



THESIS APPROVED BY

April 7, 2011

Date

Kristie Briggs

Kristie Briggs, Ph.D., Chair

Terry Clark

Terry Clark, Ph.D.

John Deskins

John Deskins, Ph.D.

Gail M. Jensen

Gail M. Jensen, Ph.D., Dean

AN EXAMINATION OF NATIONAL FACTORS THAT INFLUENCE  
LEVELS OF PERCEIVED INTELLECTUAL PROPERTY PROTECTION

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By

SILAS BROWN

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A THESIS

Submitted to the faculty of the Graduate School of the Creighton University in Partial  
Fulfillment of the Requirements for the degree of Master of Arts in the Department of  
International Relations

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Omaha, NE

April, 6<sup>th</sup> 2011



Abstract:

This paper analyzes factors that influence perceived intellectual property (IP) protection, as approximated by a sub-index of the World Economic Forum's Global Competitiveness Report. The study is conducted for 134 countries from 1999-2009. The results suggest that more developed countries will have higher levels of perceived IP protection. Furthermore, the evidence indicates that countries with independent judiciaries and those with high reliability of police services will also have higher levels of perceived IP protection. In contrast, when the same enforcement related variables are analyzed against traditional measures of statutory IP protection during the same time period, judicial independence does not have a statistically significant impact on legal patent rights and the reliability of police services has a negative impact on the level of statutory IP protection in a country. This suggests that even though many nations have adopted a minimum standard for intellectual property rights as mandated by the World Trade Organization's Trade Related Aspects of Intellectual Property Rights (TRIPS) Agreement, many nations have yet to enforce those conditions. This paper finds that enforcement related concerns are key factors in explaining differences between perceived IP protection and statutory levels of protection in a country.

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# **An Examination of National Factors That Influence Levels of Perceived Intellectual Property Protection**

## **1. Introduction**

The decisions individual countries make regarding their domestic intellectual property rights (IPRs) have increasingly garnered an international audience. Today, IPRs are widely seen as drivers of innovation and promoters of its spread through and across countries via technology transfer and diffusion. Due to this, and the increasingly globalized marketplace, nations recognize that the welfare of their own businesses depends on both foreign and domestic IPRs regimes. This recognition has encouraged countries to seek greater international harmonization of IPRs regimes.

This trend of increasing harmonization began in 1883 with the Paris Convention and continues to this day. Originally drafted by large industrializing countries and their colonies, the Paris Convention outlined minimum standards for patents, industrial designs, trademarks, and geographic sources of origin for its member countries. Soon thereafter, in 1886, the Berne Convention established minimum standards of literary and artistic works through the standardization of copyright provisions. While there were numerous other international efforts over the next century, it was not until the 1970s and 1980s, with the emergence of the internet and increasing globalization, that there was another concerted push to standardize IPR policies internationally.

In 1970, the World Intellectual Property Office (WIPO) formed as an agency of the United Nations (UN) to promote intellectual property protection worldwide. As of 2010, WIPO administered 24 international IPR-related treaties including the Patent Cooperation Treaty

(PCT), which has streamlined international patent filings by enabling individuals and firms to simultaneously apply for patent protection in multiple countries with one application.

Perhaps the most significant effort to harmonize IPRs regimes emerged from the Uruguay Round (1986-1994) of the General Agreement on Tariffs and Trade (GATT) negotiations. Resulting from these negotiations, the World Trade Organization (WTO) replaced the GATT as the vanguard of global trade and commerce. Simultaneously, the Trade Related Aspects of Intellectual Property Rights (TRIPS) Agreement was enacted as a centerpiece of the WTO. The TRIPS Agreement came into effect 1 January 1995. The Agreement built on the previous international IPR conventions and established an even more comprehensive minimum standard for IP protection applicable to all WTO members<sup>1</sup>.

The coupling of the TRIPS Agreement with WTO membership meant that nations wishing to join, or remain members of, the WTO must adopt the minimum standards outlined in the TRIPS Agreement. As a result, at this time approximately 90 percent of all countries worldwide are WTO members and are subject to the TRIPS requirements. However, it remains uncertain as to if developing countries truly desire national abidance to TRIPS, or if they have agreed to these terms for the wider benefits of WTO membership. Kabiraj (1994) recognized the potential impact of the marriage of the TRIPS Agreement with WTO membership when he wrote, “One can hardly dare suggest India be out of the GATT because the cost of being isolated in the international context may be too high. In such a situation, accepting [the TRIPS Agreement] might be the self-immiseration choice for India”. Briggs (2010) found evidence of

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<sup>1</sup> TRIPS granted developed countries one year (until 1 January 1996) to fully implement its statutes. Developing countries and some transitioning countries (those transitioning from centrally planned to market economies) were granted four additional years to implement TRIPS (until 1 January 2000) with the exception of Articles 3, 4, and 5, which deal with general principles such as non-discrimination. Least developed countries were given a total of eleven years (until 1 January 2006) to implement TRIPS; however, in late 2005, the WTO extended LDC's implementation date from 2006 to 2013 for measures not pertaining to pharmaceuticals and 2016 for measures associated with pharmaceuticals. Refer to the WTO/TRIPS website for a list of developing and least-developed countries, [http://www.wto.org/english/tratop\\_e/devel\\_e/dlwho\\_e.htm](http://www.wto.org/english/tratop_e/devel_e/dlwho_e.htm)

this and described the effect as the “international vulnerability hypothesis” wherein developing countries, which are more susceptible to international economic and political pressure, adopt higher levels of IP protection than they may consider optimal.

As some developing countries may be adopting TRIPS more out of external pressure than internal desire, it is conceivable and perhaps even likely that the legal standards of IP protection in a country are dissimilar from the enforced level of protection. If this is the case, then analyzing the legal standards (statutory protection) may not accurately approximate the enforced level of protection (effective protection). Because there is currently no way to measure effective protection, international organizations have begun measuring perceived IP protection as an alternative to measuring legal standards. Perceived IP protection is measured by surveying informed members of a nation’s business, academic, and government communities as to how well they perceive the level of IP protection in their country.

This paper provides evidence that perceived protection is substantively different than statutory protection. It does so by examining the influence of enforcement related factors on perceived IP protection and statutory protection. A key finding is that general measures of enforcement in a country are strongly statistically significant in determining perceived IP protection but these same enforcement factors are insignificant in determining IPRs written into law. This provides tangential evidence that the adoption of TRIPS compliant standards does not yet necessarily translate into an enforced standard of IP protection. This finding suggests that perceived IP protection serves as a good proxy for effective protection because perceived protection captures the enforcement component often omitted from measurements of statutory IP protection. This paper also explores the potential U-shape relationship between per capita income and IP protection in a country. This relationship has been largely explored using measures of statutory IP protection but has not been considered with perceived IP protection.

This paper is structured as follows. Section 2 further analyzes the different measures IP protection. Section 3 discusses previous research on factors that influence a nation's IPRs regime. Section 4 develops the empirical model and describes the data used in this research. Section 5 presents and discusses the results.

## **2. Measures of IPRs Protection**

IP scholars have developed two primary measures of a nation's level of IP protection; measures of statutory protection and measures of perceived protection. Measures of statutory protection are based on a nation's legal framework regarding IPRs. Two prominent indexes measuring a nation's legal framework are the Rapp and Rozek (RR) index and the Ginarte and Park Patent Rights Index (PRI). Both the RR and the PRI measure how well national patent laws conform to international standards of patent protection and illuminate variations in IP laws cross-nationally. The RR index of patent strength is based on measuring the conformity of 159 nations' patent laws in 1984 with the minimum standards proposed in the *Guidelines for Standards for the Protection and Enforcement of Patents* by the U.S. Chamber of Commerce (Rapp and Rozek 1990). The RR index ranks national levels of patent protection on a scale of zero to five, with zero associated with a nation having no patent protection laws and five corresponding with a nation whose laws are fully consistent with the guidelines proposed minimum standards<sup>2</sup>. The Ginarte and Park PRI analyzes national patent laws of 122 countries from 1960-2005<sup>3</sup>. The index considers five categories of patent laws: 1) extent of coverage, 2) membership in international patent agreements, 3) provisions for loss of protection, 4) enforcement mechanisms on the books, and 5) duration of protection (Park 2008). The PRI includes subcategories for each of the five categories adding greater depth and variance for each

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<sup>2</sup> Appendix 1 provides the scale used by the RR index.

<sup>3</sup> The original PRI, published in 1997 included 110 countries for 1960-1990, however in 2008, Park updated the PRI through 2005 and extended it to include 122 countries.

country. The total score for a country is calculated by summing the scores of each category<sup>4</sup>. For this reason, the PRI has overwhelmingly replaced the RR index in empirical studies of IP and is used as the preferred measure of statutory IP in our paper.

Measures of perceived protection are based on analyzing the opinions of informed members of a nation's business, government, and academic community regarding IPRs. Two prominent indexes measuring perceived protection are found in the Global Competitiveness Report published by the World Economic Forum (WEF) and the World Competitiveness Yearbook published by the International Institute of Management and Development (IMD). Perceived protection represents the complex interaction between a nation's legal framework and its desire, or ability, to enforce the laws. By surveying informed members of a community on how well IP is protected, rather than asking what laws are on the books, I expect the resulting ranking of perceived protection to closely approximate the actual level of IP protection. Measures of perceived protection also capture opinions on copyrights and trademarks while the RR Index and PRI exclusively focus on patents.

The WEF's Global Competitiveness Report (GCR) provides data gathered by the Executive Opinion Report, which is a survey of the opinions of informed members of the business, academic, and government communities. The WEF Global Competitiveness Report consists of numerous survey questions asked to members on a broad range of topics affecting national competitiveness from infrastructure to education. The WEF survey asks respondents "How would you rate intellectual property protection, including anti-counterfeiting measures, in your country? (1= very weak; 7= very strong)<sup>5</sup>". The survey results are then averaged for each participating country. This survey enables researchers to cross-nationally compare levels of

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<sup>4</sup> Appendix 2 provides the categories, subcategories, and scoring methodology for the PRI.

<sup>5</sup> The wording of this question has changed over the years, but remains the same in spirit. Appendix 3 documents the question that was asked for each category and the years that each question was asked for each variable that this paper utilizes that results from the WEF Global Competitiveness Report.

perceived protection. Data for the IP question in the WEF GCR is available from 1999 to 2010 with the number of countries participating ranging from 59 in 1999 to 134 in 2009.

The International Institute for Management Development's (IMD's) World Competitiveness Yearbook also utilizes an executive opinion survey to create a measure of perceived IP protection in a country. In their survey, the IMD asks informed members of the nation's business and academic community and government officials: "Intellectual Property Rights are not adequately enforced or are adequately enforced? (0= not adequately enforced, 10 = adequately enforced)" and aggregates the data to produce an average for each country. The IMD initiated the survey in 1989 for 58 countries, with data publicly available from 2003 to 2010.

Both IP surveys from the WEF and the IMD serve as a good measure for perceived IP protection. One advantage of using the WEF data is that its broad scope of years and of countries surveyed greatly enhances the sample size from what it would be using the IMD data. Therefore, the WEF dataset is primarily utilized in this paper to measure perceived protection. Data from the IMD is also used as an alternative dependent variable; therefore, the empirical estimations involving the enforcement variables as independent variables are replicated so to exemplify that the results found analyzing WEF levels of perceived IP protection are robust and not simply a consequence of the measure for perceived protection.

### **3. Literature Review**

Prior to the WEF's and the IMD's introduction of a survey question directed at IP, the PRI and the RR were the only data available to cross-nationally analyze a nation's IP regime. Therefore, most research has utilized statutory measures of IP in their empirical investigations, rather than the measure of perceived protection. However, with the introduction and ongoing

compilation of WEF's and the IMD's executive opinion surveys, researchers now have a sample of survey data large enough to analyze levels of perceived IP protection as well.

The first part of this literature review discusses previous works that have examined the factors that influence statutory IP protection. The second part of the literature review focuses on the rising importance of enforcement. This subsection discusses research that suggests that, in the post-TRIPS era, there is a growing gap between the IP laws which a country adopts and the IP laws that are enforced. This leads me to expect that enforcement related factors – such as judicial independence, reliability of the police force, and levels of imitation – will influence perceived IP protection but not necessarily statutory protection.

### *3.1 Level of Statutory IP Protection as a Dependent Variable*

Several authors have produced research examining national characteristics that provide for strong statutory IP protections (Ginarte and Park 1997; Chen and Puttitanun 2005; Park 2008; and Briggs 2010). Due to the advantages of the PRI outlined in Section 2, these studies have all utilized the Ginarte and Park PRI as the dependent variable.

Ginarte and Park (1997) identified market freedom as an important factor in determining a nation's statutory protections for both developed and developing nations. For less developed countries, openness was an important characteristic. Lastly, they found that a country's ratio of R&D spending to GDP was significant in determining a nation's level of statutory protection only after the ratio crossed a certain threshold.

In a more recent analysis, Park (2008) noted that a nation's level of patent right protection was positively correlated with per capita income levels<sup>6</sup>. In that same paper, Park

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<sup>6</sup> With the exception of the highest quintile of per capita GDP which also had the highest level of patent right protections.

echoes Grossman and Lai (2004) and Eicher and Penalosa (2006) in his finding that richer countries have both a greater “capacity” and “willingness” to increase patent right protections.

Chen and Puttitanun (2005) analyzed the relationship between income and a country’s level of IPRs in more detail, arguing that a U-shaped relationship exists between IPRs and per capita GDP. This would mean that in the early stages of growth a country implements strong IPRs to attract high technology goods, but then weakens IPRs so to engage in imitation. In later stages of growth a country again strengthens IPRs so to encourage innovation. To empirically test this theory Chen and Puttitanun (2005) incorporate both a per capita GDP and per capita GDP squared term in their regression equation. They found support for their U-shape theory with negative coefficient for per capita GDP and a positive coefficient for per capita GDP squared. The authors also found that economic freedom, trade, and secondary education are not significant predictors of a nation’s level of statutory protection.

Briggs (2010) analyzed the U-shaped relationship studied by Chen and Puttitanun (2005) and concluded that Chen and Puttitanun had mischaracterized the source of the relationship between per capita GDP and statutory protection in their analysis of panel data. Briggs found support for an alternative theory in which the U-shaped relationship was a product of cross-sectional influences based on the year a country first implemented IPRs rather than on longitudinal changes in a country’s level of IP over time<sup>7</sup>. She argued that middle income countries were less vulnerable to international pressures to implement the strong IPRs recommended by the international community and instead took advantage of imitation-led growth and, thus, adopted lower levels of IP protection than higher or low income countries. Low income countries, on the other hand, were more vulnerable to these international pressures

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<sup>7</sup> Briggs (2010) found that only 14 out of 121 countries, for which data on levels of statutory protection (as provided by the PRI) is available, have ever shown a decrease in the statutory protection over time.

and implemented stronger IP laws. However, Briggs' use of the PRI Index in her analysis analyzes the adoption of IP laws but prohibits a further understanding as to whether those laws are actually enforced.

### *3.2 Considering Enforcement in the post-TRIPS world*

During the construction of the PRI, Ginarte and Park (1997) analyzed complaints made by multi-national firms and concluded that the majority of businesses' concerns were either non-patent (e.g., copyrights, trademarks) related or statutory (that nations lacked appropriate IP laws). The authors found few complaints regarding enforcement (the speed and efficiency of courts and the prosecution of imitators). This led Ginarte and Park to conclude that, "the gap between the measured and actual levels of patent protection is not very wide." While we recognize that this may have been the case in the pre-TRIPS era, this conclusion deserves reconsideration in the post-TRIPS era due to the influence of non-IP factors brought about by WTO membership. If this conclusion is no longer accurate, and there is a divergence between the laws on the books and the laws enforced, statutory protection (specifically the PRI) may be systematically overestimating the level of (patent) protection afforded to innovators.

A significant amount of research suggests that there may be an enforcement gap, or a gap between the laws that are on the books and those laws that are enforced in practice (Falvey et al. 2006; Mertha and Pahre 2005; Jain 1996; OECD, 2010; U.S. Dept of Commerce, 2002). In the post-TRIPS world, leaders have learned that the punishment from the international community is less severe if they adopt stringent IP laws but do not enforce them than if they did not adopt these IP laws at all. Falvey et al. (2006), found that nations are likely to adopt TRIPS, but then only slowly and incrementally enforce TRIPS provisions in order to gain the benefits of WTO membership and TRIPS compliant laws (increased FDI, high tech imports and technology

transfer) without disrupting their local innovative activity (diffusion, imitation, and adaptation) and/or illicit markets (production and distribution of counterfeit goods).

Evidence of this trend is shown through a recent OECD (2010) report on international trade and piracy. Even though TRIPS membership has expanded and level of statutory protection has increased, the amount of losses due to counterfeiting and piracy as well as the percent of world trade that is counterfeit has been increasing (OECD 2010). Ostergard (2000), Sherwood (1997), and the U.S. Department of Commerce (2002) all note the lack of enforcement for IP laws adopted in the post-TRIPS era. An overview of the TRIPS Agreement published by the U.S. Department of Commerce (2002) stated that, “Enforcement issues are becoming increasingly important as more countries enact laws which are generally TRIPS consistent. *Increasingly, the compliance issues in the IPR area will not be inadequate foreign laws, but rather inadequate enforcement of TRIPS-consistent IPR laws.*”

#### **4. Determinants of Perceived Protection**

The previous section established that statutory IPRs are not necessarily enforced and supports the belief that measures of perceived IP protection serve a useful purpose in better understanding the IP decisions made by individual countries. As previously stated, the WEF data is used as the primary measure of perceived IP protection in a country and serves as the dependent variables in the empirical model. However, to ensure the robustness of the results, a second series of analyses are conducted with IMD data replacing the WEF data as the dependent variable. This section discusses those factors of national economies and governance (the independent variables) that impact the level of perceived protection.

The benchmark independent variables utilized in this paper are GDP per capita, GDP per capita squared, WTO membership, judicial independence, reliability of police, and imitation

rates. The former three measures are included as control variables in the model, while the later three measures are included to capture different aspects of enforcement. Empirical tests suggest that these enforcement variables are not multicollinear, and that each helps explain a different aspect of a country's perceived protection. The following paragraphs outline the theoretical reasons that each variable is included in the empirical analysis as well as descriptive information about the source and content of each variable.

*GDP per capita (GDPpc)*: GDP per capita is included to capture the effect of a nation's economic development on the level of perceived IP protection. It is a control variable that has been used by Ginarte and Park (1997), Chen and Puttitanun (2005), and Briggs (2010) when statutory IP was the dependent variable. Data on GDP per capita, in constant 2000 U.S. dollars, was obtained from the World Bank's World Development Indicators.

*GDP per capita squared (GDPpc<sup>2</sup>)*: The squared value of per capita GDP variable was the focus of Chen and Puttitanun's (2005) and Briggs (2010) research on the theoretical causes of a U-shaped relationship between statutory protection (as measured by the PRI) and economic development. Therefore, this variable is included in order to investigate if a U-shaped relationship is present between nation's perceived protection and economic development.

*WTO Membership (WTO)*: WTO membership is modeled as a dummy variable equal to one if a country is a WTO member in a given year and zero otherwise. This information was gathered from the WTO's TRIPS website. WTO membership implies that a nation is willing to adopt the TRIPS minimum standards upon accession to the WTO<sup>8</sup>.

*Judicial Independence (JI)*: Judicial independence provides a subjective measure of the independence of a nation's legal system. I theoretically expect that judicial independence will affect both the ease and speed of enforcement. I expect that the addition of IP protections in

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<sup>8</sup> The implementation schedule has been delayed for least developed countries as noted in Section 1 of this paper.

nations with strong legal and/or judicial systems will require only a small expansion of existing institutions and their jurisdictions; however, in nations with weak legal and/or judicial systems, I expect that increases in IPRs will require a much greater expansion of institutions to ensure enforcement of new IP laws. For these reasons I expect that Judicial Independence will have a positive effect on perceived protection. Judicial Independence is approximated using the average score for a judicial independence survey question reported in the WEF's Global Competitiveness Report. While the exact wording of the question used to measure judicial independence has varied over time (see Appendix 3), it consistently focuses on measuring the independence of the judicial system from outside actors (interference by the government, citizens, or firms).

*Reliability of Police (RP):* The Reliability of Police variable provides a subjective measure of the reliability of police services to protect citizens and businesses. The individuals primarily responsible for ensuring compliance of the law are police, customs officials, and bureaucrats. Therefore, I theoretically expect that nations with professionally trained enforcement officials will find it both quicker and easier to enforce newly adopted and implemented IP protections. In nations with poorly compensated and/or inadequately trained enforcement officials the potential for corruption and bribery is likely to persist, and the protection afforded by the law may not be afforded to the innovator. For these reasons, I expect that the reliability of police services will have a positive effect on perceived protection. Reliability of Police is approximated using the average score for a survey question on the reliability of police services in the WEF's Global Competitiveness Report. Again, while the exact wording of the question used to measure the reliability of police services has varied slightly over time (see Appendix 3), it remains focused on measuring the extent to which police services effectively enforce law and order such that security is not an ongoing concern for private businesses.

*Imitation Rate (IM)*: Countries that actively engage in imitation reflect weak enforcement of IP laws and should, subsequently, have lower levels of perceived IP protection. Data on imitation is unfortunately scarce. One of the best proxies for imitation rates in a country is a measure for software piracy rates provided by the Business Software Alliance's (BSA's) annual Global Software Piracy Study. Although the BSA data is specific to software piracy, I use it to approximate total imitation rates in a country. However, given that it is not a precise measure of total imitation rates, as well as the fact that the data is available for limited amount of countries and years (2003 – 2009), I test the model both including and excluding this independent variable. The Business Software Alliance is a major trade group representing much of the world's software industry and its hardware partners for a range of business and policy affairs. In their data, piracy rates vary from 100% (if all of the software that is in-use in a country for that year is counterfeit) to 0% (if all of the software in use is legitimate). Weng et al. (2009) also utilized BSA data to measure the level of imitation of information goods across countries.

#### *4.1 Estimation Equation and Strategy*

The above discussion reveals the benchmark equation for estimating the level of perceived IP perception. The precise benchmark equation for perceived IP protection (WEF) in country  $j$  at time  $t$  is:

$$(1) \text{ WEF}_{jt} = B_0 + B_1 \ln \text{GDPpc}_{jt-1} + B_2 \ln \text{GDPpc}_{jt-1}^2 + B_3 \text{WTO}_{jt-1} + B_4 \text{JI}_{jt-1} + B_5 \text{RP}_{jt-1} + B_6 \text{IM}_{jt-1} + \varepsilon_{j,t-1}$$

where the independent variables' acronym is as they appear in the previous section. All independent variables are lagged in order to avoid potential endogeneity with the dependent variable. It is unlikely that future levels of perceived IP protection have an impact on the currently levels of GDP per capita, WTO membership, and enforcement. GDP per capita is captured as a logged transformation in order to capture how a percentage change influences

perceived protection. Logged transformations are not necessary for JI and RP as they are measured in indexes and therefore, it is useful to estimate how a one point increase in the respective index impacts perceived protection index. Additionally, imitation (IM) is already measured as a percentage from 0 to 1 representing 0% to 100% making a logged transformation unnecessary.

Year dummies are included to isolate any possible affect attributable to a specific year but not due to the independent variables. The inclusion of year dummy variables also helps to abate the potentially exogenous impact of variations in the variable's scores that derive from changes in the wording of the survey questions over time. Lastly, standard errors are clustered by country to account for unobserved similarities in within-country observations while also accounting for unobserved differences in between-country observations.

#### 4.2 Descriptive Statistics

Table 1 presents descriptive statistics for the data utilized in this paper.

Table 1: Descriptive Statistics							
Variable	WEF	IMD	PRI	GDPpc	JI	RP	IM
	Index range: 1-7	Index range: 1-10	Index range: 0-5	Constant 2000 USD	Index range: 1-7	Index range: 1-7	Percentage: 0-1
Observations	1256	429	151	1158	1103	1025	678
Mean	3.88	5.95	3.69	8,981.95	4.11	4.32	0.60
Std. Deviation	1.24	1.68	0.75	11,438.27	1.40	1.25	0.21
Min	1.5	1.22	1.78	107.03	1.2	1.71	0.20
Max	6.6	8.97	4.88	56,624.73	6.84	6.8	0.96
WEF = perceived IPRs, PRI = statutory IPRs, GDPpc = per capita GDP JI = judicial independence RP = reliability of police, IM = imitation							

The average country in the sample has a per capita GDP of \$8,981.95. Per capita GDP also has a large standard deviation of \$11,438.27. The average index score for perceived IP protection is 3.88, which is somewhere in the middle of the index range of 0 to 7. Imitation rates are particularly high with an average rate of 60%. WTO membership has an overall (across all years and countries) prevalence of 83.6%.

Table 2: Correlation Matrix								
	WEF	IMD	PRI	GDPpc	WTO	JI	RP	IM
WEF	1							
IMD	0.92	1						
PRI	0.66	0.56	1					
GDPpc	0.81	0.75	0.65	1				
WTO	0.24	0.26	0.18	0.2	1			
JI	0.86	0.88	0.5	0.72	0.21	1		
RP	0.82	0.83	0.45	0.73	0.12	0.8	1	
IM	-0.84	-0.85	-0.75	-0.81	-0.29	-0.78	-0.69	1

WEF = perceived IPRs, PRI = statutory IPRs, GDPpc = per capita GDP, JI = judicial independence, RP = reliability of police, IM = imitation

Table 2 presents a correlation matrix for the variables utilized in the empirical analysis. The direction of correlation between all variables is as expected. The perceived IP protection (WEF) and statutory IP protection (PRI) have a correlation of 0.66, supporting the notion that there is a difference between the level of perceived IP protection and the statutory IP protection. The enforcement variables – judicial independence, reliability of police and imitation – all have correlations above 70% in absolute terms, suggesting potential multicollinearity. However, variance inflation factor (vif) tests were conducted as part of each regression analysis and those tests confirm that there is no multicollinearity between these variables or any of the included

regressors<sup>9</sup>.

## 5. Empirical Results

Table 3 presents results for the effect of the control variables on perceived protection. Column I assumes a monotonic relationship between per capita GDP and perceived protection while Column II includes a per capita GDP squared term as suggested by Chen and Puttitanun (2005) to test for a possible U-shape relationship. As shown in Table 3, WTO membership has a weak, but statistically significant impact (at the 90% level) on perceived protection in both Columns I and II. This suggests that the effect of WTO membership goes beyond the statutory level of IP protection, to influence the perceived level of IPRs in a country; perhaps serving as an indication that the dispute settlement mechanism in the WTO has a positive impact on enforcement in member countries or that WTO members are not only implementing TRIPS, but also enforcing TRIPS compliant IP regulations.

Table 3		
Dependent Variable:	WEF	WEF
Column:	I	II
Gross Domestic Product per capita	0.61*** (0.04)	-1.89*** (0.33)
Gross Domestic Product per capita squared		0.16*** (0.02)
WTO	0.32* (0.17)	0.23* (0.14)
Constant	-1.02*** (0.33)	8.78*** (1.29)
Year Dummies	yes	yes
R <sup>2</sup>	0.65	0.73

<sup>9</sup> The only regressors that display multicollinearity characteristics in the variance inflation factor tests are per capita GDP and per capita GDP squared, which is expected.

N	1158	1158
Notes: Estimated coefficients are shown together with the standard errors in parenthesis. *, **, *** denote statistical significance at the 90%, 95%, and 99%, respectively. Years 1999 - 2009 are analyzed in Columns I and II. Standard errors are clustered by country. GDP per capita is in logs.		

Although Column I suggests that the level of perceived IP protection is monotonically increasing with GDP per capita, Column II finds evidence of the U-shape relationship postulated by Chen and Puttitanun (2005). However, as noted in Briggs (2010), the U-shape captured by the panel data in Column II does not indicate whether the U-shaped relationship is due to cross-sectional or longitudinal variations in the panel data.

In Briggs' (2010) critique of Chen and Puttitanun (2005), she noted that statutory protection rarely, if ever, decreased over time. However, the nature of the measure for perceived IP protection, as derived from a composite of surveys, encourages a much wider range of fluctuations within countries across years. Therefore, additional tests were implemented to test if this U-shaped relationship is true longitudinally, for one country over time, or a result of cross-sectional forces. Chen and Puttitanun's argument (as outlined in Section 3.1) suggests that countries below a certain threshold will lower their IPRs as income increases while countries above that threshold will increase their IPRs as income increases. For our data, this threshold, or the point at which Chen and Puttitanun suggest that increases in per capita income will switch from having a negative impact on IPRs to having a positive impact, is \$415.00. The data is divided into two groups based on if their per capita income falls above or below this threshold. If the U-shaped relationship is a result of longitudinal changes I expect that per capita GDP in the below group will have a negative correlation with perceived IP protection and, inversely, that per capita GDP in the above group will have a positive correlation with perceived IP protection.

Table 4					
Below Threshold Group			Above Threshold Group		
	WEF	lnGDPpc		WEF	lnGDPpc
WEF	1.00		WEF	1.00	
lnGDPpc	0.11	1.00	lnGDPpc	0.82	1.00

Table 4 illustrates that the correlation between income and perceived IP is positive in both the below and above groups even as income levels are more strongly correlated with perceived IP protection in the above group than the below group. This suggests that increases in income are correlated with increases in perceived levels of IP. This result further suggests that the U-shaped curve initially observed is a result of cross-sectional forces, as suggested by Briggs (2010). To further analyze this, an estimating equation is tested which also divides the data into groups above and below the threshold point of per capita GDP of \$415.

Table 5		
	Below Threshold Group	Above Threshold Group
Column:	I	II
Gross Domestic Product per capita	0.14 (0.15)	0.74*** (0.02)
WTO	0.12 (0.14)	0.29*** (0.08)
Constant	1.94** (0.82)	-2.59*** (0.15)
Adj R2	0.00	0.67
N	142	1016

Notes: Estimated coefficients are shown together with standard errors are in parenthesis. \*, \*\*, \*\*\* denote statistical significance at the 90%, 95%, and 99% respectively. Years 1999 - 2009 are analyzed in all Columns. Note: GDPpc is in logs

Corresponding with the conclusions found in Table 4, Table 5 demonstrates that in both groups per capita GDP is positive, although it is not statistically significant in the below group while it is statistically significant in the above group. Analyzing the results from Table 5, one notices that the coefficient for both of the per capita GDP terms is positive and that across all levels of economic development increases in per capita GDP correspond with increases in perceived protection<sup>10</sup>. This conclusion casts doubt on the longitudinal variation theory and lends support to the theory that the U-shaped relationship is a product of the cross-sectional variations. This supports the theory that, within a country, increases in per capita GDP will likely lead to increases in perceived IP protection; therefore, the per capita GDP squared term is excluded from the remainder of the estimating equations used in this paper.

Table 6 presents the results for the full estimating equation presented as equation (1). The full estimating equation measures both the influence of the control variables and the three independent enforcement related measures on perceived protection. Recall that the inclusion of measures for judicial independence, reliability of police, and the prevalence of imitation capture different aspects of how the laws IP of a country are effectively enforced. The third enforcement variable, imitation, is theoretically important to the analysis; however, its limited data availability significantly reduces the sample size and number of years examined. Therefore, I include regressions both with and without imitation to more fully analyze the impact of the enforcement variables on perceived protection.

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<sup>10</sup> This analysis was extended by dividing per capita GDP into ascending quintiles and analyzing the impact of per capita GDP on perceived IP protection. This analysis is included in Appendix 4, which exhibits no support for a longitudinal U-shaped relationship for any income quintile.

Table 6						
Dependent Variable:	WEF	WEF	PRI	PRI	Diff	Diff
Column:	I	II	III	IV	V	VI
Gross Domestic Product per capita	0.24*** (0.02)	0.10* (0.05)	0.42*** (0.04)	0.28*** (0.09)	-0.05*** (0.02)	-0.05* (0.03)
WTO	0.26*** (0.09)	0.19 (0.12)	-0.04 (0.21)	-0.07 (0.23)	0.08 (0.10)	0.05 (0.11)
JI	0.36*** (0.05)	0.32*** (0.05)	0.02 (0.04)	-0.02 (0.06)	0.11*** (0.02)	0.11*** (0.02)
RP	0.30*** (0.05)	0.28*** (0.05)	-0.08 (0.05)	-0.13** (0.06)	0.05** (0.02)	0.06** (0.03)
IM		-1.55*** (0.40)		-1.4** (0.55)		-0.09 (0.17)
Constant	-0.78*** (0.19)	1.29*** (0.75)	0.47 (0.29)	3.00*** (1.02)	-0.28** (0.12)	-0.29 (0.34)
Year dummies	yes	yes	yes	yes	yes	yes
R2	0.86	0.89	0.58	0.63	0.50	0.56
N	988	631	148	74	146	73

Notes: Standard errors in parenthesis. \*, \*\*, \*\*\* denote statistical significance at the 90%, 95%, and 99% respectively. All standard errors are clustered by country. GDP per capita is in logs. Years 1999-2009 are utilized in Columns I and V. Due to data limitations on the IM variable, years 2003 - 2009 are utilized in Columns II and VI. Due to data limitations on the PRI variable, years 2000 and 2005 are utilized in Columns III and V, and year 2005 in Columns IV and VI.

As shown in Columns I and II, both Judicial Independence and Reliability of Police have a statistically significant and a positive impact on a country's perceived level of IP protection (as measured by the WEF). This supports the theory that nations with independent judicial branches as well as reliable and professional police forces will have higher perceived levels of IP protection. When imitation is considered in Column II, imitation is found to have a negative impact (at the 99% level) on perceived IP protection. This aligns with the theory that nations with high levels of imitation perceive themselves to have lower levels of IP protection. Also note that the inclusion of imitation does not detract from the statistical significance of Judicial Independence or Reliability of Police. To validate that the three enforcement measures independently influence a country's perceived level of IP protection, variance inflation factor

(vif) tests were performed and those tests confirm that no multicollinearity exists between the independent variables.

Table 6 also examines whether the enforcement variables impact statutory IP protection in a country (Columns III and IV), and whether these enforcement variables can explain the difference between the measures of perceived and statutory protection (Columns V and VI). The PRI measure of statutory IP protection is used as the dependent variable in Columns III and IV, while the difference between the WEF and the PRI is used as the dependent variable in Columns V and VI. The results in Column III of Table 6 indicate that neither judicial independence nor the reliability of police play a statistically significant role in determining levels of statutory protection<sup>11</sup>. In Column IV, imitation has a negative effect on statutory IP protection indicating that countries with high levels of imitation are similarly countries with low levels of statutory protection. Additionally, the inclusion of imitation causes reliability of police to become statistically significant (at the 95% level) while remaining negative. This suggests that, *ceteris paribus*, countries with more reliable police may actually have lower levels of statutory protection. One possible explanation might be that countries with more reliable police cannot inflate their statutory IP protection (in response to international pressures for stronger IPRs) beyond the level which they intend to enforce those laws.

The results from Columns I – IV of Table 6 suggest that there may be acute differences between the level of perceived protection and the level of statutory protection. To analyze the difference between perceived and statutory IPRs a new dependent variable is created. Because the WEF index of perceived IPRs ranges from zero to seven and the PRI of statutory IPRs ranges from zero to five, I transform the original data from the indexes to their natural logs to put both measure on a similar scale before creating the difference of the two by subtracting PRI from

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<sup>11</sup> In Column III, Reliability of Police has a statistical significance at the 84% level.

WEF. This variable, which is called Difference, serves as the dependent variable in Columns V and VI of Table 6. Also note that the only overlap in available years for the PRI and the WEF occurs for 2000 and 2005. When imitation is also included the only overlap for the PRI and the WEF is 2005. Due to the limited overlap of the datasets it is impossible to provide a robust analysis on the differences between the levels of perceived and statutory protection. Nonetheless, the results in Columns V and VI provide insights into these differences.

The results in Columns V and VI of Table 6 suggest that countries with higher levels of per capita GDP will have a smaller difference between perceived and statutory IP protection. This suggests that more developed countries will have a level of perceived protection more similar to their level of statutory protection. In both Columns V and VI membership in the WTO is statistically insignificant in accounting for the difference between perceived and statutory IP protection. Judicial Independence has a positive and significant impact at the 99% level, while reliability of police has a positive and significant impact at the 95% level. These results indicate that countries with high levels of judicial independence and reliable police will have a greater difference between levels of perceived and statutory protection, suggesting that enforcement measures can be used to capture differences between perceived and statutory IPRs. This also highlights the importance of analyzing the differences between the perceived and statutory IP rather than assuming they measure the same thing. In Column VI, imitation is not statistically significant in explaining the differences between the two measures, reinforcing the results shown when Columns II and IV are considered jointly; that the level of imitation in a country impacts both perceived and statutory levels of IP.

### 5.1 An Alternate Measure of Perceived IP Protection

In order to decrease the chance that the aforementioned results (found utilizing WEF data as the dependent variable) are not a statistical anomaly, an alternative measure of perceived protection is considered. As outlined in Section 2, the International Institute for Management and Development also produces a competitiveness report which includes survey data on the level of perceived IP protection. This alternative estimating equation is as follows:

$$(2) \text{IMD}_{jt} = B_0 + B_1 \ln \text{GDPpc}_{jt-1} + B_2 \ln \text{GDPpc}_{jt-1}^2 + B_3 \text{WTO}_{jt-1} + B_4 \text{JI}_{jt-1} + B_5 \text{RP}_{jt-1} + B_6 \text{PR}_{jt-1} + \mathcal{E}_{j,t-1}$$

Table 7 illustrates the interaction between the dependent variable (IMD) and the same independent variables that have been previously outlined. This alternative measure is constrained due to data limitations (data for the IMD is only available from 2003 to 2009 for 58 countries each year). This limitation reduces the ability for one to make generalizations based on the results if considered independently, but when considered as a compliment to the results produced using the WEF data the results enhance the robustness of the overall findings of this paper: that enforcement related measures are statistically significant determinates of levels of perceived IP protection.

Dependent Variable:	IMD	IMD	PRI	PRI	Diff	Diff
Column:	I	II	III	IV	V	VI
IGDPpc	0.34*** (0.06)	-0.01 (0.07)	0.42*** (0.04)	0.28*** (0.09)	-0.01 (0.03)	-0.06 (0.04)
WTO	0.33 (0.23)	-0.04 (0.21)	-0.04 (0.21)	-0.07 (0.23)	-0.15 (0.15)	-0.22 (0.16)
JI	0.70*** (0.08)	0.44*** (0.07)	0.02 (0.04)	-0.02 (0.06)	0.15*** (0.01)	0.11*** (0.03)
RP	0.29*** (0.10)	0.40*** (0.08)	-0.08 (0.05)	-0.13** (0.06)	0.07** (0.03)	0.08** (0.04)
IM		-3.46*** (0.58)		-1.4** (0.55)		-0.45* (0.23)
Constant	-1.80*** (0.46)	3.59*** (0.99)	0.47 (0.29)	3.00*** (1.02)	-0.49** (0.20)	0.33 (0.50)
Year dummies	yes	yes	yes	yes	yes	yes
R2	0.85	0.88	0.58	0.63	0.79	0.80
N	414	360	148	74	47	45

Notes: Estimated coefficients are shown together with the standard errors in parenthesis. \*,\*\*,\*\*\* denote statistical significance at the 90%, 95%, and 99% respectively. Years 2003-2009 utilized in all Columns.  
Note: GDPpc is in logs

Column I of Table 7 produces similar results to those found in Column I of Table 6 in that per capita GDP levels, judicial independence and the reliability of police are all statistically significant at the 99% level and each measures has a positive impact on levels of perceived IP protection. In Column II of Table 6, judicial independence and reliability of police remain statistically significant and again have a positive impact on a country's level of perceived IP protection and Imitation has a statistically significant and negative impact. These results mirror those found in Column II of Table 6 and provide support for the results. The results of Columns III and IV do not change between Tables 6 and 7. In Columns V and VI, the difference variable is calculated measuring the logged difference between the IMD index and the logged PRI index. The results of Columns V and VI support the claim that judicial independence and reliability of police are statistically significant and have a positive impact on the difference between the levels

of perceived IP protection and levels of statutory IP protection. It should be noted that the data for Colum V and VI is limited to data from 2005. In Column VI, when imitation is considered, imitation has a statistically significant and negative impact on the difference between the two measures.

## **6. Conclusion**

This paper analyzed the impact of different economic and governance factors on the levels of perceived intellectual property protection in a country. Not surprisingly, the results indicate that more developed countries will have higher levels of perceived protection. Furthermore, the evidence indicates that countries with independent judiciaries and reliable police services will also have higher levels of perceived protection. In contrast, when the enforcement related variables are analyzed against the Ginarte and Park Patent Rights Index (PRI) during the same time period, judicial independence and the reliability of police did not indicate higher levels of legal patent rights.

This paper contributes to the literature on IP by exploring an alternative measure to statutory protection – specifically, perceived IP protection – and emphasizing the importance of enforcement related measures in the post-TRIPS era. The empirical results identify three significant points. First, the observed U-shaped relationship between income and perceived protection in panel data appears to be a result of cross-sectional variations rather than longitudinal trends. These results support those of Briggs (2010). Second, the enforcement variables of judicial independence, reliability of police, and imitation are significant in determining the levels of perceived protection. Finally, judicial independence is not significant in determining the level of statutory protection, and reliability of police has negative impact on level of statutory protection and is statistically significant (at the 84% level for years 2000 and

2005, and at the 96% level for 2005). Correspondingly, these two variables account for the difference between the two indices when they are measured on a similar scale.

These results identify enforcement characteristics which promote high levels of perceived IP protection. These results can be linked to policy issues, supporting calls encouraging the adoption of stricter IPRs laws and emphasizing the importance of improved governance by enhancing the independence of the judiciary and the reliability of police services. Additionally, recognizing the statistically significant differences between measures of perceived and statutory protection, future research can analyze additional factors associated with perceived IP protection. Finally, future research could consider measures of perceived protection as the independent variable.

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## Appendix 1

Rapp and Rozek 1990\*

0 – No patent protection laws

1 – Inadequate protection laws, no law prohibiting piracy

2 – Seriously flawed laws

3 – Flaws in law, some enforcement laws

4 – Generally good laws

5 – Protection and enforcement laws fully consistent with minimum standards proposed by the U.S. Chamber of Commerce

\* Rapp, R.T. and Rozek, R.P. “Benefits and Costs of Intellectual Property Protection in Developing Countries. Journal of World Trade. Vol 24, 1990

## Appendix 2

### Ginarte and Park Patent Rights Index 1997\*

#### Components and scoring method of PRI

<u>(1) Coverage</u>	<u>Available</u>	<u>Not Available</u>
Patentability of pharmaceuticals	1/8	0
Patentability of chemicals	1/8	0
Patentability of food	1/8	0
Patentability of surgical products	1/8	0
Patentability of microorganisms	1/8	0
Patentability of utility models	1/8	0
Patentability of software	1/8	0
Patentability of plant and animal varieties	1/8	0

  

<u>(2) Membership in international treaties</u>	<u>Signatory</u>	<u>Not Signatory</u>
Paris convention and revisions	1/5	0
Patent cooperation treaty	1/5	0
Protection of new varieties (UPOV)	1/5	0
Budapest treaty (microorganism deposits)	1/5	0
Trade-related intellectual property rights (TRIPS)	1/5	0

  

<u>(3) Duration of protection</u>	<u>Full</u>	<u>Partial</u>
	1	$0 < f < 1$

  

<u>(4) Enforcement mechanisms</u>	<u>Available</u>	<u>Not available</u>
Preliminary (pre-trial) injunctions	1/3	0
Contributory infringement	1/3	0
Burden of proof reversal	1/3	0

  

<u>(5) Restriction on patent rights</u>	<u>Does not exist</u>	<u>Exists</u>
Working requirements	1/3	0
Compulsory licensing	1/3	0
Revocation of patents	1/3	0

where  $f$  is the duration of protection as a *fraction* of 20 years from the date of application or 17 years from the date of grant (for grant-based patent systems). Overall score for patent rights index: sum of points under (1) – (5).

\* Ginarte, Juan C. and Walter G. Park. “Determinants of Patent Rights: A Cross-National Study.” Research Policy. Vol. 26. 1997.

## Appendix 3

World Economic Forum Global Competitiveness Report years 1999 - 2009

### Intellectual Property Rights

1999 – 2000: "Intellectual property is well protected. (1 = strongly disagree; 7 = strongly agree)"

2001-2006: "Intellectual property protection in your country is (1 = weak or non-existent, 7 = equal to the world's most stringent)"

2007: Intellectual property protection in your country (1= is weak and not enforced; 7= is strong and enforced)?

(I have the data from the 2008-2009 report (which would be 2008 in the regression) however, I didn't write down the survey question and it is no longer available online (where I originally accessed it) and it has not arrived yet at the Georgetown Library or the Library of Congress)

2009-2010: "How would you rate intellectual property protection, including anti-counterfeiting measures, in your country? (1 = very weak; 7 = very strong)"

### Judicial Independence

1999-2001: "The judiciary is independent and not subject to interference by the government and/or parties in a dispute. (1 = strongly disagree; 7 = strongly agree)"

2002-2010: "Is the judiciary in your country independent from political influences of members of government, citizens, or firms? (1 = no - heavily influenced, 7 = yes - entirely independent)"

### Reliability of Police

1999: "The police effectively safeguard personal security so that it is not an important consideration in business activity (1= strongly disagree, 7= strongly agree)?"

2000: "Private business can rely on police for protection: (1 = strongly disagree, 7 = strongly agree)"

2001: There is no question on police in the 2001 report.

2002-2007: "Police services (1 = cannot be relied upon to protect business from criminals, 7 = can be relied upon to protect businesses from criminals)"

2008-2009: "Police services in your country (1 = cannot be relied upon to enforce law and order, 7 = can be relied upon to enforce law and order)"

## Appendix 4

Appendix 4 analyzes the results when the data is divided into ascending quintiles according to income levels.

Appendix 4					
	Low Income Subgroup (GDPpc<\$766)	Lower-Middle Income Subgroup (\$767<GDPpc<\$2,246)	Middle Income Subgroup (\$2,247<GDPpc<\$5,400)	Upper-Middle Income Subgroup (\$5,401<GDPpc<\$21,630)	Upper Income Subgroup (GDPpc>\$21,631)
Column:	I	II	III	IV	V
Gross Domestic Product per capita	0.16* (0.08)	0.64*** (0.14)	0.35* (0.19)	1.13*** (0.10)	0.03 (0.16)
WTO	0.20** (0.11)	0.20* (0.10)	0.30 (0.19)	0.82** (0.29)	(omitted)
Constant	1.72*** (0.48)	-1.82 (1.02)	0.47 (1.50)	-7.10*** (0.95)	5.42*** (1.67)
Adj. R <sup>2</sup>	0.03	0.07	0.03	0.39	0.00
N	239	250	221	221	227
Notes: Standard errors are in parenthesis. *,**,*** denote statistical significance at the 90%, 95% and 99% respectively. Years 1999 - 2009 are analyzed in all Columns. Income groups are shown using constant 2000 USD. GDPpc is calculated in logs. WTO is omitted in the highest quintile due to lack of variation.					

These results demonstrate the positive and significant relationship between per capita GDP and perceived protection across income levels<sup>12</sup>. This suggests that increases in incomes for first four quintiles correspond to increases in perceived protection, while increases in the highest quintile are indeterminate. Furthermore, in the highest income quintile, WTO membership is omitted as all countries analyzed were WTO members.

These results and those provided in Tables 4 and 5 cast doubt on the existence of a longitudinal U-shaped relationship between per capita GDP and perceived protection and lend support to Briggs (2010) theory of cross-sectional variation.

<sup>12</sup> Per capita GDP had an indeterminate effect on perceived IPRs for the highest quintile group which correspondingly had the highest level of perceived IPRs. These results are very similar to those results found by Park (2008) when he analyzed ascending quintiles of income levels on statutory protection.