INTELLECTUAL PROPERTY RIGHTS, QUALITY OF INSTITUTIONS, AND FDI INTO DEVELOPING COUNTRIES

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Abstract

We explore the relationship between intellectual property rights (IPR), the informal economy, and foreign direct investment (FDI) into developing countries. We develop a theoretical model which predicts that stronger IPR protection attracts more FDI in countries with small informal economies but not in countries with large informal economies. The intuition is that the informal economy is a proxy for the quality of institutions. In institutionally strong countries, IPR protection promotes FDI by reducing illegal imitation and freeing up more resources for MNCs. Our empirical analysis, based on a threshold effect model, provides some evidence supportive of our model.

Key words: Intellectual Property Rights, Foreign Direct Investment, Informal Economy, Institutions, Asia

JEL Classification: F23; O17; O34

The authors thank Arnelyn May Abdon and Jingting Liu for their excellent research assistance. The authors also would like to acknowledge Gustavo Javier Canavier-Bacarreza for his valuable comments.

1 Introduction

In recent years, developing countries have substantially strengthened their intellectual property (IP) regimes in response to growing pressures from developed countries, particularly after the advent of WTO's Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) in 1995. Intuitively, stronger intellectual property rights (IPR) protection in developing countries would enable developed countries - global technological leaders which own much of global intellectual property - to gain more from their research and development (R&D) and other innovative activity.

The benefits for developing countries, however, are less clear cut. On the whole, developing nations tend to be importers of intellectual property. As such, strengthening IPR protection often entails substantial costs. For example, paying the full cost of pharmaceutical drugs invented in developed countries often prevents their wider use in developing countries even when they deliver vital public health benefits. For developing countries with sufficient capacity to innovate, IPR protection can deliver tangible rewards such as domestic innovation and technology diffusion. However, in countries with limited innovation capacity, it will merely impose additional costs for producers and consumers.

Nevertheless, one popular and plausible argument in favor of IPR reform in developing countries rests on a positive relationship between IPR protection and FDI inflows. The underlying idea is that foreign investors are more likely to invest in countries which better protect their intellectual property. While intuitively appealing, evidence from the empirical literature that tests the relationship between IPR protection and FDI is mixed at best.

Some studies find a positive relationship – e.g. Lee and Mansfield (1996), Maskus (1998) and Branstetter et. al (2007). But other studies find no evidence of a significant relationship – e.g. Ferrantino (1993), Mansfield (1993) and Maskus and Eby-Konan (1994) – and yet others find a significant negative relationship – e.g. Glass and Saggi (2002). Upon closer inspection, even at a conceptual level, the effect of IPR protection on FDI could be either positive or negative. Stronger IPR protection could have a positive effect and thus increase FDI by reducing the threat of imitation by local firms (Park and Lippoldt 2005). But IPR protection may reduce FDI if it increases the monopoly power of foreign firms. Facing less competition, multinational firms may maximize profits by producing and investing less (Maskus and Penubarti 1995; Smith 1999, 2001).

Much of this empirical ambiguity arises from country and industry effects. It has been argued, for example, that IPR reforms are more likely to attract FDI into developed countries than into developing countries. One possible explanation is that IPR reforms tend to be more effective when an attractive overall business environment is already in place (Maskus 1997). Another possible explanation is that IPR reforms may generate "resource wasting effects" due to strict uniqueness requirements (Glass and Saggi 2002). According to this argument, as IPR protection grows stronger, developing countries are forced to spend more resources on imitation activity despite the reduction in the profitability of imitation. As a result, there are less resources available for multinational corporations (MNCs), thereby discouraging FDI.[1]

In addition to differences between developed and developing countries, there may also be significant differences across developing countries. Different regions of the developing world – i.e. Asia, Africa, and Latin America – have differing levels of IPR protection, in addition to divergent income and development levels. In light of such diversity, there is no reason to expect a uniform effect of IPR protection on FDI inflows across the different regions of the developing world. Therefore, in our empirical analysis, we will assess the relationship between IPR and FDI for the full sample of developing countries, as well as three sub-samples of African, Asian, and Latin American countries.

While IPR protection is an important determinant of FDI inflows, it is by no means the only one. A firm's decision to invest abroad is based on not only the host country's IPR regime, but also the interplay of market power, free riding, contractual uncertainties, and other features of the international markets for information (Maskus, 2000). Therefore, an accurate assessment of the impact of IPR regime on FDI in developing Asia requires controlling for the other major factors that make up the overall business climate for foreign investors.

In particular, the quality of institutions may influence the effect of IPR protection on FDI into developing countries. In order to test for this possibility, we add to the empirical literature on the relationship between IPR protection and FDI inflows by incorporating the size of the host economy's informal economy into the analysis. The underlying intuition is that the size of the informal economy reflects the quality of its institutional environment. In institutionally strong countries, IPR protection raises the cost of illegal imitation and thus reduces illegal imitation activity. This reduces the competition that foreign investors face and frees up more resources for them. In contrast, in institutionally weak countries plagued by excessive bureaucracy, corruption and government predation, IPR protection will have a noticeably weaker effect on illegal imitation activity.

The rest of this paper is organized as follows. Section 2 looks at IPR protection in developing countries. Section 3 lays out a simple Cournot model based on Landes and Posner's (2003) framework. Section 4 presents our empirical framework and reports the empirical results, and Section 5 concludes.

2 IPR protection and Informal Economy in Developing Countries: A Brief Overview

In this section, we briefly describe the level of IPR protection, the relative size of the informal economy, and the relationship between the two in Africa, Asia, and Latin America, as well as the full sample of developing countries. The three regions are at different income and development levels, and are likely to differ in IPR protection and the relative importance of the informal economy. Therefore, it is worthwhile to look at separately, in addition to looking at the full sample of developing countries.

[1] As is common in this literature, Glass and Saggi (2002) use a North-South product-cycle model in which, if imitation is costly, stronger IPR protection may not only reduce FDI but also reduce FDI in the North. This idea has also been embedded in two-sector models in which the output of one of the sectors must be consumed or produced in fixed amounts. In Gollin, Parente and Rogerson (2002), for example, distortions in agriculture actually lead to more resources being devoted to agriculture.

2.1 Africa

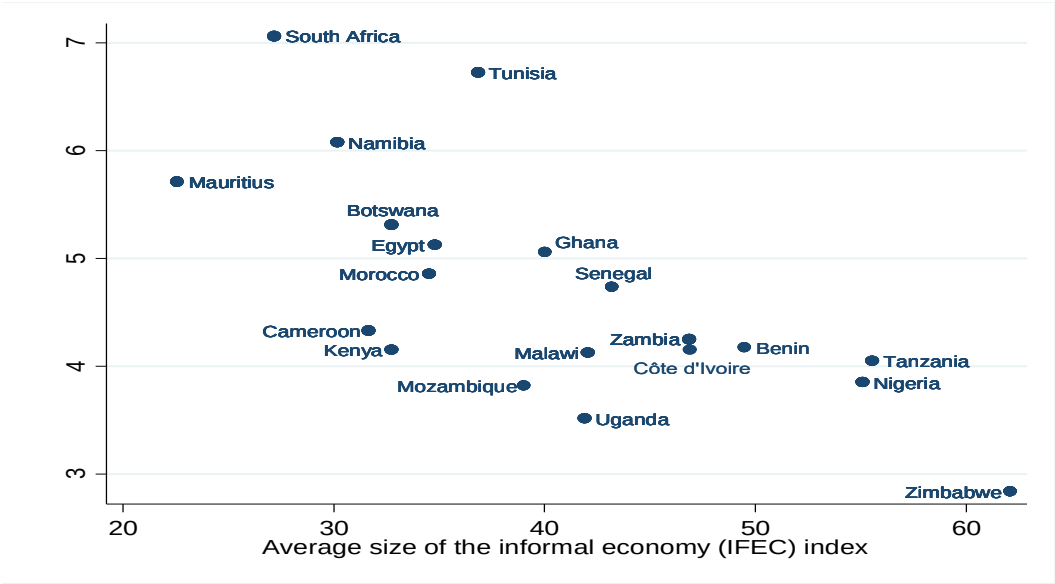
Broadly, weak governments with limited administrative capacity are ineffective in enforcing rules and regulations, including those pertaining to IPR. In addition, Africa's low overall development level means that the demand for IPR is low. Lack of IPR has predictably fueled an expansion of counterfeiting activities and the informal economy. The International Labor Organization (2009) estimates 90% of African workers work in informal jobs. The high level of informality worsens poverty, and the high level of poverty worsens informality. Encouragingly, there are couple of regional organizations that aim to boost IPR protection in its member countries – the African Intellectual Property Organisation and the African Regional Industrial Property Organisation. Nevertheless, strengthening IPR and expanding the formal sector will necessarily be long run processes in Africa.

Figure 1 plots the level of IPR protection against the relative size of the informal economy for the twenty-one African countries which are part of the sample for our empirical analysis. Both variables are averages of 2000-2007. Quite clearly, there is a negative relationship between IPR protection and the informal economy – African countries that have lower levels of IPR protection tend to have larger informal economies. For example, Nigeria, Tanzania, and Zimbabwe are characterized by poor IPR protection and extensive informality, while Mauritius, Namibia, and South Africa lie at the other end. In general, as might be expected, more developed African countries tend to perform better on both measures. However, Nigeria, which has Africa's largest economy, performs poorly on both. The likely reason is governance problems, which has held back the country for long despite its immense oil wealth.

2.2 Asia

Sustained rapid growth has transformed developing Asia into the most dynamic component of the world economy. A by-product of the transformation has been a rapid expansion of R&D and other innovative activities – for example, China is now one of the world's top R&D investors and patent producers[2]. Growing innovation, in turn, could fuel the demand for stronger IPR protection. In addition, rising pressure from advanced countries could be another major driver. As a result, there has been a visible general improvement in IPR protection in Asia, although there are still significant differences across countries. Notwithstanding its stunning economic progress, a large informal economy continues to be a key feature of Asia's economic landscape. For example, the informal sector still employs as much as 60% of the workforce.[3] Some sub-regions - South Asia – generally have larger informal economies than others - East Asia. Overall, Asia is characterized by improving IPR protection and still-large informal economies, with both variables varying a lot across countries.

Figure 1
Intellectual Property Rights (IPR) Protection and Ratio of Informal Economy to GDP in Selected African Economies, Average, 2000-2007



[2] OECD Science, Technology and Industry Outlook 2014
[3] http://www.ilo.org/asia/areas/informal-economy/lang--en/index.htm

Figure 2 plots IPR protection against the informal economy for the sixteen Asian countries which are part of our sample, with the value of both variables being the average for 2000-2007. Again, we can discern a negative relationship between IPR protection and the informal economy across the region. In general, Asian countries that have strong IPR protection tend to have smaller shadow economies. Predictably, richer and more developed countries – e.g. Hong Kong, Singapore, and Taiwan – perform well on both measures relative to poorer, less developed countries such as Bangladesh, Pakistan, Philippines, and Sri Lanka. Interestingly, a few countries with relatively weak IPR protection have small informal economies. For the transition economies of China, Mongolia, and Vietnam, the still-large role of the state and hence state-owned firms in the economy may help explain the small magnitude of the informal economy. In the case of Indonesia, strict labor regulations may explain the small informal sector.

2.3 Latin America

Latin America is broadly comparable to Asia in income and development level, although it lacked Asia's economic dynamism and has grown significantly slower than Asia in the past few decades. While unsound policies contributed to the region's poor economic performance until the 1990s, there has been a marked improvement in economic policies since then. The improvement is also visible in the area of IPR protection, which has become much stronger, largely as a result of the growing commitment of Latin American countries to openness and liberalization. In particular, Latin American countries change their IPR regimes even before the formal adoption of TRIPS in 1994 since IPR is an important means of attracting much-needed foreign investment [(Correa, 2000) Partly as a result of subdued economic growth and slow progress in poverty reduction, Latin America is home to a large informal sector. Although the informal economy has been shrinking, it still employs almost half of the region's workforce.[4]

Figure 2
Intellectual Property Rights (IPR) Protection and Ratio of Informal Economy to GDP in Selected Asian Economies, Average, 2000-2007

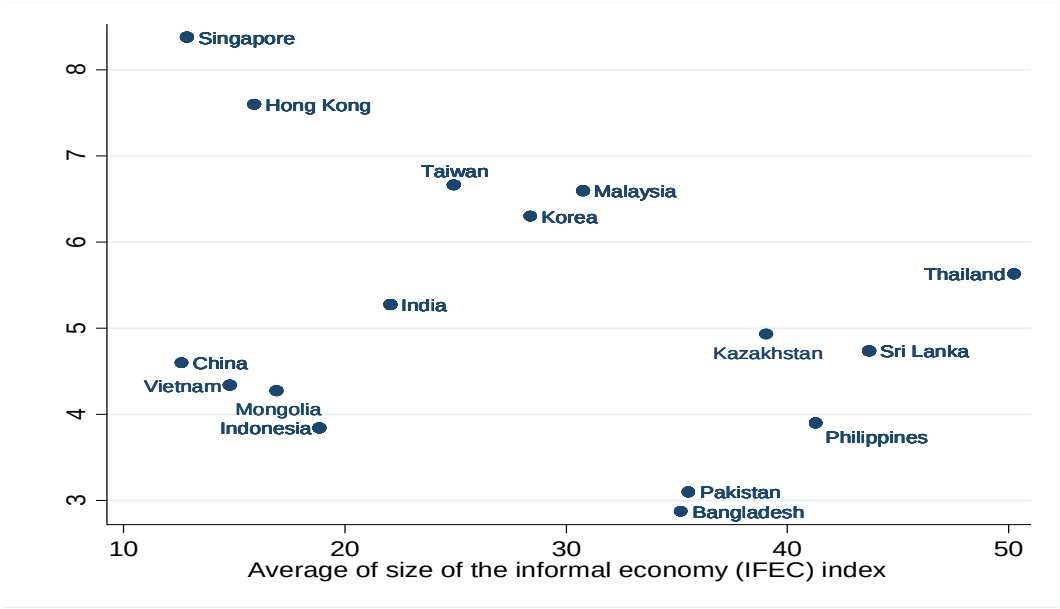


Figure 3 plots the average IPR protection level against the average relative size of the informal economy for the eleven Latin American countries in our sample, for 2000-2007. Overall, as was evident for Africa and Asia, there is a negative relationship between the level of IPR protection and the relative importance of the informal sector in the economy. Latin American countries that perform better on IPR protection tend to perform better on formalizing their economies. Chile stands out as a country that enjoys both strong IPR protection and a high level of formalization. This is hardly surprising since Chile has long been the star performer among Latin American economies, growing at a healthy pace on the back of sound economic policies. At the other end of the spectrum lies Bolivia, one of the poorest and least developed Latin American countries. Argentina, Ecuador, Paraguay, and Venezuela show a mix of weak IPR and small informal economies, which may partly reflect strict labor laws and lax IPR regulations.

[4] http://www.as-coa.org/articles/weekly-chart-latin-americas-informal-economy

2.4 Full Sample of Developing Countries

Figure 4 plots IPR protection against the informal economy for our full sample of forty eight developing countries – twenty one from Africa, sixteen from Asia, and eleven from Latin America. In line with the pattern for the three regions, there is clearly a negative relationship between IPR protection level and the relative size of the informal economy. Developing countries with stronger IPR protection tend to have smaller informal sectors, and developing countries with weaker IPR protection tend to have larger informal sectors. There are some exceptions to this general pattern such as China, which combine relatively weak IPR protection with relative low levels of informal activity. Finally, as was the case for each region, countries at higher income and development levels generally have stronger IPR protection and smaller informal sectors.

Figure 3
Intellectual Property Rights (IPR) Protection and Ratio of Informal Economy to GDP in Selected Latin American Economies, Average, 2000-2007

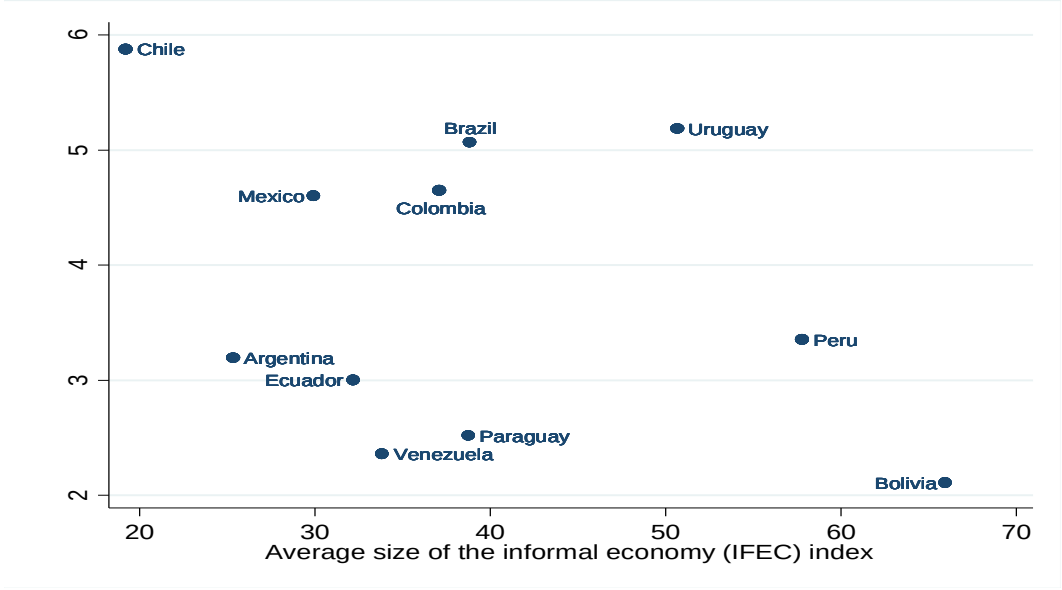
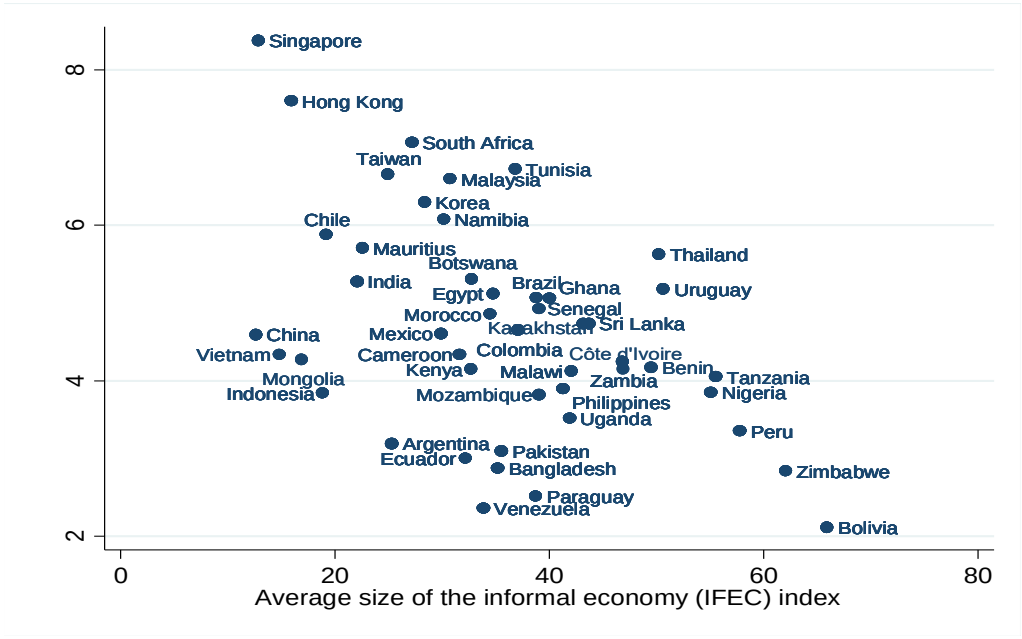


Figure 4
Intellectual Property Rights (IPR) Protection and Ratio of Informal Economy to GDP in Selected Developing Countries, Average, 2000-2007



3 Theoretical Model of IPR Protection, Informal Economy, and FDI

Our model is based on the framework proposed by Landes and Posner (2003). There are two types of firms: multinational corporations (MNCs) and copiers. MNCs operate in the formal sector of an economy and make genuine products while copiers operate in the informal sector of an economy and producing illegal imitations of the former. Assume that genuine products and illegal imitation copies are quality-adjusted substitutes. MNCs operate in a monopolistically competitive market and face a constant marginal cost $c(z)$ where *z* represents the degree of IPR protection.[5] The parameter *z* affects the marginal cost for MNCs negatively due to a resource availability effect. As IPR protection increases and the rate of imitation profitability shrinks, copiers tend to abandon their illegal imitation activity and join the labor supply in the formal sector of an economy, increasing the availability of resources for MNCs. This effect becomes stronger when the size of informal sector in an economy declines, $dc/dz < 0$ and $\left|dc/dz\right|^{si} > \left|dc/dz\right|^{li}$, where *si* and *li* represent economies with small and large informal sectors, respectively.[6]

Copiers operate in a market of competitive selection, where firms are price takers and their products are homogeneous. There is, however, no free entry and not all firms have access to the same technology. Specifically, it is assumed that different firms have different degrees of efficiency, which in turn correspond to different cost functions, and each firm is uncertain about its own efficiency. Based on its performance in producing illegal imitations in each period, the firm receives signals about its true efficiency and uses them to update its priors.[7]

This type of market structure best describes a market in which MNCs and illegal copiers coexist. Contrary to the popular assumption of `perfect' non-rivalry – i.e. an innovation can be reproduced without cost – imitation activity is costly, non-instantaneous and uncertain. Mansfield, Schwartz and Wagner (1981), for example, report that, on average, the ratio of imitation to innovation cost is about 0.65, and the ratio of imitation to innovation time is about 0.7. In a similar survey, Levin et al. (1987) find that even for unpatented production processes, 43% of firms said that imitation cost was between 51 and 75% of innovator's R&D cost while 39% said that it was between 75 and 100%. An additional 6% said that imitation cost was more than 100% or impossible. For unpatented products, the corresponding figures were 46%, 31% and 9%. In terms of imitation lag, Levin et al. (1987) find that for unpatented production processes the lag is 1 to 3 years in 66% of cases and even longer in a further 18% cases. It is less than 6 months in only 2% of the cases. For unpatented products, the corresponding figures were 70% and 12%, and 2%. This evidence thus suggests that there are technological barriers to entry and not all copiers have access to the same technology.

Two important results arise from a model of competitive selection. First, different firms earn different profit rates. In particular, firms can earn positive profits even in the long run. Second, there may be both entry and exit at the same time in an industry. These results allow us to characterize the competition for scarce resources between copiers and MNCs in our model.

Formally, copier *j* produces y_j facing an increasing marginal cost $M\left(y_j, z\right)\gamma_j$. The marginal cost *M* captures the effect of an increasing expected IPR infringement penalty. Typically, both the probability of being caught and the penalty itself increase with the number of imitation copies produced. Furthermore, *M* shifts positively with *z* since an increase in IPR protection directly raises the marginal cost of copiers at every production level. Following Jovanovic (1982), let γ_j be a random variable independent across firms. For the firm of type ϕ, let $\gamma_j = \xi\left(\eta_j\right)$ where $\xi\left(\mathrm{g}\right)$ is a positive, strictly increasing, and continuous function. Here, $\eta_j = \phi + \varepsilon_j$, $\varepsilon_j : N\left(0, \sigma^2\right) iid$. The variable γ_j thus captures the assumption that firms are uncertain about their own efficiency. Firms with small values of ϕ are less uncertain about their efficiency and will generate smaller γ_j's; therefore, they will be more efficient at all levels of output. Economic profits for illegal copier *j* are:

[5] The degree of IPR protection, *z,* should be thought of as an effective measure that includes the cost of enforcement.
[6] An increase in IPR protection may also affect *c(z)* positively via tighter room for legal imitation. We assume, however, that such effect is equally small across MNCs since IPR reforms are mainly targeted to stopping illegal imitation activity. The overall effect of IPR reforms on c(z) is dominated, therefore, by the resource availability effect.
[7] See Jovanovic (1982) for the original version of the model.

$$\Pi_j = py_j - \int M\left(y_j, z\right)\gamma_j^* dy - O\left(w\right) = 0 \qquad (1)$$

Here, *p* is the price per copy, y_j is the quantity of copies produced by copier *j*, *M* is the marginal cost of production which is a function of the number of copies produced and the level of IPR protection, γ_j^* is the expectation of γ_j conditional on prior history, and *O* are the opportunity costs faced by copiers – i.e. forgone benefits of switching to the formal economy. *O* is a positive function of w, our measure of the overall quality of the institutional environment.

Consider now two different countries, *A* and *B*. Country *A* has a strong institutional environment, and therefore a relatively small informal economy, but the opposite is true for country *B*. In other words, $O(w^A) > O(w^B)$. Starting from long run equilibrium, assume that both countries strengthen their IPR protection and *z* increases. Clearly, accounting profits for copiers in both countries, $py_j - \int M\left(y_j, z\right)\gamma_j^* dy,$ decline and the most inefficient companies may even suffer losses.[8] The last group of copiers will exit the informal economy and join the labor force in the formal economy.

However, given that $O(w^A) > O(w^B)$, other things equal, after the increase in *z*, the expected number of copiers exiting the informal economy will be larger in country *A* than in country *B*. As a result, MNCs in country *A* will face less competition and lower marginal costs than their counterparts in country *B*. In fact, if the institutional environment is extremely poor in country *B* – i.e. $O(w^B)$ is negligible – the number of illegal copiers and hence the marginal cost of MNCs may even remain constant.

Assume that initially there is one MNC and many copiers. FDI is given by an increase in the number of MNCs in equilibrium. Let p be the price of a copy – original and quality-adjusted imitation, x the number of genuine goods produced by the MNC, y the aggregate number of copies produced by the copiers, and $q\left(p\right)$ the market demand for copies. Then the copiers' supply curve becomes $y = y\left(p, z\right)$, with $dy/dp > 0,\ dy/dz < 0$, and $\left|dc/dz\right|^{si} > \left|dc/dz\right|^{li}$. Profits for the MNC are, in turn, $\Pi_{MNC} = [p - c(z)]x$. In equilibrium, this last expression is:

$$\Pi_{MNC} = \left[p - c\left(z\right)\right]\left[q\left(p\right) - y\left(p, z\right)\right] \qquad (2)$$

The price level that maximizes the above expression satisfies:

$$p\left[1 - \frac{F}{\left|\varepsilon^d\right| + \varepsilon^s\left(1 - F\right)}\right] = c\left(z\right) \qquad (3)$$

where *F* is the fraction of original copies among all copies produced, $\varepsilon^d = q_p\left(p/q\right)$ is the price elasticity of demand, and $\varepsilon^s = y_p\left(p/y\right)$ is the price elasticity of the copiers' supply. The price that maximizes profits for the MNC is higher the lower both elasticities, the higher the fraction of the market covered by the MNC, and the higher the marginal cost of production.[9]

[8] Remember that, as a result of competitive selection, and due to barriers to entry, profits for some copiers will remain positive even after the shock.

[9] We assume that the second-order condition is satisfied: $S = \partial^2\Pi/\partial p^2 = 2\left(q_p - y_p\right) + \left(p - c\left(z\right)\right)\left(q_p p - y_p p\right) < 0.$

Given the monopolistically competitive nature of the market in which MNCs operate, the potential number of MNCs operating in the host country will increase until the profits for the marginal MNC equal zero.[10] The change in profits as IPR protection increases is:

$$\frac{d\Pi_{MNC}}{dz}=\left[\frac{dp}{dz}-c_z\right]\left[q(p)-y(p,z)\right]+\left[p-c(z)\right]\left[q_p\frac{dp}{dz}-\left(y_p\frac{dp}{dz}+y_z\right)\right]. \quad (4)$$

From (4), assuming the profit maximizing condition, we get

$$\frac{d\Pi_{MNC}}{dz}=-\left[p-c(z)\right]y_z-c_z\left[q(p)-y(p,z)\right]>0. \quad (5)$$

While $d\Pi_{MNC}/dz$ is positive since because both terms in (5) are positive, and its magnitude is given by the magnitudes of both dy/dz and dc/dz. Both terms are bigger in absolute value in countries with small informal economies than in countries with large informal economies. As a result, as IPR protection increases, the number of MNCs – i.e. FDI – will increase more in countries with small informal economies. If, in fact, dy/dz and dc/dz are negligible for countries with extremely poor institutions and very large informal economies. In those cases, $d\Pi_{MNC}/dz$ will also be negligible and the number of MNCs may not change at all.

4 Empirical Framework and Empirical Results

In this section, we present the empirical framework to test for the theoretical model of IPR protection, the informal economy, and FDI outlined in section 3. We also report and discuss our main empirical findings.

4.1 Empirical Framework: Data and Model

Providing direct empirical evidence for our theoretical argument is challenging given the relative lack of information on the size of the informal economy. Although there is a rapidly growing literature on the causes and effects of the informal economy, serious disagreements remain about the empirical measurement of the shadow economy.[11] However, Schneider (2005) developed a recently updated and widely used dataset 5which estimates the size of the shadow economy as a percentage of GDP for 145 countries. Schneider (2005) defines the shadow economy as consisting of all market-based production of goods and services that are deliberately concealed from public authorities for the following reasons: (1) to avoid payment of taxes, (2) to avoid payment of social security contributions, (3) to avoid legal labor market standards such as minimum wages, maximum working hours, and safety standards, and (4) to avoid burdensome administrative procedures such as completing statistical questionnaires or other administrative forms.

Schneider's definition is appropriate and relevant for our purposes since it characterizes the informal economy as the result of institutional failures, which form the basis of our theoretical arguments. We use Schneider's data set to classify the countries in the sample in terms of the relative size of their informal economies. We then apply the same threshold effects techniques as in Falvey, Foster and Greenaway (2006). They use Hansen's (2000) methods to endogenously identify the threshold effects. The obvious advantage of those techniques is that they let the data find the cut-off points endogenously rather than determine them arbitrarily using ad hoc criteria.
In order to empirically test for our theoretical model we apply a standard panel regression model based on the gravity FDI specification:

$$\begin{aligned}\log FDI_{Sit}=&\alpha+\beta IPR_{it}+\gamma IFEC_{it}+\lambda IPR_{it}*IFEC_{it}+\alpha_1\log GDP_{St}+\alpha_2\log GDP_{it}\\&+\alpha_3 Tax_{it}+\alpha_4 Tariff_{it}+\alpha_5 BIT+\alpha_6\log dis+\alpha_7 col+c_i+\eta_t+\mu_{it}\end{aligned} \quad (6)$$

where FDI is foreign direct investment flow from the source country (S) to the host country (i) in millions of US dollars – data taken from OECD International Direct Investment Statistics database (FDI flows by partner country);

[10] The implicit assumption here is that MNCs do not face a sunk cost at the time of entry. However, allowing for this possibility does not change our results.
[11] Recent surveys on the subject of informality include Alm, Martinez and Schneider (2004), Pedersen (2003), and Gerxhani (2003).

IPR is an index of IPR protection - 0-10 scale where 10 represents the strongest protection - data taken from the Economic Freedom of the World (EWF) 2013 report; *IFEC* is the size of the informal economy as a percentage of GDP – data taken from Schneider (2005); $\log GDP_{St}$ and $\log GDP_{it}$ are the log of GDP of the source country S and the host country i, respectively with GDP in millions of US dollars – data taken from CEIC Global Database; *Tax* is the top marginal tax rate index – data taken from EFW; *Tariff* is the medium tariff rate index - data taken from EFW; *BIT* is the bilateral investment agreement – data taken from ICSID Database of Bilateral Investment Treaties of the World Bank; log dis is the log of the distance between the capital cities of the source and host countries in air miles; and finally, *col* is a dummy variable of 1 if the FDI host country is a former colony of the FDI source country and zero otherwise.[12]

Our theoretical model suggests that stronger IPR protection will have a bigger impact on FDI in countries with small informal economies than in countries with large informal economies. Hence, following Hansen (2000), we apply LM test to determine the existence of a threshold, θ_1, based on the size of the informal economy (IFEC). If a threshold exists for the IPR variable based on the IFEC, then Equation (6) is modified to incorporate the threshold effect as follows:

$$\begin{aligned}\log FDI_{Sit} &= \alpha + \beta IPR_{it} + \gamma IFEC_{it} + \alpha_1 \log GDP_{St} + \alpha_2 \log GDP_{it} + \alpha_3 Tax_{it} \\ &+ \alpha_4 Tariff_{it} + \alpha_5 BIT + \alpha_6 \log dis + \alpha_7 col + \kappa_1 IPR_{it} * D1\left(IFEC < \theta_1\right) \quad (7) \\ &+ \kappa_2 IPR_{it} * D2\left(IFEC \geq \theta_1\right) + c_i + \eta_t + \mu_{it}\end{aligned}$$

where *D1* is a dummy variable for informal economy smaller than the threshold value, θ_1, whereas *D2* is a dummy for informal economy larger than the threshold value. That is, *D1* denotes relatively small informal economies whereas *D2* denotes relatively large informal economies.

The data set includes 13 FDI source countries namely, Australia, France, Germany, Japan, Italy, Japan, Netherlands, South Korea, Spain, Sweden, Switzerland, the United Kingdom and the United States and 48 host countries in three continents. There are 21 host countries in Africa, namely, Benin, Botswana, Cameroon, Côte d'Ivoire, Egypt, Ethiopia, Ghana, Kenya, Malawi, Mauritius, Morocco, Mozambique, Namibia, Nigeria, Senegal, South Africa, Tanzania, Tunisia, Uganda, Zambia, and Zimbabwe; 11 host countries in Latin America, namely, Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico, Paraguay, Peru, Uruguay and Venezuela; and 16 host countries in Asia, namely, Bangladesh, China, Hong Kong, India, Indonesia, Kazakhstan, Malaysia, Mongolia, Pakistan, Philippines, Singapore, South Korea, Sri Lanka, Taiwan, Thailand and Vietnam.[13]

4.2 Empirical Results

We perform tests to determine appropriate specifications of Equation (6) and Equation (7). For Equation (6), we test for the correlation between the unobserved country-specific effects (c_j) and regressors using the Hausman test with the null of no correlation (random effect) and the alternative of correlation (fixed effect). We do this after performing the Wald test with the null hypothesis that all year specific effects (η_t) are zero and the alternative hypothesis that they are non-zero (Greene, 2008). Given the results of the specification tests, we perform Hansen's LM test with the null hypothesis of no threshold effect and the alternative hypothesis of threshold effect with the size of the informal economy as the threshold variable. We then run panel regression to estimate the coefficients of Equation (7).

[12] The IPR protection index by Ginarte and Park (1997) is not available for our period of study. The choice of control variables is standard in FDI gravity model specifications available for source and host countries in our sample. Notice that the variable *IFEC* serves as a measure of the investment environment in the country. See, for example, Qu´er´e, Coupet and Mayer (2005), Blonigen et al. (2007) and Brainard (1997). Data for FDI and *GDP* are from *OECD ilibrary*.

[13] Data from EFW begin in early 2000 for most countries while Schneider's (2005) begins in 1999 and ends in 2007. Some of the FDI observations especially from some African countries are negative and were assigned a value of 1 while other observations are missing from OECD database due to confidentiality and were dropped from the data set. Hence, we have an unbalanced panel data.

Table 1 reports the results of the specification tests, and Table 2 reports the results of the panel regressions of Equation (6) and Equation (7), which we refer to as Model 1 and Model 2, respectively. We run the tests and the regressions for the whole sample with 2,525 observations and the African sub-sample with 733 observations, Latin American sub-sample with 710 observations, and Asian sub-sample with 1,082 observations. The African sub-sample refers to African FDI host countries, and likewise for the Asian and Latin American sub-samples.

Table 1 shows that the Hausman test cannot reject the null that the unobserved country-specific effects are uncorrelated with the regressors at the 10% significance level while the Wald tests reject the null that the year-specific effects are zeros for the full sample and the Asian sub-sample at the 1% significance level. However, for the African and Latin American sub-samples, the Wald test cannot reject the null that the time-specific effects are zero at the 10% significance level but the Hausman tests reject the null hypothesis that the country-specific effects are uncorrelated with the regressors at the 5% and higher significance level. Hence we use the random effect panel model with year-specific effects for the full sample and Asian sub-sample while we use the fixed effect panel model without year specific effects for the African and Latin American sub-samples.

Table 1 also shows that Hansen's (2001) LM tests reject the null of no threshold for the full sample as well as the African and Asian sub-samples at the 1% significance level in which the IFEC (size of the informal economy) threshold values are 26% for the whole sample, 37.8% for Africa and 31.2% for Asia. Hansen's LM test cannot reject the null of no threshold for the Latin American sub-sample at the 10% significance level.

Table 2 reports the results of panel regressions with bilateral FDI inflows from OECD (source) countries to developing (host) countries as the dependent variable for the full sample (13 source countries and 48 host countries) as well as the African sub-sample (9 source countries and 21 host countries), Latin American sub-sample (10 source countries and 11 host countries) and Asian sub-sample (12 source countries and 16 host countries).

Model 1, denoted as M1 in Table 2, is the basic gravity FDI specification and includes IPR protection, the size of the informal economy (IFEC), and an interaction term between the IPR protection and IFEC. The specification controls for the sizes of the source and host markets (GDP_{source} and GDP_{host}), the effects of other government policies on FDI (top marginal tax rates (TAX) along with tariffs and bilateral investment treaties (BIT) between source and host countries), initial investment costs and the import of intermediate inputs by MNCs (proxied by distance), and historical links between source and host countries, represented by a colony dummy variable which is one if the FDI host county is a former colony of FDI source country and zero otherwise.[14] Model 2, denoted as M2 in Table 2, examines whether the effect of IPR protection on FDI inflows depend on threshold levels of the relative size of the informal economy.

We first report and discuss the key results – i.e. results that pertain to IPR protection, the informal economy, and the interaction between IPR protection and the informal economy – for our full sample of 13 OECD source countries and 48 developing host economies. Those results lend substantial empirical support to our central hypothesis that IPR protection promotes FDI inflows for institutionally stronger countries. The M1 results show a positive effect of IPR protection on FDI inflows at the 1% level of significance. The coefficient of the informal economy (IFEC) is positive and marginally significant at the 10% level. Most significantly and interestingly, the interaction term between IPR protection and the informal economy is significant at the 5% level, implying that strong institutions magnify the impact of IPR protection on FDI inflows.

The M2 results for the full sample reinforce the M1 results, and provide further empirical support for our central hypothesis. Based on the results of the Hansen's LM tests, we set θ_1 equal to 26% for the full sample.

*IPR*D1* which measures the impact of IPR protection in small informal economies (IFEC<θ1), and *IPR*D2* which does the same in large informal economies (IFEC>θ1), are positive and significant at the 1% and 5% levels respectively, for the full sample. Furthermore, the coefficient of *IPR*D1*, 0.220, is larger than the coefficient *IPR*D*, 0.089. The Wald test confirms the two estimates to be significantly different at the 1% significance level.[15] These findings confirm our theoretical conjectures, which predict that IPR protection attracts more FDI into institutionally stronger countries.

[14] Kleinert and Toubal (2010) derive the gravity equation from the theory of multinational firms and provide a theoretical justification of distance as a determinant of FDI.

[15] The Wald test statistic with a null that the coefficients of IPR (IFEC<θ1) and IPR (IFEC>θ1) are equal for all samples is 13.01 with a p-value of 0.0003.

Table 1 Specification tests

	All countries	Africa	America	Asia
Specification tests for Model 1				
Hausman's chi-squared statistics (null hypothesis is random effects; alternative is fixed effects)	16.32 (RE)	18.36* (FE)	26.48+ (FE)	2.82 (RE)
X^2-statistic (Wald test with null hypothesis that all time-specific effects are zero)	35.59+ (with time specific effects)	1.15 (without time specific effects)	1.69(without time specific effects)	22.02+(with time specific effects)
Specification tests for Model 2 given the results of the tests for Model 1				
Hansen's (2001) LM Test Statistic (null hypothesis of no threshold)	79.29+	49.5+	0	77.41+
Threshold (θ1)	26	37.8	n.a.	31.2
Number of observations	2525	733	710	1082

+ 1% level of significance, * 5% level of significance, and x 10% level of significance. FE and RE stand for fixed effect and random effect respectively.

Table 2 Panel regression: Log FDI inflows in developing and emerging economies

	All countries (random effect model)		Africa (fixed effect model)		America (fixed effect model)		Asia (random effect model)	
	M1	M2	M1	M2	M1	M2	M1	M2
IPR protection	0.378+ (0.087)		0.302 (0.264)		0.356 (0.299)		0.235 x (0.130)	
IFEC (size of Informal economy)	0.019 x (0.011)	0.009 (0.008)	-0.050 (0.088)	-0.064 (0.085)	-0.331+ (0.098)		-0.018 (0.021)	-0.003 (0.014)
IPR*IFEC	-0.006* (0.002)		-0.007 (0.007)		-0.012 x (0.007)		0.001 (0.004)	
Log GDP Source	0.522+ (0.066	0.517+ (0.067)	0.690 (0.540)	0.720 (0.533)	-1.967+ (0.586)		0.631+ (0.100)	0.632+ (0.100)
Log GDP Host	0.832+ (0.051)	0.856+ (0.050)	-0.225 (0.495)	-0.223 (0.491)	1.092* (0.528)		0.941+ (0.069)	0.929+ (0.069)
Tax	0.014 (0.035)	0.023 (0.035)	0.140 (0.103)	0.151 (0.102)	0.122 (0.113)		0.035 (0.063)	0.024 (0.061)
Tariff	0.120 (0.050)	0.135+ (0.049)	0.062 (0.093)	0.062 (0.094)	0.516 x (0.274)		0.203+ (0.061)	0.210+ (0.061)
Log distance	-0.615+ (0.154)	-0.639+ (0.155)	(omit)	(omit)	(omit)		-0.666+ (0.247)	-0.681+ (0.246)
Colony	0.188 (0.189)	0.303 (0.191)	-0.277 (0.321)	-0.277 (0.311)	(omit)		0.653 x (0.383)	0.626 (0.386)
Bilateral Invest Treaty (BIT)	0.588+ (0.151)	0.523+ (0.153)	(omit)	(omit)	(omit)		0.287 (0.220)	0.311 (0.221)
IPR (IFEC<θ1)		0.220+ (0.048)		0.064 (0.082)				0.269+ (0.078)
IPR (IFEC>θ1)		0.089* (0.043)		-0.012 (0.088)				0.196* (0.082)
Constant	-11.09+ (1.67)	-10.65+ (1.66)	-5.10 (8.29)	-5.13 (8.46)	26.28* (12.59)		-13.48+ (2.63)	-13.63+ (2.57)

+ 1% level of significance, * 5% level of significance, and x 10% level of significance. M1 and M2 refer to Model 1 and Model 2, respectively. The values in parenthesis are the robust standard error. The Wald test statistic with a null that the coefficients of IPR (IFEC<θ1) and IPR (IFEC>θ1) are equal for all samples is 13.01 with a p-value of 0.0003. The The Wald test statistic with a null that the coefficients of IPR (IFEC<θ1) and IPR (IFEC>θ1) are equal for sub-sample of Asia is 1.9 with a p-value of 0.16.

We now discuss the results for the regional sub-samples. The M1 results are mixed and inconclusive. IPR protection has a positive effect on FDI inflows for the Asian sub-sample at the 10% level of significance. However, IPR protection is insignificant for FDI inflows for the African and Latin American sub-samples. The size of the informal economy (IFEC) is negative and significant at the 1% level for the Latin American sub-sample. This suggests that more formalized Latin American economies tend to attract greater FDI inflows. On the other hand, the informal economy is negative but insignificant for the African and Asian sub-samples. While the interaction term between IPR protection and the informal economy is insignificant for Asia and Africa, it is negative and significant at the 10% level for Latin America.

We now report the M2 results for the regional sub-samples. M2 pertains to the threshold effect of the informal economy on the relationship between IPR protection and FDI inflows. On the basis of Hansen's LM test results, we set θ_1 equal to 37.8% for the African sub-sample and 31.2% for the Asian sub-sample. Both are substantially higher than the informal economy threshold of 26% for the full sample. The coefficients of *IPR*D1* and *IPR*D2* are insignificant for the African sub-sample but positive and significant at the 5% and higher level of significance for the Asian sub-sample. However, for the Asian sub-sample, the Wald test cannot reject the null that the coefficients of *IPR*D1* and *IPR*D2* are equal, at the 10% level of significance. Finally, the Latin- American sub-sample shows no threshold effects with respect to the size of the informal economy.

While our key variables of interest are IPR protection, the informal economy, and the interaction term between the two, our regressions include a number of standard control variables. For the full sample, log GDP_{source}, log GDP_{host}, log distance, and bilateral invest treaty (BIT) are significant at the 1% level, and carry the expected signs. The results are similar for the Asian sub-sample except that Colony is significant at the 10% level but BIT is insignificant at the 10% significance level. For the Latin American sub-sample, the coefficients of log GDP_{host} and Tariff are positive and significant at the 5% and 10% levels respectively. However, the coefficient of log GDP_{source} is negative and significant at the 1% level.

Overall, the empirical results are largely consistent with our theoretical predictions. Our empirical evidence implies that when the informal economy is relatively small, IPR has a relatively large, positive and significant effect on FDI inflows. On the other hand, when the informal economy is large, IPR has a less tangible impact on FDI inflows. This is especially true for the full sample of 13 OECD source countries and 48 developing host economies. The results of both empirical models lend support to our theoretical predictions about the relationship between IPR protection, the informal economy, and FDI inflows. Model 1 results imply that the effect of IPR protection on FDI inflows will be weaker in countries with larger informal sectors. Model 2 results imply that the FDI-attracting effect of IPR protection is stronger for countries with informal economy sizes below a certain threshold.

5 Concluding Observations

Stronger IPR protection in developing countries would enable developed countries to capture more of the fruits of their R&D and other innovative activities. On the other hand, for developing countries, which tend to be importers of IP, strengthening IPR protection often impose substantial costs. In countries with strong institutions, IPR protection raises the cost of illegal imitation and thus reduces illegal imitation activity. This reduces the competition that foreign investors face and frees up more resources for them. In contrast, in institutionally weak countries, IPR protection will have a noticeably weaker effect on illegal imitation activity.

We develop a theoretical model which shows that IPR protection has a bigger positive effect on FDI inflows in countries with larger informal economies. Based on the model, we empirically test for the validity of the model the hypothesis that the effect of IPR protection on FDI inflows depends on the size of the host country's informal economy, which reflects the quality of its institutional environment. Our empirical evidence for developing countries is consistent with the predictions of the model. The obvious policy implication is that strengthening IPR protection is more beneficial for institutionally stronger countries. This is intuitively plausible since in those countries a weak institutional environment may dilute the benefits of strong IPR protection for foreign investors. We hope that our paper serves as a springboard for further research on how the informal economy and the institutional environment affect the relationship between IPR protection and FDI.

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