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**A Framework for Assessing the Costs and Benefits
to Developing Countries of
TRIPS-Plus Rules in Trade Agreements**

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Summary

This paper looks at a variety of channels through which TRIPS-plus (TPS) provisions of trade agreements can impose costs or provide benefits to developing countries, by imposing stronger patent protections for pharmaceuticals. It describes these costs and benefits and how in principle it might be possible to quantify them. This summary briefly outlines the discussion of each of the main costs and benefits.

Potential Costs of TRIPS-Plus Rules

1) Higher Drug Prices

TPS rules can be expected to lead to higher drug prices through several mechanisms. The most important mechanism is that TPS rules impose tighter restrictions on the ability of governments to require compulsory licensing for a drug that is still subject to patent protection. Compulsory licensing effectively undermines the ability of take full advantage of its patent monopoly. TPS rules also sharply restrict the ability of countries to buy parallel imports. This can both prevent a country from taking advantage of the opportunity to buy drugs in countries where they may be available at lower prices, and also from being able to force compulsory licensing, if it lacks the manufacturing capacity to produce a drug domestically. A third component of TPS rules that could have a substantial effect on drugs prices are requirements for data exclusivity for periods of 3-10 years. These rules can effectively provide monopolies to drugs that are not subject to patent protection for a substantial period of time.

The effect of each of these measures on drug prices can be directly estimated with industry data on drug prices tabulated by IMS Health. It may not be possible to get separate estimates for the effect of each of these TPS provisions. It may be necessary instead to construct an index of patent strength that combines these three rules, along with other TPS provisions, such as requirements for patent extensions in the case of regulatory delays.

It is important that estimates take account of trends in drug prices. Drug prices have been rising much more rapidly than the overall rate of inflation. As a result, TPS rules are likely to have much more effect on drug prices in the future than in the past.

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2) Larger Rent Transfers Due to Higher Drug Prices

The estimates of the impact of TPS rules on drug prices should make it possible to determine the increase in total rents, and the rents paid to foreign drug companies, that can be expected in each country as a result of implementing TPS rules. As a first approximation, the percentage of the rents that will be paid to foreign drug companies will be proportional to their share of patents. However, it is possible that foreign companies may be less susceptible to political pressures to keep prices down on important drugs. For this reason, it would be desirable to test for whether there is a difference in the pricing patterns between drugs in which a domestic company holds the patent and drugs for which a foreign-based company holds the patent.

It is also important to recognize that not all of the increase in drug prices will be attributable to higher patent rents. Higher patent rents increase the company's incentive to promote their drugs, and will therefore lead to increased marketing expenditures. If there is no direct data available on marketing expenditures (which is likely), then some rule of thumb about the percentage of the increased revenue that will be absorbed in marketing can be taken based on evidence from other countries. The additional revenue, net of marketing expenditures, will be amount of rent transferred to foreign drug companies.

3) Deadweight Losses Due to Higher Drug Prices

The deadweight loss from higher drug prices results from people who would have benefited from buying the drug at the price that it would have sold for with less stringent patent rules, but are unable or unwilling to buy it at the price under TPS rules. There is not likely to be sufficient data to provide reliable estimates of demand elasticity for drugs in each country, and the process would be extremely time-consuming in any case. It is probably simplest to construct a range of plausible elasticities based on existing research, and then use the estimated price increases from TPS measures to calculate the resulting deadweight losses.

4) Enforcement Costs

There has been relatively little attention given to enforcement costs under TPS rules. As a practical matter, enforcement of drug patents could impose substantial economic and political costs on developing countries. The basic problem is that TPS rules will lead to large gaps between the patent protected price and the cost of production. In some cases, the patent protected price may be 10 times, or even 100 times, as high as the cost of production of the drug. This means that there will be enormous potential profits for producers of unauthorized versions of drugs.

There is not any clear basis for estimating the costs associated with keeping a check on the size of a black market in patent protected drugs, since most drug prices had not previously diverged sharply from production costs in most countries. The black market is likely to grow with time as

the divergence between price and production costs increase and more people develop the expertise to reverse engineer drugs.

The experience of the United States in trying to suppress a black market in illegal drugs is not encouraging. This has led to the imprisonment of hundreds of thousands of people and tens of billions in annual expenditures on law enforcement. With the sale of unauthorized versions of patent protected drugs potentially offering similar profit margins as the sale of illegal drugs, it may be equally difficult to suppress this industry.

There may also be substantial political costs to a government that is perceived as cracking down on black market drugs, to the detriment of the health and economic well-being of its own population, in order to benefit foreign drug producers. This effect would be extremely difficult to quantify, but concern over high drug prices has already been a cause of large-scale protests in many developing countries.

5) Quality of Health Costs

The potential for patent rents provides a large incentive to drug manufacturers to promote their drugs in situations where they may not be helpful to patients, or possibly even harmful. This has been a major problem in the United States, where the industry has often withheld data suggesting that their drugs may be ineffective or even harmful, or alternatively, made claims that were not accurate. It has been difficult to prevent this behavior in the United States, it would be much harder for developing countries, with less effective regulatory systems, to restrain false and misleading claims by the pharmaceutical industry. As a result, it is likely that many people in the developing world will receive poorer quality health care as a result of the drug industry's pursuit of patent rents.

There is no easy way to quantify the likely size of this effect, however, the damages paid out each year by the drug industry in the United States (as a percentage of GDP) may provide a guide as to the order of magnitude of this effect. The negative health effects from the pursuit of patent rents are likely to be proportionately larger in developing countries since their regulatory systems are less well established.

6) Corruption Effects

The potential to obtain large patent rents creates greater opportunities for corruption than if drugs are sold at prices closer to their cost of production. This could encourage corruption in the form of efforts to lobby for increased government payments for drugs at patent protected prices or also for legislation that allows for greater patent rents through even stronger protections. The effort of increased corruption could extend beyond government policy toward drugs and undermine the integrity of the government more generally.

The potential costs associated with a loss of governmental integrity are large although not easily measured. One possible way to estimate the potential impact of TPS measures on corruption would be to estimate the relationship between government corruption and the share of GDP paid

out in patent rents. In principle, this could be done using an index of corruption such as Transparency International's Corruption Perception Index, with a regression testing for a negative relationship between the share of GDP devoted to patent rents and the measure on the transparency index.

7) Negative Effects on the Medical Tourism Industry

A large and rapidly growing industry for several developing countries is the medical tourism industry. This industry takes advantage of the large gap between the price of medical care services in wealthy countries (especially the United States) and the developing world. With health care costs projected to continue to rise rapidly in the United States, the medical tourism industry has enormous potential for growth and could be an important industry for many developing countries.

If TPS rules raise drug prices in a developing country, it would place it at a competitive disadvantage in the medical tourism industry. The importance of this effect will depend on a country's suitability as a destination for medical tourism. It will also depend on whether the other destinations for medical tourism also adopt TPS rules and therefore have higher drug prices as well.

Potential Benefits of TRIPs-Plus Rules

1) By increasing patent rents, TPS rules will increase the incentives to research new drugs. In principle, this can have the greatest impact on the incentives for researching drugs to treat diseases that primarily affect people in the developing world. However, as a practical matter, this impact is likely to be almost invisible for all but the largest developing countries. The estimates of the cost of developing a new drug and the trend growth path from Dimasi et al. (2002) imply that the cost of developing a new drug is close to \$1.5 billion in 2006. For most developing countries, even a decade of additional patent rents from the application of TPS rules would not come close to being sufficient to finance a single new drug. (The impact of patent rents from developing countries is lessened by the fact that pharmaceutical companies would apply a greater discount rate to projected patent rents in developing countries due to the greater risk associated with these flows.)

It is a fairly straightforward exercise to relate the estimates of patent rents to their impact on drug development by using the Dimasi estimates of the cost of drug development through the patent system. The Dimasi estimates provide a simple way of measuring the likely impact of TPS measures on the pace of drug development. It is important to remember that it is net revenue (revenue minus sales cost) that would be the relevant factor in determining investment incentives, not gross revenue.

2) TPS rules can increase the FDI flows to developing countries. This is likely to be more a political issue than an economic one since TRIPs rules already guarantee companies that their research will receive the same patent protection regardless of where it takes place. (This means that if there are profitable opportunities to produce a drug through reverse engineering in a

country with weak patent protection, then anyone in the world would be able set up a manufacturing facility in the country. Locating the original research in such a country would have a minimal impact on the probability of such an operation being established.)

However, developing countries could benefit from increased FDI flows by adopting TPS rules, if pharmaceutical companies locate investment in ways that punish countries with weak patent protection and reward countries with stronger protections. In principle, it should be possible to test for such an effect by examining for changes in the trend rates of growth of investment by the pharmaceutical industry in countries that have adopted TPS measures. However, as a practical matter, such a test would be difficult since most trade agreements with TPS provisions have been in place a short period of time. Furthermore, industry/country level FDI data is not publicly available for most countries, although the Commerce Department may make this available under confidentiality agreements.

It is also important to recognize that past patterns of FDI may not predict future patterns. China and India are both rising rapidly as sources of FDI and scientific expertise, with China soon passing the United States in the number of science and engineering degrees produced each year. Since these countries lack the same history of strong IPR protection, it is possible that TPS provisions will matter less in attracting FDI from these countries than from the United States and Europe.

It is also necessary to consider that even if the adoption of TPS rules is an effective mechanism for attracting FDI, it may not be the most efficient mechanism. There is a large body of research showing that a well-developed infrastructure and a well-educated workforce are important factors determining flows of FDI. By increasing the stringency of patent protection, TPS measures are effectively allowing pharmaceutical companies to impose a tax on prescription drugs. In principle, developing country governments could impose similar (albeit more efficient) taxes on drugs and use the revenue to finance improvements in education and infrastructure. This could very likely have a larger effect on inflows of FDI both from the pharmaceutical industry and other sectors.

Finally, there is very little reason to expect that the adoption of TPS measures will offer any noticeable benefits in FDI flows for low income countries. These countries lack the infrastructure and trained workers to make themselves attractive locations for FDI. Adopting TPS measures will still leave them as unattractive locations for FDI. For these countries, TPS measures are likely to provide few visible benefits. It is possible that TPS measures will prove more beneficial as low-income countries develop, but the early adoption of TPS measures is not likely to speed this process.

Introduction

A main priority of the United States in negotiating trade agreements over the last decade has been the inclusion of provisions that provide greater protection for copyrights, patents and other forms of intellectual property than what is required by the Trade Related Aspects of Intellectual Property (TRIPs) provisions of the Uruguay Round of World Trade Organization (WTO). These additional “TRIPs-plus” (TPS) protections have been included in the NAFTA and CAFTA, and would almost certainly feature prominently in any FTAA agreement.

The most controversial of these TPS provisions apply to pharmaceutical patents. Public health experts and advocates have expressed concerns that TPS provisions will raise the price of important drugs in developing countries to levels where they are unaffordable to much of the population and/or lead to a large drain on the public budget in countries where the government pays a substantial portion of health care expenditures. While recognizing these concerns, proponents of TPS provisions have argued that these provisions will encourage the pharmaceutical industry to invest in treatments for diseases that afflict people in developing countries. They also argue that TPS provisions will lead to more research being located in developing countries, and to larger inflows of foreign direct investment (FDI) more generally.

Thus far, there has been relatively little analysis of the potential costs and benefits of TPS provisions to developing countries. The main costs would stem from stronger patent rules that would allow firms to charge prices that are substantially higher than the competitive market price for longer periods of time. The benefits would in principle stem from greater investment in research in developing countries that accept TPS provisions, in addition to increased funding for research worldwide into diseases that afflict their populations.

This paper will describe these costs and benefits in more detail and outline methods for quantifying them. It will also detail the inherent limitations of these efforts given the important changes taking place in the global economy – specifically the rapid diffusion of expertise to fast growing middle income countries like China and India, and also the declining importance of the United States as a source of foreign investment.

The first section outlines the major features of TPS agreements as they pertain to prescription drugs, and how they differ from the requirements laid out in the WTO TRIPs provisions. (The appendix discusses TPS provisions that apply to other areas.) The second section outlines the types of costs (both direct and indirect) that developing countries can be expected to incur as a result of these provisions. The third section outlines the benefits (both direct and indirect) that developing countries can expect from implementing TPS provisions. A brief conclusion summarizes the key issues.

TRIPS-Plus: What It Means

The TRIPs provisions attached to the 1995 Uruguay Round agreement of the WTO were the first major step toward the international harmonization of rules on intellectual property.² They required higher standards of protection in many areas than even the rules that most wealthy countries had in place. For example, they extended patent duration to 20 years from the date of filing, a considerably longer period than the law specified in most wealthy countries at the time. The TRIPs rules also required countries to apply the same patent rules across sectors, which meant, for example, that countries could not provide for shorter patent terms for prescription drugs than in any other sector of the economy. There were many other areas where the TRIPs provisions required wealthy countries to adopt stricter rules on intellectual property.

For developing countries the rule changes required were considerably more substantial. Many developing countries had very limited and poorly enforced rules on intellectual property. The TRIPs provisions required them to establish systems for enforcing patents copyrights, and trademarks that are comparable to the systems that already existed in wealthy countries. They also required a substantial broadening of the list of items that could be subject to protection. For example, India and several other middle income countries had previously only allowed process patents, prohibiting patents in drugs or other products. TRIPs also required that countries allow patents in plants and other types of life-forms, with limited exceptions.

In recognition of the difficulty that many developing countries would face in meeting the TRIPs standards, the agreement gave most developing countries until 2005 to establish rules that are fully TRIPS compliant. This date was extended to 2016 for the least developed countries, at the Doha round negotiations in 2001. One of the issues that arises in the context of these least developed countries negotiating TPS rules, is the early application of the TRIPs rules. In other words, TPS provisions may force the least developed countries to apply TRIPs provisions before they are required to under the current agreement. Insofar as the date of the applicability of TRIPs rules is moved forward by a TPS agreement, the costs and benefits of the TRIPs agreement itself, for the additional years in which it would be applied, would have to be included in assessing the costs and benefits of a TPS agreement.

Any assessment of the costs and benefits of TPS rules is made more difficult by the fact there is still considerable dispute about the wording and meaning of the TRIPs rules already in place. This is especially important in the case of prescription drugs. According to some interpretations, article 31 of the TRIPs provisions allows for compulsory licensing under fairly general terms.³ Such a provision would substantially weaken the impact of drug patents, since governments could force companies to license patented in exchange for a modest royalty. This would result in patented drugs being sold at prices that were much closer to their competitive market price.

The original TRIPs rules also allowed parallel imports (the importation of drugs from other countries, where they may be produced and sold at lower prices than would be charged by the patent holder) under fairly general circumstances. Parallel imports are especially important for countries that have limited manufacturing infrastructure and therefore may not be able to produce

² For accounts of the meaning and origins of the TRIPs provisions in the Uruguay Round of the W.T.O. see UNCTAD-ICTSD, 2005 and Sell (2003).

³ This is the interpretation in Maskus, K. (2000, pp 178-199). See also UNCTAD-ICTSD (2005, p 486).

drugs domestically under a compulsory license. Unless these countries have the right to import drugs at a price that is lower than what the patent holder would charge domestically, the right to require compulsory licensing would be meaningless.

In subsequent negotiations, the wealthy countries, led by the United States, have sought to tighten the TRIPs rules on both compulsory licensing and parallel imports. They have sought to reinterpret the rules on compulsory licensing so that it would only be an option under special circumstances, and even then, it would only be available to the poorest countries. The wealthy countries have gone to considerable length to discourage the use of compulsory licenses to date, often threatening retaliation against countries that might opt to take advantage of compulsory licenses. In almost every case where a developing country raised the prospect of issuing a compulsory license, the drug companies affected reached an agreement with the government for price reductions before the government found it necessary to issue a compulsory license.⁴ As a result, very few compulsory licenses on prescription drugs have been issued in the TRIPs era. The situation is similar with parallel imports, with the wealthy countries trying to limit parallel imports to cases of health emergencies in the poorest countries.

It is not clear at this point how the disputes over the meaning of the TRIPs provisions will be resolved. If the wealthy countries are successful in pushing through new wording and/or interpretations that effectively preclude compulsory licensing and parallel imports, then the impact of TRIPs rules will be considerably smaller since some of the most important provisions will already be binding due to TRIPs. For purposes of this analysis, it is assumed that TRIPs allows generalized compulsory licensing and imposes no restrictions on parallel imports (other than prohibitions on favoring domestic companies or domestically produced drugs). This means that, insofar as TRIPs agreements restrict compulsory licensing or parallel imports, it would imply a tightening of IP rules.

Another key provision of TRIPs agreements is a requirement for periods of data exclusivity. These rules prohibit the commercial use of data needed for licensing a product, such as the safety and efficacy tests required to have a drug approved, for limited periods of time. For example, data exclusivity provisions would prohibit a generic drug manufacturer from relying on the test results from a brand manufacturer to get a generic drug approved. The generic manufacturer would be required to carry through its own tests to get a drug licensed during the period of exclusivity.

Typically, the period of data exclusivity runs from 3 to 8 years.⁵ In the case of most new drugs, the period of data exclusivity would overlap with the 20 year patent period, so the manufacturer would not have their period of monopoly extended by data exclusivity provision. However, data exclusivity would provide a period of monopoly in cases where new uses were uncovered for an existing drug whose patent had already expired. In addition, there are cases where drugs were

⁴ For example, in July of 2005, Abbott agreed to make available the AIDS drug Kaletra (Lopinavir/Ritonavir) at a substantial discount in Brazil in order to stave off the threat of a compulsory license. (Abbott's statement can be found at <http://www.medicalnewstoday.com/medicalnews.php?newsid=27229>). There have been several other prominent instances in which drug companies have agreed to lower prices in order to prevent developing countries from issuing compulsory licenses.

⁵ See World Bank Group, 2005.

already available in countries under pre-TRIPs rules, that did not allow patents. A data exclusivity requirement can allow companies to gain a period of monopoly for several years following the drug's approval. Data exclusivity can also pose an obstacle to compulsory licensing, since a generic manufacturer would still be required to do its own tests to gain regulatory approval for any period in which the exclusivity rules applied.

There are several other conditions in TPS agreements that could have the effect of extending and strengthening patent monopolies on prescription drugs. For example, in some cases, the research necessary to have a generic drug approved may be prohibited during the patent term, without the permission of the patent holder.⁶ Several TPS agreements include provisions for patent extensions in cases where there were extraordinary delays in the approval process. Some agreements also provide for criminal penalties in the case of deliberate infringements. In general TPS provisions create a legal environment that is far more friendly to the patent-holder than might otherwise be the case.

The intended result of stronger patent protections is higher prices for the protected items. In the short-term this means higher costs to consumers. In the long-term, these costs can be partially or completely offset by the increased incentives for research. The next section examines the methodologies that could be used to measure the higher costs that result from TPS type agreements.

The Costs of TRIPs-Plus

The higher drug prices that result from TPS measures have both direct and indirect costs. The direct costs, while still difficult to measure, can in principle be estimated based on the anticipated price increases that result from stronger patent protections. The indirect costs are the costs that are attributable to the various forms of non-productive rent-seeking activity that are promoted by the availability of stronger patent protection. These costs would include a range of actions from misrepresenting the safety and usefulness of drugs (thereby resulting in poorer health care) to the increased cost of restricting counterfeit production as the potential profit increases. The indirect costs are considerably more difficult to quantify, but it is possible to at least outline some of the parameters.

Thus far, there have been relatively limited efforts to measure the costs that stronger patent protections impose on developing countries. The two most important studies (Maskus (2000) and McCalman (2001)) estimated the size of the patent rents extracted by domestic and foreign patent

⁶ The United States patent law includes the "Bolar exemption" which allows companies to freely use patented substances for research purposes, such as reverse engineering a drug. This allows a generic manufacturer the opportunity to have a generic equivalent in the approval phase prior to the expiration of a patent, so that it can begin marketing the drug as soon as the patent on the brand drug expires. Many of the countries signing TPS agreements have no equivalent law. This could mean that generics will not typically be able to gain regulatory approval for many months, or even years, after the patent on a brand drug has expired. There is also a question as to whether a generic producer can stockpile a generic version of the drug while the patent is still in force. If stockpiling is prohibited, this can delay the introduction of a generic drug for a number of months in countries that do not have manufacturing facilities.

holders based on the costs that they had to incur in securing a patent.⁷ While these studies both found that developing countries were likely to incur substantial costs as a result of the more stringent patent rules required by TRIPs (the estimates of the increase in net transfers due to higher patent rents was more than 0.5 percent of GDP for several countries), it is likely that this methodology would substantially understate the direct economic costs of more stringent patent protection.⁸

The main flaw in McCalman-Maskus methodology is that it would in principle only measure the net revenue that firms anticipate gaining through patent protection, not the higher prices paid by consumers. The logic of the model is that firms will on the margin be willing to pay exactly as much for a patent as they expect to earn in the form of higher rents. In other words, if a firm believes that getting or renewing a patent will earn it net revenue of \$100,000, then it should be willing to pay \$100,000 in fees and costs to obtain the patent or the renewal. The basis for the parameter estimates in the model are then the fees that firms pay for patents and patent renewals in the various countries included in the sample. (The costs include the payments to lawyers, or other agents, that are typically required to secure a patent. Since many of these payments will not generally be public information, there must be considerable error in the measurement of these costs.)

However, the payment that a firm is willing to make to obtain or extend a patent will depend on the net revenue it anticipates, not the gross revenue. The primary source of the difference between gross and net revenue in this case is the additional marketing expense that the firm is likely to incur as a result of the fact that it will be selling the product at a higher price.⁹ In a competitive market, firms will generally only invest in very limited sales efforts, since the market price is equal to the marginal cost of production. However, when a firm has a patent monopoly, it can sell its product at prices far above the marginal cost of production, which means that it has substantial incentives to try to increase sales through marketing.

This is especially likely to be the case with the pharmaceutical industry, where there are huge asymmetries in knowledge between sellers and consumers. In this situation, sellers are better positioned to try to exploit their asymmetric information by convincing doctors and/or patients that their drugs are more effective than is actually the case. This asymmetry provides a situation in which marketing expenditures are likely to be more effective than with many other products.

In the United States, the pharmaceutical industry recently reported that it employed almost twice as many people in marketing as it in research.¹⁰ While it did not disclose the relative spending in the two areas, the employment data suggest that marketing is likely to absorb at least as large a

⁷ The methodology used in Maskus (2000) is the same as the methodology used in McCalman (2001).

⁸ Maskus, 1997. "Intellectual Property Rights In Lebanon," International Trade Division, World Bank, cited in Maskus 2000, pp 157-159, finds that the static effect of the application of stricter IP rules in Lebanon, would lead to a loss of jobs equal to 0.5 percent of formal sector employment.

⁹ As a result of obtaining or extending patent protection, firms will also be willing to pay more money for other expenditures such as legal fees, political contributions, or even outright bribes. In principle, a firm's willingness to pay for a patent depends on how much revenue they anticipate *net* of all such expenditures.

¹⁰ The Pharmaceutical Research and Manufacturers of America's *2001 Industry Profile*, reported that in 2000, its members employed 87,810 in sales compared to 48,527 in research. This information has not been included in more recent annual reports.

share of the industry's revenue as research. In 2004, the industry reported spending \$40 billion on research in the United States. If it spent the same amount on marketing, then this would imply that approximately one-fifth of pharmaceutical sales in the United States were devoted to recovering marketing costs. While the costs associated with marketing patented drugs are substantial, and are reflected in drug prices paid by consumers, the McCalman-Maskus methodology would only pick up the revenue that firms anticipate after deducting additional marketing expenses. For this reason, the methodology is likely to substantially understate the costs of TPS measures.

However, the methodology does at least provide a way of getting lower bound estimates of the costs to consumers of applying TPS measures. In principle, the data needed to use the McCalman-Maskus methodology for constructing cost estimates of TPS measures are obtainable. The McCalman-Maskus methodology used a range of measures of patent strength as independent variables to derive its estimates for the cost of TRIPs. The cost of TPS measures would focus on the use of compulsory licensing, the availability of parallel imports, and rules on data exclusivity, as the key independent variables. In other respects the model could be largely left in tact.¹¹

A Direct Estimation of the Costs of TPS Provisions

It is also possible to use a more direct approach to estimating the costs of increased patent protection associated with TPS rules. In principle, the average price of drugs in a country could be expected to be a function of the per capita GDP and the stringency of patent protection. In other words:

$$1) \ln(P_i) = a + b \ln(\text{GDP}/P_i) + c \ln(\text{PS}_i) + e,$$

Where P_i is the average drug price in country i , a is a constant, GDP/P_i is per capita GDP, and PS_i is patent stringency, and e is an error term.¹² The regression could be estimated with each of the three key TPS provisions included as separate terms, so that it is possible to assign a value to each term.¹³ It is worth noting that the inclusion of per capita GDP as a term in the regression, implies that there is a degree of monopoly power, and therefore price discrimination, in the international drug market. Drugs are a tradable commodity, so in the absence of price discrimination, there is no reason to expect drugs to sell for higher prices in rich countries than

¹¹ It would also be necessary to get updated information on the cost of obtaining patents, since the data used in the McCalman-Maskus estimates date from the early nineties. It is also very important to include the cost of getting regulatory approval in the case of prescription drugs, since this is likely to be quite high compared to the expenditures needed to obtain a patent.

¹² The proposed test here is similar to the test for the impact of IP measures on drug prices in Schut and Van Bergeijk (1986).

¹³ The log form implies that the impact of each measure of patent stringency would depend on the price otherwise charged in a country. In other words, assuming that drug prices will be in general rise with per capita GDP, prohibitions on compulsory licensing might lead to comparable percentage increases in price across countries, but will lead to larger absolute increases in wealthy countries than in poor countries. It is possible to test this assumption by running the regression in additive form instead of log form.

poor countries, just as there no reason to believe that an identical computer will sell for a higher price in a rich country than a poor country.

The data requirements for this sort of estimation are relatively limited, although there are difficulties in accurately matching drugs across countries and controlling for discounts that may not be recorded in public data.¹⁴ There may also be some difficulty in determining the extent to which rules on compulsory licensing and parallel imports are meaningful. The option to issue compulsory licenses can have a substantial impact on prices, even if it is rarely used. Drug companies will often make substantial concessions on price, if they know that the alternative is to have the government issue a compulsory license under which they would only earn a nominal royalty fee. However, it is possible that some governments may be committed not to allow compulsory licenses, even in cases where domestic laws and international agreements clearly sanction compulsory licensing. (The same applies to parallel imports.) For purposes of estimation, it would be desirable to simply apply the legal rules in place in each country at the time, although it may be useful to also estimate the impact of these measures of patent stringency based on a subjective assessment of the extent to which the governments actually view compulsory licensing or parallel imports as real options.¹⁵

Other Factors Affecting Drug Prices

In addition to per capita income, it is also reasonable to believe that country size may have an impact on drug prices in some circumstances, since the ability of a country to bargain for lower prices with the pharmaceutical industry will depend in part on the size of its potential market. The industry would in principle be willing to make substantial price reductions to have access to a relatively large market such as a middle sized wealthy country like Australia or a large developing country like Brazil or India. However, smaller developing countries, like most of the countries in Sub-Sahara Africa or Central America, will have very limited bargaining power since they offer very limited markets to the pharmaceutical industry. This means that if they have surrendered the right to create competition during the life of a patent through compulsory licensing or parallel imports, they will be poorly positioned to bargain down prices.

Of course, a country's ability to bargain for lower prices will also depend on the government having some mechanism in place to bargain on behalf of its population. This mechanism can take a variety of forms, from bulk buying for a public health system to formal price controls, but countries that lack any such mechanism will typically have higher drug prices. To date, TPS rules have not been interpreted as precluding many forms of government action to constrain drug prices, but this could change in a world where many TPS agreements have already been signed. At that point, the industry would be less concerned with increasing the number of countries bound

¹⁴ The IMS Midas data base, which is produced by IMS Health, contains data on drug prices from more than 70 countries. Some of the problems associated with matching drug prices are discussed in Danzon and Furukaka (2003).

¹⁵ For example, in 2003, most wealthy countries signed onto a letter that committed them to not issue compulsory licenses for medicines, even in circumstances sanctioned by the WTO TRIPs provisions. The legal status of this letter is questionable, but it presumably makes it more difficult for governments in the countries that have signed onto the letter to issue a compulsory license at a future date.

by these agreements, and therefore might be inclined to focus more on stronger patent protection based on the wording of existing agreements.

In the cases of many of the world's poorest countries, the drug industry has been willing to make some drugs available at prices that approach the levels of generic competitors. For example, in response to considerable international pressure, several major pharmaceutical manufacturers began making AIDS drugs available to countries in Sub-Saharan Africa at prices that were comparable to the price of generic versions available from India and other middle income countries.¹⁶

While such price breaks can help increase access for some of the world's poor, it would be appropriate to exclude countries where a substantial portion of the drug supply was met with drugs offered at concessionary prices by the industry, since this is clearly not a market outcome. There is also no guarantee that concessionary pricing will persist.¹⁷

Finally, it is important that any estimate of the losses from TPS measures be explicitly forward looking. Drug prices have been rising more rapidly than the overall rate of inflation, especially in the United States, and drug spending has been growing as a share of GDP. (Real per capita spending on drugs in the United States has increased at an average annual rate of approximately 8 percent in the years from 1999-2005. Part of this rise is attributable to increased usage, but much of it is the result on higher drug prices.)¹⁸ This means that more stringent patent protections for drugs are likely to impose a substantially greater burden in the future than they did in the past. It would be appropriate to adjust estimates produced from the analysis described above for the expected increase in drug prices and drug usage in the years ahead. This growth path could easily raise the cost of TPS measures for the next ten years, by 50 percent, or more, (measured as a share of GDP) compared to their estimated cost over the last ten years.

The Impact of Higher Drug Prices

Rent Transfers

The national burden from higher drug prices due to TPS measures will depend in part on the ownership of the patents. In the case of developing countries, most patents will be foreign-owned, but in more advanced countries with substantial drug industries, for example India, Brazil, and Thailand, at least some of the additional patent-rent will remain within the country. In these cases,

¹⁶ See Fleshman (2001).

¹⁷ It is also important to recognize that obtaining drugs at concessionary prices may still involve a substantial commitment of resources from developing countries with very limited expertise in public health. Insofar as public health officials must spend time arranging for concessionary drug prices from brand producers, instead of just buying low cost generics, this is time not spent trying to improve the system of health care delivery.

¹⁸ Data on U.S. drug spending can be found in the Centers for Medicare and Medicaid Services (2006, Table 2).

consumers will still be faced with higher drug prices, but the transfers will be in part from domestic consumers and/or the government to the domestic drug industry. In order to assess the share of the additional rent that remains in the country, it would be necessary to have recent data on the percentage of drug related patents that are domestically owned. It is also necessary to know the trend in this pattern. For example, if the share of domestically owned patents has been increasing, then it is reasonable to expect that a larger percentage of the patent rents will accrue to domestic producers in the future than in the past. This can be calculated on a country-by-country basis using the same methodology as McCallum-Maskus.

It is also necessary to determine if foreign and domestic pharmaceutical companies pursue the same pricing patterns. For example, a domestically based pharmaceutical company may be more responsive to pressure to make an important drug available at a moderate price than a multinational drug manufacturer. If this proved to be the case, then basing an estimate of the percentage of patent rents that remained in the country on the percentage of patents that are domestically owned would lead to an over-estimate of the share of patent rents that stayed in the country. In the absence of evidence to the contrary, it is reasonable to assume that domestic and foreign manufacturers will pursue similar pricing policies, however, it is worth noting the possibility that their pricing patterns will differ.¹⁹

Deadweight Loss

The deadweight loss associated with higher drug prices will be the same regardless of whether the beneficiary of the transfer is a domestic or foreign producer.²⁰ The deadweight loss will depend on the elasticity of demand for drugs, which in turn will depend both on the distribution of income and the extent to which the government pays for prescription drugs. A country with a more equal distribution of income is likely to have more elastic demand for drugs (there are many people who can afford drugs at relatively low prices) and therefore experience greater losses if the price rises due to TPS rules. By contrast, in a country with a highly unequal distribution of income, it is likely that only a small share of the population would be able to afford drugs regardless of the price, so the decline in consumption in response to higher prices will be smaller. If the government is committed to providing health care for the population and pays for a large portion of the country's drug use, then there is likely to be less reduction in drug use in response to higher drug prices, although higher drug prices could pose a serious fiscal problem for the government.

As a practical, it is probably simplest to construct a range of assumptions on demand elasticity in order to set high and low bounds on the dead weight loss from higher drug prices in each country. (Elasticity is unlikely to be less than 0.1 or greater than 0.5 for an item that is generally

¹⁹ If domestic drug manufacturers are more responsive to political pressures to restrain prices, the effect of TPS rules on drug prices will also be less in developing countries with substantial domestic pharmaceutical industries.

²⁰ Deadweight loss is the lost benefit by consumers who would have purchased the drug at the price at which it would have sold under TRIPs rules, but cannot afford the drug at the price it would sell for under TPS rules.

considered a necessity.²¹ If there is a need to generate more precise estimates, then data can be obtained on the elasticity of demand in the specific countries in question.

In contrast to patent rents, which are a transfer to either a domestic or foreign producer, the deadweight loss associated with higher prices is pure economic waste. While it is possible that offsetting benefits from stronger patent protections could offset these losses, in a static context, the deadweight loss associated with patent protection is simply a drain on the economy.

Enforcement Costs

The large gap that strict patent rules create between price and marginal cost for prescription drugs will create substantial incentives for gray production of these drugs. Under TPS agreements, governments are obligated to take steps to suppress the production and sale of unauthorized versions of drugs. This could be a substantial cost in many countries, especially if drug prices follow their current trajectory, and developing countries prove unable or unwilling to use measures like price controls to restrict the price of patent protected drugs.

Enforcement carries both direct costs in the form of law enforcement personnel and indirect costs in the form of potential challenges to the legitimacy of governments. The two will to some extent interact, as the cost of restraining unauthorized sales and production will depend in part on the legitimacy attached to the drug patent laws. The fact that enforcement costs can be considerable is well demonstrated by the cost of efforts in the United States to stop the use of illegal drugs like marijuana and cocaine. Combined spending on law enforcement and incarceration by all segments of government in the United States exceeds 1.6 percent of GDP.²² If just one-quarter of these expenditures were drug related, then it implies that the government spends an amount exceeding 0.4 percent of GDP on drug enforcement. Drug enforcement policies have also resulted in millions of people being imprisoned in the United States over the last quarter century.

While the nature of the potential market for unauthorized versions of prescription drugs is very different than the market for illegal drugs in the United States, the incentives could be very comparable. Already, there are gaps on the order of 800 percent, or more, between the patent protected price of some drugs and the price at which generics can profitably be brought to the market.²³ Current trends indicate that these gaps will grow even larger in the years ahead as

²¹ The Congressional Budget Office's used 0.3 as its estimate of the elasticity of demand for prescription drugs in the United States, based on its assessment of the evidence, Congressional Budget Office (2004, fn 33).

²² This is taken from the Bureau of Justice Statistics, "Direction Expenditure By Level of Government, 1982-2001," [<http://www.ojp.usdoj.gov/bjs/glance/tables/expgovtab.htm>].

²³ Abbott raised the price it charges for a one-month dosage of the AIDS drug, Norvir, to \$265 ("Abbott Lifts Price of Norvir 400%," *Wall Street Journal*, 12-12-03. CIPLA, the Indian generics manufacturer, is selling a month's dose of the generic version for just over \$30 (see Pan American Health Organization, 2003. "Antiretroviral Prices Agreed in the Negotiations of 10 Latin American Countries," [<http://www.paho.org/English/AD/FCH/AI/negociaciones-arv-la-25.pdf>]). The gap between production costs and patent protected prices is likely to be far higher in the cases of other drugs. For example, a year's dose of some cancer drugs now costs more than \$100,000. It is unlikely that it would cost more than several

pharmaceutical companies set prices that diverge ever further from actual production costs in order to recover increased spending on research, and other non-production costs. In many cases, the gap between the production and costs and patent protected price is likely to far exceed the gaps between the production costs of illegal drugs and the street price of these drugs. Given the substantial incentive for profit created by such gaps, it is virtually certain that gray market distributors will enter the market by either reverse engineering and manufacturing drugs themselves or through unauthorized imports of drugs from countries that have lower prices.

In addition to the cost of paying for the law enforcement personnel necessary to restrict such trade, governments may also lose considerable public legitimacy if they are seen as upholding patent monopolies that primarily benefit foreign drug manufacturers, at the expense of the health of their own population. There have been several incidents of major public protests already in some developing countries against high drug prices or the prospect of high drug prices coming about as a result of TPS agreements.²⁴ If the enforcement of TPS agreements create situations in which strong patent protections allow drugs, that would otherwise be available at low cost, to be sold at very high prices, then it could potentially lead to very difficult political situations for developing country governments.

The large monopoly rents that could result from strong patent protection would also create other perverse incentives. With large gaps between the patent protected price and the cost of production, drug manufacturers have substantial incentives to heavily market their drugs, even in cases where it may be inappropriate. There have been numerous scandals in the United States and other wealthy countries resulting from drug companies making false or misleading claims about the effectiveness and safety of their drugs.²⁵ The incentive for such misrepresentations is a direct result of the large monopoly rents available because of strong patent protections. The dangers from these misrepresentations to public health is likely to be more substantial in developing countries than in wealthy countries, because wealthy countries already have a well-developed regulatory apparatus that can keep such claims in check and offer the prospect of punishment to transgressors. In developing countries, without reliable regulatory agencies, the problem of drug use based on misrepresentations by manufacturers is likely to be much more serious.

The large patent rents also create substantial opportunities for third party payments, most obviously in the form of kickbacks to doctors, in order to promote the use of specific drugs. This practice can also lead to poorer health outcomes, since many patients may end up using drugs that are inappropriate, or least not optimal, for their particular situation because of side-payments to

hundred dollars to cover the production costs of these drugs, with a normal profit. Lanjouw (1998) found that some patented drugs in the United States sold at more than 50 times their price in India.

²⁴ For example, in 2001, protests in South Africa led several multinational drug manufacturers to drop a lawsuit against the country over a law that allowed the government to provide generic drugs for treating AIDS patients (see “South Africa’s Failure on AIDS,” *New York Times*, 6-21-06;A24).

²⁵ Some of the recent cases involve the arthritis drug, Vioxx (see “Medical Journal Criticizes Merck Over Vioxx,” *New York Times*, 12-9-05;B1) and also a heart implant device produced by Guidant, one of the country’s biggest manufacturers of medical devices (see “Guidant Debated Device Peril,” *New York Times*, 1-20-06;C1). (Medical devices also sell at prices far above production costs in order to recover research costs, so the exact same economic logic applies to their marketing as with drugs.

doctors. This practice has been a problem in the advanced countries.²⁶ It is likely to be a more severe problem in developing countries where mechanisms for holding professionals accountable are less well established.

In short, the prospect of high patent rents in developing countries is likely to pose a substantial public health hazard in developing countries. There are frequent instances in wealthy countries in which the incentives created by patent rents lead firms to market their drugs in ways that have negative consequences for public health. In countries with less effective monitoring systems in place, such instances are likely to be considerably more common.

There is no easy mechanism for quantifying the damage to the public's health as a result of improper health care that resulted from the pursuit of patent rents. One measure would be the amount of damages paid by the pharmaceutical industry as a result of lawsuits or regulatory actions due to improper promotions and marketing. If this could be calculated for the United States, then it would be reasonable to assume that the damages from rent seeking behavior would be comparable (relative to the size of the economy) in developing countries. Of course, this would be a very crude measure. If many instances of improper usage go undetected, or lawsuits cannot be effectively prosecuted, then the measure would substantially understate the true amount of damage due to rent seeking. Alternatively, juries and judges could over-reward plaintiffs if they become emotionally involved in a case. It is also likely that some amount of inappropriate conduct would occur in the industry even if there were no patent rents. Recognizing these limitations, the size of damage awards should give at least an order of magnitude estimate of the harm to the public's health due to the pursuit of patent rents.

Indirect Costs of TRIPs-plus Measures

The indirect costs of TPS measures are somewhat less well defined, and therefore considerably more difficult to quantify, but they nonetheless could be substantial. The indirect costs would stem from the fact that the stronger patent protections required under TPS rules create the opportunity for increased in patent rents. The pursuit of patent rents can lead to substantial economic and political distortions, as resources are pulled away from productive uses.

At the most narrow level, there will inevitably be more legal disputes as patent holders seek to extend their protection as broadly as possible. There will also be more efforts to infringe on valid patents, since the potential gains from encroaching on patents will increase as the size of patent rents increase. There will also be more incentive for inventors to seek invalid patents in the hope

²⁶ Kickbacks can take a variety of forms. Drug manufacturers often pay for elaborate seminars at vacation locations or provide other such perks in order to encourage them to prescribe their drugs. For examples of inducements see Angell (2005). In addition, drug companies also can pay doctors excessive fees to take part in clinical trials (see "As Doctors Write Prescriptions, Drug Company Writes a Check," *New York Times*, 6-27-04; A1) or in some cases, they may simply pay outright bribes (see. "German Doctors Accused of Taking Bribes," by Geoff Dyer and High Williamson, *London Financial Times*, 3-12-02).

of being able to lay claim to some of these rents either through producing drugs based on the patents or simply through nuisance lawsuits.

More generally, the increase in patent rents creates greater opportunities for government corruption. This applies in a variety of areas. For example, there will be far more at stake in the drug approval process, as a result of higher patent rents. This will create more incentive for drug manufacturers to use political influence or bribes to gain regulatory approval for their drugs. Higher rents will also encourage drug manufacturers to use political influence to encourage government purchases or payments for their drugs in countries where the public sector pays for a portion of society's health care expenditures. In the event that a government pursues a policy of price controls or seeks bulk-buying discounts, drug manufacturers will have a strong incentive to use political influence to try to increase the prices they receive for their drugs and thereby maximize their profits.

The increased incentive for rent-seeking in this segment of the economy could also have negative feedbacks on other sectors. For example, if the drug regulatory process becomes corrupted as a result of the actions of the pharmaceutical companies, it may be more difficult to ensure the integrity of other government agencies. In the same vein, the corruption of one portion of the government could undermine confidence in the government more generally, both domestically and internationally. This could be a major problem in developing countries that already have serious problems with corruption and are viewed negatively by international businesses.

In principle, it should be possible to empirically examine the relationship between patent rents and corruption. There are a number of different indices of political corruption.²⁷ If increased patent rents are associated with increased political corruption, then a higher measure of corruption on these indices should be associated with a higher percentage of GDP being siphoned off for patent rents. It would be necessary to properly control for affluence and history. Presumably wealthy countries have less corruption than poor countries, and countries with a long history of democracy and political openness presumably have less corruption than countries without such a history. However, if these factors can be probably controlled, then it should be possible to examine whether higher patent rents are associated with greater levels of corruption.²⁸

The adoption of TPS rules, and the resulting increase in drug prices, could also impede the growth of the medical tourism industry, a sector that could hold substantial growth potential for developing countries, especially if health care costs in the United States continue on their current path. In 2006, per capita health care spending in the United States is projected to be \$7,110. It is projected to increase to more than \$10,000 annually (in 2006 dollars) by 2015.²⁹ This level of spending exceeds the per capita income of the vast majority of developing countries. In addition, expenditures are hugely skewed with older and less healthy people spending amounts that are three to four times these sums.

²⁷ Transparency International's annual Corruption Perception Index is probably the most widely known. This index surveys experts about their perception of the extent of corruption in more than 150 countries around the world [http://www.transparency.org/policy_and_research/surveys_indices/cpi].

²⁸ It is likely that causation goes in both directions. Greater levels of corruption will mean that companies will be more effective in finding ways that they can gain patent rents.

²⁹ These numbers are taken from the Centers for Medicare and Medicaid Services (2006, Table 1).

In recent years, some developing countries have begun to market medical services to people in wealthy countries, especially the United States, taking advantage of their huge cost advantage in providing medical services (e.g. see “Low Costs Lure Foreigners to India for Medical Care,” *New York Times*, 4-7-05; C6). In principle, this could be an important growth industry for many developing countries as the United States population ages and its need for health care services increase. If TPS provisions raise the price of drugs in developing countries, then those countries that commit themselves to these provisions will be at a disadvantage attracting medical tourists relative to countries that do not adopt TPS provisions.

At this point, the medical tourism industry is still quite small, but it does have potential to expand rapidly, especially if third part payers (insurance companies or the government) began to actively promote it.³⁰ It would be reasonable for countries considering TPS provisions to assess how they would impact their ability to develop a medical tourism industry.

The Benefits of TRIPs-Plus Agreements

There are two main channels through which TPS agreements can provide benefits to developing countries. The first channel is that by raising the prices for patent protected drugs within a specific country, they will be increasing the prospective profits available for drug research. This should increase incentives for research for cures and treatments of the medical problems that afflict the country’s people. The second channel is that stronger patent protection can be viewed as a sign of a stable pro-business environment. As a result, countries with strong patent protection may be viewed as better places for multinational corporations to invest.

The relationship between strong patent protection and investment can have both an economic and political dimension. The economic dimension would be paramount if multinational corporations actually believe that countries that have strong patent protection provide a better environment for business. The political dimension is that multinational corporations in general, and drug companies in particular, can use their investment decisions as a way to pressure governments for favorable patent rules. They may opt to punish countries with weaker patent rules by refusing to invest there, and reward countries with strong patent rules with increased investment. The potential gains from higher drug prices in many cases will exceed the differences in costs between research sites in various countries, so it would be a profit maximizing strategy to use location decisions as a way to pressure governments to provide stronger patent protection or allow higher drug prices through other mechanisms. This discussion will consider both the economic and political aspects of this issue.

Before examining the potential benefits from stronger patent protection, it is important to be clear on what the implicit counterfactual is in this discussion. In most treatments of this issue, the comparison in terms of promoting research into country specific health problems or attracting investment from multinationals is with a policy in which the developing country does nothing to advance these ends. While in many cases this could be a correct counter-factual (i.e. if the

³⁰ See Mattoo and Rathindran (2006).

government does not strengthen its patent laws, it will not take any other steps to promote research or foreign investment), this is not necessarily the case.

The imposition of stronger patent protection for prescription drugs can be viewed as analogous to allowing a private company to impose a tax on the sale of prescription drugs. The public benefit is supposed to be in the form of increased research and increased investment as a result of allowing a private company to collect these taxes. However, it certainly would be no more difficult for the government to impose the same taxes itself. In other words, if the government was not concerned about the distortions that result from people paying above the competitive market price for prescription drugs as a result of patent protection, it could simply impose a tax on drugs that would raise approximately the same amount of revenue as would result from more stringent patent protection. The main difference would be that the tax could be structured to be more evenly applied, and therefore it would create less economic distortions. (With the patent system, the implicit tax on some drugs can be very high, while it is effectively zero on generics. A tax that was the same percentage of the price for all drugs would lead to much less economic distortion.)

The revenue from a tax of this sort could then be invested to either directly finance research or to take other steps to encourage foreign investment. There are many different policy routes toward these ends. For example, one or several developing countries could use revenue from a patent replacement tax to directly finance research toward addressing illnesses that were specific to their populations. This could be done through direct payments from the government for research, payments to private contractors, the establishment of prize funds, or even direct payments to multinational pharmaceutical companies to undertake research. For purposes of this analysis, it is not necessary to describe a specific method of financing such research. The point is simply that stronger patent protections are not the only method of encouraging research on the medical problems that afflict developing countries. While public debate has generally framed the issue as a question of whether TRIPS and TPS measures are better than a system with no government support of research. In reality, there are many alternative mechanisms could be designed, which may lead to better economic and health outcomes than stricter patent protection.³¹

The same situation applies to whatever positive effect stronger patent rules might have on foreign direct investment in research or other areas. While there is some evidence that stronger patent protection increases inflows of FDI, there are other factors that have also been found to be strongly correlated with foreign investment, such as the education of the labor force and the quality of the physical and research infrastructure.³² If governments used funds from a patent

³¹ There have been efforts to discuss alternatives to patent support for research at the World Intellectual Property Organization, but the delegations from the wealthy countries have moved to block any important initiatives in this direction. Patents only support a limited portion of research world-wide (for example, the United States government spends almost as much money on bio-medical research each year through the National Institutes of Health as its domestic pharmaceutical industry spends through patent supported research), and developing countries certainly should be considering the potential benefits of alternative mechanisms.

³² For example, Coughlin et al. (1991) found that, within the United States, higher state expenditures on education and infrastructure were associated with higher levels of FDI. Borensztein et al. (1998) found that the impact of FDI on growth depending importantly on the education of the workforce, suggesting that countries will get substantially more benefit from whatever FDI they do attract by having a well-educated

replacement tax to improve education, specifically in science and engineering, or alternatively to ensure that modern research facilities can be adequately maintained by stable electricity supplies, access to the Internet, and good transportation, the impact on FDI flows could conceivably be larger than any gains associated with stronger patent enforcement. In principle, it would be desirable to assess other possible mechanisms for increasing FDI as alternatives to more stringent patent enforcement.

The Impact of TRIPS-Plus Provisions on Bio-Medical Research

With medical research, as with any form of knowledge, there will always be substantial opportunities for free-riding. Once a drug or form of treatment has been developed, everyone can in principle benefit from it, regardless of whether or not they shared in the research expense. However, one argument for TPS type measures is that by increasing the potential profits from patents, developing countries will increase the amount of money spent on researching new drugs. The increased profits that result from TPS measures would have a marginal impact on research into drugs for treating diseases that affect people in both wealthy countries and developing countries, and a proportionately larger effect on research into drugs for diseases that primarily affect people in the developing world.

It should be possible to get order of magnitude approximations of the likely size of this impact. Dimasi et al. (2003) estimated the cost of developing new drugs and projected trend growth rates in these costs. This study put the average cost of developing a new drug at more than \$800 million in 2000. The study also found that the cost of developing drugs increased at a real average annual rate of 8 percent between the years of 1987 and 2000, a rate which it projected to continue into the future. This would imply that the cost of developing a new drug as of 2006 would be approximately \$1.5 billion.

The prior section provided a basis for estimating the increased drug expenses incurred by developing countries as a result of TPS provisions. After subtracting the additional marketing expenses incurred by the drug industry, the additional money from stricter patent rules will provide an incentive for further drug research. Of course, the prospect of future profits in developing countries will be discounted to a greater extent than future profits in wealthy countries due to the greater risk involved. This means that additional dollars in patent rents from developing countries have less impact on promoting drug development than the same amount of dollars in the advanced countries. As a result, the impact of adopting TPS rules is likely to have a very limited impact on the process of drug development for most developing countries, even under rather extreme assumptions.

For example, if TPS rules raised the amount that El Salvador paid in patent rents by 0.5 percent of GDP – an extremely large drain on its economy, this would not be enough money to on average generate even one additional drug after 20 years as shown by the projections in Table 1. Column one of Table 1 shows projections for additional patent rents under the assumption that El Salvador's economy grows by 3.0 percent annually and that TPS provisions raise patent rents by an amount equal to 0.5 percent of GDP. Column 2 shows the portion of these rents that are

workforce.

available to support research, assuming that one-third of the rents financed additional sales effort. Column 3 shows the discounted value of these rents, using a real discount rate of 15 percent. Column 4 shows the sums of the discounted values after ten and twenty years.

Table 1

Hypothetical Flow Of TRIPs-Plus Research Funding From El Salvador

	Column 1 Patent Rents (millions \$2006)	Column 2 Net of Sales Costs	Column 3 Discounted Value (15%)	Column 4 Sums	
2006	\$85.1	\$56.7	\$56.7		
2007	87.6	58.4	50.8		
2008	90.3	60.2	45.5		
2009	93.0	62.0	40.8		
2010	95.8	63.8	36.5		
2011	98.6	65.8	32.7		
2012	101.6	67.7	29.3		
2013	104.6	69.8	26.2		
2014	107.8	71.9	23.5		
2015	111.0	74.0	21.0	\$363.0	10-year sum
2016	114.3	76.2	18.8		
2017	117.8	78.5	16.9		
2018	121.3	80.9	15.1		
2019	124.9	83.3	13.5		
2020	128.7	85.8	12.1		
2021	132.5	88.4	10.9		
2022	136.5	91.0	9.7		
2023	140.6	93.8	8.7		
2024	144.8	96.6	7.8		
2025	149.2	99.5	7.0	\$483.6	20-year sum

Source: Author's calculations, see text.

As the projections in the table indicate, the probability that the application of TPS provisions in El Salvador will create enough additional incentive to generate even a single new drug is relatively small. Even under very strong assumptions about the additional patent rent that would be generated by these provisions, the discounted value of the revenue generated over the next decade would be just 18 percent of the money that the pharmaceutical industry needs to develop a new drug. Even twenty years of additional patent rents would provide less than 30 percent of the cost to the industry of developing a new drug.

Because the costs of developing drugs are so high, TPS measures in even the larger developing countries would still have a very limited impact on the rate of development. The flow of revenue from Mexico, with a GDP more than 40 times as large as El Salvador, would be sufficient to support the development of approximately 10 new drugs over the next decade, or 1 per year. It is also important to remember that approximately two-thirds of the new drugs approved the Food and Drug Administration in the United States are rated as “standard,” meaning that they largely duplicate the function of existing drugs. This means that the additional revenue that the pharmaceutical industry would earn as a result of Mexico adopting TPS measures would be expected to provide only enough incentive to develop 3 additional breakthrough drugs over the next decade, even under very favorable assumptions. The impact would obviously be less if the increment to patent rents from TPS measures is less than the 0.5 percent of GDP assumed in these projections.

In short, the prospect of spurring much additional research by the pharmaceutical industry through TPS measures is very limited. The potential addition revenue from most developing countries would be too small to have a measurable impact on the pace of drug development. The additional revenue coming from even the largest and richest developing countries would still only have a minimal impact on the pace of drug development. Furthermore, with drug research costs under the patent system continuing to vastly outpace most countries’ growth rates, the prospect that most developing countries can have a measurable impact on the pace of drug development by adopting TPS rules will become more remote through time.

The Impact of TRIPs-Plus Provisions on Foreign Direct Investment

The other major route through which the adoption of TPS measures is expected to benefit developing countries is by increasing FDI flows. The increase in FDI would be in part coming from the pharmaceutical industry, which would be the main beneficiary of stronger patent protections, but it could come from other sectors as well. If strong patent protections are viewed by businesses as evidence of a good business environment, then companies that TPS measures could increase FDI from companies that may themselves receive little or no direct benefit from such measures.

Before examining how the potential FDI flow can be quantified, it is important to recognize the limited economic relevance of stronger domestic patent protections to decisions on FDI. Under current TPS, countries are already prohibited from applying discriminatory IPR treatment based on the nationality of the corporation or individual seeking a patent. This means that a U.S. based pharmaceutical company would have the exact same patent rights as a domestically based pharmaceutical company in any country that has signed onto the TRIPs agreement. Similarly, the rights the patent protection that a U.S. based pharmaceutical company would enjoy in the United States or any other country is completely independent of where it happens to locate its research. This means that the strengthening of patent protections through TPS provisions in developing countries does not directly increase the protections applied to research in these countries at all. In other words, the adoption of TPS provisions provides no additional economic incentive whatsoever to locate research in a developing country.

There can be indirect effects of the acceptance of TPS provisions that may have some economic implications, but these would have a very limited impact on the incentives. For example, the acceptance of TPS provisions could be an indication that a government takes enforcement of IPRs very seriously, and therefore a pharmaceutical company could be more assured that the IPRs based on any research that it carries through in that country will be respected. However, the practical meaning of this signal (if accurate) is very limited. Suppose that a developing country (e.g. China) does not seriously enforce IPR rules, but is the low-cost place to locate research. Research would still be pulled into China, if the market in prescription drugs were competitive.

The logic here is straightforward. The fact that China does not seriously enforce IPRs does not affect the status of patents based on research in China in any country in the world, including China. A company locating its research in China would have the exact same patent protection everywhere in the world as a company that refused to locate research in China, and it would have lower research costs. This competitive advantage should force all companies to locate their research in China, or go out of business.

There is one scenario – almost certainly of no practical consequence – in which companies can be harmed by doing research that have weak IPR enforcement. If producers in China produce large volumes of counterfeit copies of a drug subject to patent protection, including some amount for export, then this would hurt the patent holder. However, if the possibility to produce large volumes of counterfeit drugs exists in China, then this could be done regardless of whether the original research was actually done in China. To produce the counterfeit versions, it is only necessary to have one person who possesses the ability to reverse engineer the drug. There may be some very marginal increase in the probability that someone in China will possess the inclination and ability to do this sort of reverse engineering, if Chinese researchers are employed in the development process. But, if profitable opportunities exist, someone with the appropriate skills and connections could easily enter China from any country in the world and begin to manufacture counterfeit drugs. While actually hiring Chinese researchers to develop the original drug may increase the likelihood that someone will seek to take advantage of lax enforcement in China to produce counterfeits, the marginal impact of this location decision must be very small.

Although the direct economic link between stronger IPR enforcement and increased returns to investments by multinational pharmaceutical may be weak, there is a stronger political argument that may come into play. If the worldwide pharmaceutical industry is not competitive, then the major firms can use their investment decisions as a way to increase their patent rents. Specifically, they can opt to withhold investment from countries that do not apply strong patent protections as a form of punishment, and reward countries that do have strong IPR protection with increased investment.³³ In this way, investment is used as a tool to maximize patent rents – exactly the outcome that would be predicted in standard economic theory.

³³ Sidney Taurel, the President and Chief Executive Office of Eli Lilly, appeared to give an example of this sort of behavior by the drug industry in a recent speech in which he claimed that pharmaceutical companies had relocated their research operations from Europe to the United States because of the price controls and/or negotiated prices that the industry faces in Europe. “The Campaign Against Innovation,” International Federation of Pharmaceutical Manufacturers and Associations, [<http://www.ifpma.org/News/SpeechDetail.aspx?nID=496>].

If pharmaceutical companies use their investment decisions in this way, then developing countries may be able to increase the pharmaceutical R&D by adopting TPS rules. However, it is important to note that this would be the result of insufficient competition in the industry. If more effective anti-trust policies were in place, then pharmaceutical companies would not be able to use the location of R&D as a tool to pressure countries to adopt more stringent patent rules. Of course, developing countries have to recognize the realities of the world economy. If one of those realities is a highly concentrated pharmaceutical sector in which companies can use their R&D location decisions as a weapon to gain stronger patent protection, then this is the reality that they must accept. But, it is important to recognize that this is the result of a failure of competition policy, not an inherent feature of the global economy.

Measuring the Impact of Patent Protection on FDI

There have been some efforts to measure the impact of stronger IPRs on the inflow of FDI. These inflows would include R&D investment, but could also include other FDI that was attracted by the fact that stronger IPRs are associated with a more favorable business environment. This research has found evidence that in middle- income developing countries, stronger IPRs, in conjunction with trade liberalization policy, have a positive effect on FDI and also trade in general.³⁴ This effect is only found in middle-income countries, as opposed to the poorer developing countries, ostensibly because the poorer developing countries lack the infrastructure to support substantial amounts of FDI. For this reason, in the world's poorest countries, strong IPRs will primarily serve to increase the rents of the pharmaceutical industry. They are unlikely to have much impact on FDI flows.

This point is worth emphasizing. Maskus (2000) documents a U-shaped curve relating the strength of IPRs to per capita GDP, with the level of protection originally falling as per capita GDP increases. The explanation for this relationship is that at low levels of development, IPRs are primarily sources of rent, since countries lack the infrastructure to support the sort of investment in research and development that could benefit from IPR protection.³⁵ This means that low-income countries may typically benefit from lower levels of IPR. It is only when countries have reached middle-income levels of development that they stand to gain from the incentives provided by stronger IPRs.

³⁴ Maskus did find that stronger IPRs were associated with larger FDI flows in liberalizing middle-income countries. Similarly, Lee and Mansfield (1996) found in a survey of U.S. based multi-nationals that most companies did view the strength of IPRs as an important factor in their investment decisions. However, Mansfield (1993) and Maskus and Eby-Konan (1994) find no significant relationship between the strength of IPR and FDI flows. See also Braga and Fink (1998), which finds limited evidence of a relationship.

³⁵ While Maskus argues that IPR protection strengthens at higher levels of per capita income because the potential benefits from increased incentives rise relative to the cost in terms of rents, the more obvious mechanism would be that the interest groups that can privately benefit from increased patent rents become stronger relative to the diverse groups of consumers who will pay higher prices. In effect, this is the exact same mechanism that would allow for trade protection for certain industries. The winners from this protection form a well-organized group, whereas the losers from higher protection are broadly based and poorly organized.

For this reason, low-income countries will likely find themselves losing as a result of the higher rents required under TPS with little hope of any offsetting benefit from increased FDI. While it is arguable that they may incur benefits from increased FDI once they have attained a higher level of income, they would be advised to try to avoid adopting stronger IPRs at least until their economy has developed to the point where its infrastructure can support higher levels of R&D, especially in pharmaceuticals.³⁶

Even in the case of middle-income countries, the mixed results in the literature caution against assuming any substantial uptick in FDI flows will follow the strengthening of IPRs. While some of the literature does find that stronger IPRs are associated with more FDI, the evidence is sufficiently mixed that governments cannot confidently assume that increased FDI will necessarily follow from adopting stronger IPRs.

In addition to the fact that the evidence of the relationship in the past between FDI and IPRs is somewhat ambiguous, there is also the problem that investment patterns in the future could be very different than in the past. In particular, the rapid growth of the Chinese and Indian economies, coupled with the shrinking importance of the United States as a source of foreign investment, could radically alter the factors that determine FDI flows. This is especially likely to be the case since neither China nor India has a long history of strong IPR protection. This could mean that Chinese and Indian firms will be less likely to view IPR protection as important factor in locating their FDI. If this turns out to be the case, and China and India come to displace the United States and Europe as the main sources of FDI, then developing countries will have little hope of seeing much benefit in the form of increased FDI as a result of adopting TPS rules.

It is virtually certain that the importance of the United States in the world economy will shrink rapidly in the near future. The United States current account deficit, which is now more than 6 percent of GDP is unsustainable (Baker and Weisbrot, 2004). At the moment, the current account deficit is being supported in large part by the decision of foreign central banks to buy up large amounts of dollars. The decision to buy dollars (especially by the Japanese and Chinese central banks) is largely a conscious effort to sustain the value of the dollar in order to maintain a strong export market. At some point, these countries will presumably be able to stimulate enough domestic demand so that they no longer need the U.S. export market as an outlet for their production. (In effect, foreign countries are paying U.S. consumers to buy their exports, with the payments coming in the form of central banks buying dollars as a way of propping up the dollar.) When foreign countries find ways to build their own demand, they will stop supporting the dollar. This will lead the dollar to decline to a level at which it can support the trade deficit, quite possible by as much as 30-40 percent.

A decline of the dollar of this magnitude would effectively reduce FDI by U.S. corporations by approximately the same amount (measured against other currencies). There could be further reductions in FDI by U.S. corporations if the adjustment process to a lower dollar led to a period of prolonged stagnation, as happened in Japan following the collapse of its stock and real estate

³⁶ Maskus (2000) puts the per capita income level at which middle income countries impose more stringent IPR rules than the poorest countries at around \$10,000 a year, approximately the levels in Mexico and Argentina (Figure 4.1).

bubbles at the end of the eighties. In addition, the lower value of the dollar by itself will substantially reduce the incentive for U.S. firms to undertake FDI, since a cheaper dollar will reduce the cost advantages associated with FDI.

For these reasons, FDI by U.S. based multinationals is likely to be far less important in the world economy in the near future than it was 15 years ago, or even in 2006. This means that regression results that examine the determinants of FDI based on data from eighties and nineties may not provide much insight in the key factors determining FDI over the next twenty or thirty years. This is especially likely to be the case if countries without strong traditions of IPR protection, like China and India, come to be major sources of investment capital during these decades. In this respect, it is also worth noting that the United States is being rapidly displaced as the leading source of degrees in science and engineering. According to one study, China may have already passed the United States in the number of degrees awarded each year in these fields (Freeman, 2005). This means that the United States (and Europe) will not only be far less important as a source of capital in the next two decades than they had been in the last two decades, but they will also be far less important as a source of expertise in science and engineering.

While there is little, if any, research on the topic to date, if Chinese and Indian firms do not consider strong IPR protection to be an important factor in their investment decisions, then the adoption of TPS rules will not be helpful in gaining FDI from these sources. In that situation, the adoption of TPS rules by developing countries may end up imposing substantial costs with very little offsetting benefits.

As a practical matter, it would be difficult to design an effective test of the impact of TPS measures on FDI flows. In principle, the largest impact should be on inflows in the pharmaceutical industry, but the sums of money involved and the experience with TPS measures is still sufficiently limited that it is unlikely that any analysis would find significant results, even if such a relationship did exist.³⁷ Furthermore, since the main issue is a political one – the ability of companies to use their investment location decision as a way to force more stringent patent protection – rather than an economic one, the effect of TPS on FDI flows might be even more difficult to find in standard analyses. The willingness of the industry to withhold FDI from a country that might otherwise warrant investment on economic grounds, or to channel FDI as a reward to a country that is not the low cost location may depend on factors that are not easily identified. This could lead to a strong bias in any test to finding no relationship between the adoption of TPS measures and the inflow of FDI from the pharmaceutical industry.

With this caution, now that a large number of trade agreements with TPS provisions have been ratified, it should soon in principle be possible to perform a simple test of the effect of these agreements on FDI by the pharmaceutical industry. Such a test would involve estimating trend paths for the growth of FDI in the pharmaceutical sector, testing for an acceleration after the date when a trade agreement with TPS provisions first appeared to be likely.³⁸ The regression would take the form:

³⁷ Maskus (2001) found no effect of rules allowing for parallel imports on investment patents by pharmaceutical companies.

³⁸ It might be desirable to run regressions that included both a date at which a trade agreement first came to be viewed a likely event, for example the announcement of the beginning of negotiations toward reaching

$$2) \text{FDIph}_{it} = a_i + b_1t_i + c\text{TA}t_i + e,$$

Where FDIph_{it} is FDI by the pharmaceutical sector in country i at time t ; a_i is a country-specific constant; t is a country-specific time trend, and $\text{TA}t_i$ is a dummy variable indicating that a trade agreement with TPS provisions is either being negotiated or has been ratified. In principle, the necessary data could be obtained from the Bureau of Economic Analysis, although data at this level of country and industry detail is not freely available due to confidentiality restrictions.

To distinguish the effects of the TPS provisions from the effects of the agreement more generally, a separate set of regressions could examine the effect of the agreement on FDI as a whole. If TPS provisions are especially important in providing a boost to FDI by the pharmaceutical sector, then the acceleration in FDI flows in this sector should be larger than the acceleration in FDI generally. If the coefficient on the TA term is not significantly larger in the regression with FDI in the pharmaceutical sector than in the regression for FDI generally, then this would suggest that TPS provisions are not having an especially important effect on FDI in the pharmaceutical industry. Of course, if the main effect of TPS provisions is simply to provide a signal of a pro-business government, then the lack of a significant difference between a trade agreement's effects on investment flows in the pharmaceutical industry and other sectors would not be surprising.

Conclusion

If TPS agreements effectively prevent developing countries from issuing compulsory licenses on patented drugs, substantially curtail the use of parallel imports to obtain cheaper drugs, and extend periods of marketing monopolies through rules on data exclusivity, then developing countries may be forced to pay substantially higher prices for prescription drugs than would be the case with TRIPS rules. Such a rise in drug prices can have important public health consequences. However, higher drug prices may also impose substantial economic costs since they will cause more money to be drained from the country in patent rents. For this reason, it is important that developing countries have a clear sense of the potential costs they may incur in from high drug prices in TPS agreements, which can in principle be estimated based on available data.

In addition to the direct costs associated with higher drug prices, there could other predictable costs that are less easily quantified. The opportunity to obtain large patent rents provides drug manufacturers with substantial incentives to promote the use of their drugs even in contexts where they may not be the best drug for patients, or may even be harmful. In countries with poorly developed regulatory structures, the implications of this incentive structure could be very dangerous. The possibility of obtaining large patent rents can also have a very corrupting influence on government policy both in the pharmaceutical sector and in other areas, as pharmaceutical firms can be expected to try to buy political influence in order to maximize the

an agreement, and a date at which an agreement was ratified or signed, whichever was seen as marking the key political event marking the acceptance of the agreement. The selection of these dates would necessarily involve some subjective judgments.

opportunity to earn patent rents. In addition, medical tourism has become a large and rapidly growing industry do the differences between the price of medical care in wealthy countries (especially the United States) and developing countries. The higher drug prices that result from TPS agreements will put countries at a competitive disadvantage in the medical tourism industry.

Offsetting these costs from TPS, there are potential gains associated with increased research and increased FDI. However, both sources of gains are likely to be limited especially with smaller developing countries. Given the high and rapidly growing cost of developing a new drug through patent financing, even the larger and wealthier developing countries can only expect to have a very marginal impact on the pace of drug development by allowing the industry to charge higher prices domestically. The potential increment to industry profits from smaller and poorer developing countries, while important to these countries, will not have a noticeable impact on the pace of drug development.

There is little obvious economic link between TPS rules and the attractiveness of a country for FDI to the pharmaceutical industry. TRIPs rules already prohibit discriminatory patent protection for domestic companies, so research would be entitled to the same patent protection in all WTO member states regardless of where it takes place. However, it is possible that pharmaceutical companies may choose to reward countries for adopting TPS rules by locating investment there, and to punish countries without TPS rules by withholding investment. With a large number of trade agreements with TPS rules having been signed in recent years, it should soon in principle be possible to estimate the size of these effects. It is important to note that it is only plausible that middle-income countries will receive any substantial benefits in the form FDI from the pharmaceutical industry. Most low-income countries lack the base of researchers and infrastructure to attract FDI from the pharmaceutical industry.

Finally, it is important to note that there are other policies that countries could in principle implement that might be more successful in attracting FDI in the pharmaceutical sector and elsewhere. Factors such as a well developed infrastructure and an educated workforce also help attract FDI. Patent rents on drugs are effectively the same thing as a privately collected tax. If governments were willing to tax drugs themselves as an alternative to stronger patent protection, they would be able to use the resulting revenue to finance alternative development paths. Ideally, developing countries would have the opportunity to consider the merits of such alternative paths.

Appendix

The TPS provisions of recent trade agreements negotiated by the United States include a number of measures that affect areas other than pharmaceuticals. In all cases these will have the effect of increasing enforcement of IPRs. In the short-term this will almost certainly mean greater flows of rents from developing countries and a resulting loss of economic efficiency. In the longer term, it is possible that these losses will be partially or completely offset by the incentives created by stronger IPR protection. This appendix lists and briefly describes some of the key TPS provisions that do not directly relate to pharmaceuticals. It is drawn largely from Fink and Reichenmiller(2005).

Patenting of Life Forms

Most trade agreements include provisions that require countries allow for the patenting of life forms, with limited exceptions. This will facilitate the production and sale of genetically modified grain and foods by multi-national corporations. It will also create a basis for claiming ownership rights to certain types of crops.

Copyright Protection

Most recent trade agreements have increased the length of copyright protection well beyond the TRIPs requirements, usually to 70 years after the death of the author or first publication. In the case of the U.S. -Vietnam agreement, the term of the copyright can run for as long as 100 years from the first date of publication.

Liability of Internet Service Providers

Several trade agreements make Internet Service Providers liable for infringing, if they fail to block infringing activity upon notification by the copyright holder. This rule effectively puts the Internet Service Provider on the side of the copyright holder in a dispute, since they only face liability from allowing an infringer from using the service, not from wrongfully excluding a lawful use of material to which the copyright holder has made an invalid claim.

Burden of Proof in Cases of Copyright Infringement

Several agreements explicitly require that the law place the burden of proof on the defending party to show that the work in question is in the public domain.

Parallel Importation of Copyrighted Work

The U.S.-Morocco and the U.S.-Jordan agreements both prohibit parallel imports of copyrighted material.

Criminal Procedures and Remedies

Several of the trade agreements require criminal sanctions for willful infringement. Several agreements also require enforcement rules similar to those in the Digital Millennium Copyright Act. These rules prohibit not only actual infringement, but criminalize hardware and software that could have infringing uses.

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