crises, including those relating to HIV/AIDS, tuberculosis, malaria and other epidemics, can represent a national emergency or other circumstances of extreme urgency." World Trade Organization, Declaration on the TRIPS Agreement and Public Health, para. 5c, WT/ MIN(01)/DEC/2 (adopted Nov. 20, 2001) [hereinafter Doha Agreement], available at http://www.wto.org/english/thewto_e/minist_e/min01_e/mindecl_trips_e.htm.

\textsuperscript{53} The Council for TRIPS is responsible for reporting to the WTO General Council on issues relating to the interpretation and implementation of TRIPS. See Uruguay Round Agreement art. 68 (1994), available at http://www.wto.org/english/docs_e/legal_e/legal_e.htm.

\textsuperscript{54} Doha Declaration, supra note 52, para. 6.

\textsuperscript{55} TRIPS article 30 states, "Members may provide limited exceptions to the exclusive rights conferred by a patent, provided that such exceptions do not unreasonably conflict with a normal exploitation of the patent and do not unreasonably prejudice the legitimate interests of the patent owner, taking account of the legitimate interests of third parties."
other emergency. The North saw this as an effort to rewrite TRIPS and undercut the harmonization of IPRs.

On December 16, 2002, the Chairman of the Council for Trips, Perez Motta, circulated a compromise proposal to which all but the U.S. eventually, if reluctantly, agreed. Negotiations stalled until the summer of 2003 because of the U.S. position.

Eventually, under pressure from negative public opinion, the U.S. suggested it would be willing to drop its demand for a list of specific diseases if the exception were available only to a small group of LDCs. Initially, Southern nations and NGO activists expressed unwillingness to accept this condition. However, on August 30,


58. Note from the Chairman, Council for TRIPS, Implementation of Paragraph 6 of the Doha Declaration on the TRIPS Agreement and Public Health (Dec. 16, 2002), available at http://www.ictsd.org/ ministerial/cancun/docs/TRIPS_para6_16-12-02.pdf. Motta’s proposal would have allowed LDCs to import generic drugs made under compulsory license in a developing country to treat the kinds of “epidemics” referred to in paragraph 1 of the Doha Declaration. Id. The Motta proposal also would have required importing countries to adopt measures to prevent re-exportation of the generic goods to other markets. Id. The EC was willing to accept the Motta text, as was the African Group. Letter of Pascal Lamy, Member of the European Commission, to TRIPS Council (Jan. 7, 2003), available at http://europa.eu.int/comm/trade/issues/global/medecine/docs/pletter.pdf; Communication from the African, Caribbean, and Pacific Group of States (ACP), Paragraph 6 of the Doha Declaration on the TRIPS Agreement and Public Health, IP/C/W/401 (May 28, 2003), available at http://docsonline.wto.org/ddfdocuments/tip/c/w401.doc. The United States, however, rejected the Motta proposal because it would have left the diseases to which an exception could apply open-ended. The U.S. continued to insist on a limited defined list of conditions. Letter from Robert Zoellick, U.S. Trade Representative, to Trade Ministers on Terms for a Moratorium (Dec. 27, 2002), available at http://www.cptech.org/ip/wto/p6/zoellick12272002.html.

2003, the TRIPS Council Chairman announced that a compromise decision had been reached.  

The August 30 decision itself does not appear to place any new limitations on when a compulsory license might be appropriate. However, the Decision includes significant procedural requirements, including detailed notification to the TRIPS council of the type and quantity of the product licensed, a certification that the importing member lacks domestic manufacturing capacity, and distinctive labeling and packaging of the generic product. The responsibility to provide “adequate remuneration” to the patent owner continues as under Article 31(h) of TRIPS, but extends only to the exporting member.

The Decision also contains a series of overlapping review mechanisms. Any member may request review of the measures established under the Decision in the Council for TRIPS at any time. In addition, the Council on TRIPS will automatically conduct an annual review of the system. The Decision will terminate when


61. In fact, the Decision states that “a Member may notify at any time that it will use the system in whole or in a limited way, for example only in the case of a national emergency or other circumstances of extreme urgency or in cases of public non-commercial use.” Id. para. 1(b).

62. The importing member’s notification to the TRIPS Council must include “the names and expected quantities of the product(s) needed,” and except in the case of an LDC, must establish that the importing country has “insufficient or no manufacturing capacities in the pharmaceutical sector for the product(s) in question.” Id. para. 2(a)(i.ii). LDCs are presumed to meet this requirement. Id. Annex. This latter requirement can be met by showing that the importing member “has no manufacturing capacity in the pharmaceutical sector” or that any existing capacity “is currently insufficient for the purpose of meeting its needs.” Id. In addition to these requirements, the importing country must issue its own compulsory license under Article 31 of TRIPS. Id. para. 2(a)(ii). The exporting member also must issue a compulsory license, which must permit the manufacture of only the amount necessary to meet the importing member’s needs. Id. The exporting member’s compulsory license further must require that products produced under the license be distinguished through special labeling, packaging or product trade dress, “provided that such distinction is feasible and does not have a significant impact on price.” Id. In addition to these requirements in the compulsory license terms, importing members must “take reasonable measures within their means, proportionate to their administrative capacities and to the risk of trade diversion to prevent re-exportation of the products that have actually been imported into their territories under the system.” Id. para. 4. Developed country members must provide “technical and financial cooperation” to LDCs or developing country members that “experience difficulty in implementing this provision.” Id.

63. Id. para. 3.

64. Id. para. 5.

65. Id. para. 8.
TRIPS is amended to address the issues covered by the Decision.\textsuperscript{66} Originally, the TRIPS Council was to adopt an amendment before the end of 2003 based “where appropriate” on the Decision.\textsuperscript{67} Continued disagreement over the scope and implementation of any such amendment has pushed the amendment deadline back to March 2005.\textsuperscript{68} The August 30 Decision is further clarified and narrowed by an accompanying General Council Chairperson’s Statement.\textsuperscript{69} The Chairperson’s statement first notes that the system established under the Decision is to be used “in good faith to protect the public health” and not as “an instrument to pursue industrial or commercial policy objectives.”\textsuperscript{70} In addition, the Chairperson’s statement extends the labeling and packaging requirements in the Decision to active pharmaceutical ingredients and finished products using such ingredients as well as to finished products.\textsuperscript{71} The statement attaches a list of “best practices” that demonstrate the kinds of labeling and packaging that could distinguish products produced under a compulsory license. These “best practices” are examples of distinguishing strategies used by Northern pharmaceutical manufactures on products supplied under donation or tiered pricing programs and include unique imprints, prominently displayed brand names, distinct outer packaging, and unique shape and color of pills.\textsuperscript{72} The Chairperson’s statement also adds the requirement that an importing member include in its notification to the TRIPS Council information on how the Member established its lack of domestic manufacturing capacity. In addition to the regular review process built into the Decision, the Chairperson’s Statement allows any Member to bring to the TRIPS Council’s attention “any matter related to the

\textsuperscript{66} Id. para. 11.
\textsuperscript{67} Id.
\textsuperscript{68} TRIPS Council: Key Developing Countries Seek to Move Debate Forward on Disclosure Issues, 8 BRIDGES WKLY. TRADE DIGEST, para. 2 (Sept. 22, 2004), at http://www.ictsd.org/weekly/04-09-22/story1.htm.
\textsuperscript{70} Id.
\textsuperscript{71} Id.
interpretation or implementation of the Decision" so that the TRIPS Council can take "appropriate action." A Member also can make an informal appeal to the Chairperson if it believes the Decision's requirements have not been met.

Finally, the Chairperson's Statement notes that a number of developed country members have agreed not to use the system as importers and that twelve other countries have agreed to use the system as importers only "in situations of national emergency or other circumstances of extreme urgency."

Activist organizations advocating a broad reading of the Doha Declaration were outraged by the Decision and Chairperson's Statement. They believed the Decision and Statement were "designed to offer comfort to the US and the Western pharmaceutical industry." In particular, activists criticized the Chairperson's "statement of purpose," which apparently excludes any industrial or commercial objectives as improper efforts to restrict generic competition. Activists also criticized the anti-diversion provisions as unnecessary and costly. Finally, activists questioned the ability of nonexporting or importing members to seek review of issues relating to the system in the TRIPS Council and of the Council's power to take action in response to such petitions.

The pharmaceutical industry in developing countries also did not welcome the compromise. The Indian Pharmaceutical Alliance's secretary general, D.G. Shah, has stated that the anti-diversion packaging requirements and the uncertainty of the appeal process to

73. Chairperson's August 30 Statement, supra note 69.
74. Id.
75. Id. The Northern nations that have opted out of the system as importers are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States. Id. The nations that have agreed to limit their use of the system are Hong Kong, China, Israel, Korea, Kuwait, Macao, China, Mexico, Qatar, Singapore, the Separate Customs Territory of Taiwan, Penghu, Kinmen and Matsu, Turkey, and the United Arab Emirates. Id.
77. Id. (quoting Ellen 't Hoen of Medecins Sans Frontieres).
78. E.g., Medecins Sans Frontieres, Chairman's Text Brings New Difficulties to WTO 'Paragraph 6,' (Aug. 27, 2003) (calling on WTO members to reject the Chairperson's new statement of purpose), at http://www.msf.org/content/page.cfm?articleid=77830ACA-8EC5-419A-82AB7D7ED6A2E1ED.
79. Id.
80. Id.
the TRIPS Council will make the sale of generic drugs to LDC markets by Indian firms excessively costly.  

The compromise reflected in the Decision and Chairperson's Statement leaves unanswered a number of difficult questions. In particular, the TRIPS Council's role in resolving disputes seems problematic. It is unclear, for example, exactly how distinctive export packaging must be and whether a member can seek an injunction against exportation if the packaging is in question. Likewise, it is unclear how and on what basis a dispute about an importing member's true domestic production capacity might be resolved.

Perhaps most significantly, the Decision and Statement's prenotification and labeling requirements may limit the development of a dynamic generic export market. Generic markets work because of competition. The Decision and Statement appear to establish a quasiregulatory framework that may limit the flexibility of generic firms in developing countries to respond to demand in LDCs. In effect, the Decision and Statement institutionalize a forced donation program rather than a market-based solution.

The August 30 Decision is not the last word on this issue. It was taken as a provisional measure until the current round of trade talks is completed, at which time member nations will discuss formal amendment of TRIPS to incorporate agreements reached during the round. It is unclear whether the August 30 Decision will be incorporated without significant modifications in any eventual amendment of TRIPS. In fact, the dissatisfaction voiced by many constituencies was intensified by the collapse of the Cancun ministerial meeting in September 2003 over agricultural issues. Some developing nations felt that they had made compromises on the


essential medicines issue in order to facilitate negotiations on the agricultural issues. They felt betrayed when the agricultural talks floundered at Cancun. It remains to be seen how the issue ultimately will be resolved. Moreover, as discussed in the next Section of this Article, the August 30 Decision ignores the question of whether patents are needed in connection with technologies such as essential medicines.

III. DRUGS AND THE PATENTS COMPLEX

As the discussion above illustrates, the August 30 Decision is at best a stopgap solution to the essential medicines problem as it relates to patent policy. Moreover, neither the August 30 Decision nor the Doha Declaration include any measures that might help remedy the international orphan drug problem. A more comprehensive review of the patent system is required—a review that takes into account the true workings of the international market for pharmaceutical products. This Part presents such a review, including an overview of the pharmaceuticals market in the North and South and a case study of how differences in those markets have impacted patient access to AIDS drugs.

A. Drugs and the Patents Complex in the North

The costs of developing a new drug, by any estimate, are high. One recent study, which has been the subject of some debate, claims that the average cost of researching, developing, and introducing a new drug is $802 million. Other studies have suggested the costs are closer to $450 million—lower, but still high. Pharmaceutical

producers in the North cite strong patent protection as the bedrock of their business.\textsuperscript{88} They identify patents as a key mechanism for recouping their research and development costs.\textsuperscript{89}

Sales of new drugs in the North can vary widely. A "blockbuster" drug can reach sales in the billions. The top decile of compounds introduced from 1990-1994, for example, had sales of over $2.5 billion.\textsuperscript{90} Typically, these blockbuster drugs are the first or second entries that represent a significant therapeutic advance in treating a disease with a large market size.\textsuperscript{91} Pharmaceutical companies in the North rely heavily on large returns from these blockbuster drugs to recoup their research and development costs and to make a profit.

Not all drugs, of course, are blockbusters. In fact, the mean sales of compounds introduced from 1990-1994 peaked at $458 million.\textsuperscript{92} Many of these compounds are variations on an existing treatment—"me too" drugs—or represent incremental advances on existing treatments. These lesser-selling compounds are important because they will contribute to the firm's bottom line as long as sales exceed the variable cost of producing them.\textsuperscript{93} Lesser-selling compounds thus enable firms to remain in business until they produce another, more profitable, blockbuster.\textsuperscript{94}

These "blockbuster" business model dynamics are reflected in the research and development ("R&D") initiatives that Northern pharmaceutical companies choose to pursue and in the historical pattern of regulatory approvals in developed countries.\textsuperscript{95} According to the industry trade group Pharmaceutical Research and Manufacturers of America (PhRMA), for example, the U.S. Food and Drug

\textsuperscript{88} E.g., Pharmaceutical Research and Manufacturers of America, Intellectual Property: Overview ("Pharmaceutical companies rely on government-granted patents to protect their huge investments in researching and developing new drugs."), at http://www.phrma.org/issues/intprop/ (last visited Apr. 19, 2005).

\textsuperscript{89} See, e.g., id. (stating that eliminating patents "would seriously impact the pharmaceutical companies' ability to recoup their costs and reinvest in other research projects").

\textsuperscript{90} Henry Grabowski et al., Returns on Research and Development for 1990s New Drug Introductions, 20 PHARMACOECONOMICS SUPPL. 17 (2002).

\textsuperscript{91} Henry Grabowski & John Vernon, The Distribution of Sales Revenues from Pharmaceutical Innovation, 18 PHARMACOECONOMICS SUPPL. 23, 23- 24 (2000).

\textsuperscript{92} Grabowski, supra note 90, at 17.

\textsuperscript{93} Id. at 23.

\textsuperscript{94} Id.

\textsuperscript{95} The regulatory approval information may be more telling than figures on R&D initiatives. According to PhRMA, only 250 out of every 5,000 to 10,000 screened compounds enter preclinical testing. Of these 250, only 5 enter clinical testing and only 1 is approved by the FDA. PhRMA 2003 PHARMACEUTICAL INDUSTRY PROFILE 3 (2003), available at http://www.phrma.org/publications/publications/profile02/index.cfm.
Administration ("FDA") approved eighty-nine new medicines in 2002.76 Seventeen of these drugs were new molecular entities and nine were new biologics.97 The new drugs included treatments for heart disease, cancer, AIDS-related infections, chronic renal failure, migraine headaches, schizophrenia, rheumatoid arthritis, irritable bowel syndrome, pediatric attention deficit/hyperactivity disorder, and narcolepsy.98 The remaining 172 approvals were for new indications of previously approved drugs.99

B. The Pharmaceutical Industry in the South

Generic firms dominate the Pharmaceutical Industry in the South. A prime example of this domination is in India. There are over 250 pharmaceutical manufacturers with more than 20,000 manufacturing facilities in India.100 Although these firms primarily focus on generic and bulk drugs, some also conduct original research and development.

The leading Indian firm, Ranbaxy Ltd., is an excellent example of a thriving Southern pharmaceutical firm. Ranbaxy reported global sales of $764 million USD in 2002.101 Its principal products are generic pharmaceuticals and active pharmaceutical ingredients. However, Ranbaxy's vision is to become a research based international pharmaceutical company, and it has set a goal of developing one investigational new drug every twelve to eighteen months.102


98. Id.

99. Id. at 27.


102. Id. at 27.
company reports original research and development efforts in urology (incontinence) and respiratory (asthma and chronic obstructive pulmonary disease) drugs and in broad spectrum anti-bacterials intended for respiratory pathogens.\textsuperscript{103}

The Indian firm, Cipla, Ltd., is another good example of a strong Southern pharmaceutical firm. Cipla reported over $300 Million USD in gross sales in 2002.\textsuperscript{104} It has general manufacturing and research and development facilities in Mumbai, Bangalore, Patalganga, and Kurkumbh.\textsuperscript{105} It offers prescription medicines ranging from abortofacients to urological products.\textsuperscript{106}

Despite their wide range of products and significant research and manufacturing capabilities, neither Ranbaxy nor Cipla sell any drugs designed to prevent or treat tropical diseases. Both firms, however, make generic AIDS drugs. Cipla's principal antiretroviral product, called TRIOMUNE, is a combination of generic formulations of Stavudine, Lamivudine and Nevirapine.\textsuperscript{107} Ranbaxy sells Neviparine and Lamivudine as well as Zidovudine and Abacavir.\textsuperscript{108}

There is little direct data on the profitability of the generic drug industry as a whole in developing countries. If it is at all similar to the generic industry in the North, profit levels for individual firms will depend heavily on whether the firm is an early generic entrant. Northern generic firms that are early entrants are able to obtain rents of 20 percent to 30 percent above marginal cost until increasing numbers of entrants drive prices down to marginal cost.\textsuperscript{109} Rents fall as more entrants produce generic versions of the same drug, and prices approach marginal cost when there are eight to ten competitors.\textsuperscript{110}

\textsuperscript{103} Id. at 26-27.
\textsuperscript{104} CIPLA LTD. ANNUAL REPORT, supra note 100, at 40. The $30 Million USD figure is based on the reported 2002 sales of $1,428,869 Rupees and the August, 2003 exchange rate.
\textsuperscript{106} Cipla Ltd., Our Products, Prescription, http://www.cipla.com/admin.php?mode=cat&action=disp&id=2 (last visited Apr. 19, 2005); see Part III.C., infra, for a further discussion of these compounds.
\textsuperscript{108} RANBAXY 2002 ANNUAL REPORT, supra note 101, at 52.
\textsuperscript{109} REIFFEN & WARD, supra note 82, at 3-4.
\textsuperscript{110} Id.
C. The AIDS-Drug Case Study

The sale of generic versions of antiretroviral drugs by Cipla and Ranbaxy serves as a useful case study of patents and the access problem. There is no vaccine or cure for HIV/AIDS. There are, however, treatments that inhibit the AIDS virus' replication. These treatments, called antiretrovirals, often prolong and significantly increase the quality of the lives of the patients that take them.

One important class of antiretrovirals is the nucleoside analog reverse transcriptase inhibitors ("NRTI"). This class of drugs blocks HIV replication by inhibiting the function of a viral protein. NRTIs are often taken in combination with other antiretrovirals in a "cocktail" intended to provide a broad range of treatment mechanisms against viral strains that may have become resistant to a single drug.

Antiretrovirals are big business. Patents owned by multinational pharmaceutical companies protect the product positions in this field. Stavudine, for example, is an NRTI sold under the brand name ZERIT by Bristol-Myers Squibb in the U.S. and Canada. The patent for the use of Stavudine to treat patients infected with retroviruses was awarded to three Yale University researchers in 1990 and subsequently was assigned to Yale. Yale has a marketing and development agreement for this compound with BMS. BMS reported over $1.5 billion in worldwide sales of ZERIT during the years 2000-2002.

Another important NRTI, Lamivudine, is sold by GlaxoSmithKline individually under the brand name EPIVIR and in


112. The following table identifies the generic names, brand names, and manufacturers of the antiretroviral drugs discussed in this section:

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Brand Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stavudine</td>
<td>ZERIT</td>
<td>Bristol-Myers Squibb</td>
</tr>
<tr>
<td>Lamivudine</td>
<td>EPIVIR / COMBIVIR</td>
<td>GlaxoSmithKline</td>
</tr>
<tr>
<td>Zidovudine</td>
<td>RETROVIR / COMBIVIR / TRIZIVIR (AZT)</td>
<td>GlaxoSmithKline</td>
</tr>
<tr>
<td>Abacavir</td>
<td>ZIAGEN / TRIZIVIR</td>
<td>GlaxoSmithKline</td>
</tr>
</tbody>
</table>


combination with Zidovudine as COMBIVIR. Zidovudine, commonly called "AZT," is an NRTI also sold by Glaxo. A patent covering the Lamivudine compound and a method for using that compound to treat HIV infection is owned by IAF Biochem International, Inc. and is licensed to Glaxo. Another patent was awarded to Emory University in 1993 that covers the synthesis of enantiomers of this compound. Zidovudine is sold by Glaxo individually under the brand name RETROVIR and as a component of COMBIVIR. A method patent for the treatment of AIDS with Zidovudine was issued in 1988 and is now held by Glaxo. Glaxo holds the patent on yet another NRTI, Abacavir that is sold under the brand name ZIAGEN. ZIAGEN also is sold in combination with COMBIVIR under the brand name TRIZIVIR. Glaxo reported over $10 billion in worldwide sales of antiviral products during the years 2000-2002.

The lowest worldwide price for the triple combination “cocktail" of Stavudine, Lamivudine and Nevirapine was $10,439 per patient.

117. Id.
120. TreatHIV.com, supra note 116.

121. U.S. Patent No. 4,724,232 (Feb. 9, 1988). The patent initially was owned by Burroughs Wellcome Co. and now belongs to Glaxo as the result of a merger. GlaxoSmithKline, About GlaxoSmithKline, Our Heritage, at http://www.gsk.com/about/background.htm (last visited Apr. 19, 2005). The 232 patent was the subject of litigation concerning whether a NIH researcher should have been named as a co-inventor. See Burroughs Wellcome Co. v. Barr Labs, 40 F.3d 1223, 1227 (1994), cert. denied, 516 U.S. 1070 (1996) (discussing the particulars of joint invention).


123. GlaxoSmithKline PLC, 2002 SEC Form 20-F, Mar. 28, 2003, at 8, available at http://www.sec.gov/Archives/edgar/data/1131399/000102123103000405/b701404-20f.htm. The USD figure provided is based on a conversion of British Pounds where 1 USD = 0.6 GBP. Glaxo also includes AGENERASE, a protease inhibitor for the treatment of HIV, ZEFFIX, a treatment for chronic hepatitis B, and VALTREX, a treatment for chicken pox, shingles, cold sores and genital herpes in the antiviral category. Glaxo does not provide separate sales figures for these products. If the eight brands listed under Glaxo's antiviral category account for a roughly equal share of the total category sales, the five drugs we are considering would account for $6.25 billion in sales.

per year when it was first introduced in 2000. However, the initial cost to reverse engineer these drugs is relatively low, and the cost to manufacture them is even lower. Most bulk suppliers and generic manufacturers quickly learned how to make them by studying available scientific literature.

In September 2000, perhaps as a combination humanitarian gesture and public relations coup, Cipla began offering this combination to certain NGOs and LDCs in countries without effective patent protection for $350 per patient per year. By October 2000, the originator’s lowest worldwide price had dropped to $727 per patient per year. Other generic competitors subsequently entered the global market, including Ranbaxy at a price of $295 per patient per year.

Even the prices offered by Cipla and Ranbaxy, however, are well above marginal cost. When bought in bulk, an annual course of treatment with a single NRTI can be as low as $30. This suggests that production costs are equal to or less than $30, depending on market concentration.

The figures relating to these AIDS cocktail drugs illustrate that the patent owner is able to obtain significantly higher prices in the Northern market and thereby to earn substantial profits. The lower prices available in developing countries demonstrate how generic competition can affect prices in those markets.

125. MEDECINS SANS FRONTIERES, ACCESS TO ESSENTIAL MEDICINES CAMPAIGN, UNTANGLING THE WEB OF PRICE REDUCTIONS: A PRICING GUIDE FOR THE PURCHASE OF ARVS FOR DEVELOPING COUNTRIES 7 (4th ed. 2003) [hereinafter ACCESS TO ESSENTIAL MEDICINES CAMPAIGN].

126. See Melody Peterson, Lifting the Curtain on the Real Costs of Making AIDS Drugs, N.Y. TIMES, Apr. 24, 2001, at C1 (reporting on successful effort of ACIC Pharmaceuticals in Canada to reverse engineer AZT and sell it in bulk to South American countries).

127. See, e.g., Press Release, Kenya Coalition on Access to Essential Medicine, NGOs Denounce the Lack of Transparency in Multi-national/UNAIDS ARV Drug deal for Kenya (Feb. 21, 2001) ("Last week, CIPLA, the generic Indian manufacturer, offered to sell a Triple-Therapy combination (D4T, 3TC and Nevirapine) of antiretrovirals (ARVs) for 350$ per patient per year to MSF (Mediciens Sans Frontiers), if then donated, and for 600$ per patient per year to governments.").

128. ACCESS TO ESSENTIAL MEDICINES CAMPAIGN, supra note 125, at 7.

129. The $30 figure is based on a cost of $1,000 per kilogram, assuming that one kilogram can be used to make enough pills to treat approximately thirty patients per year. See id. (noting that bulk prices to Brazil for Stavudine were $800 to $1,000 per kilogram, with a kilogram being sufficient to make enough pills to treat thirty-four patients for one year).

130. There is substantial evidence that patented drugs are priced significantly higher than generic or non-patented drugs in developing country markets. In Thailand, for example, Fluconazole, a drug used to treat an opportunistic infection that is particularly prevalent in Thai AIDS patients, cost $14 USD per daily dose, or approximately $434 USD per month. Wilson et al., supra note 40. When generic competition was introduced, three local Thai pharmaceutical
discount in price offered by the generic competitors themselves show that there is yet more room for discounting in developing countries. Sources of supply of treatments for some Southern pandemics, such as HIV/AIDS, therefore do exist. As to these treatments, the problem is demand, and more specifically, the elasticity of demand. The next Section explains the problem of demand elasticity.

IV. THE DEMAND ELASTICITY PROBLEM

Demand elasticity is defined as the responsiveness of demand to a change in a factor that determines demand. Price elasticity of demand—the manner in which changes in price affect changes in demand—is the focus here. Where a change in price has a relatively significant affect on demand, demand is said to be “price elastic.” Where a change in price has a relatively insignificant effect on demand, demand is said to be “price inelastic.”

Demand for health care services in the North is generally price inelastic. A recent survey of empirical literature in the United States and Canada found that the price elasticity of demand for health companies entered the market, and the price dropped to approximately $6 USD per daily dose—within reach of many households. Similarly, the price of the antiretroviral drug Zidovudine fell from $324 USD to $87 USD in Thailand when a generic alternative was introduced. Another recent study shows that the lowest world prices for branded triple-combination AIDS drugs has dropped from $10,439 per patient per year to $727 per patient per year, with a steep decline after the introduction of generic competition from Cipla.

This is consistent with domestic experience in the United States. A Congressional Budget Office study found that generics cost on average one-fourth less than brand name drugs.

The issue is different with respect to AIDS vaccine research. The most prevalent strains of AIDS in the South are not prevalent in the North. International AIDS Vaccine Initiative, Progress & Challenges, The State of Global Research, Progress Towards an AIDS Vaccine Since 2002, at http://www.iavi.org/viewpage.cfm?aid=13 (last visited Apr. 19, 2005). Vaccine research has largely focused on those strains that are dominant in the North. As to vaccines, then, AIDS can also fall within the international orphan category.


More formally, the price elasticity of demand, $E_d$, is defined as the magnitude of the proportionate change in quantity demanded over the proportionate change in price. HAL VARIAN, INTERMEDIATE MICROECONOMICS 265-71 (1993). Where $E_d > 1$, price is relatively elastic; where $E_d < 1$, price is relatively inelastic.

Demand for such services in the North is considered “generally” price inelastic because elasticity ordinarily varies at different points along the demand curve. At the extremes of the demand curve, the price elasticity may be greater or less than the general coefficient provided.
care services in the United States consistently centered around -0.17.\textsuperscript{135} This means a 1 percent increase in health care prices will lead to a 0.17 percent reduction in demand.\textsuperscript{136} The price elasticity of demand for prescription drugs likewise is generally inelastic in the North. Price elasticity calculations for prescription drugs in the United States and the United Kingdom range from -0.17 to -0.22.\textsuperscript{137} This means a 1 percent increase in price will lead to a 0.17 to 0.22 percent reduction in demand.\textsuperscript{138}

There is little empirical research on the price elasticity of demand for prescription drugs in developing countries. Most of the research focuses on the elasticity of demand for health care in the context of charging user fees for services.\textsuperscript{139} Recent studies show that demand for health care services in developing countries is in fact elastic.\textsuperscript{140} Indeed, it seems logical and consistent with experience that the very low per capita income and limited health insurance in developing counties simply does not allow consumers to ignore price differences. This is particularly true with respect to expensive drugs that must be taken over a long period of time to extend life or increase its quality, such as AIDS cocktail drugs.

Price elasticity is directly related to the amount of extracompetitive profits a patent owner can obtain by virtue of owning the patent.\textsuperscript{141} If demand is inelastic, the quantity demanded by

\textsuperscript{135} Ringel et al., supra note 132, at 20.
\textsuperscript{136} Id.
\textsuperscript{137} Id. at 26.
\textsuperscript{138} Id.
\textsuperscript{140} See, e.g., B. McPake, User Charges for Health Services in Developing Countries: A Review of the Economic Literature, 36 SOC. SCI. MED. 1397 (1993); PAUL GERTLER & JACQUES VAN DER GAAG, THE WILLINGNESS TO PAY FOR MEDICAL CARE: EVIDENCE FROM TWO DEVELOPING COUNTRIES (1990). Some earlier studies concluded, somewhat surprisingly, that demand for health care in developing countries is relatively inelastic. See, e.g., JOHN S. AKIN, THE DEMAND FOR PRIMARY HEALTH SERVICES IN THE THIRD WORLD (1985); Peter S. Heller, A Model for the Demand for Medical Health Services in Peninsular Malaysia, 16 SOC. SCI. MED. 267, 281 (1982). McPake criticizes these earlier studies as not properly accounting for quality differences in the care demand and as drawing data from a too limited set of income ranges. McPake, supra, at 1400. Gertler found that price elasticity of demand for health care services in rural Cote d'Ivoire was as high as 1.8 for adults and 2.3 for children. GERTLER, supra, at 86. Gertler estimated price elasticity by reference to the opportunity cost of being away from agricultural labor in order to obtain care. Id. at 87.
\textsuperscript{141} See Paul E. Schaafsma, An Economic Review and Suggested Approach for Licensing Patent Applications, 81 J. PAT. & TRADEMARK OFF. SOCY 340, 344 (1999) ("The price elasticity of demand for a patented product is defined by several factors, including factors related to the legal,
consumers will remain sufficient at the monopoly price to allow the patent owner to obtain sufficient rents. If demand is elastic, the quantity demanded may not be sufficient at monopoly prices to provide sufficient returns to cover the investment in research and development. This concept can be illustrated as follows.

Assume a hypothetical market in which the manufacturer is able to produce a medication at a cost of $30 per yearly treatment. If the market is inelastic—for example, an elasticity of 0.2, close to the average demand elasticities for prescription drugs in the North—the manufacturer can charge a premium price of $6,500 per course of treatment (the approximate cost, for example, of a yearly course of treatment with the AIDS drugs ZERIT and VIDEX), resulting in demand for approximately 115,000 courses of treatment. In a competitive market, where price equals marginal cost, a quantity of 335,000 courses of treatment would be demanded, given a constant elasticity demand curve with an elasticity coefficient of 0.2, as shown in the following illustration:

\[ L = \frac{P - MC}{P} = \frac{1}{\eta} \]

Thus, a large elasticity of demand implies a lack of monopoly power, whereas a low elasticity of demand (in other words, inelastic demand) implies a higher index of monopoly power. KIP VISCUSI ET AL., ECONOMICS OF REGULATION AND ANTITRUST 258-59 (3d ed. 2000). Thus, elasticity of demand is tied to a firm’s ability to act as a monopolist.

142. Bristol-Myers’s combination therapy of ZERIT and VIDEX currently costs approximately $18 per day, or $6,500 per patient per year. Firms to Sell AIDS Drugs in Africa Below Cost, ASSOC. PRESS, Mar. 15, 2001, available at http://www.canoe.ca/Health0103/15_aids-ap.html. BMS reported annual sales of $705-755 million for these two compounds in 2001 and 2002. Bristol-Myers 2002 SEC Form 10-K, supra note 115. This would mean approximately 115,000 patients were treated each year at the price of $6,500 per year. Of course, this is only a rough estimation of demand, but it provides a useful illustration for the purpose of this discussion.

143. The data and calculations underlying this illustration are on file with the author.
Figure 1 – Demand at Constant Elasticity 0.2:144

The premium price of $6,500 allows the manufacturer to obtain a $720 million increase in total revenue over marginal cost pricing. The reduction in output as a result of this price increase is the area labeled "A" in Figure 1, which represents the decline from 335,000 to 115,000 courses of treatment. This reduction in output is the price society pays so that the patent owner can obtain the rents needed to fund its blockbuster research and development model.

If the market is elastic, however, the same price increase results in less than ten people being treated, with essentially no revenue to the producer, as illustrated in the following comparison between elastic and inelastic demand curves shown in Figure 2:

144. This figure assumes a constant elasticity of 0.2, meaning the elasticity coefficient is the same at all points along the demand curve. See VARIAN, supra note 12, at 271-72, for a discussion of constant elasticity demands. Ordinarily, elasticity varies at different points along the demand curve. See id. at 267 & fig.15.4. The constant elasticity demand curve, however, provides a useful illustration of the effects of differing degrees of price elasticity on output and revenue.
In fact, because revenue always declines with price increases in an elastic market, the firm will always lose revenue if it prices the product above marginal cost, even if the increase is less severe than a $30 to $6,500 jump. 146

This example illustrates how price elasticity drives the essential medicines problem. The inelastic market allows the firm to obtain the kind of supercompetitive profits it needs to recoup research and development costs with a more modest societal cost in terms of untreated patients. Where distinct markets exist, some of which are price inelastic and some of which are price elastic, the product will be unavailable to most consumers in the elastic market. When the product is an essential technology, such as an important drug, this means that people in developing countries will be shut out by price. The next Section will review some common approaches to this problem.

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145. This figure depicts a constant price elasticity of 2 compared with a constant price elasticity of 0.2. See supra note 133 for a discussion of the use of a constant elasticity demand curve in this illustration. The formula in the figure is the formula for calculating price elasticity of demand. See supra note 133.

146. See VARIAN, supra note 9, at 268-70 for a discussion of the relationship between revenue and price elasticity.
V. COMMON APPROACHES TO THE DEMAND ELASTICITY PROBLEM

Much of the literature concerning differing market elasticities assumes the importance of strong patent protection in all markets.\textsuperscript{147} Some economists and policy experts suggest that the increased social cost of the market imperfections caused by strong patent protection in developing country markets should be addressed through government or multinational subsidies, corporate altruism, or some combination of both.

Jeffrey Sachs, for example, has proposed the creation of an international vaccine purchase fund.\textsuperscript{148} The fund would be endowed by the international community and would set purchase targets and prices for designated vaccines, in effect creating an inelastic market for such vaccines.\textsuperscript{149} Mattias Ganslandt, along with Keith Maskus and Eina Wong, have proposed a similar international fund, endowed by Northern countries, that would purchase licenses for essential medicines, such as AIDS drugs, and subsidize the distribution of those medicines in developing countries.\textsuperscript{150} The authors estimate that it would cost $4.7 to $8.1 billion per year to subsidize AIDS treatment in Sub-Saharan Africa.\textsuperscript{151}

The prospect of a multinational fund to subsidize the purchase of essential medicines is compelling. Given the high cost of subsidizing the drug purchases for just a single condition in one region, however, it is unlikely that purchase subsidies could become a complete or even substantial solution to the essential medicines problem. Moreover, the political will needed to create and sustain a massive international purchase subsidy program likely does not exist. It would be difficult, at the very least, to raise taxes in the United States for such a fund in the current unilateralist climate.

Other economists have suggested that these differences in demand elasticity present a compelling case for Ramsey pricing.\textsuperscript{152}

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\textsuperscript{147} See, e.g., Mattias Ganslandt et al., Developing and Distributing Essential Medicines to Poor Countries: The Defend Proposal, 24 WORLD ECON. 779, 785 (2001) (discussing patent protection).


\textsuperscript{149} Id.

\textsuperscript{150} Ganslandt et al., supra note 147, at 20-21; see also Keith Maskus, Ensuring Access to Essential Medicines: Some Economic Considerations, 20 Wis. Int'l L.J. 563 (2002) (discussing the feasibility of the international fund).

\textsuperscript{151} Ganslandt et al., supra note 147, at 20.

\textsuperscript{152} See generally Patricia M. Danzon & Adrian Towse, Differential Pricing for Pharmaceuticals: Reconciling Access, R&D and Patents, 3 INT'L J. OF HEALTHCARE FIN. & ECON.
Ramsey pricing is a form of differential pricing in which price is at least equal to marginal cost in all markets, and price exceeds marginal cost in the aggregate over all markets by enough to cover the costs of R&D and to provide a return on capital. In the international pharmaceutical market, under Ramsey pricing, the price in markets with elastic demand would be at or close to marginal cost, while the price in markets with inelastic demand would exceed marginal cost by the appropriate amount.

Ramsey pricing may be efficient when there is inelastic demand for a pharmaceutical product in the North. Such products are likely to be developed in the first instance for the Northern market. The above marginal cost pricing permitted by patent protection in the North would allow the manufacturer to recoup its R&D expenses and obtain a return on capital. Marginal cost pricing in the South would make the drug available at a lower cost in the South and would not have any negative impact on the firm's viability.

There are a number of problems with Ramsey pricing in the international pharmaceutical context, however. A significant issue often cited by Northern pharmaceutical firms is the problem of parallel imports. Consumers in Northern countries with higher prices may attempt to import lower cost drugs from Southern countries with lower prices. This would upset the price structure in the Northern countries and circumvent the intended social welfare benefit of making the cheaper drugs available in the South.

Advocates of Ramsey pricing often cite stronger national patent laws that bar parallel imports as a solution to the Ramsey pricing problem. However, with the increased importance of regional trading areas, strict national import bars might not be workable. The European Union, for example, adheres to a doctrine of international exhaustion, which holds that patent rights in a given product (including the right to prevent parallel imports) are exhausted upon

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183 (2003) (arguing a need for economic patents and the potential for differential pricing to both increase affordability while preserving incentives for innovation in developing countries).
153. Id. at 186
154. Id. at 184
155. Id. at 202.
156. See id. at 193:
A broad-based differential pricing structure will only be possible if higher income countries accept the responsibility to pay higher prices, foregoing the temptation to try to obtain lower prices granted to low income countries, and middle income countries recognize that it may be appropriate for them to pay prices that provide a return on R&D for at least part of their populations.
the first sale of that product into a member country.\footnote{157} The United States is currently considering a similar rule for pharmaceutical products imported from Canada.\footnote{158}

Another significant problem with Ramsey pricing in global pharmaceutical markets is the prevalence of external reference prices. It is common for regulators to refer to lower prices received by consumers in other countries and to demand the same price for consumers in their home country. This creates a disincentive for manufacturers to offer marginal cost pricing in demand elastic markets. Instead, the manufacturer will forgo those markets or offer more uniform price bands in all markets.\footnote{159}

Ramsey pricing advocates respond to this objection by suggesting that Northern nations should voluntarily forgo reference pricing or that mechanisms should be established to keep pricing decisions secret.\footnote{160} Voluntary compliance, however, depends on political will, which is uncertain and transient. Secrecy provisions may be helpful, but such secrets will be difficult to keep; even one disclosure could upset the entire scheme.

Moreover, Ramsey pricing would not address the international orphan drug problem.\footnote{161} The growth of the pharmaceutical manufacturing industry in some developing countries suggests that drugs for international orphan conditions could be developed and supplied if there were a market for them. Demand for pharmaceuticals in the North is highly elastic or non-existent for drugs that are intended to treat tropical diseases because such diseases generally do not affect the population in those countries. The current patent system provides no incentive to conduct research and development under these circumstances. Ramsey pricing will not change this fact; there is no market in which the higher prices needed to recoup research and development costs could be obtained.

Ramsey pricing might also entail externalities resulting from a lack of generic competition in Southern markets. The Ramsey pricing

\footnotesize

158. Danzon, \textit{supra} note 144, at 15.

159. \textit{See} Danzon \& Towsie, \textit{supra} note 152, at 185 (noting marginal cost pricing cannot generate sufficient revenue to cover the R \& D of firms).


161. Patricia Danzon, a differential pricing advocate, agrees that differential pricing is not a solution for the international orphan problem. \textit{Id.} at 184.
model assumes that the price-differentiating manufacturer retains exclusive rights to the drug but simply refrains from seeking monopoly rents in Southern markets. If the manufacturer does not have exclusive rights in the Southern market, the potentially smaller market share resulting from the presence of generic entrants, particularly where the local generic entrant is able to market and distribute the product more efficiently, might deter the Northern manufacturer's entry into the Southern market.\textsuperscript{162} Strict exclusivity, however, would force many, if not most, Southern pharmaceutical manufacturers out of business. The resulting loss of jobs would further damage fragile Southern economies. Perhaps even more problematic, the loss of such firms would mean the depletion of indigenous research and development capability, resulting in even greater balkanization of the international orphan conditions. Ramsey pricing, therefore, is not a complete solution to the essential medicines problem.

Finally, other commentators have suggested adjustments to the patent application process or to the availability of patent remedies. Jean Lanjouw, for example, has suggested a patent system that would require the inventor to elect patent protection in either the United States or in a developing country market.\textsuperscript{163} Lanjouw's mechanism is based on the requirements in U.S. patent law that an invention made in the U.S. first be patented in the U.S. and that a foreign filing license be obtained before a patent is applied for in another country.\textsuperscript{164} Lanjouw's proposal would require that foreign license filings for certain types of technologies—cancer drugs, for example—include a declaration that the applicant will not sue for

\textsuperscript{162} See Keith E. Maskus, World Intellectual Prop. Org, Parallel Imports in Pharmaceuticals: Implications for Competition and Prices in Developing Countries 7 (2001) ("The absence of product patents and the relative ease of entry into imitative production means that there are significant numbers of ... firms producing generics ... in countries without product patents."), available at http://www.wipo.int/about-ip/en/studies/pdf/ssa_maskus_pi.pdf.

\textsuperscript{163} Jean O. Lanjouw, A New Global Patent Regime for Diseases: U.S. and International Legal Issues, 16 HARV. J.L. & TECH. 85, 91-93 (2002). Other commentators have suggested differences in the content or enforcement of patent measures in different markets, but without proposing a specific mechanism. Amir Attaran, for example, has proposed a rule of nonjusticiability for complaints relating to allegedly infringing exports of some medicines to poor countries. Amin Attaran, The Doha Declaration on the TRIPS Agreement and the Public Health, Access to Pharmaceuticals, and Options Under WTO Law, 12 FORDHAM INT'LL. PROP. MEDIA & ENT. L. J. 859, 859 (2002); see also Kelley A. Friedegen, Comment, Rethinking the Struggle Between Health & Intellectual Property: A Proposed Framework for Dynamic, Rather than Absolute, Patent Protection of Essential Medicines, 16 EMORY INT'LL. L. REV. 689, 689-93, 736 (2002) (proposing "dynamic" patent protection that would "involve a somewhat diminished expectation of protection or reward in exchange for an additional benefit").

\textsuperscript{164} Lanjouw, supra note 163, at 91-92.
patent infringement in specified developing country markets that need access to the technology.\textsuperscript{165}

Lanjouw's mechanism is appealing in that it allows for the benefits of generic competition in developing country markets. Its reliance on national foreign filing certification procedures, however, is problematic. First, the certification procedure would require changes in the national laws of other pharmaceutical-producing countries that do not currently have a foreign filing certification requirement. Lanjouw recognizes this problem and suggests that it should not be a major issue because a relatively small number of countries produce most of the world's pharmaceutical products.\textsuperscript{166} Nevertheless, the procedure requires a more fundamental change than a system that relies on the principles already established in TRIPS and the Doha Declaration and therefore would likely be more difficult to implement.

An additional problem with Lanjouw's approach is the possibility that manufacturers will "forum shop" for countries that are not currently major pharmaceutical producers and therefore will not adopt certification requirements. Lanjouw suggests that forum shopping will be limited because many other factors go into the choice of research and development sites and, if research and development becomes concentrated in additional noncertification countries, those countries could be encouraged to adopt certification requirements.\textsuperscript{167} It seems unlikely, however, that a country would adopt certification requirements if the lack of such requirements is prompting the investment from the multinational pharmaceutical industry. This would simply create an ongoing cycle of forum shopping.

Perhaps the most significant question raised by Lanjouw's approach is who would decide which technologies and countries to certify. Presumably an international body such as the World Trade Organization would make these decisions. It might be politically untenable in many countries—the U.S. not the least among them—to have a body such as the WTO dictate changes in national patent laws on an ongoing basis. The Doha Declaration, in contrast to Lanjouw's proposal, provides a means by which developing countries can exempt themselves from certain treaty obligations without requiring any change in the producing country's national patent laws.

Notwithstanding the problems with the mechanism, the idea that the international patent system should respond to differences in demand has merit. For example, where demand is inelastic in the

\textsuperscript{165} Id. at 92.
\textsuperscript{166} Id. at 110-11.
\textsuperscript{167} Id. at 111-12.
North but highly elastic in the South, the level of patent protection in the South may have little impact on R&D incentives. The prospect of patent protection in the North will provide the Northern manufacturer with sufficient incentive to conduct research and development and an opportunity to recoup its costs. The absence of patent protection in the South will encourage the growth of the Southern generic industry, which will allow the drug to be offered more cheaply in the South and will provide the spillover benefits of a local industry.

Where demand is elastic in both the North and South, as in the case of international orphan drugs, the relative strength of patent laws might make little difference. A research and development based pharmaceutical firm, for example, faces high research and development costs and high opportunity costs when considering whether to pursue a particular compound. If there is little prospect of obtaining monopoly rents because of high demand elasticity, patent protection may not provide sufficient incentive for the research and development. The next Section tests these propositions with a game theory analysis and proposes some possible changes to the international patent system based on that analysis.

VI. RETHINKING THE INNOVATION GAME UNDER TRIPS

Game theory provides a particularly useful analytical framework for the essential medicines question because it allows us to test how the players will respond given changes in one or more of the rules that govern the game. This analysis is not, of course, necessarily predictive or precise. However, a model can be constructed from the information developed in Part III above to test how different changes in the patent system might affect incentives to create new drugs. In particular, the model examines the relationship between levels of patent protection and demand elasticity.

The model includes two hypothetical firms that represent the types of pharmaceutical manufacturing firms that exist in the developed and developing world. These are the Northern country manufacturer (“NM”) and the Southern country manufacturer (“SM”).

168. For a general discussion of how game theory can be used to test legal rules, see DOUGLAS G. BAIRD ET AL., GAME THEORY AND THE LAW (1994). As Baird et al. note, “[g]ame theory, like all economic modeling, works by simplifying a given social situation and stepping back from the many details that are irrelevant to the problem at hand. . . . The spirit of the enterprise is to write down the game with the fewest elements that captures the essence of the problem.” Id. at 7. For a more detailed discussion of game theory principles, see generally ERIC RASMUSEN, GAMES AND INFORMATION: AN INTRODUCTION TO GAME THEORY (1990).
The NM is primarily a research-based pharmaceuticals firm. It has an existing international marketing and distribution network. The SM primarily produces generic drugs and active pharmaceutical ingredients ("APIs") but has budding original research and development capability and only limited capacity to market and distribute new drugs internationally.

A simple two-by-two game may be used to model whether a firm will choose to innovate or imitate (i.e., copy the innovation).¹⁶⁹ The payoff functions in this game represent returns on investments. The expected payoffs for original research and development account for the likelihood that a viable compound will be a successful drug. As noted in Part III.A. above, original research and development that leads to a viable therapeutic compound can provide two types of returns: (1) a drug that produces revenues somewhat in excess of variable costs but does not recoup all research and development costs; or (2) a more profitable compound that produces revenues substantially in excess of research and development costs. A generic compound will not have such substantial research and development costs and, therefore, will provide rents where the price can be set even a small increment above the marginal cost. This typically would occur at the early stages of generic entry when there are a limited number of generic competitors in the market.

A. Payoffs in Inelastic-Elastic Markets

As discussed in Part III.A and B. above, markets for pharmaceutical products generally are inelastic in the North and elastic in the South when the product treats a condition prevalent in the North. Based on the existing pricing and access problems relating to AIDS medications, this appears to hold true for such medications. Therefore, payoff functions in the "inelastic-elastic" market can be based on the AIDS drug case study presented in Part III.C.

As described in Part III.C., the price of $6,500 per course of treatment with AIDS cocktail drugs resulted in demand for 125,000 treatments, for total revenue of $812,500,000. If the drug has a typical sales cycle, it will have a bell-shaped curve over a life of about twenty years, with sales peaking in about the eighth year.¹⁷⁰ Total gross revenues for the drug would then be approximately $6.5 billion.

¹⁶⁹. RASMUSEN, supra note 168, at 294-95.

¹⁷⁰. Joseph A. DiMasi, et al., Returns on Research and Development for 1990's New Drug Introductions, 20 PHARMACOECONOMICS SUPPL. 3, 11, 16 (2002). Based on DiMasi's statistics, we can expect sales to increase by approximately 20 percent each year until year 10, at which time they will plateau for several years and then decline by 20 percent each year through year 20.
Given the assumption that the cost of producing the drug is $30 per course of treatment, costs of production total $30 million over the twenty years.\textsuperscript{171} Research and development cost for a new drug is between $450 and $800 million. A total cost of $650 million, therefore, is a reasonable mid-range estimate of total research, development, and production costs. This makes the NM's profits for innovation ten times its costs for a baseline payoff of 10.\textsuperscript{172}

The SM's costs for innovating are higher than the NM's. This is because the NM has a broad and well-established research and development program. The NM regularly screens thousands of potential compounds and therefore the marginal cost of screening additional compounds for a particular condition is relatively low.\textsuperscript{173} Moreover, the NM's large research and development capacity means that the opportunity costs of screening additional compounds for a particular condition is also relatively low.\textsuperscript{174} In contrast, the SM may need to add additional capacity or to divert capacity from generic manufacturing and development efforts in order to conduct a systematic original research and development effort. These actual costs and opportunity costs are likely to be relatively significant to the SM. Therefore, the SM's payoff function for original research and development is discounted to account for these costs. The SM's baseline payoff for innovating is thus 5.

The payoff function for "imitating" reflects the expected return on investment of producing a generic compound for distribution in

\textsuperscript{171} This represents a demand of 125,000 at the price of $6,500 during the peak years, with an increase and reduction in demand towards and away from the peak years, resulting in a bell-shaped curve.

\textsuperscript{172} The payoff could potentially be somewhat smaller if marketing costs are included in the calculation. Direct-to-consumer advertising spending, for example, can approach $53 million for a heavily promoted drug such as VIAGRA. NATIONAL INSTITUTE FOR HEALTH CARE MANAGEMENT RESEARCH AND EDUCATIONAL FOUNDATION, PRESCRIPTION DRUGS & MASS MEDIA ADVERTISING 2000 2 (2001). It is unlikely, however, that the types of "essential" medicines with which we are concerned would require the same high level of marketing and promotional expenditures as would "lifestyle" drugs or other drugs for common conditions for which there are numerous alternative treatments. For example, in a recent study, of the top fifty drugs in terms of direct-to-consumer advertising spending, only a few are in categories such as antivirals or antifungals that might fall within an "essential" medicines category. See id. Even as to those few, direct-to-consumer spending did not exceed $41 million. Id. (listing for VALTREX). Therefore, the baseline payoff of 10 represents a reasonable estimate even if some level of marketing and promotional expenses are included.

\textsuperscript{173} See PHARMACEUTICAL RESEARCH AND MANUFACTURERS OF AMERICA, PHARMACEUTICAL INDUSTRY PROFILE 3, 10 (2003) (noting that 5,000 compounds are screened for every compound that is approved as a new medicine and that pharmaceutical companies spent approximately $26.4 billion on research and development in the United States); cf. Joseph A. DiMasi, The Value of Improving the Productivity of the Drug Development Process, 20 PHARMACOECONOMICS SUPPL. 1, 4 (2002) (noting differing costs of drug development at different phases of review).

\textsuperscript{174} See supra notes 86-87 and accompanying text.
developing countries and LDCs. As noted in Part III.C., the marginal cost of producing a year's treatment with a single NRTI is as low as $30, and generic manufacturers have charged approximately $300 per patient per year for AIDS drugs, or ten times costs. Thus, the generic manufacturer's payoff from imitating is also 10.

The NM's cost of imitating is higher than the SM's. An NM that is an imitator will incur significant opportunity costs by diverting capacity away from its original research and development mission to generic production. The NM may also incur reputational costs if it is seen as a supplier of "cheap" generic compounds. Moreover, the NM will incur political costs if its generic pricing is used as reference pricing for its patented products. The NM's payoff function for original research and development is discounted to account for these costs, for a baseline payoff of 5.

Finally, the payoff functions must be adjusted to reflect different levels of patent protection. The level of patent protection in the game can be "Strong" or "Weak." Under Strong protection, the level of patent protection in both the developed and developing countries is similar to that which is currently available in the United States. Under Weak protection, either there is no available patent protection, or LDCs or the SM can easily obtain a cheap compulsory license that allows the SM to sell to the domestic market and to export to LDCs.

1. Weak Patent Protection in Inelastic-Elastic Markets

The Weak level of patent protection reflects to a large extent the current market prior to full implementation of TRIPS. Developing countries are not required to harmonize their patent laws under TRIPS until 2005, and many have not yet done so. This level of patent protection also represents a market in which developing countries can readily obtain low-cost compulsory licenses for domestic use and export to LDCs.

175. It is true, of course, that the NM could establish a subsidiary to produce generic products, but public securities disclosure requirements will not allow the NM to "hide" behind a subsidiary.

176. See World Trade Organization, Frequently Asked Questions About TRIPS, Which Countries are Using the General Transition Periods (discussing the general transition period to TRIPS Agreement provisions for developing countries, least developed countries and new members), at http://www.wto.org/english/tratop_e/trips_e/tripfq_e.htm#Transition (last visited Apr. 19, 2005); YOUANDAIDS, Cheap Indian AIDS Drugs Under a Cloud (noting that an amendment to India's Patent Act designed to meet the TRIPS deadline has been tabled by the Indian Parliament and that local pharmaceutical manufacturers have been resisting compliance), at http://www.youandaids.org/Features/IndiaIPSNov2004.asp (last visited Apr. 19, 2005).
The following bi-matrix illustrates these conditions:\footnote{177}

\[
\begin{array}{c|cc}
 & \text{Innovate} & \text{Imitate} \\
\hline
\text{Innovate} & 7.5, 3.75 & 10, 10 \\
\text{Imitate} & 5, 5 & 0, 0 \\
\end{array}
\]

Payoffs to: NM, SM

The parties' baseline payoffs are as discussed above. The payoff where both parties imitate is 0 for each party because there is nothing in that case to imitate. The payoff to each party if both parties innovate is 25 percent lower than their respective payoffs for being the sole innovator. This is because the resulting patent race likely lowers the value of any resulting invention and eliminates some of the innovator's first mover advantage.\footnote{178}

When we examine each player's best responses to the other player's possible moves, we can see that the SM will choose Imitate where the NM chooses Innovate and Innovate where the NM chooses Imitate. The NM, however, will choose Innovate regardless of whether the SM chooses Innovate or Imitate. The Nash equilibrium of

\footnote{177. For the sake of simplicity, the models used in this Article are simultaneous move games in which the parties have complete information. See ROBERT GIBBONS, GAME THEORY FOR APPLIED ECONOMISTS 1 (1992) for a general discussion of this type of game. Reality, of course, is not so clear-cut. A decision whether to conduct research and development for a given condition is based on a complex set of economic, political, and social factors and often involves a series of sequential moves. Moreover, although information about the potential payoffs from innovation and about the research and development activities of competitors is available, it is seldom complete. As discussed in Part V., however, this simplified model is a useful tool for illustrating the potential impact of differing legal rules on a particular decision point. See supra note 168 and accompanying text.}

\footnote{178. A patent race can lower the value of the resulting invention in at least ways. First, both parties can obtain patents on different aspects of the invention, effectively dividing the value of a patent. In addition, one or both parties may decide at various points in the race to make strategic public disclosure of information, which places such information outside the scope of any patent that eventually may issue. See generally Douglas Lichtman et al., Strategic Disclosure in the Patent System, 53 VAND. L. REV. 2175 (2000) (discussing the incentives for strategic disclosure for both firms that are trailing and those leading in a given patent race); Gideon Parchomovsky, Publish or Perish, 98 MICH. L. REV. 926 (2000) (discussing strategic publication of research findings).}
this game therefore is Innovate, Imitate. This equilibrium in fact reflects the current realities of the market—Northern multinational pharmaceutical companies innovate and Southern pharmaceutical firms focus on generic substitutes.

2. Strong Patent Protection in Inelastic-Elastic Markets

The level of patent protection in this model reflects the patent protection that is the goal of TRIPS. In this model, there is Northern-like patent protection in all markets. Compulsory licensing may be available to the Southern manufacturer, but it is restricted procedurally and/or substantively.

Because the Southern market is elastic, the availability of patent protection in that market adds little, if anything, to the innovator's returns. The demand conditions in the Southern market simply do not permit pricing above marginal cost. Therefore, the innovator's payoff functions remain the same as in the Weak patent protection model.

The Strong patent protection in the Southern market does, however, affect the imitator's returns. The imitator is not able to market a product during the life of the patent. At least ten to twelve years of returns are not, therefore, available to the imitator. Thus, returns from imitating are reduced by 50 percent from the prior model.

The following bi-matrix illustrates these conditions:

<table>
<thead>
<tr>
<th></th>
<th>Innovate</th>
<th>Imitate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovate</td>
<td>7.5, 3.75</td>
<td>10, 5</td>
</tr>
<tr>
<td>NM</td>
<td>2.5, 5.5</td>
<td>0, 0</td>
</tr>
</tbody>
</table>

Payoffs to: NM, SM

179. In simple terms, a Nash equilibrium (named after the famous Princeton economist John Nash) exists with respect to a pair of strategies "when each player cannot do better given the strategy the other player has adopted." GIBBONS, supra note 177, at 22.

This change in the patent rules produces no change in the equilibrium solution to the game. The Northern manufacturer will continue to choose Innovate and the Southern manufacturer will continue to choose Imitate.

3. Implications of the Innovation Game in the Inelastic-Elastic Market

The games described above illustrate that the level of patent protection in elastic markets is unlikely to change the players' incentives as long as a profitable inelastic market with Strong patent protection continues to exist. Any argument that weakening patent protection in developing countries or LDCs in order to facilitate access to essential medicines will undercut incentives for new drug innovation is misplaced. The level of patent protection in developing countries and LDCs does not matter when there is an inelastic market for the drug in the North.

These games, however, do not illustrate the social welfare loss that results from Strong patent protection in the South. Under Strong patent protection, the imitator is precluded from the market until the patent expires. This eliminates the cheaper generic drugs from the Southern market for ten to twelve years, causing a large and devastating welfare loss in untreated patients. This social welfare loss in the South further contributes to the divide between the wealthy North and poor South. The better policy, then, would seem to be to eliminate patent protection in elastic Southern markets for essential technologies for which there is an inelastic market in the North.

There are several potential criticisms of this approach. The first is that weakening patent protection in the South will drain the South of foreign direct investment ("FDI"). FDI might include, for example, a drug manufacturing facility built by a Northern manufacturer in a Southern country or a codevelopment agreement between a Northern and Southern manufacturer. Such investments arguably contribute to social welfare in the Southern country by creating jobs and transferring knowledge and skills to workers.

181. A similar conclusion was reached by Colleen Chien in a recent empirical study of the effect of compulsory patent licenses, typically granted as part of antitrust settlements, on investment in research and development. Colleen Chien, Cheap Drugs at What Price to Innovation: Does the Compulsory Licensing of Pharmaceuticals Hurt Innovation?, 18 BERKELEY TECH. L. J. 853, 868, 896-97 (2003).

182. Some argue, however, that excessive reliance on FDI perpetuates an atmosphere of colonialism, whereby the Southern nation remains dependent on the Northern patron. See, e.g., Oddi, supra note 10, at 877 (arguing in many instances the economic chains of colonialism still
Another welfare loss could be the persistence in Southern nations of social norms that accept and even favor a culture of piracy. Nations that lack strong intellectual property laws or fail to enforce existing laws tend also to lack a culture of technological innovation. The lack of an innovation culture further ossifies moribund economies.

A third problem is potential parallel importation. Products purchased from generic manufacturers in Southern markets without patent protection would be diverted to Northern markets. This would undercut the Northern manufacturer’s profits in the North, reducing the incentives provided by patent protection in that market, and would deprive Southern consumers of their cheap source of supply.

The first two objections are answered by the limited nature of the exception. Patent protection would be relaxed in the Southern market only where the technology, such as a drug, is essential to public health and then only when there is a strong inelastic market for the technology in the North. Otherwise, the South would continue to be required to implement and enforce Strong patent protection under TRIPS.

The answer to the third problem, parallel importation, is enforcement of existing import and export rules. It would remain unlawful for a developing country or LDC to export a lower priced product to an inelastic developed country market with Strong patent protection, and it would remain unlawful to import such a product into the developed country. A simple, uniform, low cost marking system could be developed to distinguish such products. This would differ from the system proposed in the current Article 6 compromise, which is ill-defined, complex, and subject to an uncertain review process in the TRIPS council. Instead, the system would require a single mark that all generic manufacturers would use in addition to whatever other marks they ordinarily would use on products destined for markets with Weak patent protection.

The game theory analysis has helped clarify the appropriate levels of patent protection for essential technologies in Inelastic-Elastic markets. The next Part reviews Elastic-Elastic markets, such as the market for international “orphan” drugs.

remain by "providing import monopolies in the form of patents granted by developing countries to many of the former colonial powers").
B. Payoffs in Elastic-Elastic Markets

The key difference between the Inelastic-Elastic market and the Elastic-Elastic market is the payoff for innovation. In the Elastic-Elastic market, the innovator cannot reap supercompetitive profits even with Strong patent protection in the North. Under the method we used above for calculating payoffs, the baseline payoff for innovating under these circumstances is less than zero.183


As in the Inelastic-Elastic games, the Weak patent protection scenario represents the current situation, or a situation in which there are no patents or simple compulsory licensing requirements in developing countries and LDCs.

The following bi-matrix illustrates these conditions:

<table>
<thead>
<tr>
<th></th>
<th>Innovate</th>
<th>Imitate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovate</td>
<td>-2, -2</td>
<td>-1, 10</td>
</tr>
<tr>
<td>NM</td>
<td>5, -1</td>
<td>0, 0</td>
</tr>
</tbody>
</table>

Payoffs to NM, SM

The Nash equilibrium in this game is Imitate, Imitate. In other words, neither player will produce the drug. This is in fact what presently occurs.


If the game is changed to reflect the level of patent protection that is the goal of TRIPS, the payoffs from innovation will not increase because the market does not provide an opportunity to obtain rents. The payoff from imitation, however, will decrease since the imitator must wait until the patent expires to enter the market.

183. The payoff is set at -1 to represent a loss of 1 times the research and development investment. The loss is greater if both parties innovate because of the costs of the patent race. See supra note 178 and accompanying text.
The following bi-matrix illustrates these conditions:

<table>
<thead>
<tr>
<th></th>
<th>Innovate</th>
<th>Imitate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovate</td>
<td>-2, -2</td>
<td>-1, 5</td>
</tr>
<tr>
<td>Imitate</td>
<td>2.5, -1</td>
<td>0, 0</td>
</tr>
</tbody>
</table>

Payoffs to NM, SM

The solution to this game is the same as under Weak patent protection. Both parties will choose to do nothing.


a. Public Subsidies

As the games described above illustrate, international orphan conditions present an intractable problem: regardless of whether patent protection in developing countries and LDCs is "Strong" or "Weak," there is insufficient incentive for either Northern or Southern firms to develop treatments. Activists and Northern pharmaceutical interests have suggested a variety of solutions to this problem. For example, some activists advocate the creation of an international fund for neglected diseases.\(^ {184} \) One organization is attempting to establish a research and development center for neglected diseases.\(^ {185} \) Northern countries and pharmaceutical firms tend to focus on voluntary donation programs.\(^ {186} \)

Each of these possible solutions suffers from the problems discussed in Part V above: they rely too heavily on the vagaries of political will and corporate philanthropic sentiment. This is particularly true of corporate donation programs and private nonprofit centers that are based on nonguaranteed private initiative.

While a public subsidy might at least be more stable and predictable if it becomes a legal obligation, even a very significant subsidy is unlikely to change the outcome of the innovation game. A

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subsidy of 100 percent of research and development costs, for example, would raise the payoff for innovation from a negative number to zero. The payoff matrix in the Weak patent regime would then appear as follows:

<table>
<thead>
<tr>
<th></th>
<th>Innovate</th>
<th>Imitate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovate</td>
<td>0, 0</td>
<td>0, 10</td>
</tr>
<tr>
<td>Imitate</td>
<td>5, 0</td>
<td>0, 0</td>
</tr>
</tbody>
</table>

**Payoffs to NM, SM.**

The game now starts to change, but the results still are not compelling. There is no unique Nash equilibrium to this game in pure strategies. There are three solutions in pure strategies that are Nash equilibrium solutions: Innovate, Imitate; Imitate, Innovate; and Imitate, Imitate. We could seek to find a Nash equilibrium in mixed strategies, which yields a result of the NM choosing Innovate at a probability of 0.2 and the SM choosing Innovate at a probability of 0.1. Therefore, if the players are mixing strategies, more often than not each player will choose Imitate.

187. A mixed strategy equilibrium calculates a probability distribution of a player's strategies. GIBBONS, supra note 177, at 30-31; see also RASMUSEN, supra note 168, at 69-73 (giving a detailed discussion of mixed strategies).

188. These probabilities are calculated by taking a partial derivative and setting it to zero. We can call the probability that the NM will Innovate \( p \) and the probability that it will Imitate \( 1 - p \); the probability that the SM will Innovate is \( q \) and the probability that it will Imitate is \( 1 - q \). The probability that the SM will choose Innovate can then be calculated as follows:

\[
q[p(U) + (1-p)(10)] + (1-q)[q(0) + (1-q)(U)]
\]

which may be simplified to:

\[
q(1-10q) + (1-p)(0q + 0)
\]

Taking the partial derivative and setting it to zero yields:

\[
\frac{\partial E_{NM}}{\partial p} = 0 \quad 1-10q - 0 = 0 \quad 10q = 1 \quad q = \frac{1}{10} = 0.1
\]

The calculation for the probability that the NM will choose Innovate is as follows:

\[
q[p(U) + (1-p)(5)] + (1-p)[p(U) + (1-p)(U)]
\]

which may be simplified to:

\[
q(1-5q) + (1-p)(0q + 0)
\]

Taking the partial derivative and setting it to zero yields:
Another way to find a likely solution is to look for a focal point. A focal point is an equilibrium solution among multiple pure strategy Nash equilibria that is compelling because of psychological, social or historical factors. In this game, it is likely that the focal point would reflect the long-ingrained “do nothing” tradition, particularly where resources could be invested in research and development for conditions for which there is an inelastic Northern market. Under either mixed strategies or a focal point analysis, then, it seems unlikely that even a very substantial subsidy can change the game’s outcome in the Elastic-Elastic market.

b. Public Subsidies Plus Market Exclusivity

What about a subsidy program that also involves changes in the patent system? Although there is much discussion about patents and essential medicines for which there is demand in the North, there is little discussion of how the patent system could be modified to encourage innovation as to treatments for international orphan conditions. Patents, however, are a key cog in the economic engine of innovation, and we should expect that an effort to encourage innovation would involve patent policy.

Precedent for such thinking exists in the United States Orphan Drug Act. Under the Orphan Drug Act, firms can receive research grants and tax credits for the development of treatments for rare “orphan” conditions and can also receive a seven-year market exclusivity period for such treatments.

Industry representatives and activists generally agree that the Orphan Drug Act has been wildly successful in the United States. Over 200 compounds have been approved as “orphan” drugs since the Act’s inception, for the treatment of conditions ranging from Sickle Cell Anemia to Leprosy. Because of the small size of the market for

\[
\frac{\partial E\Pi_{NM}}{\partial p} = 0 \quad 1 - 5q - 0 = 0 \quad 5q = 1 \quad q = \frac{1}{5} = 0.2
\]

189. RASMUSEN, supra note 168, at 36; BAIRD, supra note 168, at 39-40. A classic example of a focal point is a thought experiment in which individuals were told they must meet friends in New York City on a given day without being given a specific location. Most participants selected Grand Central Station (at the time a culturally significant meeting place) as the most likely spot for a meeting. Id.


191. Id.

such treatments, prior to the Orphan Drug Act there were no incentives for large pharmaceutical firms to pursue such treatments and no resources for small firms to do so.\textsuperscript{193}

The basic types of incentives offered under the U.S. Orphan Drug Act could transfer to the international orphan drug problem. For example, firms could be provided a period of international exclusivity for developing a treatment of an international orphan condition. As discussed in Part II.C, however, the international orphan problem typically is not one of global market size but one of differing demand elasticity across markets. "Strong" patent protection, which is a period of exclusivity, is not in itself likely to change the equilibrium that favors neither player innovating. Even with a relatively large market size, the inability to charge monopoly rents limits the value of the market exclusivity period.

Indeed, a game theory analysis confirms this intuition. With subsidies and a period of market exclusivity equivalent to patent protection, the matrix appears as follows:

\begin{tabular}{|c|c|c|}
\hline
 & Innovate & Imitate \\
\hline
Innovate & 0, 0 & 0, 5 \\
\hline
Imitate & 2.5, 0 & 0, 0 \\
\hline
\end{tabular}

Payoffs to NM, SM.

Once again, there are three Nash equilibria in pure strategies: Innovate, Imitate; Imitate, Innovate; and Imitate, Imitate. The equilibrium in mixed strategies is somewhat different: the probability that the NM will choose Innovate ($p$) is 0.4, while the probability that the SM will choose Innovate ($q$) is 0.2.\textsuperscript{194} Thus, in mixed strategies,

\textsuperscript{193} FDA Fact Sheet, \textit{supra} note 192, at 1.

\textsuperscript{194} The calculation for $p$ is as follows:

\[ q[p(0) + 1 - p(2.5)] + (1 - q)(p(0) + (1 - q)(0)) , \]

which can be simplified to

\[ q(1 - 2.5p) + (1 - q)(0) . \]

Taking the partial derivative, fixing it at Zero gives:

\[ \frac{\partial E_{\text{NM}}}{\partial p} = 0 \ 1 - 2.5p - 0 = 0 \ 2.5q = 1 - 2p = \frac{1}{2.5} = 0.4 \]

The calculation for $q$ is as follows:
the NM and SM each will choose Innovate with a higher probability with a market exclusivity period than they would without such exclusivity, but the probability still remains under 50 percent. Moreover, the market exclusivity period likely will do little to change the focal point. Where the players have done nothing for many years, they will continue to do nothing. Therefore, although adding a market exclusivity period may begin to tip the scales, it will not solve the problem.

In addition, a market exclusivity period could result in externalities that limit the social welfare benefits of encouraging innovation. If a party should choose Innovate, the imitator will not be able to enter the market until the patent protection expires. This will result in a social welfare loss if the innovator is unable or chooses not to produce a quantity sufficient to meet demand.

Consequently, an international orphan drug act modeled on the U.S. Act will not be enough. The question, then, is whether the payoffs, or at least the focal point, of the Inelastic-Inelastic "Weak" patent protection game can be changed.

c. Incentivizing the Southern Firm

It will be very difficult to make any reasonably attainable changes that might induce a Northern manufacturer to innovate with respect to international orphan drugs. The Northern manufacturer's business model depends too heavily on blockbuster drugs. Moreover, the Northern manufacturer's research and development efforts historically have been focused on conditions for which there are inelastic demand curves in the North. The Northern manufacturer has developed institutional knowledge and expertise and a business culture that naturally tends towards conditions prevalent in the North.

The Southern manufacturer, in contrast, does not yet have much institutional experience with a particular research and development program. The Southern manufacturer also does not have

\[ p[q(0) + 1 - q(5)] + (1 - q)[q(0) + (1 - q)(0)], \]

which can be simplified to:

\[ q(1 - 5q) + (1 - p)(0q + 0) \cdot \]

Taking the partial derivative, fixing it at Zero gives:

\[ \frac{\partial ETI_{NM}}{\partial q} = 0 \cdot 1 - 5q - 0 = 0\]

\[ 5q = 1 \cdot p = \frac{1}{5} = 0.2 \]
a business model focused on blockbuster drugs. Its revenues currently derive largely from bulk formulations, APIs, and generic drugs. Yet the Southern manufacturer will soon be required to adapt its business model to the higher levels of patent protection required under TRIPS. This presents an opportunity to use the TRIPS and Doha mechanisms to create a research and development culture in the South focused on diseases that are endemic to the developing world.

The game theory analysis presented in Part VI demonstrates that a lack of Strong patent protection in the South will not inhibit research and development of drugs for which there is inelastic demand in the North. Southern manufacturers should have ready access to compulsory licenses to produce such products for domestic use or export to other Southern nations. However, under TRIPS, the Southern manufacturer must pay "adequate remuneration" for such licenses. Perhaps the concept of "adequate remuneration" can be tied to a public benefit obligation. That is, Southern manufacturers that obtain compulsory licenses to make generic products could be required to devote original research and development efforts to cures for tropical diseases.

Compulsory licenses are not unique to TRIPS. Many national patent laws provide for compulsory licenses to remedy antitrust violations, governmental or "crown" use, or failure to work an invention. However, the concept of "adequate remuneration" under TRIPS is untested and undefined.

Textually, there are two main elements to this obligation: (1) payment to the right holder (2) of adequate remuneration. Under this construction, an evaluation of "the circumstances of each case" and

195. TRIPS Article 31(f) states as follows: "the right holder shall be paid adequate remuneration in the circumstances of each case, taking into account the economic value of the authorization."


"the economic value of the authorization" would illuminate what constitutes "adequate remuneration." This could implicate an analysis akin to that undertaken in many cases under U.S. law, in which a compulsory license may be part of an injunction to remedy antitrust violations, contingent upon the payment by the licensor of a reasonable royalty based on a market value calculation of the license.198

The TRIPS compulsory licensing provisions should, however, be construed in light of the Doha Declaration's affirmation that "the [TRIPS] Agreement can and should be interpreted and implemented in a manner supportive of WTO members' right to protect public health and, in particular, to promote access to medicines for all."199 A compulsory license based on a market value calculation would do little to "promote access to medicines for all" because the generic producer would then need to raise its prices to recover those licensing costs. The concept of adequate remuneration to the patent holder under TRIPS cannot, therefore, implicate a market value licensing fee.

Instead, adequate remuneration could be construed to permit a Southern manufacturer to discharge a duty that might otherwise fall on the Northern manufacturer—in particular, the duty to develop treatments for international orphan conditions. There are at least three ways in which such a duty could exist: (1) as a requirement for obtaining patent protection on a pharmaceutical product, (2) as part of a regulatory drug approval process or, (3) as part of an international intellectual property regime.

A developing country could change its patent law so that, in order to obtain a patent on a compound, method, or process with a therapeutic use, the applicant must commit to contribute to research and development of treatments for orphan conditions endemic to the region in which the national patent office is located. This approach, however, would violate Article 27(1) of TRIPS, which provides that patent protection must be available if the invention meets the basic criteria of novelty, inventive step, and industrial application.200 Therefore, Article 27(1) would need to be amended to allow the national patent law of a developing country or LDC to include such a requirement. Even with such an amendment, the inclusion of such a requirement in a developing country's or LDC's patent law might deter Northern firms from entering those markets.

198. See e.g., United States v. Nat'l Lead Co., 332 U.S. 319, 348-50 (1947) (noting that compulsory license made available at "uniform, reasonable royalties" was an appropriate remedy against patent misuse and that the royalty should be calculated based on past market royalties).
199. Doha Declaration, supra note 52, at para. 4.
200. TRIPS, supra note 20, at art. 27(1).
Alternatively, a developing country could require that any manufacturer wishing to sell pharmaceutical products in that country must conduct or contribute to research and development efforts relating to local diseases. This approach would avoid any conflict with TRIPS because it is tied to regulatory marketing approval rather than patentability. Once again, though, this might cause Northern manufacturers to forgo sales in the developing country market.

The best approach might be to build an obligation into the international patent system. Under such an obligation, for example, a firm that desires uniform patent protection for a pharmaceutical product in the lucrative North American and European markets would be required to contribute to research and development relating to international orphan conditions.

Although it may seem unrealistic to suggest such an option, momentum has been building for some time towards a more integrated international patent system, as is reflected by the adoption of TRIPS. In fact, a fundamental premise of TRIPS is that the international harmonization of IPRs will contribute to global social and economic welfare. The nature of the social bargain underlying patent protection, then, is moving away from insular territoriality toward a more global bargain. The suggestion that the benefit of global patent protection will carry a burden to contribute to research and development of international orphan technologies is consistent with these principles.

Indeed, an obligation to undertake local orphan research and development may already exist under international “soft” human rights law. Although states, rather than corporations, are the actors generally bound by international human rights treaties, “soft” law instruments, such as internal codes of conduct and guidelines promulgated by international standards setting bodies, may impose

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201. Such an obligation might become part of the compulsory licensing system under TRIPS. This might, however, require some modification of TRIPS' national treatment provisions. Alternatively, the obligation might become part of a more integrated international patent system located under a new convention.

202. See, e.g., Reichman, supra note 23, at 14-15 (“[T]he TRIPS Agreement should replace a patchwork system of territorial regulation (that allowed free-riders in some countries readily to appropriate the fruits of foreign investment in technical innovation) with a global competitive framework built around the international minimum standards of protection adopted for specified intellectual creations.”).

203. TRIPS, supra note 20, at art. 7:

The protection and enforcement of intellectual property rights should contribute to the promotion of technological innovation and to the transfer and dissemination of technology, to the mutual advantage of producers and users of technological knowledge and in a manner conducive to social and economic welfare, and to a balance of rights and obligations.
morally binding obligations on multinational corporations. The Organisation for Economic Co-operation and Development, for example, has published “Guidelines for Multinational Enterprises” that include an obligation to perform local research and development work. Likewise, the United Nations is drafting a code relating to the obligations of transnational corporations under the Universal Declaration of Human Rights. The U.N.’s draft code and its related commentary state that transnational companies should apply intellectual property rights in a manner that promotes social welfare and local development objectives.

Once the obligation is recognized, it is a short step to conclude that a Southern manufacturer may assume part of the obligation as its payment of remuneration for a compulsory license. The compulsory license is not intended to be free. Of course, the research and development expenditures expected of any one manufacturer would need to be calibrated to the expected value of the compulsory license. In some cases, some of the research and development costs might need to come from an international fund. In other cases, a consortium of manufacturers who have obtained compulsory licenses for a class of drugs might need to work together on research and development efforts for the tropical disease. The TRIPS council or another international body could establish such terms when the compulsory licenses are obtained. If a viable compound for a tropical


207. Id. § 10.

208. The size of such a fund should not need to be as large as the purchase funds proposed by Jeffrey Sachs or Mattias Ganslandt and Keith Maskus. See supra note 147 and accompanying text. Those would entail multibillion dollar obligations to buy up stocks of particular medicines. In contrast, the type of fund discussed in this Part would defray research and development costs. Such costs are, of course, significant (see Part III.A, supra), but at $400 to $800 million per drug, they are substantially less, for example, than the $4.7 to $8.1 billion per year proposed by Ganslandt and Maskus for AIDS treatment in Sub-Saharan Africa. See supra note 147 and accompanying text. Therefore, the more modest research and development fund should be easier to establish as a practical and political matter.
disease is developed through this process, the compound and the research that led to its development would become publicly available.

Finally, this system could well change the payoffs sufficiently to affect the innovation game. The Southern manufacturer's ability to imitate in the Inelastic-Elastic market is quite valuable to the Southern manufacturer. If that ability is tied to a requirement that the Southern manufacturer innovate in the Elastic-Elastic market, then the payoff to the Southern manufacturer for innovation in the latter market will increase. Thus, assuming that basic research and development costs are subsidized, the game might change as follows:

<table>
<thead>
<tr>
<th></th>
<th>Innovate</th>
<th>Imitate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SM</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Innovate</td>
<td>0, 10</td>
<td>0, 5</td>
</tr>
<tr>
<td><strong>NM</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Imitate</td>
<td>2.5, 10</td>
<td>0, 0</td>
</tr>
</tbody>
</table>

Payoffs to NM, SM.

The SM's payoff for being the sole innovator in this game is 10 because innovating allows the SM to obtain a compulsory license in the separate Inelastic-Elastic, Weak Patent Protection game, and the payoff to the SM for imitating in that game is 10. The SM's payoff for innovating is not decreased if the NM also innovates—the SM obtains the compulsory license in the other market regardless of what the NM does in this market. The game has now changed. The Nash equilibrium in pure strategies is Imitate, Innovate. The SM will innovate with respect to the tropical diseases.

VII. CONCLUSION

The analysis set forth above demonstrates that a rational international patent system for essential technologies should respond to the differences in price elasticity of demand in different national markets.

Where demand is inelastic in developed countries, a decrease in the level of patent protection offered in developing countries is unlikely to have much effect on the equilibrium of the innovation game. Northern (developed country) manufacturers are likely to expend R&D resources in hopes of winning monopoly profits from patent protection in the developed countries. This is true even if the product will be subject to weak patent protection (in other words, compulsory licenses or parallel imports) in developing countries.
Southern (developing country) manufacturers are likely to copy rather than innovate regardless of the level of patent protection in their home countries. Under these circumstances, incentives for innovation remain intact, and the developing country markets, where demand is always highly elastic, can be supplied with cheaper generic substitutes. Thus, broad Doha-like exceptions are efficient where developed country demand is inelastic.

Where demand in developed countries is elastic, however, the game changes. The developing country manufacturer is unlikely to invest in R&D because the ability to recoup that investment through monopoly pricing is diminished. This is true regardless of whether patent protection in developing countries is strong or weak. The high demand elasticity in developing country markets makes the R&D investment too great a gamble for developed country manufacturers if the developed country market cannot support monopoly prices.

In the case of essential medicines, the market in developing countries is highly elastic, or very small, for vaccines and treatments for most tropical diseases. Therefore, no matter what level of patent protection is afforded in developing countries, it is unlikely that developed country manufacturers will devote significant R&D resources to such vaccines or treatments. Likewise, it is unlikely that strong patent protection, by itself, will provide significant incentives to developing country manufactures, which can make easier and higher profits producing generic versions of other medicines. This suggests that the international patent system must incorporate other incentives to stimulate R&D in essential technologies where demand in developed countries is highly elastic.

Such an incentive can be incorporated into the “adequate remuneration” requirement for compulsory licenses. The Southern manufacturer’s payment for a compulsory license could be a requirement that the Southern manufacturer invest in research and development towards cures for tropical diseases. If such research and development also is funded in part through an international fund, the promise of readily available compulsory licenses for other compounds could be enough to change the outcome of the innovation game. In this way, we can perhaps find a better balance between innovation, profits, and the public good.