The Economic Effect of the Intellectual Property Obligations in Free Trade Agreements

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1. Introduction

Since the creation of the World Trade Organization (WTO), global intellectual property rules have been governed by the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS). It contains minimum standards for patents, trade secrets, copyrights, trademarks, test data, and other forms of protection, and it requires countries to enforce the laws in place to satisfy these trade obligations.[1] TRIPS requirements are enforceable through the WTO dispute settlement system, which may authorize retaliatory measures against Member nations that do not meet them.

During the negotiation of TRIPS, the U.S. introduced texts that would have required even stronger intellectual property protection, but which were eventually negotiated out of the agreement. For instance, earlier drafts included longer terms of patent and copyright protection. They required that countries extend IP protection for more types of subject matter (for instance, patents on new uses of known inventions) and limited the flexibilities available to countries in crafting their IP laws (for instance, compulsory licenses for patents and copyrights that allow government to fight abuse of monopoly powers by IP holders).[2]

Since TRIPS went into force, the U.S. has negotiated bilateral and regional Free Trade Agreements (FTAs) with 17 countries.[3] The FTAs include intellectual property measures negotiated out of earlier texts of the TRIPS Agreement, generally referred to as "TRIPS-Plus,"

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[1] For a good explanation of TRIPS obligations, see Pedro Roffe, et. al. Resource Book on TRIPS and Development, Cambridge University Press. 2005. http://ictsd.org/i/ip/11572/

[2] For a thorough history of the TRIPS negotiations at the Uruguay Round, see Daniel Gervais. *The TRIPS Agreement: Drafting History and Analysis.* (1998).

[3] FTAs have been signed and ratified with Australia, Bahrain Chile, Colombia, Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Jordan, Korea, Morocco, Nicaragua, Oman, Panama, Peru, and Singapore.

because they exceed the level mandated by TRIPS.[4] These TRIPS-Plus provisions have been highly controversial in developing countries, which often view themselves as net consumers of intellectual property and view TRIPS-Plus protections as a means to transfer resources from the global South to the North.[5] Controversies related to generic medicines have been especially intense; as health advocates argue that stronger patent rules block access to generic medicines, including antiretrovirals needed to fight HIV/AIDS.[6]

More recently, the U.S. government has been negotiating plurilateral trade agreements with many countries at once. Last year, the U.S completed negotiation of the Anticounterfeiting Trade Agreement (ACTA) with 23 other countries. Like the earlier bilateral agreements, ACTA includes TRIPS-plus rules on copyright, trademarks and enforcement, but opposition to the agreement in Europe may prevent the agreement from being ratified. The U.S. is currently negotiating the Trans Pacific Partnership Agreement with either other countries, and has proposed many of the controversial TRIPS-Plus intellectual property provisions found in the bilateral agreements.[7]

Proponents of stronger intellectual property protection argue that it will lead to increased foreign direct investment, technology transfer, and ultimately economic growth in developing countries. For example, the World Intellectual Property Organization advises nations that

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[4] Susan Sell. "The Global IP Upward Ratchet, Anti-Counterfeiting and Piracy Enforcement Efforts: The State of Play." PIJIP Research Paper no. 15. American University Washington College of Law, Washington, DC. 2010.

[5] Carlos Correa. *Intellectual Property Rights, the WTO and Developing Countries: The TRIPS Agreement and Policy Options*. Zed Books/ Third World Network. (2002).

[6] Ellen t'Hoen. The Global Politics of Pharmaceutical Monopoly Power: Drug patents, access, innovation and the application of the WTO Doha Declaration on TRIPS and Public Health. AMB Publishers, the Netherlands, 2009. Available at http://www.msfaccess.org/content/global-politics-pharmaceutical-monopoly-power

[7] Sean Flynn, Brook Baker, Margot Kaminski, and Jimmy Koo. "Public Interest Analysis of the US TPP Proposal for an IP Chapter." PIJIP Research Paper No. 21. December, 2011. http://digitalcommons.wcl.american.edu/research/21/

> In the 1990s, an increasing number of policy-makers in emerging economic powers recognized the important role of the IP system in encouraging private investment in R&D, especially in the industrial and scientific fields. Many studies suggest a healthy IP system is a key element in encouraging foreign direct investment (FDI).[8]

Similarly, an industry-funded nonprofit group USA for Innovation published a report by Robert Shapiro and Kevin Hassett claiming that:

> intellectual property protections in developing societies, especially countries with low per capita incomes, directly encourage technology transfers from more advanced economies through both direct imports and foreign direct investment. Moreover, technology transfers to developing nations expand as those nations strengthen their patent protections. Data also show that intellectual property protections in developing nations can directly stimulate the pace of innovation in advanced countries.[9]

On the other hand, critics of TRIPS-Plus intellectual property provisions in trade agreements have warned that they would harm consumers by expanding the monopoly powers of rightholders. They claim that promises of greater investment, technology transfer and growth resulting from stronger IP rights are greatly exaggerated. For instance Debabrata Saha, Deputy Permanent Representative of India to the World Intellectual Property Organization, warned its General Assembly in 2004 that

> higher and higher levels of IP protection, inherent in any harmonization exercise that takes no account of the circumstances of each country, are extremely detrimental to developing countries. ... While the benefits of strong IP protection for developing countries are a matter of debate, and nearly always in the distant

[8] Kamil Idris. "Intellectual Property: A Powerful Tool for Economic Growth." World Intellectual Property Organization, 2003. Overview of the full report available at: http://www.wipo.int/freepublications/en/intproperty/888/wipo_pub_888_1.pdf

[9] Robert Shapiro and Keven Hassett. "The Economic Value of Intellectual Property." USA for Innovation, 2005. Available at http://www.sonecon.com/docs/studies/IntellectualPropertyReport-October2005.pdf

future, such protection invariably entails substantial real and immediate costs for these countries.[10]

However, there has been little empirical study to date of the effect that TRIPS-Plus intellectual property protection required by FTAs has had on the economies of our trading partners. This paper examines data on foreign direct investment, licensing, employment, sales, and exports from three countries – Guatemala, Peru, and Nicaragua. Data is observed at the national and the firm level before and after each country strengthened its intellectual property laws (and demonstrated active enforcement of them) in order to comply with trade agreements. These variables will show whether or not the stronger IPRs related to the trade agreements are correlated with increased technology transfer and growth.

2. Literature Review

One reason there is very little empirical work on the effect of the intellectual property requirements of TRIPS-Plus FTAs is that they are relatively new. The first FTA with the U.S. signed after TRIPS was signed in 2000 by Jordan. It was gradually implemented throughout the rest of the decade. FTAs were signed with more countries in the 2000s and usually required a couple of years for implementation. When the intellectual property obligations FTAs are first formally "implemented" in the sense that laws are passed, these laws are often not enforced immediately.

[10] Debabrata Saha, Deputy Permanent Representative of India. Statement to the WIPO General Assembly. October 1, 2004. Availabel at: http://lists.essential.org/pipermail/open-wipo/2004-October/000023.html

a. Studies on the Effect of TRIPS-Plus IPRs Implemented as a Result of FTAs

Last year, researchers led by Alexander Koff at the International Intellectual Property Institute conducted a study that looked at the change in trade flows and licensing revenues in countries that had TRIPS-Plus FTAs in place with the United States.[11] They ran a series of regressions based on a gravity model of trade[12] to see how the strength of IPR protection, and the existence of an FTA with the U.S., effect the level of trade and technology licensing with the U.S. The study used a firm-level dataset covering 233 companies from 32 industries over eight years (2002-2009). The equations incorporate independent variables for per capita GDP, population, openness to trade, distance, and IPR protection. To measure the effect of the FTAs, the authors add a dummy variable to a subset of the equations.

Koff et. al. used two indexes that each measure the strength of a nation's IPR protection on a scale of one to five. The first is the Economist Intelligence Unit (EIU) annual index, which rates countries according to both the strength of the laws and how well they are enforced in practice; the second is Walter Park's index of patent strength.[13]

Models using each index of IPR strength predict that an FTA with the U.S. would increases exports and imports by over 100%. Technology licensing to countries with US FTA's is also

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[11] Alexander Koff, Laura Baughman, Joseph Francois and Christine McDaniel. "Study on the Economic Impact of 'TRIPS-Plus' Free Trade Agreements." International Intellectual Property Institute and the U.S. Patent and Trademark Office. August 2011. Available at http://iipi.org/wp-content/uploads/2011/09/IIPI-USPTO-TRIPS-Plus-Study-10-Aug-2011.pdf

[12] The gravity model of trade predicts that the size of trade flows between two nations is generally a function of the size of their economies (GDP) and the geographical distance between them.

[13] The "Park Index" is frequently cited by others working in this field. It is the unweighted sum of five factors – the scope of patentability, membership in IP treaties, patent term, enforcement mechanisms, and restrictions on patents (including compulsory licenses). It is described more fully in: Walter Park, "Intellectual Property Rights and International Innovation." Chapter in Frontiers of Economics and Globalization, (ed. Keith Mascus) Vol. 1, Handbook Series, Elsevier Science, 2008.

higher, as measured by a 38% or 45% increase in licensing payments to the U.S., depending on which IPR index is used. The FTA dummy variable is statistically significant at the 99% level across all of their models.

Koff et al. also found that stronger IPR protection – independent of whether or not a nation has a trade agreement in place with the U.S. – is significantly correlated with a large increase in exports to the U.S. A one unit increase in either IPR index is also correlated with a 28% increase in imports from the U.S. and a 21-44% increase in royalty and licensing payments from the U.S. For trade in services, however, Koff et al. found no statistically significant relationship between trade and IPR. The authors suggest two explanations for this: the term "service" is too broad, incorporating a wide range of businesses and some service firms need to be close to their customers.

Koff et al. disaggregated the dataset into industries to isolate the R&D intensity of industries using data from the National Science Foundation on R&D-to-sales ratios. They found the R&D intensive industries are more sensitive to IPR protection "in terms of trade and royalty and licensing transactions."

The authors also reported on interviews with business and government officials in Australia, Chile, the Dominican Republic, Guatemala, Jordan, Peru and Singapore, in which many common themes emerged. TRIPS-Plus IPRs were viewed as "important, but not essential" for attracting investment. Many countries had recently strengthened their laws to comply with TRIPS, so the extra changes for the FTA were less significant. Interviewees said that strengthening IPR alone would not increase innovation in a country, because many other factors matter (taxes, human capital, clustering, etc). The patent obligations were the most controversial because people fear

that costs of essential goods will rise. Many interviewees believed that the *way* in which the obligations were implemented was important. It is not wise to simply impose one legal framework on top of another. Implementation of FTAs requires taking specific nations' legal systems into account. In some cases, countries implementing FTAs have learned from the experience of others. For instance, the Dominican Republic drafted their law on data exclusivity carefully to protect its generic industry, after learning from Chile.

Koff et al. concluded that countries with stronger intellectual property laws and enforcement tend to have higher levels of trade with the U.S., but that there are also costs associated with the strengthening of IPRs in developing countries. IPRs are meant to drive innovation, and they are only one many factors that are needed to stimulate innovation. The authors recommend that countries should consider the costs and benefits of stronger IPR protection when negotiating FTAs with the United States.

Two other studies that bear mention examined domestic pharmaceutical markets, providing examples of instances where prices of protected medicines increased after FTAs went into effect. Oxfam reported in 2007 that the average cost of all drugs increased 20% after the implementation of the US- Jordan FTA, and newer medicines were unavailable in generic form (and therefore unobtainable by many Jordanians).[14] A 2009 study by Ellen Shaffer and Joe Brennan show that medicines protected by higher levels of IP required by CAFTA were up to 800% more expensive than drugs that came to market before the IPRs were in place.[15]

[14] Oxfam. "All Costs, No Benefits: How TRIPS-plus intellectual property rules in the US-Jordan FTA affect access to medicines." March 22, 2007. http://www.oxfam.org/en/policy/bp102_jordan_us_fta

[15] Ellen Shaffer and Joseph Brenner. "A Trade Agreement's Impact on Access to Generic Drugs." Journal of Health Affairs. September/October 2009 vol. 28 no. 5. http://content.healthaffairs.org/content/28/5/w957.abstract

b. Empirical studies on the relationship between IPRs, Licensing, FDI and growth

Edwin Mansfield's 1994 study of the relationship between intellectual property rights and technology transfer is a seminal paper often cited in the literature.[16] Mansfield surveyed management of 94 American firms in six manufacturing industries – chemicals, transportation equipment, electrical equipment, machinery, food, and metals. The countries were selected "because of their size and importance, as well as the frequency with which they have been cited in connection with controversies over intellectual property protection." (Spain and Japan were included as examples of countries with reliable IP protection.)

Mansfield developed a "crude index" from three survey questions:

- Whether the strength or weakness of IPR in each country would affect a firm's decision to invest in the following ways – sales and distribution; rudimentary production and assembly facilities; manufacture of components; manufacture of complete products' and research and development.
- Whether the strength or weakness of IPR protection in each country would affect a firm's decision to "permit it to licenses its newest or most effective technology" to a wholly owned subsidiary
- Whether the strength or weakness of IPR protection in each country would affect a firm's decision to "permit it to licenses its newest or most effective technology" to a local firm in the country.

To develop his index, Mansfield assigned numbers to the answers and took the mean for each country. This index was used as the measurement of strength of perceived IPR protection in regression analysis. (Mansfield noted that the three measures of the perceived strength or weakness of IPR are highly correlated with each other.)

[16] Edwin Mansfield. "Intellectual Property Protection, Foreign Direct Investment, and Technology Transfer." International Finance Corporation Discussion Paper #19. World Bank. 1994.

Regression results show that perceived strength of IPRs is a significant determinant of FDI, holding market size constant at the macro level. A 10 point increase in the index is associated with $200 million in annual FDI in manufacturing. Strength of IPR protection was also found to have a "substantial effect" on technology transfer to developing countries, particularly in high-technology industries. Strength of IPR protection also influences the types of investment made by U.S. companies, and the size of the effect differs from industry to industry.

Mansfield noted that his results support those of Rapp and Rosek (1990), who used an index of IPR strength based on how well a country's patent laws adhered to minimum standards proposed by the U.S. Chamber of Commerce.[17] Rapp and Rozek used a numerical measurement of the strength of laws, while Mansfield measured *perceptions* of the strength of IPR protection, yet the two studies yielded similar results.

The survey results vary greatly from one industry to the next. In some industries (i.e., metals) "competitors frequently cannot make effective use of a firm's technology without many expensive and complex complimentary inputs." In other industries, (i.e., chemicals) "local firms can imitate an innovator's new products relatively easily." In some industries, local firms may be more aggressively exploiting weaknesses in IPR than in others. In other industries, final products involve limited R&D, so intellectual property rights are relatively unimportant.

Firms were generally more willing to make investments in sales and distribution facilities than advanced manufacturing or R&D facilities in countries with weak IPRs. The type of investments made by firms engaging in FDI is important. Facilities that make components or finished products will be more beneficial for technology transfer than investments in sales and

[17] Richard Rapp and Richard Rozek. "Benefits and Costs of Intellectual Property Protection in Developing Countries." national Economic Research Associates, New York, 1990.

distribution or rudimentary assembly plants. Some executives surveyed said they transfer old technology to countries with weak IPR protection.

Mansfield noted that FDI is also likely to be related to the size of a country's market, which must be large enough to "absorb efficiently the technology which the direct investor desires to introduce." Other factors, like distance between the host and home country, wages, and level of education are important too.

Soon after Mansfield's paper, a study by Nicholson examined industry-level data on FDI and licensing from the U.S. Census Bureau from 1995.[18] He found that capital intensive firms investing overseas behave differently according to the level of intellectual property protection in the countries where they do business. The firms tended to set up operations in host countries where IPR protection is low, and tended to use licensing in countries where IPR protection is strong.

American University professor Walter Park has conducted a series of empirical studies on the relationship between IPRs and various kinds of technology transfer. His studies, usually examine country-level data rather than industry survey data. His index on the strength of patent protection is cited widely cited by other writers in the literature, and is described above (see footnote 13).

In a 2008 study,[19] Park examined the relationship between the strength of patent protection and innovation. He found that the effect of IPRs on innovation in a country depends on its

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[18] Michael Nicholson. "The Impact of Industry Characteristics and IPR Policy on Foreign Direct Investment." Review of World Economics, Vol. 143, No. 1. 2007. http://goo.gl/Tv7pC

[19] Walter Park. "Intellectual Property Rights and International Innovation." Chapter in Frontiers of Economics and Globalization,(ed. Keith Mascus) Vol. 1, Handbook Series, Elsevier Science, 2008. http://www.american.edu/cas/faculty/wgpark/upload/elsevier_ipr_Park2.pdf

initial level of IP protection and its stage of economic development. Stronger IPR in developing countries have an "insignificant effect on R&D and a negative effect on licensing." Like Mansfield, Park also found that stronger IPRs in developing countries may affect the *composition* of investment in foreign countries. It can incentivize firms to invest more in R&D and manufacturing, relative to sales and distribution. Similarly, stronger IPR will increase patenting by domestic firms in the North, but not in the South. This could mean that the technologies transferred to host countries tend to be dated or sub-par. The fact that stronger IPR does not seem to drive domestic innovation in the South will "raise the cost of policy harmonization for the developing world."

Park concluded that empirical evidence supports the theory that stronger IPRs may not be conductive to patentable innovation in developing countries. A country may need to reach a threshold level of development before IPR reforms can drive greater domestic research and development.

A study by Robert Ostergard examines the link between IPR and GDP growth, but finds no statistically significant relationship. [20] Ostergard was critical of the methodologies used in earlier studies, and he argued that many contained one or more of the following problems:

- They measured the strength of IPR based on legislation, but ignored the level of enforcement
- They relied on interviews with experts who could be biased
- They lacked an element of time, and were therefore unable to capture the effect of changes in national IPR laws

[20] Robert L. Ostergard., Jr. "Policy Beyond Assumptions: Intellectual Property Rights and Economic Growth." Chapter 2 of The Development Dilemma: The Political Economy of Intellectual Property Rights in the International System. LFB Scholarly Publishing, New York. 2003.

To overcome these problems, Ostergard constructed a measurement of the strength of legislation using criteria for patent, copyright, and trademark law recommended by the U.S. Chamber of Commerce. He next developed a measurement of enforcement that draws on the State Department "Country Reports on Economic and Trade Practices." Ostergard multiplied the score for each type of IP law by the measurement of IPR enforcement and converted the data to logarithms to reduce the wide range. He collected the data for three time periods: 1988, 1991, and 1994. Next, Ostergard constructed a model of economic growth where GDP is a function of earlier GDP, consumption, investment, labor, human capital, and intellectual property protection. The model was applied to 76 nations for each of the three time periods.

Ostergard's regression results were inconsistent in their significance across time periods. The coefficients on the patent and trademark variables had negative signs where positive signs were expected. Ostergard isolated the developing countries in the sample and repeated the experiment, but the problems of inconsistency and directionality of effect remained. He concluded that "no consistent evidence emerged to show that IPR contributed significantly to economic growth cross-nationally. Furthermore, when the nations are split into developed and developing countries, results to suggest otherwise did not emerge."

A 2007 study by Yasdua and Kato summarized a WIPO-sponsored series of reports on the relationship between intellectual property and economic growth in Asian countries.[21] Separate reports had been conducted in Japan, Korea, China, Vietnam, Malaysia and India. They sought to examine the effect of IPR reforms by studying economic factors before and after specific

[21] Futoshi Yasuda and Hiroshi Kato. "Impact of the Intellectual Property System on Economic Growth: General Remarks." WIPO-UNU Joint Research Project. 2007. http://goo.gl/iGaRa

reforms in each country. However, the definitions of IPR reforms are inconsistent across country studies. (Some studies consider the entrance into an agreement with IPR obligations to be a reform itself. Others studies consider the implementation of domestic IP laws.)

At the national level, the WIPO reports found that Foreign Direct Investment, patent filings, GDP, and research and development expenditures increased after countries acceded to the TRIPS agreement and instituted the necessary IP reforms. The results were more mixed at the industry level. Though most of the firms reported higher incomes, FDI and licensing varied by nation and by industry.

c. Empirical studies of IPRs and levels of innovation

Dutta and Sharma's 2008 study on the effect of IPR reforms in India focused on innovative activity as defined by R&D expenditures at the firm level.[22] They used panel data from 1989 to 2005 to test if the signing of the TRIPS agreement increased innovative activity among firms in IP-intensive industries. (The time period in their study *ended* when the patents act is amended in 2005, so they do not report firm-level R&D spending after TRIPS was fully implemented.)

The authors argued that India has certain characteristics that should help TRIPS drive domestic innovation. Unlike other developing countries, India's market is large enough IPR incentives to work. When India joined the WTO, its firms enjoyed new access to large markets abroad, allowing them to earn the revenues necessary to afford high fixed R&D costs. Finally, WTO membership attracts more multinational firms into India and improves general trade relations between India and many developed nations.

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[22] Antara Dutta and Siddharth Sharma. "Intellectual Property Rights and Innovation in Developing Countries: Evidence from India." World Bank. October 2008. http://goo.gl/MAU5G

During the time period studied, India saw "sweeping economic changes." These included sharp increases in R&D and patenting activity among many firms. To isolate the effect of TRIPS, Dutta and Sharma examined changes across industries, figuring that TRIPS would have a greater effect on "innovation intensive" industries. They determined industries that are innovation intensive with two measures: R&D-to-sales ratio, and the patents-to-sales ratio. (The authors used compustat data on R&D spending, and National Bureau of Economic Research patent data to determine which industries are R&D intensive and patent intensive.)

The study found that firms in industries with above-median R&D intensity have a higher increase in R&D spending than those below the median. Specifically, "the estimated within-firm increase in annual R&D spending after TRIPS is on average 20 percentage points higher in an industry with a one standard deviation higher value of our primary measure of innovation intensity." Firms in these industries also generally have sales and R&D-to-sales ratios that grow at a higher rate. Finally, the authors found that innovation intensive firms were more likely to apply for patents overseas.

Kaplan et al. studied the link between IPR and innovation their 2008 World Bank paper on ways to increase the "absorptive capacity" of countries trying to attract and benefit from Foreign Direct Investment.[23] The authors showed through regression analysis that some measurements of innovation – such as the introduction of new products and processes – do rely on IPR. While IPR does have a positive effect on innovation, however, it is not the primary driver. Other factors, such as the skills of the labor force, domestic R&D capacity, and the

[23] David Kaplan, Smita Kurlakose, Krista Tuomi, and Chunlin Zhang. "Fostering Technology Absorption in Southern African Enterprises." Africa Finance and Private Sector Department, World Bank. 2009.

existence of public-private initiatives played a larger role. Intellectual property is more important for firms in certain industries, such as information technology.

d. Non-Empirical Studies Describing the Effects of IPRs in Developing Countries

The British government's Commission on Intellectual Property Rights produced a cautious report in 2002 which argued that developing countries could gain from stronger intellectual property rights, but their gains relied on wise and balanced implementation of the rights.[24] It states that "strong IP rights alone provide neither the necessary nor sufficient incentives for firms to invest in particular countries… The evidence that foreign investment is positively associated with IP protection in most developing countries is lacking." Chapter 7 of the UK's Committee on Intellectual Property Rights report noted that enforcement of intellectual property rights could negatively affect employment in infringing industries

In their 2005 book *Intellectual Property and Development,* economists Carsten Fink and Keith Mascus emphasized that strengthening intellectual property protection involves costs and benefits, and the "net effect of stronger IPRs is an empirical question."[25] The costs to a developing country include higher prices for both final and intermediate goods, including medicines and software, and the loss of employment in copying industries. The benefits include greater opportunities for formal technology transfer and greater trade with developed countries. Developing countries have special characteristics that one could use to support arguments for stronger or weaker IP rights:

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[24] UK Commission on Intellectual Property Rights. Integrating Intellectual Property Rights and Development Policy. 2002. Available at: http://www.iprcommission.org/

[25] Carsten Fink and Keith Maskus. "Why We Study Intellectual Property and What We Have Learned." Chapter one of Intellectual Property and Development: Lessons from Economic Research. 2005.

- *Strong IPR:* If a country lacks the know-how and skills to imitate foreign technologies and apply them to further economic development, than strong IPRs could be used to attract foreign business and to promote formal technology transfers through joint ventures and licensing.
- *Weak IPR:* "Traditional intellectual property instruments" may be inappropriate for developing countries, which are different from developed countries "in their innovative potential, the education of their workforce, the structure and funding of research and development, the management of technological assets, and the existence of complementary IP institutions, such as collection agencies and tech transfer offices."

Fink and Mascus concluded that "countries that strengthen their IPR are unlikely to experience a sudden boost in inflows of FDI. At the same time, the empirical evidence does point to a positive role for IPRs in stimulating formal technology transfer, through FDI in production and R&D facilities and through cross-border licensing." The benefits, however, should be weighed against the costs, and the best outcome will differ by nation. A good way to study the question would be to see how economic variables have changed in a country after a "regime shift of a well-defined element of the intellectual property system."

In a 2008 study, Carsten Fink further discussed costs and benefits of the enforcement of intellectual property rights in developing countries.[26] The costs can be significant for countries with limited means and competing objectives. It is important to prioritize the types of intellectual property to be enforced – for instance, it makes sense to focus enforcement in areas where consumers are deceived or harmed.

Fink argued that IPRs should not affect employment in the long run, because (at least in economic theory) long run market forces push national economies towards full employment. In

[26] Carsten Fink. "Enforcing Intellectual Property Rights: An Economic Perspective." International Centre for Trade and Sustainable Development. 2008. http://ictsd.org/i/publications/42762/

the short run, however, greater enforcement of IPRs can lead to "substantial unemployment," because piracy is a large source of employment in the informal sector in many developing countries. He notes that jobs in IP-intensive industries may pay higher wages and have better working conditions (here Fink cites a 2007 OECD study[27]), but the workers employed in these new industries are likely to be different workers than those who lose their jobs in the informal economy when enforcement of IPRS is strengthened.

An earlier paper by Ha-Joon Chang took a historical view of economic development and IPRs.[28] He stressed that the first intellectual property laws in what are today's developed countries (introduced in the 18th and 19th centuries) were weak by modern standards. Significantly, these laws did not offer equal protection to IPRs owned by foreigners. Most advanced countries "were still routinely violating IPRs of other countries' citizens well into the 20th century." Switzerland and Netherlands serve as examples of countries that have seen technological development coincide with weak IPR protection.

Low and middle income countries often build technological capacities using the imitation and adaptation of advanced technologies "through informal channels." Benefits from strong IPR protection may be small in these countries. "Technology assimilation is a lot more important than the generation of patentable technology" for these countries, and strong IPR will create barriers for duplicating technology. Furthermore, if developing countries have poor innovative capacity, then extra innovations due to stronger IPRs could be insignificant. Empirical

[27] OECD. "The Economic Impact of Counterfeiting and Piracy." (2007). http://oecd.org/dataoecd/36/36/39543399.pdf

[28] Ha-Joon Chang. "Intellectual Property Rights and Economic Development – Historical Lessons and Emerging Issues." Third World Network, IPR Paper Series, no. 3. 2001.

evidence does not show that IPRs have driven FDI or technology transfer to developing countries, or that IPRs have resulted in more innovative economies.

In addition to questioning the benefits of strong intellectual property rights for developing countries, Chang warned that the costs of implementing strong IPR mechanisms can be high. Domestic businesses can face higher royalty payments, and consumers can face monopoly pricing and other restrictive behavior by multinationals. The government can incur high costs of running a sophisticated IPR regime, including spending on human resources. Informal innovation may be slowed because IPRs create barriers to the development of technological capacities through imitation and tinkering.

In a recent paper meant to brief developing country trade negotiators negotiators, Harvey Purse and Sanya Reid Smith argued that stronger IPR protection is not linked to greater FDI inflows.[29] They believe that the often-cited Mansfield study has been "comprehensively rebutted by Heald (2004) for a number of reasons."[30] Additionally, they also cite a UN study in 1993 which found no significant relationship between patents and FDI, and which found more

[29] Harvey Purse and Sanya Reid Smith, "Some Impacts of a TPPA Investment Chapter," Australian Fair Trade & Investment Network, Australia and the Third World Network, Malaysia. January 2012. http://web.me.com/jane_kelsey/Jane/TPPA_files/Investment%20paper%20Santiago.pdf

[30] According to Heald, Mansfield's survey is often misinterpreted by scholars and policymakers to justify calls for strong enforcement of all types of IPR across the board. He argues that respondents to Mansfield's survey were not asked to differentiate between types of intellectual property protection, and that trade secret laws – bnot patent – would be necessary to protect countries engaging in FDI. Additionally, firms' manufacturing decisions will be based on other factors - wages, productivity, transportation costs, distance from markets, level of workforce education, health of the legal system, health of the financial system, and transparency of the government. Finally, Heald pointed out that it is often unclear what the term "investment" is used inconsistently throughout Mansfield's paper – sometimes it is used to refer to the decision of whether to market a product as opposed to open a facility for manufacturing or R&D. *See* Paul Heald. "Misreading a Canonical Work: An Analysis of Mansfield's 1994 Study." Scholarly Works Paper 352, University of Georgia Law. April 2003.

important determinants of FDI, included "market size, levels of human capital and infrastructure development and broad macroeconomic conditions were more important."[31]

e. U.S. Studies

In 2010, Nam Pham studied the effect of intellectual property protection in the United States by comparing the activities of firms in the U.S. that are more (or less) reliant on intellectual property.[32] Pham used R&D expenditures to measure of the intensity of IP across industries. Her data on firm level R&D spending is the annual U.S. Census Bureau survey on R&D, conducted for the National Science Foundation. To defend this methodology, she cited four studies that show R&D spending is an appropriate indicator of innovative capacity.[33]

Pham organized firms into industries identified by the North American Industry Classification System (NAICS). Her dataset includes broadly defined industries at the 3-digit NAICS level, as well as more specific ones at the 4-digit level. Pham isolates 15IP-intensive industries (those with above-average expenditure on R&D), and 12 non-IP-intensive (those below average). She compared economic indicators for the IP-intensive industries and the non-IP intensive industries. The report found that the IP-intensive industries outperform the non-IP-intensive industries in a range of ways: they create more jobs; they create more highly paid jobs for

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[31] Carlos Correa and Richard Kozul-Wright. "Intellectual Property Rights and Foreign Direct Investment." United Nations (ST/CTC/SER.A/24). New York, 1993. http://web.me.com/jane_kelsey/Jane/TPPA_files/Investment%20paper%20Santiago.pdf

[32] Nam Pham. "The Impact of Innovation and the Role of Intellectual Property Rights on U.S. Productivity, Competitiveness, Jobs, Wages, and Exports." NDP Consulting. April 2010.

[33] The studies Pham cites to justify the use of R&D spending as an indicator of innovative capacity are: Boskin, Michael and Lawrence Lau. 1992. "Technology and the Wealth of Nations: Role of R&D and the Changing R&D Paradigm." Stanford University Press; Mairesse, Jacques and Pierre Mohnen. 2004. "The Importance of R&D for Innovation: A Reassessment Using French Survey Data." NBER Working Paper No. 10897; Wilson, Daniel J. 2001. "Is Embodied Technological Change the Result of Upstream R&D? Industry-Level Evidence." Federal Reserve Bank of San Francisco.

workers at all skill levels; they average higher output and sales per employee; they report higher exports; they spend almost 13 times more on R&D expenditure per employee than non-IP-intensive industries; and they allocate over 2.2 times the amount on capital expenditures per employee that non-IP-intensive industries allocated.

Economist Stephen Siwek has written a series of reports on the contribution of industries that rely on copyright for the International Intellectual Property Association. The reports have been frequently cited by policymakers in debates over the proper level of intellectual property protection.[34] The most recent report,[35] published last year, found that the copyright industries paid employees wages that equaled 115% percent of the national average. The "core" copyright industries (that rely more directly on protection) paid 127% of the average U.S. wage. Additionally, the growth rate of the core copyright industries exceeded the growth rate of the overall economy from 2007 to 2010 (1.47% versus 0.05%)

f. Summary of Literature Review

The existing literature is mixed regarding the effect of intellectual property protection in developing countries. Much of the literature seems to doubt a robust link between IPRs and FDI, though there appears to be stronger support for a link between the strength of IPRs and

[34] *See, for instance:* Republican staff of the House Committee on Ways and Means. "U.S. Trade Agreements Protect Our Intellectual Property Rights Abroad, Supporting the U.S. Economy, Jobs and Exports." June 28, 2010. http://republicans.waysandmeans.house.gov/UploadedFiles/FTAs_and_IPR_Fact_Sheet.pdf; Franklin J. Vargo, Vice President for International Economic Affairs, National Association of Manufacturers. Testimony before the Subcommittee on Government Management, Organization, and Procurement of the House Committee on Oversight and Government Reform. December 9, 2009.http://oversight.house.gov/wp-content/uploads/2012/01/20091209Vargo.pdf; Maria A. Pallante, Director, U.S. Copyright Office. Statement before the Subcommittee on the Legislative Branch of the Senate Appropriations Committee. March 2012.

[35] Steven Siwek. "Copyright Industries in the U.S. Economy." International Intellectual Property Alliance. 2011. http://www.iipa.com/pdf/2011CopyrightIndustriesReport.PDF

licensing. (Koff et al. that specifically examined TRIPS-Plus FTAs found that stronger IPRs were correlated with greater licensing payments, a finding shared by Mansfield and Nicolson.) More than one author noted that IPRs can have an effect on the composition of technology transfer, not just on the level. Many also point out that IPR is only one of many factors that will help attract FDI and technology transfer, and lead to economic growth.

3. Methodology

The aim of this study is to examine the economic effects of laws that were implemented to meet the requirements of FTAs, both at the macro and industry levels. Therefore, I need to determine when FTA obligations were implemented, obtain data on indicators before and after the implementation, and identify IP-intensive industries to survey.

This is a new approach to studying the impact of intellectual property protection required by FTAs. Most of the studies I reviewed considered some overall measurement of IPR protection, and Koff et al. included a dummy variable indicating the existence of an FTA between a country and the U.S. However, in my literature review I found no other study that examines economic data before and after the implementation of specific TRIPS-Plus FTA obligations.

a. Year of implementation IPR obligations

Determination of the year in which a country has fully implemented its trade obligations is not a straightforward process. It requires consideration of the years in which the countries passed laws to comply with the FTA, as well as consideration of evidence that the laws are being enforced.

The World Intellectual Property Organization maintains a database of IP laws at the national level,[36] which can be used to find the years in which laws were passed to comply with the FTA obligations.

Determining the year in which the laws were enforced is trickier. The office of the U.S. Trade Representative publishes two reports annually that describe the IP landscape in various countries – the National Trade Estimate Report on Foreign Trade Barriers gives "an inventory of the most important foreign barriers affecting U.S. exports of goods and services, foreign direct investment by U.S. persons, and protection of intellectual property rights."[37] Its description of each nation's alleged trade barriers includes a subsection on intellectual property protection. USTR also publishes the yearly Special 301 Report, which identifies countries that "deny adequate and effective protection of intellectual property rights, or deny fair and equitable market access to United States persons that rely upon intellectual property protection."[38] Both reports are based on input from other government agencies, including the Departments of Commerce and State, and the US Patent and Trademark Office, and comments received from American businesses and trade associations representing businesses that own intellectual property. Previous studies, including the papers by Walter Park, have used USTR reports to determine the level of implementation of intellectual property laws in foreign countries.

Unfortunately, the government reports can be vague, and it takes some reading between the lines to determine the level of satisfaction of the writers at USTR with a country's

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[36] WIPO Lex Database, available online at http://www.wipo.int/wipolex/en/

[37] 2012 USTR National Trade Estimate Report on Foreign Trade Barriers. Available at http://www.ustr.gov/about-us/press-office/reports-and-publications/2012-1

[38] 2012 Special 301 Report. April 30, 2012. Available at: http://www.ustr.gov/sites/default/files/2012%20Special%20301%20Report_0.pdf

compliance with the obligations in specific trade agreements. (The comments received by USTR from industry groups are far more detailed than the government reports, but they are also more heavily biased.) Even after an FTA has been implemented, the U.S. government – driven by industry lobbying – continues to advocate stronger IPRs. There is no instance in the reports of USTR stating clearly that a country has fully satisfied all of the requirements of its FTA. The reporting on most of our FTA partners explicitly accuses them of being out of compliance with their FTA trade obligations. However, there is a small subset of countries for which USTR eventually drops this explicit claim.

For this study, a country is considered to have "implemented" its FTA obligations after 1) laws for implementation have been passed, and 2) USTR stops claiming they are out of compliance.

Below is a brief description of three countries that implemented their obligations, and for which there I found firm-level data available before and after the year of implementation.

Guatemala: The Central American Free Trade Agreement (CAFTA) went into effect in 2006, and Guatemala's implementation legislation went into force in May of that year.[39] Decrees No. 11 and 30 included specific patent provisions that granted extensions, broadened the scope of what could be patented, introduced 'linkage' provisions on pharmaceutical patents, and reinstated the protection of pharmaceutical test data.[40] In 2008, Guatemala passed additional

[39] USTR, National Trade Estimate Report of Foreign Trade Barriers, 2007.

[40] Ermias Tekeste Biadgleng and Jean-Christophe Maur. "The Influence of Preferential Trade Agreements on the Implementation of Intellectual Property Rights in Developing Countries A First Look." UN/International Centre for Trade and Sustainable Development. Issue Paper No. 33. November 2011.

regulations related to the enforcement of pharmaceutical patents.[41] USTR reported that "enforcement of these provisions [had] yet to become fully effective," in 2008[42] but it acknowledged the following year that "Guatemala undertook legislative reforms providing for stronger IPR protection and enforcement."[43]

The 2010 National Trade Estimate report drops the assertion made in the previous year's report that Guatemala had not fully implemented its FTA. In the 2010 Special 301 Report, USTR described the changes that took place in 2009 in more detail:

> Specific improvements in 2009 included the appointment of a new IPR prosecutor and the establishment of an interagency IPR working group under the leadership of the IPR prosecutor to strengthen enforcement and inter-governmental cooperation. These improvements, fortified by a program of U.S. training for relevant officials, have contributed to an increase in enforcement actions, including raids, seizures, and prosecutions. The United States recognizes and appreciates Guatemala's efforts to date in these areas.

Firm level data is available for 2006 and 2010 – allowing one to examine variables before and after the implementation of CAFTA intellectual property obligations in 2009.

Peru: The trade agreement with Peru entered into force on February 1, 2009. A series of laws and executive orders were passed to implement the agreement before that date. In 2008, the executive branch issued eight decrees on intellectual property topics that are available in the WIPO database, including decrees on copyright enforcement carried out by customs authorities, and on the protection of pharmaceutical and agricultural test data. Similar

[41] Regulation No. 55-2008, available in the WIPO Lex database at http://www.wipo.int/wipolex/en/profile.jsp?code=GT

[42] USTR, National Trade Estimate Report of Foreign Trade Barriers, 2009.

[43] USTR, National Trade Estimate Report of Foreign Trade Barriers, 2010.

legislative decrees were passed the following year. [44] A clear law (not decree) ordering the full implementation of the FTA oblgations was signed in 2009.[45] USTR described the 2010 landscape in Peru as follows:

> As a result of the PTPA, Peru enhanced its IPR legal framework significantly to strengthen IPR protection and enforcement. Among other improvements, Peru strengthened its intellectual property office and created a National Strategic Plan to combat counterfeiting and piracy.[46]

Unlike the section of the report for most countries with FTAs in force, USTR did *not* indicate that Peru needs to enact new changes to law or policy in order to comply with its trade agreement obligations, therefore, I consider 2010 to be the year in which Peru's trade obligations had been implemented.

Nicaragua: CAFTA went into effect in 2006, and in the same year Nicaragua passed new laws protecting copyright, trademark, patent, and satellite signals. The following year it passed a second amendment to its patent law. In 2008, Nicaragua passed a new law that amended its criminal code to include stronger penalties for copyright infringement in 2008.[47]

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[44] Law and decrees available on the WIPO Lex database page for Peru: http://www.wipo.int/wipolex/en/profile.jsp?code=PE

[45] The main law for the implementation of the trade agreement's intellectual property obligations was *Law No. 29316 amends, incorporates and regulates miscellaneous provisions on the implementation of the Trade Promotion Agreement signed between Peru and United states*. Signed into law January, 2009. Available at: http://www.wipo.int/wipolex/en/details.jsp?id=5754

[46] USTR. National Trade Estimate Report on Foreign Trade Barriers, 2011. Page 292. Available at: http://www.ustr.gov/webfm_send/2731 Note that USTR did ask Peru to "clarify" its laws regarding the protection of test data.

[47] These laws can be accessed through the WIPO Lex database at: http://www.wipo.int/wipolex/en/profile.jsp?code=NI

Also in 2008, Nicaragua implemented a plan to increase enforcement of intellectual property law. The U.S. Embassy staff worked with Nicaraguan enforcement officials over the next few years, gradually strengthening enforcement.[48]

None of the NTE reports from 2007 forward state that Nicaragua is out of compliance with its CAFTA obligations. They indicate that the U.S. wants Nicaragua to strengthen enforcement, but they consistently indicate that enforcement is improving.

For this paper, I consider the date of implementation to be 2008, when the last of the IP-related laws in the WIPO database were enacted. I am able to obtain firm level data for the years 2006 and 2010.

b. World Bank Enterprise Data

The World Bank Enterprise surveys provide firm-level data that is comparable across countries and time periods. The countries surveyed are low- and middle-income countries. The surveys began in the late 1990s, but most nations in the dataset were not surveyed until the 2000s. The Enterprise survey consists of core survey questions that are identical across countries and for all years (there are additional questions that are asked for particular subsectors).

The survey is conducted by contractors for the World Bank according to a highly specific set of instructions.[49] The respondents are people who run business establishments. An

[48] See the 2009 diplomatic cable from the U.S. Embassy staff in Managua to the Secretary of State and other government officials requesting that Nicaragua be left off of the Special 301 Report because local officials are cooperating well with Embassy staff to improve the enforcement of intellectual property: http://www.cablegatesearch.net/cable.php?id=09MANAGUA227

"establishment" as defined by the instructions for interviewers is a "physical location where business is carried out and where industrial operations take place or services are provided." Also for the purposes of the survey, an establishment must "make its own financial decisions and have its own financial statements separate from those of [a parent] firm." The survey is conducted in each country in roughly four-year intervals, and the World Bank provides panel for countries after the survey has been conducted twice.

This study examines data from the survey related to

- Foreign Direct Investment, as measured by the percentage of firms in a sample of which foreign investors have a 10% or greater ownership stake.
- Licensing, as measured by the percentage of firms in a sample using technology licensed from abroad.
- Overall employment and skilled employment
- Sales and exports by firms in each industry, reported in currency, not quantity sold.

c. Identifying IP-intensive industries

To explore the effect of FTA intellectual property obligations at the industry level, I isolate the IP-intensive industries identified by Pham (2010). As noted above, Pham indentified IP-intensive industries by the average level of R&D spending by firms, as reported to the U.S. Census Bureau and identified by the North American Industry Classification System (NAICS) at the three-digit and four-digit levels of classification.[50] The three-digit level is a broader measure (i.e. – manufacture of chemical products) and the four-digit level is more precise (i.e. – manufacture of pharmaceuticals).

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[49] World Bank. World Bank's Enterprise Survey: Understanding the Questionniare. January 2011. http://www.enterprisesurveys.org/~/media/FPDKM/EnterpriseSurveys/Documents/Methodology/Questionnaire-Manual.pdf

[50] Information on the NAICS available at http://www.census.gov/eos/www/naics/

The industries identified by Pham as being IP-intensive are the same identified by Koff in his study. The list of industries correlates well with those identified by Dutta and Sharma (2008) who use the ratio of R&D to sales to rank industries identified by India's National Industry Classification code, a similar though not identical classification system. Yasuda and Kato also report on the activities of IP-intensive industries, and though they do not describe a methodology, the industries described are generally the same as those identified by Pham. The similarities of the studies that focus on IP-intensive industries indicate a general agreement in on which industries ought to be considered.

The respondents to the World Bank Enterprise survey identify their establishment's industry using the United Nations' International Standard Industrial Classification, Revision 3.1 (ISIC Rev. 3.1).[51] This is comparable to the NAICS classification used by Pham, but the comparison in some cases is more "apple-to-apple" at the less precise levels. In other cases, use of the less precise classification also helps address issues of data availability, which is important because the firm-level data in developing countries can be sparse.

In this study, some of the industries are identified at the two- or three-digit level in the ISIC Rev. 3.1 in order to correspond to the NAICS industry at the three-digit level, and one industry (transportation equipment) is covered by one NAICS code, but two codes in the ISIC Rev. 3 classification system.

[51] Detailed structure and explanatory notes of the ISIC Rev 3.1 are available at http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=17

The industries and their corresponding ISIC Rev. 3.1 codes used in this study are

242X	Chemical products (includes pharmaceuticals)
3000	Computer/Electronic Device Manufacture
34XX + 35XX	Transportation Equipment
331X	Medical Equipment
2320	Petroleum Products
722X	Information Software

4. Results

In this section, the results for each variable are presented, both at the country level and industry level. In general, the data paints a complicated picture – there are few instances where all of the data show an unambiguous relationship between changes in IPR laws and other variables.

Implementation of the IP obligations of free trade agreements in the countries observed has not generally raised FDI (no statistically significant results in the national level and only one significant increase in one country at the industry level). However, stronger IPRs have led to greater licensing of foreign technology by domestic firms in two of three countries. Employment has risen substantially at the national and firm levels. The effect on hiring of skilled workers is not different than the effect on hiring of workers overall. Sales have risen, but exports as a percentage of sales have not seen a significant increase.

For certain industries, there is insufficient data to make significant comparisons (or in some cases, any comparisons at all) between time periods. The one exception consistent across countries is the chemical industry, which had a substantial number of establishments

represented in the dataset for each country in each time period. The table below shows the number of firms in the dataset in each industry:

		2006				2010		
Code	**Industry**	**Guatemala**	**Peru**	**Nicaragua**		**Guatemala**	**Peru**	**Nicaragua**
24XX	Chemical Manufacturing	23	81	30		19	111	12
2929	Computers/Electronics	0	0	0		0	0	0
34XX +35XX	Transportation Equipment	2	0	5		3	8	0
331X	Medical Equip	0	1	0		1	2	0
2320	Petroleum Products	0	0	0		0	0	0
722X	Information Software	0	0	0		0	2	2

In the industries other than chemical manufacturing, there is a shortage of data. Even when comparisons between time periods within a country can be made, small sample sizes lead to large variances and often statistically insignificant results.

One trend apparent from the data on IP-intensive industries is that more firms entered IP-intensive industries in Peru after the implementation of its trade agreement with the United States (specifically, the transportation equipment, medical equipment, and information software industries).

a. Foreign Direct Investment

The OECD defines FDI as the "direct or indirect ownership of 10% or more of the voting power of an enterprise resident in one economy by an investor resident in another economy."[52] The Enterprise dataset reports the average percentage of foreign ownership of each firm. I

[52] Organization for Economic Co-operation and Development. "Glossary of Foreign Direct Investment Terms and Definitions." http://www.oecd.org/dataoecd/56/1/2487495.pdf

constructed a dummy variable that equaled 1 if the percentage of foreign ownership was .10 or greater, and equaled 0 if the percentage of foreign ownership was less than .10. The mean of the dummy variable for each year is the *percentage* of firms in the dataset for each year of which 10% or more is owned by foreign investors.

At the macro level, there was no statistically significant change in the average level of foreign ownership of firms in any of the three countries. However, there was an insignificant increase in the dummy variable for Guatemala and Nicaraguan firms, and a very insignificant decrease among Peruvian firms.

When the industries are isolated, there is a significant increase in the level of foreign ownership of Nicaraguan chemical manufacturing firms. There is a statistically insignificant increase in Guatemala and an insignificant decrease in Peru. In other IP-intensive industries, there is a shortage of data that makes observation of the changes within industries difficult. In many cases, there were no observations in either year. In other cases, small numbers of firms entered or left the industry, but there are not enough observations to determine statistical significance. For this reason, the sample size (n) for each observed mean is provided under the mean value for each observation from 2006 and 2010 displayed in the table below. The last column shows the change between the mean from 2006 and 2010, with the *t* statistic underneath. (The symbols * are used to indicate significance at the 10% level, ** significance at the 5% level, and *** at the 1% level.)

The data shows that new entrants into the Peruvian transportation equipment industries were supported by foreign investment after Peru implemented its trade obligations. There is

no foreign ownership of any of the firms in any other industry in Guatemala or Nicaragua either before or after the implementation of the FTA.

Guatemala

Industry	2006	2010	Change
Full Economy	0.11 n=521	0.13 n=589	0.12 t=0.99
Chemical Manufacturing	0.13 n=23	0.16 n=19	0.03 t=0.25
Comptuers/Electronics	0.00 n=0	0.00 n=0	0.00 t=na
Transportation Equipment	0.00 n=2	0.00 n=3	0.00 t=na
Medical Equip	0.00 n=0	0.00 n=1	0.00 t=na
Petroleum Products	0.00 n=0	0.00 n=0	0.00 t=na
Information Software	0.00 n=0	0.00 n=0	0.00 t=na

Peru

Industry	2006	2010	Change
Full Economy	0.12 n=632	0.12 n=999	0.00 t=-0.13
Chemical Manufacturing	0.19 n=81	0.13 n=111	-0.06 t=-1.13
Computers/Electronics	0.00 n=0	0.00 n=0	0.00 t=na
Transportation Equipment	0.00 n=0	0.38 n=8	0.38 t=na
Medical Equip	0.00 n=1	0.50 n=2	0.50 t=na
Petroleum Products	0.00 n=0	0.00 n=0	0.00 t=na
Information Software	0.00 n=0	0.00 n=0	2.00 t=na

Nicaragua

Industry	2006	2010	Change
Full Economy	0.09 n=476	0.11 n=334	0.02 t=0.75
Chemical Manufacturing	0.00 n=30	0.17 n=12	0.17*** t=2.39
Computers/Electronics	0.00 n=0	0.00 n=0	0.00 t=na
Transportation Equipment	0.20 n=5	0.00 n=0	-0.20 t=na
Medical Equip	0.00 n=0	0.00 n=0	0.00 t=na
Petroleum Products	0.00 n=0	0.00 n=0	0.00 t=na
Information Software	0.00 n=0	0.00 n=2	0.00 t=na

The results support Fink and Mascus' assertion that strengthening intellectual property will not result in a sudden boost of foreign direct investment and Kaplan et al.'s point that the relationship between IPRs and FDI is "nuanced." To a lesser extent, the results support Ha Joon-Chang's statement that stronger IPRs do not drive FDI in developing countries, and Purse and Smith's argument that there is no empirical relationship between strength of IPR protection and FDI. They could feasibly support Nicholson's argument that firms do not set up operations in countries where IPR protection is low, because they can expand into those markets by licensing (the next section will examine licensing behavior of firms).

The results conflict with the studies by Mansfield, Park, and Yasuda and Kato that indicated a positive relationship between the strength of IPR protection and foreign direct investment. However, each of these studies' conclusions had caveats that would apply to the Enterprise data from Guatemala, Peru and Nicaragua. Mansfield reported that the relationship was less clear in developing countries, that small countries may lack markets large enough to attract

foreign FDI, and that his results were hampered by a paucity of data at the industry level. Park reported that the relationship between strength of IPRs and FDI might not apply to countries at early stages of development. Yasuda and Kato reported that their results were mixed at the industry level.

b. Technology Transfer through Foreign-Licensed Technology

The Enterprise survey asks managers whether their firms use technology licensed from foreign companies. Data from Guatemala and Peru, and Nicaragua all show a significant change at the macro level after the implementation of stronger IPRs, but the direction of the relationship is inconsistent. Peruvian and Nicaraguan firms increased their use of foreign-licensed technology, but Guatemalan firms decreased their use of it.

Use of foreign-licensed technology by firms in the chemical manufacturing industries increased significantly in Nicaragua. It increased by a substantial amount in Guatemala, but due to a high variance and small sample size, the increase is statistically insignificant. There was no change in Peru.

It is hard to analyze changes in other industries due to a lack of data. However, roughly a third of the Peruvian firms entering the IP-intensive transportation equipment industries after the nation strengthened IP protection utilized foreign-licensed technology. New entrants to the Guatemalan transportation equipment industry and the Nicaraguan information software industry used foreign licensed technology as well. However, we cannot test for statistical significance because there are no observations in 2006.

Guatemala

Industry	2006	2010	Change
Full Economy	23.64 n=313	15.58 n=353	-8.06*** t=-2.64
Chemical Manufacturing	26.09 n=23	38.89 n=18	12.80 t=0.86
Computers/Electronics	0.00 n=1	0.00 n=0	0.00 t=na
Transportation Equipment	100.00 n=2	50.00 n=2	-50.00 t=1.00
Medical Equip	0.00 n=1	100.00 n=1	100.00 t=na
Petroleum Products	0.00 n=0	0.00 n=0	0.00 t=na
Information Software	0.00 n=0	0.00 n=0	0.00 t=na

Peru

Industry	2006	2010	Change
Full Economy	10.56 n=360	14.47 n=760	3.92** t=1.81
Chemical Manufacturing	20.99 n=81	20.91 n=110	0.08 t=-0.01
Computers/Electronics	0.00 n=0	0.00 n=0	0.00 t=na
Transportation Equipment	0.00 n=0	37.50 n=8	0.00 t=na
Medical Equip	0.00 n=1	0.00 n=2	0.00 t=na
Petroleum Products	0.00 n=0	0.00 n=0	0.00 t=na
Information Software	0.00 n=0	0.00 n=0	0.00 t=na

Nicaragua

Industry	2006	2010	Change
Full Economy	6.84 n=351	12.80 n=125	5.96** t=2.07
Chemical Manufacturing	0.00 n=30	20.00 n=10	20.00*** t=2.67
Specialized Machinery	0.00 n=0	0.00 n=0	0.00 t=na
Transportation Equipment	0.00 n=5	0.00 n=0	0.00 t=na
Medical Equip	0.00 n=0	0.00 n=0	0.00 t=na
Petroleum Products	0.00 n=0	0.00 n=0	0.00 t=na
Information Software	0.00 n=0	50.00 n=2	50.00 t=na

On balance, companies in general, and some of the domestic IP-intensive industries, increasingly utilized foreign licensed technology after FTA intellectual property obligations were met. However this was not the case in Peru, and the evidence at the industry level is not robust due to a paucity of data.

The results support Mansfeild's finding that IPRs are important for technology transfer to emerging markets, and Koff's finding that more firms will license technology after strengthening IPRs and joining a free trade agreement with the U.S. Together with the results for FDI, they support Nicholson's finding that firms are more likely to license technology to overseas firms than to engage in FDI when IPR protection strengthens. However, the results conflict with Chang's assertion that technology transfer is unaffected by the strength of intellectual property protection.

The results also contradict Park's finding that stronger IPRs in developing countries will have a "negative effect on licensing." However, their lack of consistency across countries and

industries supports his assertion that the picture is complicated for developing countries. This lack of consistency also supports Kaplan et. al.'s statements about the complicated nature of the link between IPRs and technology transfer.

c. Employment

In each of the countries, employment at the macro and industry level increased greatly between 2006 and 2010. At the macro level, the average number of employees in surveyed firms rose 56% in Guatemala, 95% in Peru, and 43% in Nicaragua (all of the increases at the macro level were statistically significant). At the industry level, there were many increases in employment, though small sample sizes and much interindustry variance mean that the results are often statistically insignificant or untestable.

Guatemalan chemical firms increased employment by an average of 96%. New entrants to the Guatemalan transportation and medical equipment industries increased the industries' average employment but small sample sizes yield statistically insignificant results.

Firms in the Peruvian chemical industry increased employment by 31%, but due to high variance of results, the increase is not statistically significant. New entrants to the transportation equipment and software industries led to new employment for Peruvian workers, and the entrant of a new firm into the medical equipment industry (where there was previously only one firm) increased average employment by 265%, but T tests were either not applicable or small sample sizes yielded statistically insignificant results.

The Nicaraguan chemical industry saw an increase in average employment of 190%. Firms left entered the software industry, bringing new jobs, but firms left the transportation equipment industry.

Guatemala

Industry	2006	2010	Change
Full Economy	103.85 n=522	162.50 n=589	58.65*** t=2.24
Chemical Manufacturing	182.30 n=23	358.00 n=19	175.70* t=1.36
Computers/Electronics	0.00 n=0	0.00 n=0	0.00 t=na
Transportation Equipment	33.50 n=2	44.33 n=3	10.83 t=0.28
Medical Equip	0.00 n=0	19.00 n=1	19.00 t=na
Petroleum Products	0.00 n=0	0.00 n=0	0.00 t=na
Information Software	0.00 n=0	0.00 n=0	0.00 t=na

Peru

Industry	2006	2010	Change
Full Economy	97.08 n=632	189.11 n=1000	92.03*** t=3.53
Chemical Manufacturing	99.74 n=81	131.20 n=111	31.36 t=0.86
Computers/Electronics	0.00 n=0	0.00 n=0	0.00 t=na
Transportation Equipment	0.00 n=0	118.16 n=8	118.16 t=na
Medical Equip	40.00 n=1	145.00 n=2	105.00 t=na
Petroleum Products	0.00 n=0	0.00 n=0	0.00 t=na
Information Software	0.00 n=0	92.50 n=2	92.50 t=na

Nicaragua

Industry	2006	2010	Change
Full Economy	52.67 n=477	75.43 n=329	22.75** t=1.95
Chemical Manufacturing	25.90 n=30	75.17 n=12	49.27*** t=3.06
Computers/Electronics	0.00 n=0	0.00 n=0	0.00 t=na
Transportation Equipment	13.40 n=5	0.00 n=0	-13.40 t=na
Medical Equip	0.00 n=0	0.00 n=0	0.00 t=na
Petroleum Products	0.00 n=0	0.00 n=0	0.00 t=na
Information Software	0.00 n=0	20.00 n=2	20.00 t=na

The results generally support findings by Pham and Siwek that correlate IP-intensive industries with job creation, though these studies only examine the U.S. economy.

These results conflict with assertions by Fink that stronger enforcement of intellectual property right could lead to "substantial unemployment" in the short run, because IP infringement supports many jobs among low skilled workers in developing countries.

d. Skilled employment

Firms surveyed hired 33% more skilled workers in Guatemala, 77% in Peru, and 96% in Nicaragua. These increases are large (two of the three are statistically significant at the 10% level or higher), but the increase in skilled workers hired in Guatemala and Peru is less than the increase in overall employment in those countries. Nicaragua is the only country where the data show a higher increase in skilled workers hired than workers hired overall.

There were very large and statistically significant increases in skilled workers hired by chemical firms in Guatemala (131%) and Nicaragua (179%), and a substantial increase (46%) in Peru, but this is not significant due to a high variance in the data. Only Guatemala experienced a statistically significant increase in skilled employment that is greater than the increase in overall employment within the industry.

In other industries, there is little data, but one observation can be made. Guatemalan and Peruvian transportation firms substantially increased hiring at all levels. However, the increased hiring of skilled workers was greater than the increase of overall hiring in each country (206% versus 33%; 650% versus 263%, respectively) more skilled workers (compared to 33% more workers overall), but due to small sample size and large variance, this result is not statistically significant.

Guatemala

Industry	**2006**	**2010**	**Change**
Full Economy	39.23 n=313	52.25 n=353	13.02 t=1.20
Chemical Manufacturing	66.48 n=23	153.67 n=18	87.19* t=1.37
Computers/Electronics	0.00 n=0	0.00 n=0	0.00 t=na
Transportation Equipment	8.00 n=2	24.50 n=2	16.50 t=0.92
Medical Equip	0.00 n=0	8.00 n=1	8.00 t=na
Petroleum Products	0.00 n=0	0.00 n=0	0.00 t=na
Information Software	0.00 n=0	0.00 n=0	0.00 t=na

Peru

Industry	2006	2010	Change
Full Economy	45.35 n=358	80.11 n=745	34.76** t=1.80
Chemical Manufacturing	32.01 n=80	47.00 n=108	14.99 t=0.89
Computers/Electronics	0.00 n=0	0.00 n=0	0.00 t=na
Transportation Equipment	0.00 n=0	58.50 n=8	58.50 t=na
Medical Equip	6.00 n=1	45.00 n=2	39.00 t=na
Petroleum Products	0.00 n=0	0.00 n=0	0.00 t=na
Information Software	0.00 n=0	0.00 n=0	0.00 t=na

Nicaragua

Industry	2006	2010	Change
Full Economy	17.98 n=351	35.18 n=123	17.20** t=2.26
Chemical Manufacturing	10.20 n=30	28.50 n=10	18.30** t=2.28
Computers/Electronics	0.00 n=0	0.00 n=0	0.00 t=na
Transportation Equipment	8.40 n=5	0.00 n=0	-8.40 t=na
Medical Equip	0.00 n=0	0.00 n=0	0.00 t=na
Petroleum Products	0.00 n=0	0.00 n=0	0.00 t=na
Information Software	0.00 n=0	12.00 n=2	12.00 t=na

The data on skilled employment does not show that stronger IP protection increased the employment of skilled workers relative to workers overall at the macro level. In some industries, the increase in skilled employment exceeded the increase of overall employment, but this does not hold across many of the IP-intensive industries. One explanation is provided by the Stolper-Samuelson theory: when countries trade, more resources are directed towards

industries in which they have a competitive advantage and away from industries in which they have a competitive disadvantage. This implies that when developing countries increase trade with the U.S., they would hire more workers in labor and natural-resource intensive industries rather than the IP-intensive industries. Most of the studies arguing that IP-intensive industries hire more skilled workers, such as the Siwek and Pham studies reviewed above, are focused on developed country markets. These results are not necessarily comparable.

e. Total Sales, Adjusted for Inflation

In this section, I report total sales figures reported in the survey, adjusted for inflation using a deflator based on World Bank figures for nominal and real GDP.

At the macro level, average total sales for firms in Guatemala and Peru rose significantly by 132% and 59%, respectively. The average growth of total sales for Nicaraguan firms was 20%, but due to high variance, this is not statistically significant.

At the industry level, the Guatemalan chemical, specialized machinery, and transportation equipment industries had increased sales, but none were statistically significant. Only one firm reported sales for one time period in the medical equipment industry, and there was no data reported in the computer, petroleum or software industries.

The Peruvian chemical and medical equipment industries had insignificant increases in sales. Transportation equipment and software firms only answered the survey in 2010, and there is no data for the petroleum industry.

The Nicaraguan chemical manufacturing industry reported a highly statistically significant increase in inflation-adjusted sales of 235%. Firms only provided data for one time period for the transportation equipment and software industries, and there was no data for the other

industries. Overall, the industry-level data does not show that IP-intensive industries enjoyed larger increases in sales than other industries.

Guatemala

Industry	2006	2010	Change
Full Economy	18,400,000 n=0=495	42,700,000 n=436	24,300,000*** t=3.15
Chemical Manufacturing	99,100,000 n=22	152,000,000 n=15	52,500,000 t=0.57
Computers/Electronics	0 n=0	0 n=0	0 t=na
Transportation Equipment	3,356,382 n=2	8,381,031 n=2	5,024,649 t=0.89
Medical Equip	0 n=0	650,078 n=1	650,078 t=na
Petroleum Products	0 n=0	0 n=0	0 t=na
Information Software	0 n=0	0 n=0	0 t=na

Peru

Industry	2006	2010	Change
Full Economy	18,000,000 n=606	28,700,000 n=916	10,700,000** t=2.04
Chemical Manufacturing	19,200,000 n=78	16,500,000 n=105	2,723,914 t=0.48
Computers/Electronics	0 n=0	0 n=0	0 t=na
Transportation Equipment	0 n=0	6,387,327 n=8	6,387,327 t=na
Medical Equip	5,728,165 n=1	8,775,018 n=2	3,046,854 t=na
Petroleum Products	0 n=0	0 n=0	0 t=na
Information Software	0 n=0	4,130,494 n=2	4,130,494 t=na

Nicaragua

Industry	2006	2010	Change
Full Economy	52,800,000 n=444	63,100,000 n=295	10,300,000 t=0.58
Chemical Manufacturing	8,552,392 n=27	28,600,000 n=11	20,100,000*** t=2.51
Computers/Electronics	0 n=0	0 n=0	0 t=na
Transportation Equipment	1,420,543 n=4	0 n=0	-1,420,543 t=na
Medical Equip	0 n=0	0 n=0	0 t=na
Petroleum Products	0 n=0	0 n=0	0 t=na
Information Software	0 n=0	838,022 n=2	838,022 t=na

It is important to note that the dataset reports sales earnings, but it lacks data on *quantity of units* sold before and after the implementation of FTA intellectual property obligations. Since intellectual property rights grant innovators temporary monopolies over their creations, expanding and enforcing intellectual property rights will likely lead to higher prices of protected goods. As noted by Oxfam and by Shaffer and Brennan, anecdotal evidence from the pharmaceutical industry provides examples of instances where prices of protected medicines increased dramatically after FTAs went into effect. It is unclear from the available data whether the increases in sales are mostly attributable to greater production and distribution of products, or to higher prices charged by firms enjoying greater intellectual property protection.

Nonetheless, the increased sales revenues reported by firms in the Enterprise survey support arguments by Yasuda and Kato that output rises with stronger IPR protection at the macro level, and often at the firm level for IP-intensive industries. Unlike Pham and Siwek's studies of the U.S. economy, the data for these developing countries does not show that firms

in IP-intensive industries have higher sales than firms in other industries (with the one exception being the Guatemalan chemical industry).

f. Exports as a Percentage of Sales

At the macro level, there were no statistically significant changes in exports – reported in the Enterprise Survey as a percentage of total sales – in any of the three countries. There was an insignificant increase in Guatemala and Peru, and a very insignificant decrease in Nicaragua. (However, since total sales rose for these industries, this still indicates the countries increased exports.)

Industry-level results generally failed to show an increase in exports as a percentage of sales. In Guatemala, there was an insignificant decrease in the percentage of sales that were exports in the chemical manufacturing and transportation equipment industries. No exports were reported by firms in the computer, medical equipment, petroleum products, or software industries.

There was a statistically insignificant decrease in exports as a percentage of sales for the Peruvian chemical industry, and an insignificant increase for the medical equipment industry. Firms entering the transportation equipment, and software industries reported exports for 2010, and there was no data for the computer and electronics nor the petroleum products industries.

In Nicaraguan chemical industry reported a statistically significant increase in exports as a percentage of sales. No other Nicaraguan industry reported any significant increases in exports.

Guatemala

Industry	2006	2010	Change
Full Economy	12.84 n=522	13.97 n=590	1.13 t=0.70
Chemical Manufacturing	25.13 n=23	21.53 n=19	-3.60 t=-0.45
Computers/Electronics	0.00 n=0	0.00 n=0	0.00 t=na
Transportation Equipment	12.50 n=2	12.00 n=3	-0.50 t=-0.04
Medical Equip	0.00 n=0	0.00 n=1	0.00 t=na
Petroleum Products	0.00 n=0	0.00 n=0	0.00 t=na
Information Software	0.00 n=0	0.00 n=0	0.00 t=na

Peru

Industry	2006	2010	Change
Full Economy	14.70 n=632	14.91 n=1000	0.21 t=0.14
Chemical Manufacturing	8.63 n=81	7.49 n=111	-1.14 t=-0.41
Computers/Electronics	0.00 n=0	0 n=0	0.00 t=na
Transportation Equipment	0.00 n=0	4.00 n=8	4.00 t=na
Medical Equip	45.00 n=1	48.50 n=2	3.50 t=na
Petroleum Products	0.00 n=0	0.00 n=0	0.00 t=na
Information Software	0.00 n=0	0.50 n=2	0.50 t=na

Nicaragua

Industry	2006	2010	Change
Full Economy	6.59 n=478	6.44 n=335	-0.14 t=-0.10
Chemical Manufacturing	0.73 n=30	5.08 n=12	4.35** t=1.94
Computers/Electronics	0.00 n=0	0.00 n=0	0.00 t=na
Transportation Equipment	0.00 n=5	0.00 n=0	0.00 t=na
Medical Equip	0.00 n=0	0.00 n=0	0.00 t=na
Petroleum Products	0.00 n=0	0.00 n=0	0.00 t=na
Information Software	0.00 n=0	0.00 n=2	0.00 t=na

The data indicates that the share of exports did not automatically rise in the countries studied after they strengthened intellectual property protection. These results conflict with Koff's finding that an increase in IPR strength will lead to increased exports. They do not contain data to internationalize the findings made in the studies by Pham and Siwek that American IP-intensive industries are more inclined to export than other industries.

5. Conclusion and suggestions for future research

Data presented in this study suggests that implementation of the intellectual property provisions in FTAs by developing countries has had positive effects in some countries and in some industries. However, it does not support broad statements that intellectual property rights will necessarily lead to foreign direct investment, technology transfer, more and better employment, or growing exports. The picture is more complicated, and the data available at the industry level remains thin. To summarize:

- There was little observable statistically significant increase in foreign direct investment after the implementation of IPR obligations.
- Licensing, however, did increase with the strengthening of intellectual property laws and enforcement
- Employment rose significantly after the FTA was implemented, but there was no boost in the IP-intensive industries relative to the rest of the economy. There was also no boost for skilled employment relative to employment overall.
- Sales increased at the national and industry levels. The proportion of sales that were exports did not change significantly.

Areas for future research are plentiful. Additional case studies conducted by researchers based in the countries that are strengthening IPRs as required by FTAs would augment data-driven studies and contribute to a greater understanding of the changes' outcomes. Researchers could conduct studies that describe the changes' effects on *consumers* as well as producers.

A survey of changes in industry-level average prices would be especially interesting. This would test the assertions of critics of TRIPS-Plus intellectual property that stronger IPRs will lead to higher prices that 1) reduce consumer welfare, and 2) raise the cost of intermediate goods used by domestic producers.

As more countries implement and reliably enforce intellectual property rights as required by trade agreements, and as the World Bank continues to periodically survey firms in these countries, more industry-level examination using data from the Enterprise surveys will be possible.

Finally, the World Bank Enterprise data added many new variables in 2010 that are relevant to the debate over relationship between IPR strength and innovation. These include establishments' R&D expenditures, whether establishments launched of new products, their

spending on IP licenses, and whether or not they hold patents (both domestically and overseas). These new variables provide opportunities for analysis of cross section data from a sample of firms in many countries. A study could examine the correlation between the new variables and one of the existing IPR indexes described in this paper. If the World Bank keeps these new variables in its next round of surveys, researchers can examine how they change over time in relation to changing IPR environments.