Intellectual Property Rights and Foreign Direct Investment in Low Income Countries

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Abstract

This paper explores the connection between intellectual property (IP) rights protection and inward foreign direct investment in low and lower-middle income countries. The study uses the Ginarte and Park (2008) Index to measure the level of IP protection a country offers, as well as several control variables from the World Bank's World Development Indicators and the Fraser Institute's Economic Freedom of the World Index. Conducting an OLS and fixed panel econometric analysis, no clear conclusion can be drawn. The OLS regressions generated a negative but insignificant Intellectual Property Rights (IPR) coefficient, meaning its estimates are not different from zero. The panel data analysis produced significant and negative IPR coefficients, meaning that intellectual property protection can actually decrease the amount of FDI coming into a country. While the model produced unexpected results, they do not entirely conflict with previous literature. Instead, the analysis is undermined by a small sample size and the lack of detailed data.

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1. Introduction

Foreign direct investment (FDI) is an incredible economic benefit to most countries. If a developing country meets the minimum institutional requirements, such as a low degree of corruption, a healthy business environment, and generally peaceful politics, FDI can help the country develop through capital accumulation, higher employment, and knowledge transfer (Borensztein et al., 1996). But what drives a multinational company to open a subsidiary or investors to advance capital in a greenfield business? The determinants of FDI are the subject of many academic investigations. One possible determinant, intellectual property rights (IPR), has been of interest to researchers since the early 1970s. Better protection for intellectual property implies that a country has stronger institutions, which in turn implies that investors should feel more secure that the risk of default on debts is mitigated, that any knowledge transferred is done so legally, and that there are legal processes in place to address cases in which intellectual property is obtained illegally. Following the path of FDI determinant researchers, this paper aims to explore the relationship between foreign direct investment and intellectual property rights.

I explore the specific hypothesis that stronger protection for intellectual property should result in greater foreign direct investment in developing countries. In the empirical investigation, the dependent variable is incoming FDI measured in 2010 constant US dollars. The control variables are gross domestic product per capita (also measured in 2010 constant US$), GDP growth, population size, and the Fraser Institute's Economic Freedom of the World Index. The independent variable of interest is the Ginarte and Park (2008) index of intellectual property rights protection.

The hypothesis will be investigated in two steps. First, a series of single-year, cross-sectional linear models will be estimated using ordinary least squares for the years 1995, 2000, and 2005 in order to capture the effect of IPR on FDI individual years. Then, with an expanded dataset and larger sample size, a fixed effect panel data estimation will be conducted. The panel data estimation has the ability to capture time-specific effects, as well as net out the effects of time-invariant variables, features that the OLS estimation lacks.

The results contradict those of previous investigations. Whereas many previous authors found IPR to have a positive effect on incoming FDI, my estimations yielded a negative relationship. Specifically, the regressions produced negative IPR coefficients, but also large p-values, meaning that the estimated coefficient cannot be distinguished from zero. The panel data regressions also revealed a negative IPR coefficient, but with a small p-value, meaning that the result is significant. This means that in my model, increases in the value of IPR decrease the values of incoming FDI. The reasons for these outcomes are discussed in the results section.

The layout of this paper is as follows: the second section provides a summary of intellectual property, its global trends and a literature review of several academic papers that have also explored the link between IPRs and FDI. The third section presents, in-depth, the data and methodology used in the study. Last, the fourth section examines the empirical results and the key findings of this study. This is followed by some concluding remarks.

2. Literature review

2.1 Intellectual Property Rights and Global Trends

Intellectual property (IP) is an important element underlying many economic transactions, such as the formation of a business or the distribution of a product to consumers. It can boost the innovation levels of a country, firm, or individual, act as a source of income, and serve as a keystone in technological and economic progress. IP can take many forms, including trademarks, copyrights, and industry secrets. However, this paper, like many before it, will focus solely on patents**.** A patent is an exclusive right contracted to the inventor that gives him/her legal rights to prevent others from reproducing that item or concept for a certain number of years. The awarding and protection of patents is typically overseen by a dedicated government-run agency, such as the Canadian Intellectual Property Office in Canada or the U.S. Patent and Trademark Office in the United States. Globally, organizations such as the World Intellectual Property Organization (WIPO) oversee international IP agreements and licensing.

IP laws, both national and international, give individuals and organizations exclusive rights to sell and license the IP they register, usually for a limited period. Such laws are intended to be both a positive incentive encouraging the creation of intellectual property for consumers – and a negative incentive discouraging the free-riding and theft of IP through the use of fines and other legal actions. Because profit can be derived from the development and sale of such goods and services, there are monetary incentives for people to create IP. However, intangible intellectual properties are inherently different from physical goods and must be protected as such. Intellectual goods are harder to protect than physical goods; they can suffer from

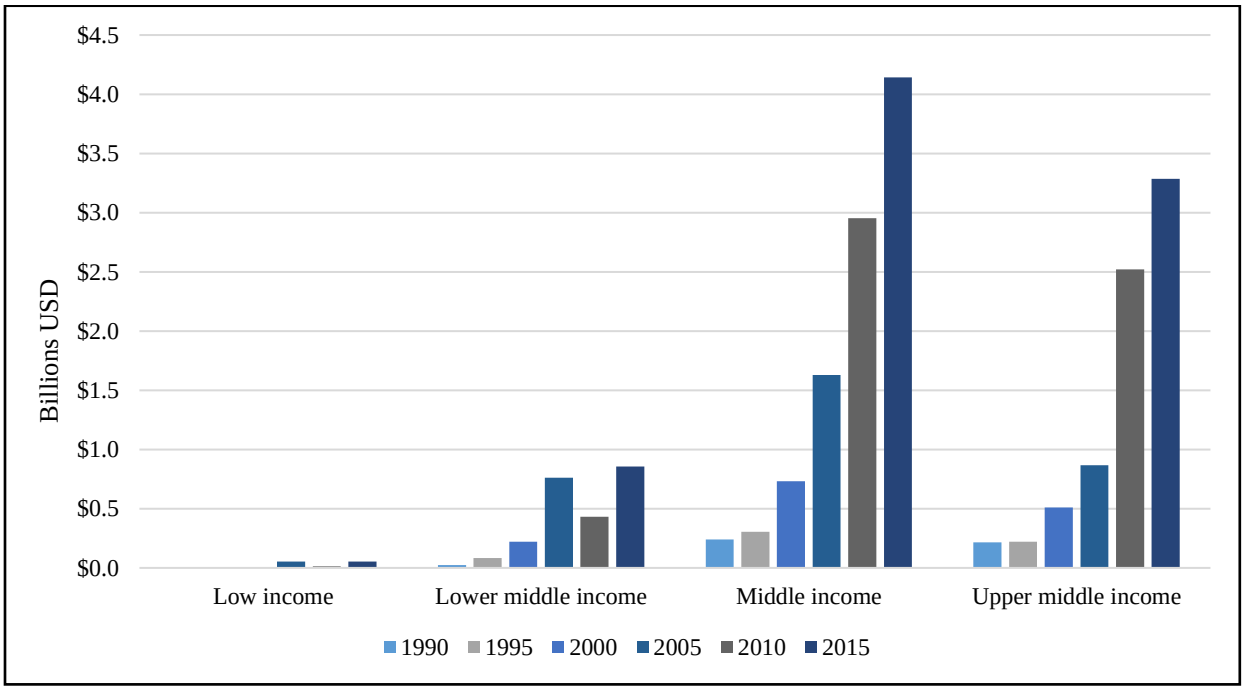
misappropriation; while someone who owns physical property can invest in security and insurance to protect their property, someone who owns IP has little power to stop consumers from copying and selling the IP at a lower price if there are no legal restrictions. To add to this problem, while a physical resource will eventually be used and depleted, IP can be infinitely reused without depleting its quantity or quality. In reality, national patent offices are constantly struggling to balance IP protection laws for them to boost the creation and development of IP, but not inhibit their use for consumption purposes, or discourage knowledge transfer. In other words, IP laws represent an imperfect system of rewarding creativity and innovation: it generates monopoly rents to the holder, which is not always in the interests of consumers.

Just as IP laws allow individuals and organizations to benefit from their creations and ideas, financial gain in turn creates incentive for the development of IP. A third element of this cycle is economic growth: in the case of patents, monetary gains from licensing can pay the costs of research and development (R&D), which is itself a crucial piece of the development puzzle, given the importance of technological progress in a country's economic growth (Romer (1990)). Researchers such as Maskus and Yang (2018) found that stronger IP rights can boost exports in R&D-intensive sectors. Falvey et al (2006) found that increased IP rights can positively influence a country's annual growth. Chen and Puttitanun (2005) found that improved IP protection can help developing countries innovate. According to the European Union Intellectual Property Office, 45% of the total economic activity (GDP) in the EU is attributable to IPR-intensive industries, and this output is worth EUR 6.6 trillion. A joint research project by WIPO and the United Nations found a "positive correlation between the strengthening of the IP system and subsequent economic growth" in a study of six East Asian countries. Previous research on

FDI and IPRs is outlined in further detail in the Literature Review section. Thus, under certain conditions, IP is closely tied to innovation, financial gain and economic growth.

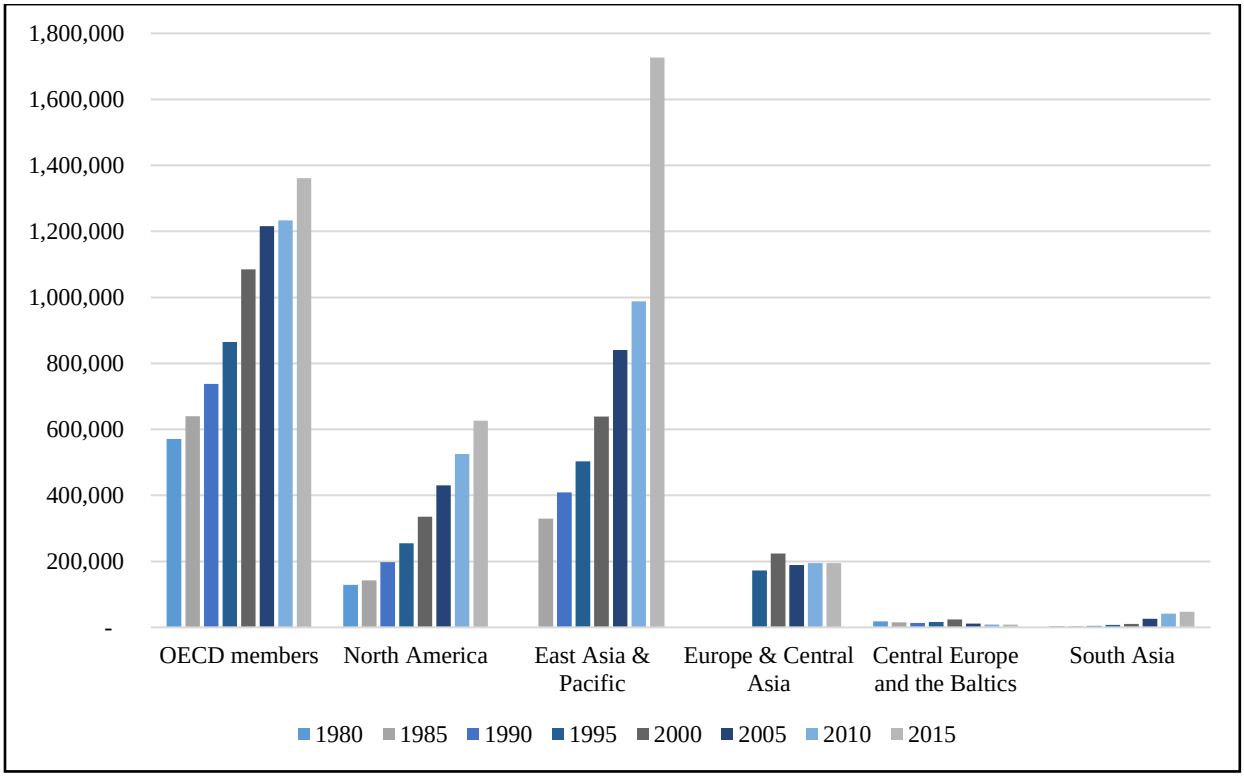
As the world becomes more globalized and economies more intertwined, another opportunity for financial gain and economic growth has developed: countries now have an opportunity to increase their benefit from the transfer of knowledge by selling or licensing their IP for a fee. As seen in Figure 1, upper middle-income and middle-income countries have gained the most from IP sales, while lower middle-income countries have benefitted less. High-income countries were excluded from this chart because they heavily outweighed the other categories of countries; in 2015, the sum of upper middle-, middle-, and low-income countries only accounted for 2.5 percent of the profit accrued to high-income countries through IP deals.

Figure 1: Charges for the Use of Intellectual Property (Graph constructed by the author. Source: World Development Indicators)



Total patent applications in Figure 2 can describe the process of development: in 1985, East Asia had about half of the patent application that OECD members claimed, but through integration into global supply chains and careful, forward-looking policy management, East Asia (dominated by China, Japan, South Korea and Singapore) managed to surpass OECD countries in terms of patent applications.

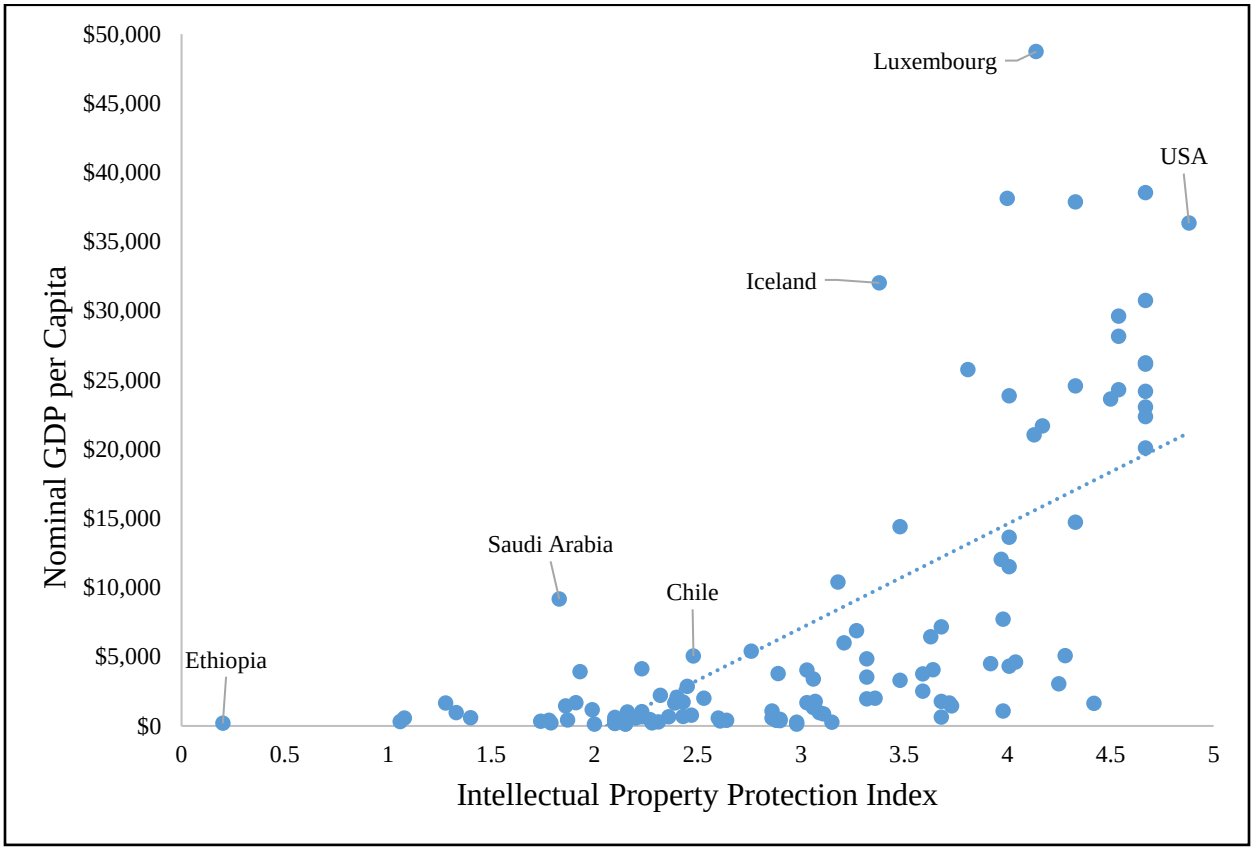
Figure 2: Total Patent Applications (Graph constructed by the author. Source: World Development Indicators)



Unsurprisingly, the richer areas of the world – the ones with enough stability and resources to be able to improve their IP strategies – have better IP protection, as outlined in Figure 3. In 2005, the country with the highest level of IP protection was the United States, which scored 4.88 out of a possible 5. Next came Canada and then several Western European countries; the country with the lowest ranking was Myanmar, scoring just 0.2. Among East

Asian countries, Japan and Singapore lead the way in terms of IPRs. China is not far behind – despite only having created an IP strategy in 1995, it scored 4.08 in 2005.

Figure 3: IPR vs Income (Graph constructed by the author. Source: Ginarte and Park (2008); World Development Indicators)



2.2 IPR Measurements and Indexes

IPRs can be measured in many different ways. Academics such as Ginarte and Park (1997), Sherwood (1997) and Rozek (1990) created their own rating system by examining countries' legal texts and codices. Institutions such as the *World Economic Forum* and consulting companies such as *Taylor-Wessing* created their own measures based on surveys. Some researchers use one or more of the above systems to investigate the ties between IPR and

economic indicators; others, like Javorcik (2004) and Mansfield (1996), use a combination of existing measures and ones of their own creation. The following is a brief summary of the different IP indexes that exist, as well as their strengths and weaknesses.

Sherwood (1997) created an IP measure based on a perfect theoretical score of 100, with the final results coming from each subsequent deduction due to shortcomings. The facets studied included enforceability, administration, and several forms of intellectual property including patents, treaties, and public commitments. Sherwood derived the scale based on his field work and academic judgement. This system takes into account enforceability and administration, as well as a variety of intellectual properties, which yields a more useful analysis than simply the laws as they are written. However, ranking and scores are still subject to the author's subjective discretion.

Rapp and Rozek (1990) rated the patent laws of 157 countries on a scale from zero to five. Their system established a comparative baseline against which other countries can be rated, since countries' laws were rated against the standards described by the *United States Chamber of Commerce*. However, the index is considered to be incomplete because it only studies patents and does not take into account the enforcement. Additionally, there is little nuance in this metric; the scale is fluid, and, like Sherwood's, subject to the authors' interpretations.

Park and Ginarte (1997) created an index based on five different categories: coverage, duration, enforcement, loss of protection, and membership in international treaties. Each country received a score of either 1 or 0 depending on the presence or lack of protection in each category.

The sum of these categories represented a country's score. The scores are calculated in five-year increments starting in 1960. Park updated the index in 2008 to take account of newer data and the effects of the 1995 Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS). The Ginarte and Park index is widely used by researchers because it provides a comparative list of countries, and the rating itself is based on a thorough analysis of patent laws, which is particularly useful for time series analyses. Unfortunately, this index does not capture the enforcement of the IP laws- only whether the laws are present or absent in the codices. Consequently, some countries may have a relatively high Ginarte-Park IP score but weak effective enforcement, or other institutional problems that might make for an unwelcoming business environment. For example, in 1990 Malawi had a considerably higher score than Singapore, despite Singapore having much stronger institutions for investor protection than Malawi.

2.3 Previous Research on IPR and FDI

The purpose of this section is to analyze past works which explored the link between FDI and IPR. While the determinants of FDI have been the subject of many academic publications, academics have only recently begun to explore the role of IP as an FDI determinant. While researchers have used both theoretical and quantitative or empirical approaches to explore the link between IPR and FDI, this literature review will focus mostly on the papers which employed some advanced statistical method. Studies have produced conflicting results.

Lai (1998) was one of the first researchers to formalize theoretically the relationship between IPR and FDI. The author appeals to the international product cycle paradigm – one that

includes the *North* (developed countries) as the only source of innovation, and the *South* (developing countries), whose only way of acquiring technology is through Northern transfers (at a reduced cost, since there are lower fixed expenses incurred from research and development). There is an inherent risk of imitation when products and technologies are transferred from North to South, meaning without a legal system in place to protect knowledge, fewer transfers may occur between the two regions. Lai's dynamic general equilibrium model concluded that, if the channel of product transfer is FDI, then a stronger IPR system will benefit the Southern country. Northern firms innovate but also have the option of producing in Southern firms, who imitate the product and technology of production when possible. This runs the risk of Southern firms imitating Northern firms' products. Therefore, stronger IP rights reduce the risk of imitation, and increase the Northern firms' returns. As a result, stronger IPRs act as an incentive for Northern firms to transfer production to Southern countries, and FDI in this model increases.

Like Lai (1998), Glass and Saggi (2002) are among the minority of researchers who used a formal approach. However, they came to the conclusion that stronger IPRs negatively affect inward FDI. Glass and Saggi developed a product cycle model in which Northern innovation, Southern imitation, and FDI are all endogenous variables. Unlike the model of Lai, the product transfer channel in this paper was imitation. Their model finds that in the case of strong Southern IPR protection, FDI still occurs, but at a reduced rate compared to a situation with less IP protection. This is due to imitation becoming more expensive since the probability of successful imitation is decreased. More resources are needed in order to execute imitation, which creates a labour-wasting effect such that more labor is diverted to imitation rather than the production of goods. Profits are lost for investing Northern firms as soon as imitation is achieved, and the firm

ultimately reduces its FDI. The decreased production and return on investment also leads Northern innovation to contract.

Javorcik (2004) investigates the localized effect of IPRs. This paper investigates two hypotheses. First, it tests whether foreign investors are more affected by IP protection if their investment is in an IP-sensitive area, such as pharmaceuticals. Second, it studies whether the IPR protection influences a foreign investor's choice between setting up greenfield investments or simply a product distribution network. This study employs two measures of IPR protection: the law-based Ginarte and Park (1997) index and a custom enforcement-based index created by the author. Using firm-level data from former Eastern European communist states for the period between 1989 and 2004, it was found that stronger IPRs have a positive and significant effect on incoming FDI. This effect is the greatest in IP-intensive industries, such as pharmaceuticals and machinery, and more muted in other industries. The analysis also found that when the degree of IP protection is weak, investors will tend towards manufacturing or sales. The author used a probit model to measure the likelihood of investment in a transition economy, with FDI as the dependent variable. Javorcik's results are consistent with Lee and Mansfield (1996), who studied the link between IPR and outgoing FDI. The authors used similar survey data of outward American FDI and an OLS estimate. Their model contained variables measuring market size, FDI stock, industrialization, and trade openness. Lee and Mansfield also created their own index to measure IP rights based on a survey of US firms. The index simply measured US firms' opinions on a host country's IP laws.

Nunnenkamp and Spatz (2004) criticized previous authors such as Lee and Mansfield (1996) for using aggregate FDI data. The main element of their study focused on using disaggregated sectoral data, as well as seeing how improvements in IPRs improved not only the quantity of incoming investments, but also the quality. Using US FDI stocks in disaggregated form such as sales, value added, total exports, parent company exports, etc., Nunnenkamp and Spatz analyzed the FDI activities of US firms in 166 countries. Like Javorcik (2004), they used the Ginarte and Park (1997) index, supplemented with survey results from the World Economic Forum, to counteract the "on-the-books" nature of the Ginarte and Park index. Using a gravity-type model and several interaction terms to analyze how FDI and IPR are shaped by host country specificities, the authors found evidence to support their hypotheses. Specifically, stronger IP protection positively and significantly affects incoming FDI. The authors predicated that a higher educational level in a host country would have a negative effect on incoming FDI, since the capacity for imitation would be much higher. Their interaction term between schooling and IP protection described exactly the effect that had a strongly negative effect on FDI. Calculations using the *World Economic Forum* publication produced similar but insignificant results. Regarding the quality side of FDI, the estimates show that higher IP protection positively and significantly influenced the level of R&D expenses as well as exports.

Zhang and Yang (2016) take a somewhat different approach compared to previous work. While much attention has been paid to the general relationship between IPR and FDI, relatively little has been paid to specific IPR agreements, such as the Trade Related Aspects of Intellectual Property Rights (TRIPS) agreement. The degree of TRIPS enforcement was measured using a dummy variable in the models, equalling 1 if the country had enforced the agreement and 0

otherwise. The data frequency was annual over a period of obsrevation from 1985 to 2012. The authors used a variety of estimation techniques, including Ordinary Least Squares, Fixed Effects, and Generalized Method of Moments to find that enforcement of the TRIPS agreement had a positive effect on incoming FDI in a sample of 23 developing countries.

Following the path of Javorcik (2004), Khan and Samad (2010) assessed the impact of IPRs on trade flows in localized areas of the world. The authors used a sample of 14 developing South and Southeast Asian countries between the years of 1970 and 2005. The authors chose a panel data estimation, since their data were unbalanced and had 473 observations, but also employed a fixed effects and random effects model for comparison. Like many pieces of scholarship in the field, the Ginarte and Park (1997) index was used to measure IPRs. Khan and Samad found that IPRs had a positive effect on incoming FDI for all three models, and the results were significant in the panel and random effects estimations.

Titus Awokuse wrote several papers on the topic of IPR as an FDI determinant. Awokuse and Yin (2009) examined the effects of strengthening IPR and the FDI surge in China, while Awokuse and Gu (2013) studied IPR as an outward FDI determinant of American exports. The former used panel data for 38 countries which sent FDI to China between the years of 1992 and 2005 and a gravity model with random effects. To measure the level of protection for IPR, Awokuse and Yin used the Ginarte and Park (1997) index, as well as the number of yearly patents filed in China from an FDI-providing nation. Awokuse and Gu (2013) conducted three total estimations: one with pooled countries, and two that separated high- and low-income countries. This was done in order to fully capture the differing effects between rich and poor

countries. IPR was found to have a positive and significant effect on FDI in all three estimations.

Awokuse's 2013 paper found similar results when looking at outward American FDI. The authors used a generalized method of moments model on a panel of 53 countries receiving FDI from the U.S.A between 1994 and 2006. IPR was measured by the Ginarte and Park (1997) index, as well as the IPR index in the Economic Freedom of the World report created by the Fraser Institute. Two interaction dummy variables measuring a country's imitation capacity were added, one indicating strong capacity and the other weak capacity; both were interacted with the IPR measure. IPR was found to have a positive and significant effect on FDI. Imitation capacity (constructed as an indicator using educational, research and infrastructure statistics), when strong, had a positive and significant effect on FDI, suggesting that trading partners strengthening their IPR has a positive market power effect in the U.S.A.. This result is contrary to the findings of Glass and Saggi (2002).

Following previous authors who studied outward FDI, Chen (2013) suggests that Taiwanese firms are more likely to enter joint ventures in countries where IP protection is strong. Firm level data in the study were taken for 2003, 2004 and 2005. Unlike other authors, who estimated the effect of IPR on aggregate FDI variables, the author estimates the probability of a Taiwanese firm in the manufacturing sector engaging in a joint venture based on the level of IP protection a host country offers. As such, estimates are conducted with binary outcome models; variations include fixed and random effects. Continuing the methodological departure from the established literature, the Ginarte and Park (2008) index is not used, instead favoring the Global Competitiveness Report published by the *World Economic Forum*. The results of the estimations

indicate that the probability of a manufacturing firm engaging in a wholly-owned subsidiary (WOS) is lower if a host country has strong IP protection; conversely, the probability of a joint venture (JV) is higher when IP protection is high. Both results were significant. This is likely because WOS-type businesses face fixed costs, unlike a JV-type business, meaning higher IP protection would increase fixed costs for the WOS-business and reduce its profitability. The results are justified by the authors with an analysis of the business environment of Taiwan. A large portion of Taiwanese firms are in the technology and electronics sector and are likelier to partake in a joint venture and therefore prefer strong IP rights. Manufacturing firms are likelier to engage in subsidiaries, and therefore react negatively or neutrally to IP protection. Following Chen (2013) in the area of sectoral analyses, Jeong (2014) analyses the effects of IPRs on the business services industry and finds that IPR have a strong and significant impact on FDI. 34 countries were used in the analysis, as well as a custom-built IP index. The time range for this study was 2002-2006.

3. Data

The data utilized in this paper are collected from a variety of sources, including the World Bank's World Development Indicators (WDI) (GDP per capita, GDP growth and Population), the updated version of the Ginarte and Park Index of intellectual property protection (2008), and the Economic Freedom of the World Index. All data were downloaded from public electronic databases. The data cover the years between 1970 to 2005 in order to minimize any large data gaps, a common occurrence for data covering the period before 1970. The observation period ends in 2005 because the Ginarte and Park index ends the same year. There are a total of 47 developing countries featured in the Ginarte and Park IPR index, however due to the lack of

data for other variables (namely those pertaining to Economic Freedom), the first model's sample and the second model's sample each consist of 37 and 40 low- and lower middle-income countries respectively. Developing countries were chosen to capture the effect of formative IP protection policies – in the period of analysis, many developed countries already had good IPR environments, therefore the effects of IPR on FDI could not have been disentangled from other variables. Despite some missing data, the dataset is strongly balanced overall. FDI magnets like China had to be excluded from the study, since they did not have a rating on the Ginarte-Park index before 2000.

Table 1 describes the summary statistics and shows the full spectrum of the variables. FDI has a very large standard deviation, meaning that the data are not clustered closely to the mean. The minimum value is -1.98 billion (2010) US$ recorded by Angola in 2005. Computing the natural log of FDI reduces not only the standard deviation, but also the number of observations, since one cannot calculate the natural log of a negative number. Although the average annual growth rate in the sample is 3.28 percent, some countries experienced severe economic contractions, such as Rwanda in 1994, whose economy contracted by 50.25 percent towards the end of their civil war, making Rwanda an outlier in terms of annual growth rate. GDP per capita and Population size also have large standard deviations, but nearly no missing data. The single observation missing from both variables is due to the lag calculation. The average person in the sample earned 1088 US$ per year; some citizens earned less (Rwanda, 2004: 220 US$), and some earned more (Algeria, 2005: 4290 US$). The average country housed 39 million citizens. The Economic Freedom index had a fairly small standard deviation and has the smallest number of observations. The average country scored 4.89 out of 10, meaning most

countries did not have well-established institutions, or were not very well integrated into the global economy. Some countries, like El Salvador in 2000, were open to the world economy and had decent institutions- their score of 7.72 being comparable to some developed countries. Last, IPR presents the summary of scores from the Ginarte and Park index. The small standard deviation comes mainly from the small range of possible scores. The average developing country in the sample had a score of 2.30, meaning that it had the framework of IP protection, but lacked some essential features. Several countries had a score of zero over the course of decades. Others, like the Philippines in 2005, scored 4.18, giving it a high ranking in terms of IP protection.

Table 1: Summary Statistics

Variable (Measurement In Brackets)	Observations	Mean	Std. Dev.	Coefficient of Variation	Minimum	Maximum
FDI (2010 US$*$10^6$)	1,389	352	1,080	3.06	-1,980	14,000
Ln(FDI) (2010 US$)	1,229	17.87	2.27	0.13	7.46	23.36
GDP Growth (%)	1,437	3.28	5.43	1.66	-50.25	35.22
GDP Per Capita (2010 US$)	1,439	1088.38	767.73	0.71	220.54	4290.53
Population (People*10^6)	1,439	39.4	133.0	3.38	1.15	1,115.0
Ln(Population) (People)	1,439	16.21	1.23	0.08	13.95	20.86
Economic Freedom (1-10 Index)	1,119	4.89	1.01	0.21	1.99	7.72
IPR (0-5 Index)	1,439	2.30	0.70	0.30	0	4.18

Despite being strongly balanced, the dataset is not perfect. Two main issues affect it: data gaps and outlier values. The maximum number of observations any one variable can have in my data is 1,440[1]. As described in the table of summary statistics, the only variables for which large gaps are present are ln(FDI) and, in particular, the Economic Freedom Index. The natural log of FDI has a reduced number of observations because several countries, over several years, have recorded negative values for incoming FDI. This does not mean that the country was a net outward investor, instead, due to events such as civil wars and natural disasters, investors pulled out their investments from the country (this is also known as disinvestment). Even though the natural log computation reduces the number of observations, it is necessary for a reliable regression analysis; it reduces the influence of outlying observations described later.

The Economic Freedom Index is missing the most observations. This is simply because several low-income countries have not been evaluated by the Fraser Institute. Despite the Economic Freedom Index having large data gaps, it remains the most useful and obtainable proxy for institutional development for my purposes. Other similar measures, such as those on corruption or bribery are available, but they either are provided at a cost from private research firms or also suffer from large data gaps for developing nations. The second main issue plaguing this dataset is potential outlier bias, a common issue with lower income countries. For example, the incidences of disinvestment, negative economic growth, and miniscule income per capita are quite high in our dataset. Computing a natural log of some variable helps mitigate this bias, but if the raw value was negative, the observations had to be deleted.

[1] The Maximum number of observations is calculated as [40 Countries*36 Years = 1,440 Observations]

The dependent variable is incoming FDI, as measured in constant 2010 US$. Inward FDI refers to direct investment flows in the host economy, with the aggregate investments recorded in the balance of payments. This variable was obtained from the World Bank's World Development Indicators. The independent variables are defined as follows:

GDP PER CAPITA: GDP per capita is simply the gross domestic product divided by population in constant 2010 US$. Researchers like La Porta (1998) argue that GDP per capita can serve as an indicator of general economic health and development, because the higher the GDP per capita, the more industrially advanced a country is likely to be. This variable was drawn from the World Bank's World Development Indicators.

GDP GROWTH: This is the annual percentage growth of the GDP value, based on market exchange rates. Like GDP per capita, this variable serves as a proxy for industrialization and economic advancement. This variable was obtained from the World Bank's World Development Indicators

POPULATION: This is simply the number of people in a country. This variable is included as a natural log for ease of regression coefficient interpretation. This variable was acquired from the World Bank's World Development Indicators

ECONOMIC FREEDOM OF THE WORLD INDEX: This is a measure of economic freedom published by the Fraser Institute. It encompasses several sub-indexes including legal rights, trade openness, property rights and legal regulation- factors which all positively affect incoming FDI according to Mayer et al (2007). It serves as a proxy for institutional quality and should, in theory, have a positive effect on FDI, as investors would feel more confident investing in a country if its institutions were open to trade and offer protection. The index ranges from 1 to

10, with 1 being the lowest score and indicating minimal economic freedom, and 10 being the highest score and indicating maximum economic freedom.

INTELLECTUAL PROPERTY RIGHTS PROTECTION: This is the IPR scale measured by the Park and Ginarte Index, who created five different categories: coverage, membership in international treaties, loss of protection, degree of enforcement, and duration. For each category, they used several benchmark conditions (e.g., the patentability of pharmaceuticals as a measure of coverage) and calculated the share of realized criteria. The unweighted sum of these shares over all categories represents a country's score. The first iteration was published in 1997; Park updated the index in 2008 to allow for newer data (up to 1995) and the effects of the 1995 TRIPS agreement. The index ranges in value from 0 to 5, with 0 being the lowest score, indicating the complete absence of patent protection laws, and 5 being the maximum score, indicating full patent protection.

Table 2: List of Countries used in Model (1) and (2)			
Saharan and Sub-Saharan Africa	Central , Latin America and Caribbean	North Africa, Middle East and South Asia	South East Asia and Oceania
Algeria	Bolivia	Bangladesh	Papua New Guinea
Angola	El Salvador	Egypt	Philippines
Benin	Haiti	India	
Burkina Faso	Honduras	Morocco	
Burundi	Nicaragua	Nepal	
Cameroon		Pakistan	
CentralAfricanRepublic		Sri Lanka	
Chad			
Republic of Congo			
Cote D'Ivoire			
Ghana			
Kenya			
Madagascar			
Malawi			
Mali			
Mauritania			
Niger			
Nigeria			
Rwanda			
Senegal			
Sierra Leone			
Tanzania			
Togo			
Uganda			
Zambia			
Zimbabwe			

4. Empirical Methodology

In order to study the connection between inward FDI and IPR, a methodology similar to that of other FDI determinant papers will be followed. As outlined in the literature review section, many papers treat FDI as a dependent variable, mostly as a monetary measure. Sometimes, researchers use a probit model to determine the likelihood of a company or country conducting outward FDI given a certain level of macroeconomic and IP indicators in a host country. I will use the former approach: incoming FDI in terms of current American dollars, with

a natural log applied. Details and sources of the data are described in the earlier data section. The analysis will be based on only lower middle-income and least developed nations; a full list can be found in Table 2 above.

Researchers like Lee and Mansfield (1996) and Javorcik (2004) were able to obtain firm-level data from surveys, country risk indicators from private consultation companies, and industry-level outward investment data. These variables at that level of aggregation are unfortunately too time-consuming, expensive and difficult to obtain, and so, despite their usefulness in analyzing IPR as a determinant of FDI, will not be included in this study.

I will use two estimation methods in order to capture the relationship between IPR and FDI. Ordinary Least Squares and panel data estimations will be used because the two methodologies complement each other. OLS captures single-year cross-section effects but suffers from small sample sizes, while panel estimation expands the sample size and takes time effects into account.

In the first model, we will estimate several determinants of FDI using a methodology similar to that of Schneider (1985). Schneider studied the economic and political determinants of foreign investments coming into developing nations. They used an ordinary least squares methodology, estimating one regression for each studied year, for a total of three cross-sectional regressions. Their variables included GDP-per-capita, real annual GDP growth, deficits in the current account, inflation, and several variables measuring skill and schooling levels.

I will include only the first two variables, and substitute the rest with variables employed other studies- those which specifically study the link between IPR and investment. Equation (1) gives the model's specification in detail. In the equation, **GDPCAP** represents the per capita

gross domestic product, **GROWTH** is the annual real GDP growth rate[2], **POP** is the country's population size, and **FREE** is the measure of economic freedom taken from the Economic Freedom of the World index. The dependent variable, **FDI**, is the inward foreign direct investment a country receives in terms of constant 2010 US dollars. The subscript *i* represents the country, while the subscript *t* represents the year 1995, 2000 or 2005. All independent variables are lagged by one year, since investors would have taken into account delayed information when deciding whether or not to invest, and also to avoid endogeneity issues. For ease of analysis, the variable FDI and population are included with a natural log. Like in Schneider, the first regression will be estimated using Ordinary Least Squares, in order to capture the effects of IPR on FDI, not taking into account time-specific effects.

$$FDI_{i,t} = \beta_0 + \beta_1 GDPCAP_{i,t-1} + \beta_2 GROWTH_{i,t-1} + \beta_3 POP_{i,t-1} + \beta_4 FREE_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

The second model will try to determine the relationship between FDI and IPR using a panel data analysis. While the first model captures the IPR-FDI relationship in individual years, its results may not be as accurate as a time series analysis due to the small sample size of the data. Following the method of Zhang and Yang (2016), a panel data analysis with fixed effects will be used, covering a 35-year period. A fixed effects panel regression will be conducted with the variable **IPR** in order to see how IP protection affects FDI in low-income countries. The regression equation is represented in Equation (2), for which the dependent variable is inward foreign direct investment measured in constant 2010 US dollars. The variable **X** represents the

[2] Calculated annually compared to the previous year, i.e. the growth rate for 1995 is the percentage difference between GDP in 1995 and 1994.

set of control variables used in the previous regression: GDP per capita, annually calculated GDP growth, population, and economic freedom. The variable **IPR** once again represents the Ginarte and Park (2008) index of IP protection. β_0 is the constant term, a_i represents the individual country-specific effects, *i* represents the country, and *t* represents the years between 1970 and 2005.

$$FDI_{i,t} = \alpha_i + \beta_0 + \beta_1 \mathrm{X}_{i,t-1} + \beta_2 IPR_{i,t-1} + \mu_{i,t} \quad (2)$$

The variables included in both regression specifications were chosen based on previous research on FDI determinants. The variable **GDP PER CAPITA** is expected to have a positive influence on FDI, as investors may generally evaluate the safety and likelihood of success of their projects based on GDP per capita. The reasoning behind the presence of this variable is that it controls for a country's general economic health; any major internal events would be captured by the GDP per capita fairly quickly. **GDP GROWTH** is expected to have a positive impact on FDI, as an expanding local market would be attractive to investors. Underdeveloped countries typically have higher GDP growth rates than developed ones, which makes them particularly attractive to investors looking for a fast return, although the risk of default or project failure may be greater than in developed nations. Indeed, Addison and Heshmati (2003) found GDP growth to be a positive and significant factor of incoming FDI. **POPULATION** size is expected to have a positive effect on FDI, as a greater population in a country would mean more local employment opportunities and a bigger local market for investors. As well established and functioning institutions should be attractive to investors, measures for them should be included in the model. Specifically, the **ECONOMIC FREEDOM INDEX** and the Ginarte and Park **IPR**

Index are used to proxy for institutional quality. The former is expected to have a positive effect on incoming FDI, because better trade openness would be attractive to investors. Similarly, IPR is expected to have a positive effect on FDI inflows, since a stronger IP protection is more likely to give investors confidence.

5. Results and Analysis

5.1 OLS Regressions

Table 3 presents the results of the OLS regressions for the years 1995, 2000, and 2005. In the 1995 estimation, all control variable coefficients have a positive effect on the dependent variable, while, contrary to expectations, the estimated **IPR** coefficient is negative. The estimated **GDP GROWTH** and **GDP PER CAPITA** coefficients are positive, results which coincide with those of Schneider (1985), as well as the theory involving growth and investment. The coefficient of the variable **POPULATION** size is positive and significant, meaning that a country with a large population is likelier to receive FDI, probably due to the presence of a larger workforce and market. This estimation presented a problem in terms of significance. While the overall probability value of the model is 0, meaning its results have a better fit compared to a model with no predictors, the individual variables' estimation results have a variation in the of p-values attached to them. The coefficients of **GDP PER CAPITA** and **POPULATION** size had 0 p-values, meaning they were significant and different from zero. The estimation result for **ECONOMIC FREEDOM** had a p-value of 0.05, meaning it was also significant. The estimated coefficients **GDP GROWTH** (p-value:0.673) and **IPR** (p-value: 0.794) both presented p-values above 0.1, meaning they were not significantly different from zero and their influence on the dependent variable cannot be accurately established.

The year 2000 model presented a similar result. This time, all variables, including **IPR**, had a positive effect on FDI, but only **GDP PER CAPITA** and **POPULATION** size were significant, meaning that the estimated coefficients of all other variables were not significantly different from zero and did not appear to have explanatory power. The 2005 estimation presented the same overall results, with the exception that the estimated coefficient for **IPR** became negative once again. The probability value for both models was 0, meaning the results of the estimation were significantly different from the hypothetical results of a model with no variables at all. However, due to the overall lack of significance of the estimated **IP**R coefficient, we cannot make any legitimate claim that IPR has an influence on incoming FDI in the years 1995, 2000 or 2005. The lack of significance amongst the individual coefficients in the estimations may be due to the small sample size and multi-collinearity of the **IPR** and **ECONOMIC FREEDOM** variables. These specific years were chosen because, as the most recent years in our time frame, they were likelier to have less data gaps. In the dataset, **ECONOMIC FREEDOM** had several gaps, even in more recent years. Furthermore, several countries reported negative FDI during those years, which does not mean that outward FDI is greater, but rather that investors decided to pull investments out of the country due to a lack of profit or an unfavourable business environment. In 2005, Chad and Angola recorded the greatest losses of investments, losing 278 and 38 million US$ respectively. The negative values prevented their use in the model once a natural logarithm was applied, further reducing the sample size. By contrast, Schneider (1985) had a sample size of 54 countries, as well as access to corruption measuring variables from a private economic consultant service, which minimized data gaps.

Table 3: OLS estimation of intellectual property rights effect on inward FDI			
	(1)	(2)	(3)
VARIABLES	1995	2000	2005
GDP Growth	0.0120	0.0164	0.1015
	(0.0282)	(0.0887)	(0.0803)
GDP Per Capita	1.7327***	1.1759***	1.7805***
	(0.3234)	(0.4502)	(0.3795)
Total Population	0.8676***	0.7256***	0.8514***
	(0.1492)	(0.2206)	(0.1938)
Economic Freedom	0.4744**	0.1815	-0.0826
	(0.2381)	(0.3419)	(0.3121)
IPR	-0.0847	0.0278	0.3125
	(0.3223)	(0.4988)	(0.4992)
Constant	-9.8950**	-2.1699	-7.757**
	(3.2136)	(4.4073)	(3.8127)
Number of observations	34	34	36
Coefficient of Determination	0.7639	0.4790	0.6929
F-Statistic	18.12	5.15	13.54

Standard errors in parentheses
* p<0.1, ** p<0.05, ***p<0.01

5.2 Panel Data Estimation

Table 4 presents the results of the panel data estimation. All coefficients' estimations, as well as the model itself had respective p- and F- statistics of 0, meaning both the estimated coefficients and the regression model are significantly different from zero. The control variables' estimates are positive, while the estimated coefficient for **IPR** is negative, implying that FDI decreases when a low-income country increases its level of IP protection.

As some previous authors have found, IPRs have a negative impact on incoming FDI in low-income countries. Theories surrounding FDI and IPR (like Lai (1998)) are built on a theoretical model that assumes Northern countries are innovators and Southern countries are imitators, therefore, a negative IPR coefficient suggests that the method of product transfer in developing countries (at least the ones in my sample) is imitation, as opposed to the intention of investing Northern firms, which is FDI in the form of new factories or subsidiaries. Following the theory of Lai, a negative IPR result suggests that Southern countries are wasting labor on imitation, and Northern firms' profits are and foreign direct investment are being reduced as a result. While our result is not consistent with most previous research (with the exception of Glass and Saggi (2002)), the outcome may be the result of differing methodologies and samples, as well as the possibility of omitted variables. Some researchers use American outward investment, focus on only a handful of countries chosen for their geography, or consider different measures of IP protection. Perhaps the biggest difference between this investigation and previous ones is that past papers have focused on mostly middle- or high-income countries, and not lower-middle or least developed. Researchers who use developed countries in the IPR sample and outward FDI, including Braga and Fink (1998) and Kumar (1996), often find no significant statistical relationship between the two variables for developing countries, which leads some researchers to the conclusion that IP protection simply does not matter to some multinational companies.

Researchers like Watkins and Taylor (2010) found no significant relationship but noted that disaggregated FDI data are better for estimation than aggregated data. Mayer and Pfister (2001) identified a negative relationship between IPRs and French firms' willingness to conduct foreign investment in less-developed countries (LDCs). The coefficient for IPR was likely very negative because of our choice to use receiving investments as opposed to outgoing ones, and to

reduce our sample size to only the lower-income countries found in the GP index. Aggregated data may have also played a role in the negative result, as it made differentiating between IPR-sensitive and insensitive sectors impossible. Additionally, the omitted influence of country context must be taken into account: many countries in our sample experienced extreme circumstances during our analyzed period, including wars and severe recessions. This likely affected the results of the regression. Therefore, a strongly negative result should be interpreted as inconclusive because of aggregated data, a limited sample size and country context restricted the full effect on IP on LDCs.

Table 4: Fixed effect panel estimation of IPR effects on FDI

VARIABLES	FDI
GDP Growth	0.0280***
	(0.0096)
GDP Per Capita	0.8810***
	(0.2371)
Total Population	0.5399***
	(0.1267)
Economic Freedom	0.7124***
	(0.0637)
Intellectual Property Rights	-0.7836***
	(0.1313)
Constant	1.3798
	(2.6393)
Number of observations	947

Standard errors in parentheses
* p<0.1, ** p<0.05, ***p<0.01

6. Conclusion

The relationship between FDI and IPRs is complicated and produces mixed results when studied by economists. Glass and Saggi (2002), Braga and Fink (1998) and Mayer and Pfister (2001) all found that strengthening IPRs may have a negative effect on incoming FDI, whereas Lee and Mansfield (1996), Nunnenkamp and Spatz (2004) and Javorcik (2004) found that investment tends to increase with better IP protection. I conducted several OLS regressions and fixed-effect panel estimates on 40 least developed and lower-income countries. Our FDI data were aggregated, so we were not able to capture the full extent and impact of IP protection in certain industries; results may have been muted as a result. Furthermore, I used an IP index created by Ginarte and Park that only examined patents, which means that our model was unable to capture the effects of licensing, trademarks, or copyrights. Our model showed inconclusive results due to a small sample size and aggregate data. Further research is required to fully understand the connection between IP and FDI in lower income countries, ideally with a large sample size, and detailed data.

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