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The composition of foreign direct investment and protection of intellectual property rights: Evidence from transition economies

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Abstract

While existing literature examined the impact of intellectual property protection on the volume of foreign direct investment (FDI), little is known about its effect on the composition of FDI inflows. This paper addresses this question empirically using a unique firm-level data set from Eastern Europe and the former Soviet Union. It finds that weak protection deters foreign investors in technology-intensive sectors that rely heavily on intellectual property rights. Moreover, the results indicate that a weak intellectual property regime encourages investors to undertake projects focusing on distribution rather than local production.

JEL classification: F23; O34

Keywords: Foreign direct investment; Intellectual property rights; Transition economies; Firm-level data

1. Introduction

Protection of intellectual property rights (IPRs) has been a prominent item on international policy agenda. Despite the introduction of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs), many developing economies are not eager to strengthen their IPR legislation and its enforcement fearing that the losses resulting from this action would outweigh the benefits. This paper contributes to a better understanding of potential gains from a stronger IPR regime by providing empirical evidence indicating that the extent of IPR protection affects the composition of

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inflows of foreign direct investment (FDI). More specifically, this study finds that a weak IPR regime deters foreign investment in high technology sectors where intellectual property rights play an important role. It also shifts the focus of FDI projects from manufacturing to distribution.

The relationship between IPR protection and FDI is quite complex. On the one hand, a weak IPR regime increases the probability of imitation, which makes a host country a less attractive location for foreign investors. On the other hand, strong protection may shift the preference of multinational corporations from FDI towards licensing. As surveys of multinationals have shown, the importance of IPR protection varies between industries. The concern about the IPR regime also depends on the purpose of an investment project, being the highest in the case of R&D facilities and the lowest for projects focusing exclusively on sales and distribution (see Mansfield, 1994, 1995).

This paper investigates two hypotheses that emerge from the above studies. First, it tests whether foreign investors in IPR sensitive sectors (as indicated by Mansfield, 1995) are more affected by the extent of intellectual property protection in a host country than investors in general. Second, it examines if the IPR regime influences a foreign investor's choice between setting up production facilities and engaging in activities focused solely on distribution.

A unique firm-level data set used in this study allows for a more in depth examination of this phenomenon than was possible in the earlier literature which concentrated mostly on aggregate inflows and case studies. The data set was compiled from a worldwide survey of companies conducted by the European Bank for Reconstruction and Development (EBRD) in 1995. The survey recipients were asked whether they had undertaken FDI in twenty-four economies in Eastern Europe and the former Soviet Union and if so, what type of projects they were engaged in. These responses were supplemented with information on firm characteristics and host country specific variables.

This study employs two measures of IPR protection. The first one is the index capturing the strength of patent rights developed by Ginarte and Park (1997) and extended by the author to include more transition economies. While the Ginarte–Park measure is quite detailed, it focuses only on laws present in the books but not their enforcement. Therefore a second index, developed specifically for this study, more crude in nature but taking into account all IPR laws on the books as well as their enforcement is also used.

The empirical analysis confirms the hypotheses thus indicating that weak protection of intellectual property rights has a significant impact on the composition of FDI inflows. First, it deters foreign investors in four technology-intensive sectors: drugs, cosmetics and health care products; chemicals; machinery and equipment; and electrical equipment. These are the sectors in which, according to survey studies, IPRs play a particularly prominent role. Second, weak protection encourages foreign investors to set up distribution facilities rather than to engage in local production. Interestingly, this effect is significant in the case of all investors, not just those in sensitive industries. Finally, the results suggest that investors respond to both laws on the books and their enforcement. The above findings are robust to controls for privatization, transition progress, corruption level and effectiveness of the legal system.

In addition to an intrinsic interest in transition, a focus on Eastern Europe and the former Soviet Union can offer insights into the broader question of the role of FDI in economic development throughout the world. While investment in other developing regions has been studied extensively, one finding of that research has been the importance of previous investment experience as a determinant of current FDI flows (see Hallward-Driemeier, 1996). Thus, the impact of current policy variables may be obscured and overcome by a long history of past policies, for which it is difficult to control. Transition economies offer almost a natural control since FDI in the region was negligible prior to 1989. Therefore, the results of this paper suggest that the importance of IPR protection in developing countries may have been understated in past research.

This study is structured as follows. The next section briefly reviews the related literature and formulates the hypotheses to be tested. Section 3 describes the econometric specifications and the data set. In Section 4, empirical results are presented. Section 5 concludes the study.

2. Related literature and hypotheses to be tested

The connection between technological capabilities of a firm and its decision to undertake FDI is highlighted in Dunning's (1993) OLI paradigm, which explains activities of multinational corporations in terms of ownership (O), localization (L) and internalization advantages (I).[1] When selling its products abroad, a firm is at least initially disadvantaged relative to local producers. Thus, in order to compete effectively with indigenous firms, a foreign producer must possess some *ownership advantages.* They can take the form of a superior production technology or improved organizational and marketing systems, innovatory capacity, trademarks, reputation, or other assets. Ownership advantages assure a firm's ability to enter the host country's market, but do not explain why the foreign presence should be established through production rather than exports. This issue is, in turn, addressed by *localization advantages* that arise due to differences in factor quality, costs and endowments, international transport and communication costs, overcoming trade restrictions, and host government policies. The last advantage, *internalization*, explains why a foreign firm prefers to retain full control over the production process instead of licensing its intangible assets to local firms. This decision may be attributable to high transaction costs involved in regulating and enforcing licensing contracts.

Weak IPR protection increases the probability of imitation, which erodes a firm's ownership advantages and decreases localization advantages of a host country. At the same time, a weak IPR system increases the benefits of internalization, since it is associated with a greater risk of the licensee's breaching the contract and acting in direct competition with the seller. An inadequate IPR regime, therefore, deters FDI and encourages exporting. A strong IPR system may also have a negative impact on

[1] Other theories of FDI can be found in the surveys of Dunning (1993), Caves (1996) and Markusen (1995).

FDI by making licensing a viable alternative to direct investment.[2] Thus, the overall relationship between the level of IPR protection and FDI is ambiguous.

The results of empirical studies exploring the impact of IPR protection on FDI lead to mixed conclusions. Ferrantino (1993) finds no statistically significant relationship between the extent of U.S. affiliate sales in a foreign country and that country's membership in an international patent or copyright convention. Similarly, Maskus and Konan (1994) who employ the Rapp and Rozek (1990) index of IPR protection as well as Primo Braga and Fink (2000) who use the Ginarte and Park (1997) index do not obtain statistically significant results. Lee and Mansfield (1996), on the other hand, show that the strength of a country's IPR protection, as perceived by 100 U.S. firms surveyed, is positively correlated with the volume of U.S. FDI inflows into that country. Smith (2001) also finds a positive correlation between sales of U.S. affiliates and the strength of IPR protection in a host country. None of these studies, however, looks at the impact of the IPR regime on the composition of FDI inflows.

Intellectual property rights do not play an equally important role in all sectors or even in all technology-intensive industries. For instance, Mansfield (1995) mentions that IPR protection may be less crucial in sectors such as automobile production, in which firms frequently cannot make use of a competitor's technology without many complex and expensive inputs. On the other hand, the IPR regime is likely to be important for sectors such as drugs, cosmetics and health care products; chemicals; machinery and equipment; and electrical equipment.[3]

Additionally, a survey of U.S. manufacturing firms conducted by Mansfield (1994) revealed that the importance of IPR regimes for investment decision depends on the purpose of the investment project. For instance, in the case of investment in sales and distribution outlets, only about 20 percent of survey respondents were concerned about IPR protection. In the case of investment in rudimentary production (i.e., involving basic technologies) and assembly facilities, 30 percent of respondents viewed IPR protection as important. This percentage increased to 50–60 for investments in manufacturing components and complete products and to 80 when R&D facilities were involved.

Case studies from transition economies echo the concerns of foreign investors about weak IPR protection and are consistent with the survey findings. For instance, Sharp and Barz (1997, p. 110) mention that ICI (company producing synthetic organic chemicals) and Zeneca, a pharmaceutical company, "are wary of piracy and doubtful about transferring either product or process know-how to these countries [i.e., transition economies]. Both companies, however, recognize that eventually Central and Eastern Europe and the FSU [former Soviet Union] will be important markets. That is why Zeneca is investing in developing its distribution links in high value-added areas such as medical supplies and equipment and healthcare systems." A similar picture emerges from the case study of Shell:

[2] Indeed Yang and Maskus (2001) find that licensing is more likely to take place in countries with strong IPR protection. Oxley (1999) also shows that U.S. companies tend to choose contract-based alliances rather than equity joint ventures when they partner with firms based in countries with strong intellectual property protection.

[3] Baldwin (1996) also confirms that these sectors rely heavily on IPR protection.

> Shell provides know-how to its Russian partners where necessary, but does not pass on anything it regards as commercially sensitive. A relevant example is Shell's contract with the Russian R&D Institute for Element-Organic Compounds (INEOS) to produce a new construction plastic, called Noril. Shell will supply the chemical intermediates for production, while the technology will be Russian. There is no question of the Russians either supplying the intermediates or obtaining access to the more up-to-date technology used by General Electric for the manufacture of Noril in the United States (Sharp and Barz, 1997, pp. 107–108).

Such examples are obviously not restricted to Eastern Europe and the former Soviet Union. Lan and Young (1996, p. 73, footnote 9) present a case from China: "Local staff working in the laboratories of two foreign affiliates manufacturing detergents discovered the contents of production by repeatedly trying the combinations. They then moved out to set up their own firms. In only a few years, more than ten small local firms were manufacturing detergent."[4]

In the light of the theoretical prediction presented above as well as the conclusions emerging from interviews with foreign investors, the following testable hypotheses emerge. (1) FDI in sectors relying heavily on protection of intellectual property is likely to be deterred by a weak IPR regime. It is not clear, however, that this should be true for FDI inflows in general. (2) In countries with weak protection of intellectual property, investors may be more inclined to engage solely in distribution activities rather than in local production. These two hypotheses are tested in this study.

3. Econometric specification and data

3.1. Econometric specification

To test the first hypothesis, a probit model of the determinants of investment decision is estimated. The model is of the following form:

$$FDI_{ic} = \begin{cases} 1 & \text{if } FDI_{ic}^{*} > 0, \\ 0 & \text{otherwise,} \end{cases} \tag{1}$$

where

$$FDI_{ic}^{*} = d_i + X_c\beta_1 + d_{HT}X_c\beta_2 + u_{ic}.$$

The dependent variable takes on the value of one if firm i has invested in country c, and zero if a firm has not undertaken FDI in country c. Thus for each firm the number of observations is equal to the number of possible destination countries in the sample. To control for unobserved firm characteristics, firm specific dummy variables d_i are included. Additionally, country specific explanatory variables X_c are included in the

[4] Several Western law firms active in Eastern Europe (contacted by the author) confirmed that their clients, who were potential or actual foreign investors, expressed concerns about weak IPR protection in the region. Two firms represented foreign clients in patent infringement cases in transition economies.

model. Since the impact of IPR protection and possibly other variables is expected to differ between sectors, the model allows for a separate coefficient for high technology sectors in which IPRs play a more prominent role. It is achieved by interacting X_c with a dummy variable for these sectors. Following the survey findings of Mansfield (1995), the IPR sensitive sectors include: drugs, cosmetics and health care products; chemicals; machinery and equipment; and electrical equipment. The errors are corrected for a correlation between observations for the same destination country.

One way of testing the second hypothesis would be to estimate a probit model with the dependent variable representing the choice between manufacturing projects and those focusing solely on distribution. This, however, would imply that the decision to invest and the decision about the type of the investment project are taken separately, which may not be the case. To overcome this limitation, we estimate a system consisting of two parts: (i) decision whether or not to invest, and (ii) decision regarding the purpose of the investment project, conditional on investment taking place. To learn more about investor characteristics that influence investors' choices, we use firm specific variables rather firm dummies in the regressions. Note that anyway it would not be possible to employ firm fixed effects in the second part of the model as firms engaged in a single project or multiple projects of the same type would have to be dropped from the estimation.

As mentioned, the first part of the model describes the investor's decision to enter a particular host country c. As in the estimation above, we allow for a different impact of host country characteristics on firms in IPR-sensitive sectors.

$$FDI_{ic} = \begin{cases} 1 & \text{if } FDI_{ic}^{*} > 0, \\ 0 & \text{otherwise,} \end{cases} \tag{2}$$

where

$$FDI_{ic}^{*} = X_i\theta + X_c\beta_3 + d_{HT}X_c\beta_4 + \varepsilon_{ic}.$$

The second part describes the choice between setting up production facilities in country c (possibly accompanied by distribution networks) and engaging in a project focusing solely on distribution, conditional on FDI taking place. The dependent variable equals one in the case of manufacturing FDI. On the right-hand side, both firm (X_i) and host country (X_c) specific variables are included. Again the model allows for a different impact of the intellectual property regime on IPR sensitive sectors.

$$MANUFACTURING_{ic} = \begin{cases} 1 & \text{if } MANUFACTURING_{ic}^{*} > 0 \text{ and } FDI_{ic}^{*} > 0, \\ 0 & \text{if } MANUFACTURING_{ic}^{*} \leqslant 0 \text{ and } FDI_{ic}^{*} > 0, \end{cases} \tag{3}$$

where

$$MANUFACTURING_{ic}^{*} = X_i\delta + X_c\beta + \pi d_{HT}IPR_c + \upsilon_{ic}.$$

Assuming that (ε, v) are i.i.d normal variables with zero means and a correlation coefficient of ρ, we estimate these equations (probit with sample selection) simultaneously by maximum likelihood. The errors are corrected for a correlation between observations for the same destination country. The number of observations in the FDI decision equation is equal to the number of firms in the sample, multiplied by the number of destination countries in the sample. In the second decision equation, the number of observations is equal to the total number of FDI projects in the sample. The latter number is smaller than the former because not all firms invest in all countries.

3.2. Data

The empirical analysis employs a unique firm-level data set based on the EBRD Foreign Investment Survey. In January 1995, a brief questionnaire was sent to all companies listed in *Worldscope* (about 9500 firms). *Worldscope* is a commercial database that provides detailed financial statements and business descriptions for about 10,000 public companies located in more than 50 countries. Sending the questionnaire to all of them assured that all major public companies in the world would be included. Responses were obtained from 1405 firms that answered questions regarding their undertaken and planned investments in Eastern Europe and the former Soviet Union. Additionally, information on the function of the projects (manufacturing, distribution, representative office) was collected.[5] The data set does not include any information on the time when each investment was undertaken. Since the magnitude of FDI inflows was marginal before 1989, the information collected pertains mostly to the period 1989–1994.[6] Since the objective of this study is to explore the impact of government policies on the magnitude and nature of FDI inflows, firms in the oil, gas and coal sector, which are likely to be attracted to natural resource endowments, are excluded from the estimations.

[5] One hundred and seventeen of the survey respondents were chosen for in-depth interviews whose results are discussed in Lankes and Venables (1996).

[6] Eastern European countries and the former Soviet Union were virtually closed to foreign investment before 1989 (see Meyer, 1995; Dunning and Rojec, 1993; Hunya, 1997). The figures presented in the table below reflect this situation.

	No. of joint ventures on Jan 1, 1989
Hungary	270
Poland	55
Czechoslovakia	16
Bulgaria	25
Romania	5
USSR	291
TOTAL	662

Source: Dunning (1991).

3.3. Measures of IPR protection

The key variable in the regression is a proxy for the IPR regime. The indices of patent rights protection developed by Rapp and Rozek (1990) and Ginarte and Park (1997) are the two most popular measures employed in the literature. The former index, while widely used, is inadequate for the purpose of this paper since it covers only five countries from the data set and pertains to the pre-transition period. The Ginarte–Park measure, on the other hand, covers 10 transition economies and includes information for 1995.[7] In order to test the hypotheses using the full data set, the Ginarte–Park index was extended to cover nine more countries.[8]

The Ginarte–Park index takes into account five categories of patent laws: (1) extent of coverage, (2) membership in international patent agreements, (3) provisions for loss of protection, (4) enforcement mechanisms, and (5) duration of protection. Each of the categories is assigned a value between 0 and 1, and the unweighted sum of these values constitutes the patent rights index (see Ginarte and Park, 1997, for a detailed description). Thus, the index ranges from zero to five with the higher values indicating a stronger level of protection. The index refers to 1995 or the closest year for which the information was available. Table 1 lists the index values. The highest score in the group of countries under consideration was obtained by Hungary (3.75), while the lowest score of 2.52 belongs to Uzbekistan and former Yugoslav Republic of Macedonia. The average value of the index is 3.04. For comparison, the mean value of the index for 110 countries rated in 1995 was 2.67. A *positive* coefficient on the Ginarte–Park index will indicate that stronger patent laws are associated with a greater probability of FDI being undertaken. The advantages of the Ginarte–Park index are a great level of detail and taking into account the treatment of foreigners. Its main disadvantage is the fact that it focuses on the laws present on the books but it does not capture their enforcement.

Since the issue of enforcement may have a crucial impact on foreign investors' decisions, the paper also employs another index of IPR protection developed specifically for this study. This simple index captures both the legislative and the enforcement aspect of the IPR regime. It is based on the descriptions of IPR regimes provided by the International Intellectual Property Alliance in their recommendations for countries to be placed on the U.S. Special 301 Watch List. These descriptions include the issue of enforcement and pay special attention to trademark and copyright laws. Note that the actual placements on the Special 301 Watch List have not been used in developing the index, since they depend not only on the extent of IPR violations in a specific country but also on the importance of the country to the U.S. interests. Again 1995 is used as a reference point in the rating. The table below presents the rating criteria. A higher value of the index corresponds to stronger IPR protection, thus a positive coefficient on this variable is expected. Table 1 lists the values of the index. The correlation between the Ginarte–Park measure and this index is 0.57.

[7] The author would like to thank Walter Park for kindly sharing the updated version of the index.

[8] The sources used to extend the index include Garrison (various years), Baxter (various years) and websites of the State Intellectual Property Offices in Croatia and Latvia.

Table 1
Measures of IPR protection

	Ginarte–Park patent rights index	IPR index based on IIPA special 301 recommendations
Armenia		1
Azerbaijan		1
Belarus	3.19[a]	1
Bulgaria	2.57	2
Croatia	3.71[a]	
Czech Republic	3.19	3
Estonia	2.86[a]	2
FYR Macedonia	2.52[a]	
Georgia	3.00[a]	1
Hungary	3.75	3
Kazakhstan	3.19[a]	1
Kyrgyzstan		1
Latvia	2.88[a]	2
Lithuania	2.57	1
Moldova	3.00[a]	2
Poland	3.23	3
Romania	2.71	1
Russia	3.04	2
Slovak Republic	3.19	3
Slovenia	3.52[a]	
Tajikistan		1
Turkmenistan		2
Ukraine	3.04	2
Uzbekistan	2.52[a]	1
Average	3.04	1.71

[a]Denotes index values calculated by the author.

Index of intellectual property protection

Points	Description
3	Close to adequate IPR legislation present by the end of 1995; Some enforcement efforts undertaken
2	Close to adequate IPR legislation present by the end of 1995; No enforcement efforts undertaken
1	Lack of adequate IPR legislation at the end of 1995

Source: Constructed by the author based on IIPA Special 301 Recommendations.

3.4. Other control variables

The IPR regime may be correlated with other host country characteristics such as the overall progress in reform, effectiveness of the legal system, corruption level, privatization policies and openness to trade. Therefore, additional variables are included in the regression to control for these factors.

Multinational corporations are less likely to invest in risky and unstable countries, and the perceived riskiness of Eastern Europe and the former Soviet Union has often been cited as a factor discouraging foreign capital inflows.[9] Lankes and Venables (1996) find a negative association between EBRD transition indicators and country risk as perceived by the interviewed firms, with the rank correlation coefficient equal to −0.89. The transition indicators rate the progress of a country's reforms in the following areas: price liberalization and competition, trade and exchange system, large- and small-scale privatization, enterprise restructuring, and banking reform. See EBRD (1994, p. 11) for a detailed description. Thus, in the empirical analysis, the average of the EBRD indicators is used as a proxy for risks associated with undertaking FDI in a given host country. Since the higher values of the transition index indicate a greater progress in reform, one would expect to observe a positive coefficient on this variable.

Further, the effectiveness of the legal system is controlled for using another indicator produced by the EBRD (see EBRD, 1995, p. 103). This indicator, ranging from 1 to 4*, assesses the extent to which legal rules affecting investment are clear and accessible as well as adequately supported administratively and judicially. The value of one is assigned to countries where legal rules are usually very unclear and often contradictory, the availability of independent legal advice is limited, and the administration of the law is substantially deficient. The highest value (4*) is assigned to countries with clear and readily ascertainable laws, sophisticated legal advice available and well functioning courts. Note the maximum score achieved by the countries in the group is 4.

Moreover, a measure of the extent of corrupt practices in the country is added to the model. The measure is the 1999 Transparency International Corruption Perception Index which pools information from ten different surveys of business executives, risk analysts and the general public. The original index ranges between 10 (highly clean) and 0 (highly corrupt). To facilitate interpretation of the results, we re-scaled the index in the following way: re-scaled TI index = 10 − original TI index. Thus, a higher index value corresponds to a higher level of corruption and a negative coefficient is expected.[10]

Since privatization policies may influence the inflows of FDI, the model also contains the share of GDP accounted for by the private sector. The figures pertain to 1995 and come from the EBRD (1995). Additionally, a measure of openness to trade (the sum exports and imports as a percentage of GDP) is included in the model to control for tariff jumping FDI. The data refer to 1993 and come from the EBRD.[11]

The existing literature finds the host country's market size to be an important determinant of FDI inflows (see Dunning, 1993; Caves, 1996; Braunerhjelm and Svensson,

[9] See, for example, Zloch-Christy (1995), World Bank (1996), Estrin et al. (1997), and Hunya (1997).

[10] While the mismatch in timing between the index and the dataset is regrettable, it is not possible to use the ratings from earlier years since they cover very few transition economies. Employing an alternative measure of corruption based on 1994 interviews with German exporters (see Ades and Di Tella, 1997, for a description) leads to similar results (not reported in the paper).

[11] The openness measure could potentially be endogenous as FDI contributes to increased trade flows. Given, however, that we focus on the beginning of the transition process when the volume of FDI inflows was limited, the endogeneity problem is unlikely to affect our results.

1996). Most studies show that a large market size attracts FDI inflows. Therefore, the model includes GDP per capita which is a proxy for the purchasing power of local consumers and the population size which reflects the potential size of the market. Both variables come from EBRD (1994) and refer to 1993. They are entered in the logarithmic form. Finally, we control for the corporate tax rate as higher taxation is likely to discourage investment. The figures (expressed as percentages) come from PriceWaterhousePaineWebber. If several rates apply, the highest one was used. [12]

As explained above, it is necessary to include firm specific variables when testing the second hypothesis. Thus, standard variables found in most FDI studies are included in the model. These are firm size (measured by the firm's sales in US dollars, entered as logarithm), R&D intensity (measured by R&D outlays as a percentage of net sales), advertising intensity (proxied by selling, general & administrative expenses as a percentage of net sales; [13] and a proxy for production diversification (the number of four-digit SIC codes describing a firm's activities). All information on firm characteristics was obtained from the *Worldscope* database and pertains to fiscal year 1993 (from 4/93 to 3/94). Additionally, we control for investor's regional experience, proxied by a dummy variable indicating whether a firm had a trading relationship with the region before 1989. The last variable comes from the EBRD survey.

4. Empirical results

4.1. Impact of IPR protection on probability of FDI taking place

The empirical analysis confirms the first hypothesis of the study. The estimation results with the Ginarte–Park index are presented in Table 2.[14] In five out of six regressions, the extent of intellectual property protection affects the probability of investment in those high technology sectors that rely heavily on IPRs but not in other industries. The coefficients for the IPR sensitive sectors bear, as expected, positive signs and are significant at least at the five percent level. In the last regression both coefficients on the Ginarte–Park index are significant.

The other variables also have the anticipated signs. Population size is found to have a positive impact on FDI inflows in all industries. IPR sensitive sectors do not appear to be affected differently by this variable. GDP per capita is positively related to FDI inflows and in majority of cases, it does not affect the high technology sectors differently. As expected, progress in transition, greater effectiveness of the legal regulations governing investment and more advanced privatization process increase the probability

[12] Because of data constraints, we use statutory tax rates even though effective tax rates might be more appropriate. However, Wei's (1999) findings indicate that substituting the former tax rates with the latter has a negligible effect on the results.

[13] Note that this is a standard proxy in the literature and has been used, for instance, by Grubaugh (1987).

[14] Note that the number of observation is equal to the number of firms in the sample times the number of possible destination countries. Because of firm specific dummy variables, firms with no investment in the region drop out of the estimation. The sample is further reduced by the fact that the Ginarte–Park index covers only 19 countries.

Table 2
Probit results with Ginarte–Park index

Ginarte–Park index	0.30	0.25	−0.15	−0.25	0.32	**0.37***
	(0.40)	(0.34)	(0.41)	(0.25)	(0.21)	(**0.23**)
IPR sensitive×Ginarte–Park index	**0.40****	**0.42*****	**0.43****	**0.55*****	**0.56*****	**0.31***
	(**0.18**)	(**0.16**)	(**0.18**)	(**0.15**)	(**0.21**)	(**0.18**)
GDP per capita	0.00	−0.06	**0.55*****	**0.44*****	**0.23*****	0.15
	(0.17)	(0.14)	(**0.19**)	(**0.15**)	(**0.07**)	(0.09)
IPR sensitive×GDP per capita	0.12	0.10	0.05	0.01	0.01	**0.35*****
	(0.14)	(0.14)	(0.12)	(0.10)	(0.13)	(**0.13**)
Population	**0.52*****	**0.56*****	**0.58*****	**0.61*****	**0.43*****	**0.40*****
	(**0.05**)	(**0.07**)	(**0.09**)	(**0.06**)	(**0.05**)	(**0.05**)
IPR sensitive×Population	0.00	0.01	0.00	0.02	0.00	**0.12****
	(0.04)	(0.03)	(0.06)	(0.05)	(0.04)	(**0.05**)
Progress in reform	**1.08*****	**1.21*****				
	(**0.17**)	(**0.15**)				
IPR sensitive×Progress in reform	−0.15	−0.10				
	(0.19)	(0.19)				
Corporate tax rate		**−0.02***				
		(**0.01**)				
IPR sensitive×Corporate tax rate		−0.01				
		(0.01)				
Legal effectiveness			**0.29***			
			(**0.15**)			
IPR sensitive×Legal effectiveness			−0.03			
			(0.09)			
Corruption				**−0.40*****		
				(**0.08**)		
IPR sensitive×Corruption				−0.02		
				(0.05)		
Privatization					**0.04*****	**0.04*****
					(**0.00**)	(**0.00**)
IPR sensitive×Privatization					0.00	0.00
					(0.01)	(0.00)
Openness						−0.17
						(0.11)
IPR sensitive×Openness						**0.71*****
						(**0.16**)
No. obs.	6707	6707	6707	6354	6707	6707
χ^2	47.8	89.78	54.1	50.9	141.5	120.0
Prob $> \chi^2$	0.00	0.00	0.00	0.00	0.00	0.00
Pseudo-R^2	0.36	0.36	0.34	0.34	0.38	0.39
Log Likelihood	−1820	−1801	−1890	−1828	−1752	−1746

*** Denotes significant at 1% level, ** at 5%, * at 10%. Standard errors are in parentheses. The dependent variable is equal to one if firm i invested in country c, and zero otherwise. Firm dummies have been included in all regressions. 'IPR sensitive' denotes a dummy variable for IPR sensitive sectors.

of FDI in all sectors. Higher level of corruption and higher corporate tax rates, on the other hand, deters foreign investors. The coefficients on the interactions of these variables with a dummy for IPR sensitive sectors are not significant. The openness

measure has a significant impact only on the IPR sensitive sectors. A possible explanation is that firms in these sectors may be more reliant on imports as they tend to transfer only part of (rather than whole) production process to the region for fear of losing their intangible assets.

Table 3 presents the estimation results with the second IPR measure. Unlike the Ginarte–Park index of patent rights protection, this index captures both the legal and the enforcement aspect of an IPR regime. It is also broader in scope as it pertains to IPRs in general rather than just patents. As in the previous table, we find that stronger IPR protection increases the probability that multinationals in the four sensitive sectors will undertake FDI. In five out of six cases, the coefficients are significant at the five or one percent level. Additionally, in four regressions, the strength of the IPR regime affects all investors not just those in the sensitive sectors. The signs and significance levels of other control variables are similar to those found in Table 2.

The reason why all firms, not just those in IPR sensitive sectors, may be affected by the extent of intellectual property protection is that an IPR regime may also play a signaling role. As Lall (1997, p. 244) points out, "... the 'signaling value' of the intellectual property regime has become extremely important in recent years. In general, countries that seek to attract technology-intensive foreign investment also offer strong protection to those investments." As the results in Tables 2 and 3 suggest, signaling takes place only if the legislative changes are accompanied by enforcement efforts.

To further test the robustness of the findings, the following exercise was performed. An OLS regression was estimated with the dependent variables equal to the share of firms in the four sensitive sectors that undertook FDI in each of the countries in the sample.[15] The same explanatory variables as those in Tables 2 and 3 were included. The results are presented in Appendix Table 6. They suggest that the earlier findings are quite robust. In 10 out of 12 regressions, the IPR measure is significant and bears the expected sign. All regressions have a high explanatory power.

In summary, the empirical analysis indicates that the strength of patent laws as well as the overall level of IPR protection (both laws on the books and their enforcement) affect FDI inflows in several high technology sectors where, as surveys show, IPRs play an important role. Moreover, there is some evidence that the overall strength of the IPR regime and its enforcement influences the investment decision of multinationals active in other sectors as well.

4.2. Impact of IPR protection on the choice of project function

Table 4 presents the empirical results from the test of the second hypothesis. As mentioned above, the hypothesis was tested by looking jointly at two decisions: (1) whether or not FDI is taking place and (2) conditional on an FDI project being undertaken, whether it involves setting up production facilities or focuses solely on building distribution networks. The results of the investment decision with respect to host country characteristics are consistent with those found in the earlier section. One

[15] In other words, the dependent variable is equal to the number of firms in IPR sensitive sectors that invested in country c divided by the total number of firms in these sectors in the sample.

Table 3
Probit results with IPR index

IPR index	**0.25****	**0.27*****	0.16	**0.24****	0.12	**0.13***
	(**0.10**)	(**0.06**)	(0.16)	(**0.10**)	(0.08)	(**0.07**)
IPR sensitive×IPR index	**0.29*****	**0.33*****	**0.33*****	**0.25****	**0.30*****	0.03
	(**0.10**)	(**0.08**)	(**0.09**)	(**0.10**)	(**0.12**)	(0.12)
GDP per capita	**0.34*****	**0.28*****	**0.60*****	**0.46*****	**0.46*****	**0.43*****
	(**0.10**)	(**0.11**)	(**0.10**)	(**0.11**)	(**0.06**)	(**0.09**)
IPR sensitive×GDP per capita	0.03	0.01	0.01	−0.04	−0.01	**0.48****
	(0.11)	(0.09)	(0.11)	(0.11)	(0.10)	(**0.22**)
Population	**0.43*****	**0.45*****	**0.47*****	**0.48*****	**0.40*****	**0.40*****
	(**0.04**)	(**0.04**)	(**0.07**)	(**0.06**)	(**0.04**)	(**0.04**)
IPR sensitive×Population	0.03	0.04	0.01	0.07	0.04	**0.15*****
	(0.04)	(0.04)	(0.05)	(0.07)	(0.04)	(**0.06**)
Progress in reform	**0.60*****	**0.66*****				
	(**0.12**)	(**0.14**)				
IPR sensitive×Progress in reform	−0.14	−0.14				
	(0.13)	(0.14)				
Corporate tax rate		**−0.02*****				
		(**0.01**)				
IPR sensitive×Corporate tax rate		**−0.02*****				
		(**0.01**)				
Legal effectiveness			**0.27****			
			(**0.12**)			
IPR sensitive×Legal effectiveness			−0.10			
			(0.07)			
Corruption				**−0.31*****		
				(**0.08**)		
IPR sensitive×Corruption				−0.06		
				(0.10)		
Privatization					**0.03*****	**0.03*****
					(**0.00**)	(**0.00**)
IPR sensitive×Privatization					0.00	0.00
					(0.01)	(0.01)
Openness						−0.05
						(0.11)
IPR sensitive×Openness						**0.80*****
						(**0.24**)
No. obs.	7329	6631	7329	6631	7329	7329
χ^2	77.01	52.67	64.93	78.02	56.74	9800
Prob $> \chi^2$	0.00	0.00	0.00	0.00	0.00	0.00
Pseudo-R^2	0.43	0.42	0.42	0.42	0.44	0.44
Log-Likelihood	−1629.9	−1595.5	−1650.2	−1603.4	−1612.2	−1606.7

*** Denotes significant at 1% level, ** at 5%, * at 10%. Standard errors are in parentheses. The dependent variable is equal to one if firm i invested in country c, and zero otherwise. Firm dummies have been included in all regressions. 'IPR sensitive' denotes a dummy variable for IPR sensitive sectors.

interesting change is that the new model suggests that firms in IPR sensitive sectors are more strongly deterred by corruption in a host country than firms in other industries. This may be associated with investor's fear that in the case of legal disputes on, for

Table 4
Bivariate probit with sample selection. Manufacturing vs. distribution projects. Ginarte–Park index

Investment decision					
Ginarte–Park index	−0.26	−0.29	−0.29	0.21	0.08
	(0.19)	(0.19)	(0.19)	(0.24)	(0.12)
IPR sensitive×Ginarte–Park index	**0.22***	**0.33***	**0.33***	−0.08	0.04
	(**0.13**)	(**0.18**)	(**0.17**)	(0.16)	(0.19)
GDP per capita	**0.28*****	**0.29*****	**0.29*****	−0.04	0.02
	(**0.07**)	(**0.07**)	(**0.07**)	(0.10)	(0.05)
IPR sensitive×GDP per capita	−0.01	−0.07	−0.07	0.05	**0.16****
	(0.05)	(0.08)	(0.08)	(0.10)	(**0.08**)
Population	**0.34*****	**0.35*****	**0.34*****	**0.37*****	**0.31*****
	(**0.06**)	(**0.07**)	(**0.07**)	(**0.04**)	(**0.03**)
IPR sensitive×Population	0.11	0.11	0.11	−0.04	0.08
	(0.07)	(0.08)	(0.09)	(0.04)	(0.06)
Corruption	**−0.18****	**−0.17****	**−0.17***		**−0.08****
	(**0.07**)	(**0.08**)	(**0.09**)		(**0.04**)
IPR sensitive×Corruption	**−0.12*****	**−0.17*****	**−0.17*****		**−0.12*****
	(**0.04**)	(**0.06**)	(**0.06**)		(**0.04**)
Corporate tax		−0.00	−0.00	−0.01	
		(0.01)	(0.01)	(0.01)	
IPR sensitive×Corporate tax		0.02	0.01	0.00	
		(0.01)	(0.01)	(0.00)	
Progress in reform				**0.67*****	
				(**0.11**)	
IPR sensitive×Progress in reform				−0.06	
				(0.12)	
Privatization					**0.03*****
					(**0.00**)
IPR sensitive×Privatization					**−0.01*****
					(**0.00**)
Openness					0.03
					(0.08)
IPR sensitive×Openness					0.02
					(0.12)
Firm size	**0.17*****	**0.17*****	**0.17*****	**0.17*****	**0.17*****
	(**0.02**)	(**0.02**)	(**0.02**)	(**0.02**)	(**0.02**)
R&D intensity	**0.03*****	**0.03*****	**0.03*****	**0.03*****	**0.03*****
	(**0.01**)	(**0.01**)	(**0.01**)	(**0.01**)	(**0.01**)
Advertising intensity	**0.01*****	**0.01*****	**0.01*****	**0.01*****	**0.01*****
	(**0.00**)	(**0.00**)	(**0.00**)	(**0.00**)	(**0.00**)
Production diversification	**0.04****	**0.04****	**0.04****	**0.04****	**0.04****
	(**0.02**)	(**0.02**)	(**0.02**)	(**0.02**)	(**0.02**)
Regional experience	**0.95*****	**0.95*****	**0.95*****	**0.97*****	**0.98*****
	(**0.04**)	(**0.04**)	(**0.04**)	(**0.04**)	(**0.04**)
Constant	**−5.37*****	**−5.32*****	**−5.33*****	**−7.65*****	**−6.74*****
	(**0.71**)	(**0.69**)	(**0.75**)	(**0.61**)	(**0.50**)

Table 4 (*continued*)

Decision regarding project type (*Manufacturing vs. distribution*)					
Ginarte–Park index	**0.28***	**0.29***	**0.31****	**0.38****	**0.57*****
	(0.16)	**(0.17)**	**(0.16)**	**(0.18)**	**(0.14)**
IPR sensitive×Ginarte–Park	−0.05	−0.05	−0.05	−0.01	−0.04
index	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)
GDP per capita	**−0.26****	−0.25	−0.26	−0.16	**−0.22***
	(0.12)	(0.17)	(0.22)	(0.11)	**(0.13)**
Population	−0.06	−0.04	−0.05	**0.37*****	**0.19*****
	(0.12)	(0.17)	(0.21)	**(0.03)**	**(0.03)**
Corporate tax rate			0.00		
			(0.01)		
Progress in reform				**0.71*****	
				(0.12)	
Privatization					**0.02****
					(0.01)
Openness					−0.01
					(0.14)
Firm size	−0.07	−0.06	−0.06	**0.16*****	**0.08*****
	(0.07)	(0.09)	(0.11)	**(0.02)**	**(0.02)**
R&D intensity	**−0.08*****	**−0.08*****	**−0.08*****	**−0.04*****	**−0.09*****
	(0.02)	**(0.02)**	**(0.03)**	**(0.01)**	**(0.02)**
Advertising intensity	**−0.03*****	**−0.03*****	**−0.03*****	−0.00	**−0.03*****
	(0.01)	**(0.01)**	**(0.01)**	(0.00)	**(0.00)**
Production diversification	**−0.06*****	**−0.06*****	**−0.06*****	0.01	**−0.05***
	(0.02)	**(0.02)**	**(0.02)**	(0.02)	**(0.03)**
Regional experience	**−0.90*****	**−0.88*****	**−0.88*****	**0.60*****	**−0.36****
	(0.11)	**(0.17)**	**(0.18)**	**(0.12)**	**(0.17)**
Constant	**4.93***	4.57	4.69	**−7.19*****	−1.72
	(2.59)	(3.73)	(4.09)	**(0.63)**	(2.01)
ρ	−0.84	−0.80	−0.82	0.98	0.01
χ^2 (Wald test of $\rho = 0$)	2.05	1.07	0.72	5.93	0.00
Prob $> \chi^2$	0.15	0.30	0.40	0.01	0.95
No. of obs.	5459	5459	5459	5764	5459
No. of obs. (Eq. (1))	4959	4959	4959	5260	4959
No. of obs. (Eq. (2))	500	500	500	504	500

*** Denotes significant at 1% level, ** at 5%, * at 10%. Standard errors are in parentheses. The dependent variable is equal to one for manufacturing projects and zero for projects focusing solely on distribution.

instance, patent infringement higher level of corruption will lower the chances that the dispute will be adjudicated fairly.[16] The coefficients on firm characteristics also have the expected signs. Namely, the data suggest that larger firms and those with greater intangible assets, regional experience and more diversified production are more likely to undertake investment in the region.

[16] See Smarzynska and Wei (2000) for a discussion on the impact of corruption on the composition of FDI inflows.

The hypothesis of interest is supported by the data. As Table 4 indicates, foreign investors are more likely to engage in local production, as opposed to focusing solely on setting up distribution networks, in countries with stronger IPR regimes. The relevant coefficient (Ginarte–Park index) is statistically significant in all regressions. Interestingly, this effect is significant for all sectors and does not appear to be stronger in the case of IPR sensitive industries.[17] These findings are consistent with the survey evidence provided by Mansfield (1994) and the Zeneca case study cited above.

The data also indicate that manufacturing FDI is more likely to take place in countries with a larger population size, which may be explained by the economies of scale enjoyed in large markets. GDP per capita appears to be negatively correlated with the probability of local production. A possible explanation is that countries with higher GDP per capita tend to have higher labor costs which make local production less attractive. The probability of manufacturing FDI is positively affected by the transition progress. Since setting up a production plant is more costly than setting up a distribution network alone, it is not surprising the foreign investors choose the former option in countries that appear to be more stable due to an advanced reform process. Manufacturing projects are also more likely to take place in economies where the privatization process is more advanced as it brings opportunities for acquiring domestic production facilities. Corporate taxation and openness to trade do not appear to have a statistically significant impact.

Turning to investor characteristics, the findings indicate that firms possessing more intangible assets, as measured by R&D and advertising intensity, are less likely to undertake manufacturing projects. This may be due to the fact that the potential for knowledge dissipation is greater when the production takes place in a host country than when the final products are imported. Firm size appears to be, albeit not very robustly, positively correlated with the probability of a manufacturing project. To the extent that larger firms have more resources for investment, this finding would indicate that the choice between the two types of activities is affected by financial constraints. Finally, we find that manufacturing projects are more likely to be undertaken by firms without previous regional experience.[18]

Table 5 presents the results obtained using the other IPR index. While in this case, the support for the hypothesis is much weaker, other results are broadly comparable with those in Table 4.

As an additional robustness check, we estimated a multinomial logit model with the left hand side variable reflecting three options available to a potential investor: (i) no investment at all; (ii) investment solely in distribution networks; and (iii) investment in production facilities possibly accompanied by distribution networks. Appendix Table 7

[17] A possible explanation is that investors in IPR sensitive sectors may not be interested in setting up distribution networks unless they expect the host country environment to be conducive to undertaking local production in the future.

[18] While one would expect that less experienced firms shy away from manufacturing projects, it is possible that their investments take place through joint ventures and thus previous regional experience matters less as they can benefit from the knowledge of local partners (see Smarzynska, 2000).

Table 5
Bivariate probit with sample selection. Manufacturing vs. distribution projects. IPR index

Investment decision					
IPR index	**0.12***	**0.13****	0.13	0.10	−0.06
	(**0.07**)	(**0.06**)	(0.08)	(0.10)	(0.07)
IPR sensitive×IPR index	0.05	0.04	0.04	**0.14***	0.08
	(0.06)	(0.05)	(0.05)	(**0.07**)	(0.08)
GDP per capita	**0.30*****	**0.30*****	**0.30*****	**0.28*****	**0.35*****
	(**0.05**)	(**0.06**)	(**0.06**)	(**0.10**)	(**0.08**)
IPR sensitive×GDP per capita	0.04	0.04	0.04	−0.03	0.12***
	(0.03)	(0.03)	(0.03)	(0.05)	(0.04)
Population	**0.26*****	**0.26*****	**0.26*****	**0.29*****	**0.30*****
	(**0.03**)	(**0.04**)	(**0.04**)	(**0.04**)	(**0.03**)
IPR sensitive×Population	**0.13*****	**0.14*****	**0.14*****	−0.01	**0.14*****
	(**0.03**)	(**0.04**)	(**0.04**)	(0.04)	(**0.03**)
Corruption	**−0.11*****	**−0.11****	**−0.10****		**−0.06****
	(**0.04**)	(**0.04**)	(**0.04**)		(**0.03**)
IPR sensitive×Corruption	**−0.11*****	**−0.13*****	**−0.13*****		**−0.15*****
	(**0.02**)	(**0.05**)	(**0.04**)		(**0.03**)
Corporate tax		−0.00	−0.00	−0.01	
		(0.01)	(0.01)	(0.01)	
IPR sensitive×Corporate tax		0.01	0.01	0.00	
		(0.01)	(0.01)	(0.00)	
Progress in reform				**0.29***	
				(**0.16**)	
IPR sensitive×Progress in reform				−0.07	
				(0.13)	
Privatization					**0.02*****
					(**0.00**)
IPR sensitive×Privatization					**−0.01****
					(**0.00**)
Openness					**0.25*****
					(**0.08**)
IPR sensitive×Openness					0.08
					(0.06)
Firm size	**0.17*****	**0.17*****	**0.17*****	**0.18*****	**0.17*****
	(**0.02**)	(**0.02**)	(**0.02**)	(**0.02**)	(**0.02**)
R&D intensity	**0.03*****	**0.03*****	**0.03*****	**0.03*****	**0.03*****
	(**0.01**)	(**0.01**)	(**0.01**)	(**0.01**)	(**0.01**)
Advertising intensity	**0.01*****	**0.01*****	**0.01*****	**0.01*****	**0.01*****
	(**0.00**)	(**0.00**)	(**0.00**)	(**0.00**)	(**0.00**)
Production diversification	**0.04*****	**0.04*****	**0.04****	**0.04****	**0.04****
	(**0.01**)	(**0.02**)	(**0.02**)	(**0.02**)	(**0.02**)
Regional experience	**0.95*****	**0.95*****	**0.95*****	**0.97*****	**0.96*****
	(**0.04**)	(**0.04**)	(**0.04**)	(**0.04**)	(**0.04**)
Constant	**−6.84*****	**−6.80*****	**−6.80*****	**−8.29*****	**−8.41*****
	(**0.36**)	(**0.48**)	(**0.44**)	(**0.54**)	(**0.72**)

Table 5 (*continued*)

Decision regarding project type (*Manufacturing vs. distribution*)					
IPR index	−0.04	−0.04	−0.04	**0.19****	**0.11****
	(0.07)	(0.06)	(0.08)	(**0.10**)	(**0.05**)
IPR sensitive×IPR index	−0.03	−0.03	−0.03	−0.02	−0.03
	(0.02)	(0.02)	(0.03)	(0.04)	(0.03)
GDP per capita	**−0.42*****	**−0.41*****	**0.41*****	0.01	**−0.48*****
	(**0.08**)	(**0.07**)	(**0.08**)	(0.12)	(**0.09**)
Population	**0.13*****	**0.13*****	**0.13*****	**0.32*****	**0.16*****
	(**0.02**)	(**0.03**)	(**0.03**)	(**0.04**)	(**0.03**)
Corporate tax rate			−0.00		
			(0.00)		
Progress in reform				**0.41*****	
				(**0.13**)	
Privatization					**−0.01****
					(**0.00**)
Openness					**−0.27*****
					(**0.09**)
Firm size	**−0.12*****	**−0.12*****	**−0.12*****	**0.17*****	**−0.12*****
	(**0.02**)	(**0.02**)	(**0.02**)	(**0.02**)	(**0.02**)
R&D intensity	**−0.06*****	**−0.06*****	**−0.06*****	**−0.05*****	**−0.06*****
	(**0.01**)	(**0.00**)	(**0.01**)	(**0.01**)	(**0.01**)
Advertising intensity	**−0.02*****	**−0.02*****	**−0.02*****	−0.01	**−0.02*****
	(**0.00**)	(**0.0027**)	(**0.00**)	(0.00)	(**0.00**)
Production diversification	**−0.05*****	**−0.05*****	**0.05*****	0.01	**−0.05*****
	(**0.01**)	(**0.02**)	(**0.02**)	(0.02)	(**0.02**)
Regional experience	**−0.95*****	**−0.94*****	**−0.94*****	**0.53*****	**−0.93*****
	(**0.04**)	(**0.05**)	(**0.04**)	(**0.12**)	(**0.05**)
Constant	**7.98*****	**7.94*****	**7.94*****	**−6.62*****	**8.73*****
	(**0.48**)	(**0.37**)	(**0.39**)	(**0.79**)	(**0.81**)
ρ	−1.00	−1.00	−1.00	0.95	−0.98
χ^2 (Wald test of $\rho = 0$)	3.91	0.22	0.11	14.39	13.48
Prob > χ^2	0.05	0.64	0.74	0.00	0.00
No. of obs.	5766	5766	5766	5766	5766
No. of obs. (Eq. (1))	5292	5292	5292	5292	5292
No. of obs. (Eq. (2))	474	474	474	474	474

*** Denotes significant at 1% level, ** at 5%, * at 10%. Standard errors. are in parentheses. The dependent variable is equal to one for manufacturing projects and zero for projects focusing solely on distribution.

presents the results. Since the choice between manufacturing and non-manufacturing project is of interest to us, the results are presented relative to option (ii), that is, investment in distribution networks. As the first part of the table indicates, in seven out of eight cases, the coefficient on IPR protection is positive and statistically significant, indicating that stronger IPR regimes increase the likelihood of FDI in production facilities relative to distribution only projects. IPR protection, however, does not appear to have a statistically significant impact on the choice between investment in distribution networks and no investment at all.

Summing up, the empirical results indicate that weaker protection of intellectual property discourages foreign investors from undertaking local production and tilts their preferences towards projects focusing on distribution alone. This is the case for all investors, not just those in IPR sensitive sectors.

5. Conclusions

Governments all over the world compete fiercely to attract foreign direct investment hoping that multinational corporations will bring new technologies, management skills and marketing know-how. In order to create an investment friendly environment, it is important to understand the factors that influence FDI inflows as well as the determinants of the composition of such flows. This study sheds some light on this issue by examining the impact of IPR protection on the structure of FDI inflows.

Unlike the earlier literature, which focused on aggregate FDI flows, we employ a unique firm-level data set describing investment projects in Eastern Europe and the former Soviet Union. Since this region was virtually closed to FDI before 1989, its sudden opening to foreign investment can be compared to a natural experiment. Therefore, the data set used in this study presents a unique opportunity to estimate the effect of IPR protection on FDI in the absence of investment history. It is possible that in earlier studies, the lack of controls for past policy variables and investment history has obscured the impact of IPR protection on FDI.

Both hypotheses tested in the study find empirical support. First, the data indicate that investors in sectors relying heavily on protection of intellectual property are deterred by a weak IPR regime in a potential host country. There is also some evidence that weak IPR protection may discourage all investors, not just those in the sensitive sectors. Second, the lack of IPR protection deters investors from undertaking local production and encourages them to focus on distribution of imported products. Interestingly, this effect is present in all sectors, not only those relying heavily on IPR protection.

The results of this study suggest that more research is needed to improve our understanding of the implications of IPR regimes for the magnitude and composition of FDI inflows and their impact on developing countries. More specifically, it would be useful to study the characteristics of actual technologies transferred by multinationals to their subsidiaries to learn whether it is the case that newer technologies are more likely to be transferred to host countries with stronger IPR protection while only older technologies are used in subsidiaries located in economies with weak intellectual property regimes.

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Appendix A

Results of OLS regressions and multinational logit results are given in Tables 6 and 7

Table 6
Results of OLS regressions

Ginarte–Park index	**0.07***	**0.08****	0.03	0.04	**0.07****	**0.07****						
	(**0.03**)	(**0.03**)	(0.04)	(0.04)	(**0.03**)	(**0.03**)						
IPR index							**0.05*****	**0.04*****	**0.04****	**0.05*****	**0.04****	**0.04****
							(**0.02**)	(**0.01**)	(**0.02**)	(**0.02**)	(**0.02**)	(**0.02**)
GDP per capita	−0.01	−0.02	**0.04***	0.02	0.01	0.01	0.00	0.00	0.02	0.01	0.01	0.01
	(0.02)	(0.02)	(**0.02**)	(0.02)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
Population	**0.04*****	**0.05*****	**0.04*****	**0.05*****	**0.03*****	**0.03*****	**0.03*****	**0.04*****	**0.03*****	**0.03*****	**0.03*****	**0.03*****
	(**0.01**)	(**0.01**)	(**0.01**)	(**0.01**)	(**0.01**)	(**0.01**)	(**0.01**)	(**0.01**)	(**0.01**)	(**0.01**)	(**0.01**)	(**0.01**)
Progress in reform	**0.08****	**0.10*****					**0.03****	**0.05****				
	(**0.03**)	(**0.02**)					(**0.01**)	(**0.02**)				
Corporate tax rate		**−0.004****						**−0.004****				
		(**0.00**)						(**0.00**)				
Legal effectiveness			0.01						0.01			
			(0.02)						(0.01)			
Corruption				**−0.03****						−0.02		
				(**0.01**)						(0.01)		
Privatization					**0.003*****	**0.003*****					**0.001****	**0.001****
					(**0.00**)	(**0.00**)					(**0.00**)	(**0.00**)
Openness						0.00						0.00
						(0.02)						(0.02)
Constant	**−0.39*****	**−0.29*****	**−0.40*****	−0.06	**−0.41*****	**−0.42*****	**−0.20*****	−0.10	**−0.22*****	0.00	**−0.20*****	**−0.19*****
	(**0.09**)	(**0.08**)	(**0.12**)	(0.19)	(**0.07**)	(**0.10**)	(**0.06**)	(0.06)	(**0.06**)	(0.17)	(**0.06**)	(**0.09**)
No. obs.	19	19	19	18	19	19	21	19	21	19	21	21
F-statistic	12.86	18.11	7.31	9.85	19.87	14.81	22.05	26.27	16.46	16.49	21.87	16.42
Prob > F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R^2	0.79	0.87	0.68	0.75	0.85	0.85	0.85	0.91	0.80	0.81	0.85	0.85
Adjusted R^2	0.72	0.83	0.58	0.68	0.81	0.79	0.81	0.88	0.76	0.77	0.81	0.79

*** Denotes significant at 1% level, ** at 5%, * at 10%. Standard errors are presented in parentheses. The dependent variable is the share of firms in the four IPR-sensitive sectors with FDI projects.

Table 7
Multinomial logit results. Manufacturing vs. distribution projects vs. no FDI

FDI in manufacturing facilities relative to FDI in distribution networks								
Ginarte–Park index	**0.83*****	**0.84*****	**0.63****	**0.97*****				
	(**0.30**)	(**0.27**)	(**0.25**)	(**0.20**)				
IPR index					**0.40****	0.22	**0.31****	**0.44*****
					(**0.18**)	(0.22)	(**0.14**)	(**0.16**)
GDP per capita	**−0.64*****	**−0.73*****	**−0.74*****	**−0.57*****	**−0.41***	**−0.60****	**−0.79*****	**−0.62*****
	(**0.24**)	(**0.23**)	(**0.20**)	(**0.20**)	(**0.22**)	(**0.25**)	(**0.22**)	(**0.24**)
Population	**0.32*****	**0.41*****	**0.41*****	**0.19*****	**0.27*****	**0.40*****	**0.40*****	**0.17****
	(**0.07**)	(**0.07**)	(**0.05**)	(**0.07**)	(**0.09**)	(**0.09**)	(**0.07**)	(**0.08**)
Progress in reform	**0.96*****	**0.83*****	**0.99*****		0.30	**0.54****	**0.94*****	
	(**0.26**)	(**0.22**)	(**0.20**)		(0.24)	(**0.25**)	(**0.24**)	
Corruption		**−0.21****	**−0.15***			−0.21	−0.03	
		(**0.09**)	(**0.08**)			(0.16)	(0.14)	
Corporate tax			**−0.02***				**−0.04*****	
			(**0.01**)				(**0.01**)	
Privatization				**0.04*****				**0.02***
				(**0.01**)				(**0.01**)
Openness				−0.27				**−0.50****
				(0.17)				(**0.20**)
Firm size	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.02
	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)
R&D intensity	**−0.13*****	**−0.13*****	**−0.13*****	**−0.13*****	**−0.15*****	**−0.14*****	**−0.14*****	**−0.15*****
	(**0.03**)	(**0.03**)	(**0.03**)	(**0.03**)	(**0.04**)	(**0.04**)	(**0.04**)	(**0.04**)
Advertising intensity	**−0.03*****	**−0.03*****	**−0.03*****	**−0.03*****	**−0.03*****	**−0.03*****	**−0.03*****	**−0.03*****
	(**0.01**)	(**0.01**)	(**0.01**)	(**0.01**)	(**0.01**)	(**0.01**)	(**0.01**)	(**0.01**)
Production	−0.01	−0.01	−0.01	−0.01	−0.01	0.00	0.00	−0.01
diversification	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Regional experience	**−0.69*****	**−0.70*****	**−0.70*****	**−0.68*****	**−0.68*****	**−0.70*****	**−0.69*****	**−0.69*****
	(**0.14**)	(**0.14**)	(**0.14**)	(**0.14**)	(**0.14**)	(**0.14**)	(**0.14**)	(**0.14**)
Constant	−0.57	1.81	**2.30***	−0.33	1.48	3.83	**3.66***	**3.42****
	(1.27)	(1.84)	(1.39)	(1.44)	(1.27)	(2.33)	(**2.02**)	(1.69)
No FDI relative to FDI in distribution networks								
Ginarte–Park index	−0.08	0.14	0.18	0.01				
	(0.40)	(0.24)	(0.21)	(0.28)				
IPR index					−0.07	−0.10	−0.09	**0.31****
					(0.22)	(0.15)	(0.15)	(**0.13**)
GDP per capita	−0.22	−0.15	−0.15	**−0.49*****	**−0.65*****	**−0.64*****	**−0.66*****	**−1.14*****
	(0.17)	(0.19)	(0.18)	(**0.12**)	(**0.23**)	(**0.17**)	(**0.17**)	(**0.20**)
Population	**−0.53*****	**−0.58*****	**−0.58*****	**−0.50*****	**−0.46*****	**−0.48*****	**−0.48*****	**−0.56*****
	(**0.06**)	(**0.07**)	(**0.07**)	(**0.05**)	(**0.07**)	(**0.07**)	(**0.07**)	(**0.07**)
Progress in reform	**−0.80*****	**−0.65*****	**−0.70*****		**−0.52***	−0.10	−0.03	
	(**0.19**)	(**0.24**)	(**0.25**)		(**0.29**)	(0.26)	(0.31)	
Corruption		**0.25****	**0.22****			**0.24****	**0.28****	
		(**0.10**)	(**0.11**)			(**0.10**)	(**0.13**)	
Corporate tax			0.01				−0.01	
			(0.01)				(0.01)	
Privatization				**−0.03*****				**−0.03*****
				(**0.01**)				(**0.01**)
Openness				**−0.37****				**−0.88*****
				(**0.16**)				(**0.21**)
Firm size	**−0.35*****	**−0.35*****	**−0.35*****	**−0.35*****	**−0.37*****	**−0.37*****	**−0.37*****	**−0.37*****
	(**0.04**)	(**0.04**)	(**0.04**)	(**0.04**)	(**0.04**)	(**0.04**)	(**0.04**)	(**0.04**)
R&D	**−0.08*****	**−0.09*****	**−0.09*****	**−0.08*****	**−0.08*****	**−0.08*****	**−0.08*****	**−0.08*****
intensity	(**0.01**)	(**0.01**)	(**0.01**)	(**0.01**)	(**0.01**)	(**0.01**)	(**0.01**)	(**0.01**)
Advertising	**−0.04*****	**−0.04*****	**−0.04*****	**−0.04*****	**−0.04*****	**−0.04*****	**−0.04*****	**−0.04*****

Table 7 (*continued*)

intensity	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Production	−0.08**	−0.08**	−0.08**	−0.08**	−0.09**	−0.08**	−0.08**	−0.09**
diversification	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)
Regional	−2.25***	−2.26***	−2.27***	−2.26***	−2.25***	−2.25***	−2.25***	−2.25***
experience	(0.10)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)
Constant	15.80***	12.55***	12.58***	17.29***	18.11***	15.10***	14.97***	21.91***
	(0.97)	(1.38)	(1.42)	(0.78)	(1.30)	(1.10)	(1.05)	(1.69)
No. of obs.	5795	5490	5490	5795	6405	5795	5795	6405
Pseudo-R^2	0.26	0.27	0.27	0.27	0.30	0.29	0.29	0.31

*** Denotes significant at 1% level, ** at 5%, * at 10%. Standard errors are presented in parentheses. Errors have been corrected for a correlation between observations for the same destination country. The dependent variable reflects the following investment choices: (i) no FDI, (ii) FDI in distribution network, and (iii) FDI in production facilities.

References

Ades, A., Di Tella, R., 1997. National champions and corruption: Some unpleasant interventionist arithmetic. The Economic Journal 107, 1023–1042.

Baldwin, J., 1996. The use of intellectual property rights by Canadian manufacturing firms: Findings from the innovation survey. Mimeo., Statistics Canada.

Baxter, J.W., (Ed.), Various years. World Patent Law and Practice. M. Bender, New York.

Braunerhjelm, P., Svensson, R., 1996. Host country characteristics and agglomeration in foreign direct investment. Applied Economics 28, 833–840.

Caves, R.E., 1996. Multinational Enterprise and Economic Analysis. Cambridge University Press, Cambridge.

Dunning, J.H., 1991. The prospects for foreign direct investment in Eastern Europe. Discussion paper in international investment and business studies no. 155, University of Reading.

Dunning, J.H., 1993. Multinational Enterprises and the Global Economy. Addison-Wesley Publishing Company, Wokingham, England.

Dunning, J.H., Rojec, M., 1993. Foreign Privatization in Central & Eastern Europe. CEEPN, Ljubljana, Slovenia.

EBRD, 1994. Transition Report. European Bank for Reconstruction and Development, London.

EBRD, 1995. Transition Report. European Bank for Reconstruction and Development, London.

Estrin, S., Hughes, K., Todd, S., 1997. Foreign direct investment in Central and Eastern Europe: Multinationals in transition. Pinter/Royal Institute for International Affairs, London and Washington.

Ferrantino, M.J., 1993. The effect of intellectual property rights on international trade and investment. Weltwirtschaftliches Archiv 129, 300–331.

Garrison, D. (Ed.), Various years. Intellectual Property: Eastern Europe and Commonwealth of Independent States. Oceana Publications, Inc., New York.

Ginarte, J.C., Park, W.G., 1997. Determinants of patent rights: A cross-national study. Research Policy 26, 283–301.

Grubaugh, S.G., 1987. Determinants of direct foreign investment. Review of Economics and Statistics 69, 149–152.

Hallward-Driemeier, M., 1996. Understanding foreign direct investment by firms: Market pull, cost push and knowledge accumulation. Mimeo., Massachusetts Institute of Technology, Cambridge, MA.

Hunya, G., 1997. Large privatisation, restructuring and foreign direct investment. In: Zecchini, S. (Ed.), Lessons from the Economic Transition. Central and Eastern Europe in the 1990s. Kluwer Academic Publishers, Dordrecht, pp. 275–300.

International Intellectual Property Alliance. Various years. Special 301 recommendations.

Lall, S., 1997. Investment, technology and international competitiveness. In: Dunning, J.H., Hamdani, K.A. (Eds.), The New Globalism and Developing Countries. United Nations University Press, New York, pp. 232–259.

Lan, P., Young, S., 1996. Foreign direct investment and technology transfer: A case-study of foreign direct investment in north-east China. Transnational Corporations 5, 57–83.

Lankes, H.P., Venables, A.J., 1996. Foreign direct investment in economic transition: The changing pattern of investments. Economics of Transition 4, 331–347.

Lee, J.-Y., Mansfield, E., 1996. Intellectual property protection and U.S. foreign direct investment. Review of Economics and Statistics 78, 181–186.

Mansfield, E., 1994. Intellectual property protection, foreign direct investment and technology transfer. International Finance Corporation discussion paper no. 19.

Mansfield, E., 1995. Intellectual property protection, foreign direct investment and technology transfer. International Finance Corporation discussion paper no. 27.

Markusen, J.R., 1995. The boundaries of multinational enterprises and the theory of international trade. Journal of Economic Perspectives 9, 169–189.

Maskus, K., Konan, D., 1994. Trade-related intellectual property rights: Issues and exploratory results. In: Deardorff, A., Stern, R. (Eds.), Analytical and Negotiating Issues in the Global Trading System. University of Michigan Press, Ann Arbor, MI, pp. 401–446.

Meyer, K., 1995. Direct foreign investment in Eastern Europe. The role of labor costs. Comparative Economic Studies 37, 69–88.

Oxley, J.E., 1999. Institutional environment and the mechanisms of governance: The impact of intellectual property protection on the structure of inter-firm alliances. Journal of Economic Behavior and Organization 38, 283–309.

Primo Braga, C., Fink, C., 2000. International transactions in intellectual property and developing countries. International Journal of Technology Management 19, 35–56.

Rapp, R.T., Rozek, R.P., 1990. Benefits and costs of intellectual property protection in developing countries. Journal of World Trade 24, 75–102.

Sharp, M., Barz, M., 1997. Multinational companies and the transfer and diffusion of new technological capabilities in Central and Eastern Europe and the former Soviet Union. In: Dyker, D.A. (Ed.), The Technology of Transition. Science and Technology Policies for Transition Countries. Central European University Press, Budapest, pp. 95–125.

Smarzynska, B., 2000. Technology transfer and foreign investors' choice of entry mode. World Bank Policy Research working paper no. 2314.

Smarzynska, B., Wei, S.-J., 2000. Corruption and composition of foreign direct investment: Firm level evidence. National Bureau of Economic Research working paper no. 7969.

Smith, P.J., 2001. How do foreign patent rights affect U.S. exports, affiliate sales and licenses? Journal of International Economics 55, 411–439.

Wei, S.-J., 1999. Does corruption relieve the burden of taxes and capital controls for international investors? World Bank Policy Research working paper no. 2209.

World Bank, 1996. World Development Report: From Plan to Market. Oxford University Press, New York.

Yang, G., Maskus, K., 2001. Intellectual property rights and licensing: An econometric investigation. Weltwirtschafliches Archiv 137, 58–79.

Zloch-Christy, I., 1995. Economic transformation, external imbalances, and political risk in post-communist Eastern Europe. In: Zloch-Christy, I. (Ed.), Privatization and Foreign Investments in Eastern Europe. Praeger, Westport, CT, pp. 215–238.