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## Intellectual Property Rights, Quality of Institutions, and Foreign Direct Investment into Developing Asia

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## ADB Economics Working Paper Series



### Intellectual Property Rights, Quality of Institutions, and Foreign Direct Investment into Developing Asia

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Minsoo Lee and Donghyun Park

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## **ABSTRACT**

Developing Asian countries are strengthening their intellectual property rights (IPR) regime as they themselves become producers of intellectual property. At the same time, developing Asia has attracted large amounts of foreign direct investment (FDI) and this trend is expected to continue in light of the region's strong growth prospects. In this paper, we explore the relationship between IPR and FDI in developing Asia. To do so, we develop a theoretical model which predicts that stronger IPR protection attracts more FDI in countries with small informal economies—i.e., strong institutions—but not in countries with large informal economies—i.e., weak institutions. Our empirical analysis, based on a threshold effect model, yields some evidence which supports our theoretical model.

**Keywords:** intellectual property rights, foreign direct investment, informal economy, institutions, Asia

**JEL Classification:** F23, O17, O34





## I. 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 World Trade Organization's (WTO) 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 account for 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.

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). 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), discouraging FDI.<sup>1</sup>

While IPR protection is an important determinant of FDI inflows, it is not the only one. A firm's decision to invest abroad is based on not only the host country's IPR regime, but also the

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<sup>1</sup> 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.

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 which holds the key to attracting FDI.

In particular, the quality of institutions may influence the effect of IPR protection on FDI into developing Asia. 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 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 II looks at IPR protection in Asia. Section III lays out a simple Cournot model based on Landes and Posner's (2003) framework. Section IV presents our empirical framework and reports the empirical results, and Section V concludes.

## II. IPR PROTECTION IN ASIA

The relationship between IPR protection and FDI is especially relevant for developing Asia. For one, the region is in the midst of a transition from IP importer to a major producer of IP in its own right. Furthermore, due to robust growth, Asia attracted large amounts of FDI inflows and this trend is expected to continue. FDI inflows into Asia favor economies with relatively low technological capacity and relatively strong IPR regimes (Petri 2012). Technology imports through FDI play an important role in Asia's technological upgrading. Petri (2012) finds that in Asia FDI often leads to the diffusion of technology and technological progress. Awokuse and Yin (2010) also find a positive and significant effect of stronger IPR protection on FDI in the People's Republic of China (PRC).

During 2007–2011, Asia received about \$2 trillion of the \$8 trillion global FDI inflows. The newly industrialized economies (NIEs: Hong Kong, China; the Rep. of Korea; Singapore; and Taipei, China) received \$710 billion or 36% of total inflows in the region and the PRC alone accounted for 27%. Asia is responsible for 20% of global outflows and the NIEs accounted for 43% of these.

Understanding the effects of IPR protection on FDI matters a great deal for developing Asia. The region's governments are subject to growing pressures from advanced economies to reform their IPR regimes. However, such reforms often entail high costs, including opportunity costs of reducing imitation activity. In many cases, they are highly controversial and unpopular, and politically difficult to implement. This paper will help inform the debate about the pros and cons of IPR reforms by examining their impact on FDI.

There is a great deal of controversy about the role of IPR protection regime, especially the patent system, in fostering innovation, technological progress, and industrial development. On one hand, IPR protection encourages innovation by rewarding the inventor with monopoly rights over their inventions for a specified period. On the other hand, a strong IPR protection regime inhibits the diffusion of new technology and knowledge. In the international context,

while IPR protection advances the global technology frontier, it slows down the diffusion of technology within the frontier, especially from advanced to developing countries.

In Asia, formal IPR systems were established only during the postwar period. The exception is Japan, which had instituted intellectual property rules prior to the 19th century. Table 1 shows the year when IPR laws were enacted in selected Asian countries. Additional years indicate when the laws were amended or replaced. IPR regimes in Asia have improved but enforcement of IPR laws is still weak and inefficient (Anh 2011). Evidence suggests that the PRC's administrative enforcement authorities handled more than 40,000 cases relating to copyrights and trademarks in 2005. However, less than 1% resulted in prosecution (Brilliant 2006). Similarly low rates of prosecution were found in Indonesia, the Philippines and Viet Nam.

**Table 1: Developments in Intellectual Property Legislation in Selected Asian Countries**

	<b>Patent Law</b>	<b>Utility Model Law</b>	<b>Trademark Law</b>	<b>Design Law</b>
PRC	1984	1984	1982, 1993	1984
Rep. of Korea	1947, 1961	1961	1949	1961
Taipei, China	1949, 1994	in Patent Act	1945, 1993	in Patent Act
Hong Kong, China	1997	1997	2000	2000
Thailand	1992, 1997, 1999, 2000	2000	1910, 1931, 1991	1910, 1931, 1991
Japan	1888, 1921, 1959	1905, 1959	1884, 1959	1884, 1959
Indonesia	1989, 1997, 2001	1997, 2001	1961, 1992, 2001	2000
Philippines	1995	1995	1995	1995
Malaysia	1983, 1995	1983	1974, 1995	1996, 1999
Singapore	1995	No	1998	2000
India	1970–1999	No	1958–2002	1911
Viet Nam	1981, 1996, revised 2001	1981, 1996	1982, 1996, 2001	1981, 1996

PRC = People's Republic of China

Source: Heath (2003), pp. 7–9.

Developing countries in Asia have had relatively weak IPR protection systems at the early stage of their economic development but these became stronger as those countries transformed themselves into producers of innovations and new technology themselves. It is only after countries accumulate sufficient indigenous technological capabilities and a strong science and technology infrastructure capable of undertaking creative imitation that IPR protection becomes an important element in technology transfer and industrial activities.

Kumar (2003) notes that in Asia the success of Japan and the newly industrialized East Asian nations was partly attributed to their ability to imitate, absorb, assimilate, and replicate foreign innovations. These efforts were supported by accommodating IPR protection regimes. India also had a weak IPR regime in place in the 1970s but departed from East Asian economies in that it did not encourage adaptive and minor innovations based on utility and design models. In the case of the Republic of Korea, strong IPR protection would have hindered rather than facilitated technology transfer and indigenous learning activities in the early stages of industrialization, when learning took place through reverse engineering and duplicative imitation of mature foreign products (Falvey, Foster, and Greenaway 2006).

### III. THEORETICAL MODEL OF IPR PROTECTION, FDI, AND AN INFORMAL ECONOMY

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 manufacturing genuine products and copiers operate in the informal sector of an economy 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.<sup>2</sup> 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 gets smaller,  $dc/dz < 0$  and  $|dc/dz|^{si} > |dc/dz|^{li}$ , where  $si$  and  $li$  represent economies with small and large informal sectors, respectively.<sup>3</sup>

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 of producing illegal imitations in each period, the firm receives signals about its true efficiency and uses them to update its priors.<sup>4</sup>

This type of market structure represents better than perfect competition in capturing markets where illegal copiers participate. Contrary to the common assumption of 'perfect' non-rivalry—i.e., once an innovation is made it 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 without patent protection for major unpatented processes, 43% of firms said that imitation cost was between 51% and 75% of innovator's R&D while 39% said that it was between 75% and 100%. A further 6% said that imitation cost was more than 100% or impossible. For major unpatented products, the corresponding figures were 46%, 31%, and 9%. In terms of imitation lag, Levin et al. (1987) find that for major unpatented processes, the lag is 1 to 3 years in 66% of cases and longer than that in a further 18% cases. It is less than 6 months in only 2% of the cases. For major unpatented products, the corresponding figures were 70%, 12%, and 2%, respectively. This evidence suggests that there are technological barriers to entry and not all copiers have access to the same technology.

<sup>2</sup> The degree of IPR protection,  $z$ , should be thought of as an effective measure that includes the cost of enforcement.

<sup>3</sup> 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.

<sup>4</sup> See Jovanovic (1982) for the original version of the model.

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

Formally, copier  $j$  produces  $y_j$  facing an increasing marginal cost  $M(y_j, z)\gamma_j$ . 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  $\gamma_j$  be a random variable independent across firms. For the firm of type  $\phi$ , let  $\gamma_j = \xi(\eta_j)$  where  $\xi(\cdot)$  is a positive, strictly increasing, and continuous function. Here,  $\eta_j = \phi + \varepsilon_j$ ,  $\varepsilon_j \sim N(0, \sigma^2)$  iid. The variable  $\gamma_j$  captures, therefore, the fact that firms are uncertain about their own efficiency. Firms with small values of  $\phi$  are less uncertain about their efficiency and will generate smaller  $\gamma_j$ 's; therefore, they will be more efficient at all levels of output. Economic profits for illegal copier  $j$  are:

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

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,  $\gamma_j^*$  is the expectation of  $\gamma_j$  conditional on prior history, and  $O$  are the opportunity costs faced by copiers—i.e., forgone benefits of switching to the formal economy. Naturally,  $O$  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 healthy institutional environment, 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, after this shock, accounting profits for copiers in both countries,  $py_j - \int M(y_j, z)\gamma_j^* dy$ , decline and the most inefficient companies may even suffer losses.<sup>5</sup> 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 the marginal cost for MNCs may even remain constant.

<sup>5</sup> 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.

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  $q(p)$  the market demand for copies. Then the copiers' supply curve becomes  $y = y(p, z)$ , with  $dy/dp > 0$ ,  $dy/dz < 0$ , and  $|dc/dz|^{si} > |dc/dz|^{li}$ . Profits for the MNC are, in turn,  $\Pi_{MNC} = [p - c(z)]x$ . In equilibrium, this last expression is:

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

The price level that maximizes the above expression satisfies:

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

where  $F$  is the fraction of original copies among all copies produced,  $\varepsilon^d = q_p(p/q)$  is the price elasticity of demand, and  $\varepsilon^s = y_p(p/y)$  is the price elasticity of the copiers' supply. Naturally, the price that maximizes profits for the MNC is higher the lower the elasticities  $\varepsilon^d$  and  $\varepsilon^s$ , the higher the fraction of the market covered by the MNC, and the higher the marginal cost of production.<sup>6</sup>

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 profits, for the marginal MNC, equal zero.<sup>7</sup> The change in profits as IPR protection increases is:

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

From which, assuming the profit maximizing condition, we get

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

While  $d\Pi_{MNC}/dz$  is positive since because both terms in (5) are positive, 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,  $d\Pi_{MNC}/dz$  will also be negligible and the number of MNCs may not change at all.

<sup>6</sup> We assume that the second-order condition is satisfied:  $S = \partial^2 \Pi / \partial p^2 = 2(q_p - y_p) + (p - c(z))(q_{pp} - y_{pp}) < 0$ .

<sup>7</sup> 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.

#### IV. EMPIRICAL FRAMEWORK AND EMPIRICAL RESULTS

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

##### A. Empirical Framework: Data and Model

Providing direct empirical evidence for our theoretical argument is challenging given the lack of unified information on the size of the informal economy. Although the literature on the causes and effects of the informal economy is rapidly growing, disagreements remain about the appropriate statistical methods to use.<sup>8</sup> However, one recently updated and commonly used dataset, however, is the one generated by Schneider (2005), which 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: (i) to avoid payment of income, value-added or other taxes; (ii) to avoid payment of social security contributions; (iii) to avoid having to meet certain legal labor market standards, such as minimum wages, maximum working hours, and safety standards; and (iv) to avoid complying with certain 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. Recall the primarily institutional nature 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). 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 test our empirical model, we employ a standard panel regression model:

$$FDI_{it} = \alpha_0 + \beta IPR_{it} + \gamma IFEC_{it} + \lambda IPR_{it} * IFEC_{it} + \alpha_1 LGDP_{it}^{pc} + \alpha_2 Pop_{it}^g + \alpha_3 Tax_{it} + \alpha_4 Tariff_{it} + \alpha_5 Open_{it} + \alpha_6 Capital_{it} + \alpha_7 Inf_{it} + \nu_i + \eta_t + \varepsilon_{it}, \quad (6)$$

where *FDI* is total inward and outward FDI—net inflows and outflows in constant 1990 billion dollars; *IPR* is an index of IPR protection—0–10 scale, where 10 represents the strongest protection—taken from the Economic Freedom of the World (EFW) 2007 report; *IFEC* is the size of the informal economy as a percentage of GDP taken from Schneider (2005); *LGDP<sup>pc</sup>* is lagged real GDP per capita in constant 1990 dollars; *Pop<sup>g</sup>* population growth rate; *Tax* is the top marginal tax rate index taken from EFW; *Tariff* is the medium tariff rate index taken from EFW; *Open* is Imports plus Exports divided by GDP; *Capital* is the capital stock; and *inf* is the inflation rate.<sup>9</sup>

<sup>8</sup> Recent surveys on the subject of informality include Alm, Martinez-Vazquez, and Schneider (2004), Pedersen (2003), and Gerxhani (2003).

<sup>9</sup> 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. Notice that the variable *IFEC* serves as a measure of the investment environment in the country. See, for example, Quéré, Coupet, and Mayer (2005), Blonigen et al. (2007), and Brainard (1997). Data for *GDP<sup>pc</sup>*, *Open*, and GDP deflator are taken from the United Nations National Account Statistics while *FDI* is taken from WDI online.

## B. Empirical Results

Table 2 reports the results of FDI for the global sample and Asian sub-sample, which consists of Bangladesh, the PRC, India, Indonesia, the Republic of Korea, Malaysia, the Philippines, Singapore, Sri Lanka, Thailand, and Viet Nam. The dependent variable is total FDI inflows. Model 1 is the basic FDI specification and includes a cross-product term between the IPR protection level and the size of informal economy (IFEC). Neither IPR nor IFEC has a significant effect on FDI inflows for both samples. While real GDP per capita growth and population growth variables are all positive and significantly related to FDI for the global sample, openness variable turns out to be significant for the Asian sub-sample. For both samples, we test for an interaction effect between IPR and IFEC—our hypothesis is that the effect of IPR protection on FDI is conditional on the relative size of the informal economy. We find that this cross-product term is negative but not significant for both groups. This implies that the size of the informal economy does not influence the effect of IPR protection on FDI. For Asian countries, the marginal tax rate and the tariff rate have the expected sign but they are not significant.

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. In fact, in the latter case, IPR protection may not have any effect at all on FDI if the institutional environment is extremely weak. Following Hansen (1999, 2000), we apply a threshold panel regression model to divide the sample based on the size of the informal economy and search for threshold effects. In the regression equation (7),  $D1$  is a dummy variable for informal economy smaller than the threshold value 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.

$$\begin{aligned}
 FDI_{it} = & \alpha_0 + \gamma IFEC_{it} + \alpha_1 GDP_{it}^{pc} + \alpha_2 Pop_{it}^g + \alpha_3 Tax_{it} + \alpha_4 Tariff_{it} \\
 & + \alpha_5 Open_{it} + \alpha_6 Capital_{it} + \alpha_6 Inf_{it} + \kappa_1 IPR_{it} * D1(Inf < \theta_1) \\
 & + \kappa_2 IPR_{it} * D2(Inf \geq \theta_1) + \nu_i + \eta_t + \varepsilon_{it}
 \end{aligned} \tag{7}$$

The results from the threshold panel regression—Model 2 in Table 2—support our theoretical conjectures. Our key variables of interest are  $IPR*D1$ , which measures the impact of IPR protection in small informal economies and  $IPR*D2$ , which does the same in large informal economies. According to our results, IPR protection attracts more FDI into countries with informal economy size smaller than the threshold value of 16% of GDP for the global sample and 13% of GDP for Asian countries. On the other hand, IPR protection does not have a significant effect on FDI in countries with informal economies larger than the threshold values. These findings echo our theoretical prediction that IPR protection attracts more FDI into institutionally strong countries but not institutionally weak countries. An additional finding is that the informal economy size is now independently negative and significant for Asian sub-sample.



**Table 2: Total FDI Inflows**

	Global Sample		Asian Sub-sample	
	Model (1)	Model (2)	Model (1)	Model (2)
IPR	14.922 [14.091]		62.829 [50.785]	
IFEC	−0.53 [1.945]	−0.677 [2.175]	−5.862 [5.199]	−7.242** [2.386]
IPR*IFEC	−0.421 [0.378]		−1.915 [1.508]	
GDPpc	4.551*** [1.715]	4.399*** [1.599]	−10.572 [6.737]	−16.677*** [1.316]
Pop	−20.496** [9.072]	−19.932*** [7.218]		
Tax	4.79 [4.610]	5.041 [4.652]	−1.236 [9.566]	7.854** [2.978]
Tariff	−3.494 [4.587]	−1.122 [4.261]	−14.213 [20.172]	0.742 [3.011]
Open	0.433 [0.322]	0.414 [0.292]	0.841** [0.333]	0.379* [0.174]
Capital	20.603 [19.428]	17.645 [19.170]	−108.343 [85.255]	−35.177 [33.435]
Inf	−0.038 [0.358]	−0.102 [0.342]	7.476 [5.604]	5.008 [3.240]
IPR*D1		19.640** [8.647]		123.627*** [7.639]
IPR*D2		0.634 [3.649]		−1.527 [2.717]
Constant	−24.933 [81.494]	−48.014 [96.675]	194.315 [195.937]	43.236 [81.900]
Sample size	553	553	67	67
Sample size_clust	95	95	11	11
F-test	2.953	8.884	16.675	9175.762
P-value	0.004***	0.000***	0.000***	0.000***
R <sup>2</sup>	0.11	0.131	0.338	0.67
BIC	6,237.705	6,224.398	724.666	678

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01; Standard error in brackets.

BIC = Bayesian Information Criterion, FDI = foreign direct investment, GDP = gross domestic product, IFEC = informal economy size, Inf = inflation, IPR = intellectual property right, US = United States.

Source: Author's calculations.

Table 3 reports the results when the dependent variable is FDI inflows from the US rather than total FDI inflows. Again, Model 1 is the basic FDI specification. The results for both global sample and Asian sub-sample are quite similar to the results for total FDI in Table 2.<sup>10</sup> For both samples, a larger informal economy has a significant negative effect on FDI inflows while IPR protection is not significant. The cross-product term between IPR and IFEC is insignificant for both groups, implying that the size of the informal economy does not influence the relationship between IPR protection and FDI. In the panel threshold regression—Model 2—for both global sample and Asian sub-sample, IPR protection has a positive, significant effect on FDI in countries with informal economies smaller than the threshold values but not in countries

<sup>10</sup> The Asian sub-sample now consists of the PRC, India, Indonesia, Malaysia, the Philippines, Singapore and Thailand.

with large informal economies. Interestingly, for the global sample, IPR protection has a *negative* and significant effect on FDI in institutionally weak countries.

**Table 3: FDI Inflows from the US**

	Global sample		Asian sub-sample	
	Model (1)	Model (2)	Model (1)	Model (2)
IPR	0.385 [0.739]		2.372 [1.841]	
IFEC	-0.519*** [0.190]	-0.425** [0.171]	-0.800** [0.312]	-0.870*** [0.183]
IPR*IFEC	-0.026 [0.020]		-0.079 [0.059]	
GDPpc	0.188** [0.085]	0.199*** [0.061]	-0.419 [0.255]	-0.596*** [0.112]
Pop	-1.045** [0.454]	-2.620*** [0.499]		
Tax	0.525 [0.391]	0.401 [0.277]		
Tariff	0.930** [0.427]	0.895*** [0.315]		
Open	-0.02 [0.029]	-0.039 [0.025]	0.019 [0.037]	0.006 [0.027]
Capital	0.020* [0.011]	0.026** [0.011]	-5.564 [3.121]	-4.280*** [0.917]
Inf	0.028 [0.025]	0.024 [0.023]		
IPR*D1		0.939*** [0.312]		3.885*** [0.139]
IPR*D2		-0.387** [0.176]		-0.157 [0.162]
Constant	10.814 [7.223]	12.337** [5.489]	25.157* [11.806]	24.694*** [5.492]
Sample size	300	300	45	45
Sample size_clust	47	47	7	7
F-test	2.403	5.358	270.873	7172.087
P-value	0.025**	0.000***	0.000***	0.000***
R <sup>2</sup>	0.197	0.408	0.447	0.748
BIC	1397.845	1306.512	182.679	147.238

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01; Standard error in brackets.

BIC = Bayesian Information Criterion, FDI = foreign direct investment, GDP = gross domestic product, IFEC = informal economy size, Inf = inflation, IPR = intellectual property right, US = United States.

Source: Author's calculations.

In order to shed more light on the relationship between IPR protection, FDI and the informal economy, we now divide the FDI inflows from the US into different industries in the host economies. Such industry-based analysis allows us to identify the industries in which the informal economy and IPR protection have the most significant impact on FDI. Table 4 reports empirical results from the standard panel regression. For the global sample, the informal economy size has a negative and significant effect on FDI in the computer and transportation industries but IPR protection has negligible effect. For the Asian sub-sample, the informal economy size adversely affects FDI in the computer and food industries while IPR protection attracts FDI into the metals industry. For the metals industry, the interaction term between IPR and IFEC also becomes significant, albeit weakly. GDP per capita growth has a mixed effect on

FDI inflows from the US. It is positive and significant for machinery and trade but negative and significant for computer.

**Table 4: FDI Inflows from the US, by Industry (Standard Panel Regression)**

	Global Sample				Asian Countries			
	Computer	Transportation	Chemicals	Computer	Food	Machinery	Metals	Trade
IPR	0.345 [0.350]	-0.03 [0.301]	0.762 [0.414]	1.575 [1.027]	0.0183 [0.0202]	0.1727 [0.1447]	0.154** [0.062]	0.113 [0.227]
IFEC	-0.141* [0.070]	-0.115*** [0.042]	-0.107 [0.151]	-0.452** [0.139]	-0.0076* [0.0032]	-0.0196 [0.0466]	-0.006 [0.018]	-0.041 [0.053]
IPR*IFEC	-0.013 [0.011]	-0.004 [0.008]	-0.024 [0.013]	-0.048 [0.032]	-0.0006 [0.0009]	-0.0057 [0.0047]	-0.004* [0.002]	-0.006 [0.009]
GDPpc	-0.004 [0.022]	-0.007 [0.027]	-0.058 [0.066]	-0.302** [0.098]	-0.0023 [0.0046]	0.0413** [0.0118]	-0.011 [0.006]	0.105*** [0.023]
Pop	-0.450** [0.175]	-0.179* [0.097]						
Open	-0.005 [0.006]	0.014 [0.012]	0.009 [0.008]		0.0004 [0.0004]			
Capital	0.002 [0.003]	0.006** [0.003]	-0.443 [0.750]	-2.493 [1.701]	-0.1018 [0.1174]	-0.2174 [0.2369]	-0.179* [0.073]	1.193 [1.060]
Tax	0.023 [0.112]	0.186** [0.082]						
Tariff	0.026 [0.117]	0.043 [0.139]		-0.599 [0.401]		0.0161 [0.0397]		0.184 [0.149]
Inf	0.008 [0.008]	0.004 [0.006]						
Constant	4.842 [2.968]	2.584* [1.398]	2.04 [4.778]	19.844** [6.617]	0.2678* [0.1374]	0.3101 [1.6006]	0.127 [0.645]	0.37 [2.237]
Sample size	255	237	45	44	46	42	33	40
Sample size_clust	44	44	7	7	7	7	7	7
F-test	4.018	1.374	17.655	7918.5	28.332	194.97	1.499	214000
P-value	0.001***	0.23	0.002***	0.000***	0.000***	0.000***	0.313	0.000***
R2	0.091	0.071	0.54	0.393	0.129	0.523	0.53	0.338
BIC	553.396	535.8	56.125	126.303	-152.454	-37.233	-79.725	59.566

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01; Standard error in brackets.

BIC = Bayesian Information Criterion, FDI = foreign direct investment, GDP = gross domestic product, IFEC = informal economy size, Inf = inflation, IPR = intellectual property right, US = United States.

Source: Author's calculations.

The results for the standard panel regression model (Table 4) do not support our theoretical conjecture about the relationship between IPR protection, the informal economy, and FDI. For most industries, the interaction term between IPR protection and the informal economy is insignificant. In striking contrast, the empirical results from the threshold panel regression model for FDI by different industries (Table 5) support the predictions of our theoretical model. The results indicate that for the computer industry in the global sample and for all industries in Asian countries, IPR protection attracts FDI into countries with the informal economy smaller than the threshold value of the informal economy. On the other hand, for countries with large informal economies IPR protection has a positive effect only in the transportation industry in the global sample.

**Table 5: FDI Inflows from the US, by Industry (Threshold Panel Regression)**

	Full Sample				Asian Countries			
	Computer	Transportation	Chemicals	Computer	Food	Machinery	Metals	Trade
IFEC	-0.077 [0.064]	-0.120** [0.048]	-0.101 [0.100]	-0.423*** [0.054]	-0.008 [0.0041]	-0.0512 [0.0362]	-0.012 [0.010]	-0.095 [0.060]
GDPpc	0.002 [0.014]	-0.015 [0.031]	-0.092* [0.041]	-0.380*** [0.024]	-0.0042 [0.0038]	0.024*** [0.0026]	-0.013*** [0.001]	0.042* [0.017]
Pop	-0.815*** [0.235]	-0.128* [0.074]						
Open	-0.006 [0.006]	0.012 [0.013]	0.006 [0.007]		0.0004 [0.0003]			
Capital	0.004 [0.003]	0.004* [0.002]	-0.124 [0.270]	-1.410** [0.396]	-0.0805 [0.1311]	-0.1154 [0.1663]	-0.162*** [0.042]	2.014** [0.807]
Tax	0.002 [0.116]	0.175** [0.084]						
Tariff	0.008 [0.093]	0.102 [0.107]		-0.084 [0.050]		0.082*** [0.0205]		0.295 [0.175]
Inf	0.007 [0.006]	0.001 [0.007]						
IPR*D1	0.290* [0.164]	0.073 [0.142]	1.037*** [0.066]	1.897*** [0.164]	0.029*** [0.0067]	0.252*** [0.0200]	0.145*** [0.007]	0.400*** [0.067]
IPR*D2	0.028 [0.080]	-0.179* [0.104]	0.049 [0.056]	-0.078 [0.069]	-0.0001 [0.0062]	-0.0494 [0.0327]	-0.005 [0.011]	-0.192 [0.124]
Constant	3.888 [2.472]	2.237* [1.205]	1.098 [2.452]	13.52*** [1.711]	0.2629* [0.1149]	0.5278 [0.9351]	0.156 [0.315]	1.031 [1.489]
Sample size	255	237	45	44	46	42	33	40
Sample size_clust	44	44	7	7	7	7	7	7
F-test	4.159	6.457	1649.819	273000	244.274	35437.18	639.366	3E+06
P-value	0.001***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
R <sup>2</sup>	0.23	0.172	0.723	0.626	0.165	0.771	0.668	0.492
BIC	511.256	508.413	33.355	104.985	-154.408	-68.008	-91.123	48.939

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01; Standard error in brackets.

BIC = Bayesian Information Criterion, FDI = foreign direct investment, GDP = gross domestic product, IFEC = informal economy size, Inf = inflation, IPR = intellectual property right, US = United States.

Source: Author's calculations.

## V. CONCLUDING OBSERVATIONS

Stronger IPR protection in developing countries would enable developed countries, global technological leaders which account for much of global intellectual property, to capture more of the fruits of their R&D and other innovative activities. On the other hand, the benefits for developing countries are less clear cut. Since they tend to be importers of IP owned by developed countries, strengthening IPR protection often impose substantial costs. In countries with well-established and 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 plagued by excessive bureaucracy, corruption, and government predation, 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 is consistent with the predictions of the model. In particular, threshold panel regression results indicate that IPR protection

promotes FDI inflows in countries with informal economies smaller than a threshold value—as a share of GDP—but not in countries above the threshold value. The obvious policy implication is that strengthening IPR protection is more beneficial for institutionally stronger countries. This is intuitively plausible since in those countries domestic firms may own substantial IP. 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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## **Intellectual Property Rights, Quality of Institutions, and Foreign Direct Investment into Developing Asia**

Developing Asian countries are strengthening their intellectual property rights (IPR) regime as they themselves become producers of intellectual property. At the same time, developing Asia has attracted large amounts of foreign direct investment (FDI) and this trend is expected to continue in light of the region's strong growth prospects. This paper develops a theoretical model and examines the relationship between IPR and FDI in developing Asia. It finds that stronger IPR protection attracts more FDI in countries with small informal economies—i.e., strong institutions—but not in countries with large informal economies—i.e., weak institutions.

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