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Intellectual Property Rights and Foreign Direct Investment: The Role of Industry and Host-Country Characteristics

by

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Abstract:

This paper aims at overcoming several shortcomings of previous empirical studies on the relationship between IPR protection and FDI. First, FDI is analyzed on a sectorally and regionally disaggregated level. Second, we address the proposition that stronger IPR protection raises not only the quantity, but also the quality of FDI. Third, we check to which extent the relationship between IPR protection and FDI is affected by applying alternative measures of IPR protection. Our empirical findings support the hypothesis that the threat of an unauthorized use of intellectual-property-related assets and, thus, FDI depends on industry as well as host-country characteristics. Furthermore, stronger IPR protection tends to induce high-quality FDI.

Key Words: **intellectual property rights, ownership advantages, imitative capacity, quantity and quality of FDI, industry characteristics, host-country characteristics**

JEL classification: F21, F23

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I. INTRODUCTION

An essential ingredient of economic globalization is that multinational enterprises are striving to make use of their intellectual-property-related assets beyond national borders. However, multinational enterprises are reluctant to engage in countries where an unauthorized use of such assets by outsiders is not prevented. It is, thus, not surprising that intellectual property rights (IPRs) became a major issue of multilateral negotiations during the Uruguay Round of the GATT. The conclusion of the Agreement on Trade-Related Intellectual Property Rights (TRIPS), representing one of the pillars of the WTO framework that emerged from the Uruguay Round, has "strongly rebalance[d] global policies in favour of information developers" (Maskus 1998: 205). The TRIPS Agreement contains a set of minimum standards for IPR protection and requires all member countries to apply the most-favored-nation principle to IPR protection.[1] Yet, IPR protection has remained far from harmonized across countries.

The attempt of policymakers to lure foreign direct investment (FDI) by all possible means may have contributed to the strengthening of IPR protection, especially since the early 1990s (Section II). Nevertheless, the question of

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1 For a detailed assessment of the TRIPS Agreement, see, e.g., Primo Braga (1996) and UNCTAD (1996).

whether IPR protection is an important determinant in the locational competition for FDI is still unsettled. Theoretical reasoning and empirical investigations point to an ambiguous relationship between IPR protection and the distribution of FDI across countries (Section III). In the present paper, we focus on overcoming two major shortcomings of previous empirical studies:

- We analyze the impact of IPR protection on FDI on a sectorally and regionally disaggregated level since the threat of an unauthorized use of intellectual-property-related assets can be expected to depend on industry as well as host-country characteristics. In doing so, we can address different hypotheses on the causes of the above mentioned ambiguity.

- Apart from the quantity of FDI, we consider alternative dependent variables, including the technology content of, and the value added, employment and exports created by FDI, in order to test the proposition that IPR protection raises not only the quantity but also the quality of FDI.

Furthermore, we apply different measures of IPR protection. Apart from the widely used index on IPR protection developed by Ginarte and Park (1997), we refer to survey results presented by the World Economic Forum (2002). This enables us to check the stability of our results and identify the strengths and weaknesses of different measures of IPR protection. The subsequent analysis is based on sectorally disaggregated data on FDI and FDI-related activities of US direct investors in a large number of host countries. The data and estimation

procedures are described in Section IV. Empirical results are presented in Section V. Section VI summarizes and offers some conclusions.

II. IPR PROTECTION: STYLIZED FACTS

The protection of IPRs involves various aspects, including patents, copyrights and trademarks. Measurement problems are endemic in the area of IPR protection.[2] This is partly because recent advances in technology resulted in innovative forms of creative activity (Maskus 1998: 190). Furthermore, while it may be relatively easy to classify relevant laws and regulations, i.e., IPR protection on the books, actual enforcement is almost impossible to judge objectively.

Nevertheless, substantial evidence exists on IPR protection in a large number of countries. This refers especially to patents. The right of a patent holder to exclude, for a specified time, other economic agents from making use of the protected product or process without authorization is considered by Maskus (1998: 189) to be the most important aspect of IPR protection. Ginarte and Park (1997) have constructed a widely used index of patent rights protection in more

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2 Maskus (2000: 15) notes that "it is difficult to capture the economic incentives afforded by a system of laws, regulations, and enforcement, such as IPRs, in a meaningful international index".

than 100 countries, covering the period 1960–1995.[3] The index comprises five categories of national patent laws: extent of coverage, membership in international patent agreements, provisions for loss of protection, enforcement mechanisms, and duration of protection. The summary index ranges from zero to five, with higher values indicating stronger levels of protection.

The Ginarte-Park index has clear advantages over earlier measures of IPR protection.[4] It covers more countries, a longer time span, and more elements of patent systems. At the same time, however, this data source has serious limitations. First, as mentioned before, patents represent just one aspect of IPR protection.[5] Second, it is open to question whether laws on the books are actually carried out.[6] Third, the effects of the TRIPS Agreement on the level and variation of IPR protection are captured at best partly in the most recent Ginarte-Park index values for 1995.

Therefore, we consider another measure of IPR protection by drawing on survey results of the World Economic Forum (2002). From this source, we obtain a

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3 We are most grateful to Walter G. Park, who provided us with the 1995-data on the Ginarte-Park index.

4 For details, see Ginarte and Park (1997: 284–291).

5 As argued by Rapp and Rozek (1990), however, the strength of patent laws across countries is highly correlated with the strength of trademark and copyright laws.

6 Note that the enforcement mechanisms, which constitute one of the five elements of the Ginarte-Park index, relate to statutory provisions, namely the availability of preliminary injunctions, contributory infringement pleadings and burden-of-proof reversals.

more recent assessment by survey respondents on whether IPR protection is "weak or nonexistent" (score 1) or "equal to the world's most stringent" (score 7).[7] This information is available for 75 countries, though not over time.[8] It can reasonably be assumed that survey respondents took enforcement problems into account when answering this question. Moreover, this survey item relates to IPR protection in general, and not specifically to patent rights. In other words, all three weaknesses of the Ginarte-Park index may be overcome by referring to the survey results of the World Economic Forum as an additional source of information.

The Ginarte-Park index reveals that the average level of IPR protection steadily increased for the overall sample throughout the period under consideration (Figure 1). The same is true for all subgroups of countries, except Latin America where the average level of IPR protection declined slightly until 1985. It was mainly in the early 1990s that IPR protection was strengthened, notably in Latin America. Given their low level of development, it may be surprising that African countries, on average, ranked second only to industrialized countries. This is mainly because patent laws – though possibly not patent law enforcement – in various former African colonies are similar to patent laws in

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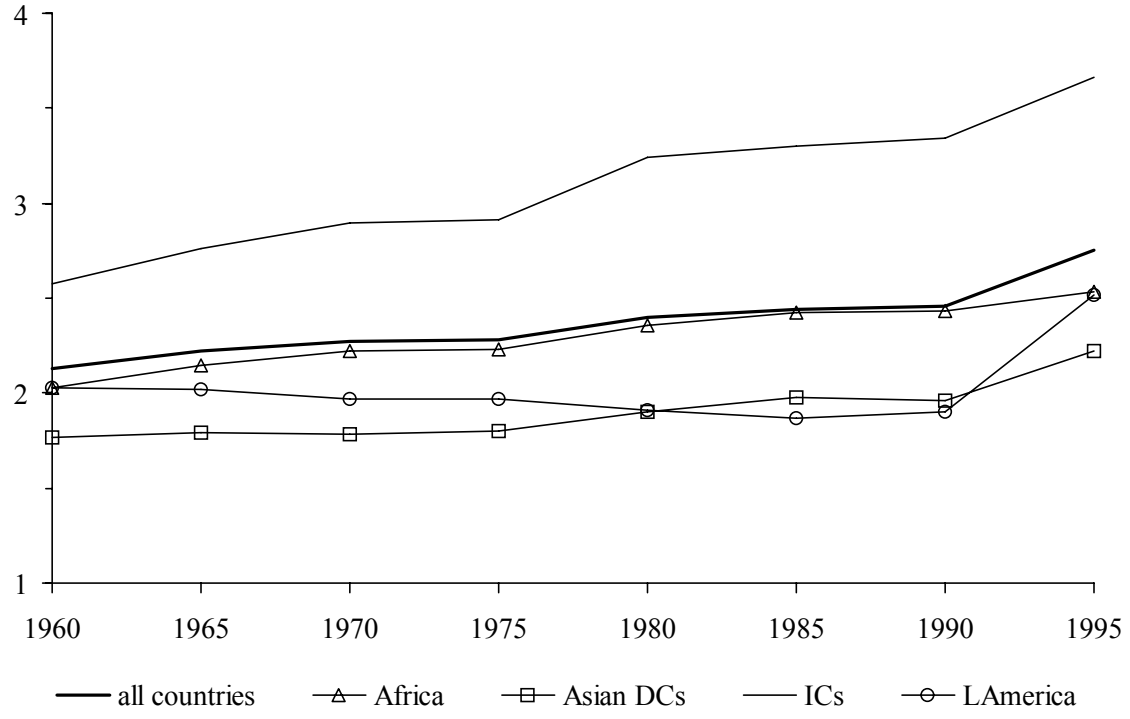
7 See indicator 6.03 in World Economic Forum (2002: 398).

8 Survey results on IPR protection are also presented by the European Round Table of Industrialists (2000). However, information from this source is restricted to 28 developing countries and is, therefore, not used here.

France and the United Kingdom (Ginarte and Park 1997: 291). However, the margin between IPR protection in Africa and IPR protection in developing countries in Asia and Latin America narrowed considerably at the end of the observation period.

Figure 1 — The Development of IPR Protection according to the Ginarte-Park Index[a], 1960–1995



[a]Range from zero (no protection) to five (strongest protection); unweighted averages; ICs = industrialized countries; Asian DCs = developing countries in Asia; LAmerica = Latin America.

Source: Ginarte and Park (1997); data for 1995 provided by Walter G. Park.

The relatively pronounced rise in the Ginarte-Park index since 1990 may be partly due to countries anticipating the provisions of the then pending TRIPS Agreement.[9] In various developing countries, however, stronger IPR protection appears to be part of the more general move towards relaxing FDI restrictions unilaterally, in order to encourage FDI inflows (Maskus 1998).[10]

The harmonization of minimum standards of IPR protection negotiated under TRIPS and unilateral measures of various developing countries also explain that the earlier trend towards an increased variation in IPR protection levels across countries was reversed in the 1990s. According to Ginarte and Park (1997: 291), the increased spread in patent rights protection until 1990 was because countries with traditionally high index values further strengthened protection, whereas countries with lower index values did not (or less so). By contrast, the increase in protection levels in 1990–1995 was most pronounced in Latin America and Asia, which had the lowest levels of protection in 1990. The coefficient of variation of the Ginarte-Park index, which had steadily risen for the overall sample from 0.33 in 1960 to 0.39 in 1990, dropped slightly below its 1960–level in 1995.

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9 After the conclusion of the Uruguay Round, and taking into account transition periods, developing countries were obliged to meet the detailed obligations of the TRIPS Agreement by the end of 1999 (least developed countries: by the end of 2005).

10 See also Nunnenkamp and Pant (2003: 3–4), who portray regulatory changes favoring FDI since the early 1990s on the basis of UNCTAD data.

The more recent survey results on IPR protection taken from the World Economic Forum (2002) reveal a similar degree of variation across countries. Both indices show the highest level of protection for the group of industrialized countries and a lower level of protection for Asia and Latin America than for Africa. Figure 2 portrays average IPR protection levels relative to the United States. This benchmark is chosen for two reasons: First, IPR protection in the United States is rated as particularly strong;[11] second, our subsequent analysis on the impact of IPR protection on FDI is performed for US-based multinational enterprises.

The differences between the two indices shown in Figure 2 for relative protection levels are partly to be attributed to differences in country coverage.[12] For some countries, however, deficiencies in actual enforcement of IPR protection on the books seem to account for particularly low scores in the survey by the World Economic Forum.[13] For the 70 countries covered in both sources,

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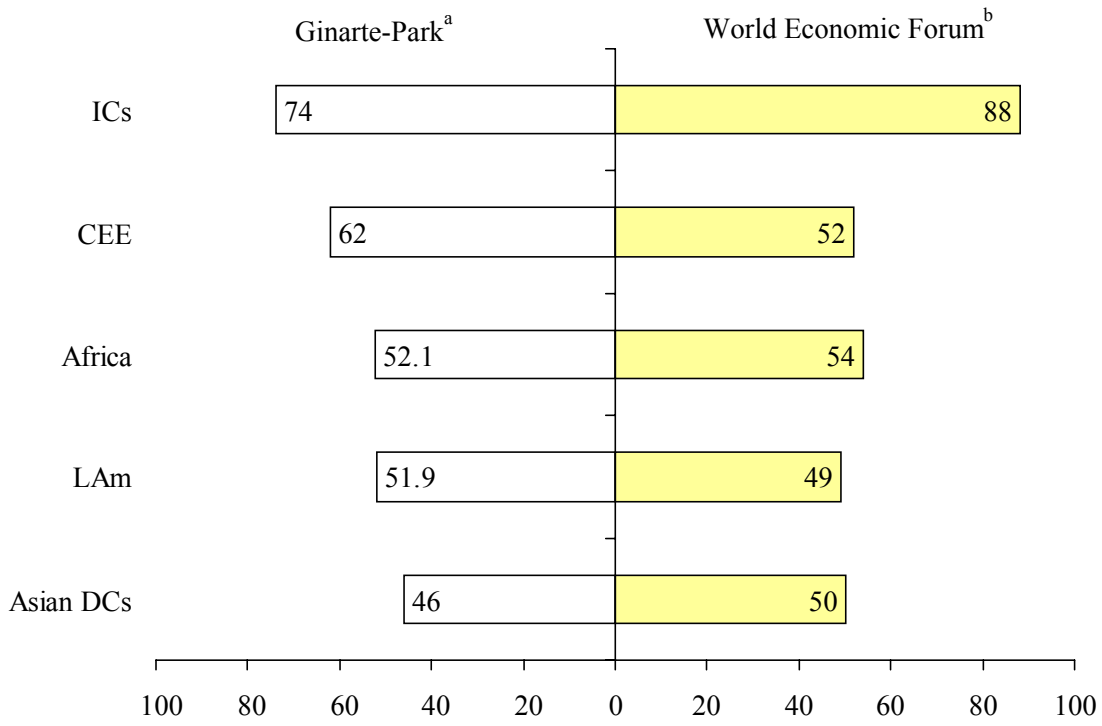
11 The United States had the highest value of the Ginarte-Park index in 1995 and ranked third only to France and Switzerland in World Economic Forum (2002: 398).

12 Most notably, the sample of the World Economic Forum comprises only five African countries, compared to 40 in the case of the Ginarte-Park index. According to the World Economic Forum (2002:398), IPR protection was above the mean of the overall sample in the Republic of South Africa and Egypt, close to the mean in Mauritius, and fairly weak in Zimbabwe and Nigeria.

13 For instance, Russia and Ukraine scored above the average for Central and Eastern Europe according to the Ginarte-Park index in 1995, while they ranked at the bottom of the World Economic Forum survey.

the Spearman rank correlation coefficient between the Ginarte-Park index in 1995 and the survey results of the World Economic Forum is 0.71.

Figure 2 — IPR Protection according to Different Indicators, relative to the United States (=100)



ICs = industrialized countries, excluding the United States; CEE = Central and Eastern Europe; LAm = Latin America; Asian DCs = developing countries in Asia.

[a]The Ginarte-Park index ranges from zero (no protection) to five (strongest protection); data for 1995; the index value for the United States is 4.86 (=100). – [b]Survey results ranging from one (protection is weak or nonexistent) to seven (protection is most stringent); the score for the United States is 6.5 (=100).

Source: World Economic Forum (2002: 398); data on GP index provided by Walter G. Park.

The latter result seems to support the reasoning of Ginarte and Park (1997: 291) that "the gap between the measured and actual levels of patent protection is not very wide."[14] Nevertheless, we consider it an advantage over previous empirical studies, which are reviewed in the subsequent section, to apply different measures of IPR protection in the empirical analysis of Section V. Apart from checking the sensitivity of our results to different measures, this allows us to perform estimations for the most recent past when FDI boomed in various countries.

III. IPR PROTECTION AND FDI: HYPOTHESES AND PREVIOUS FINDINGS

The empirical evidence on the relationship between IPR protection and host-country attractiveness for FDI is mixed. According to Lee and Mansfield (1996), FDI by US multinational enterprises was positively related to the strength of IPR protection in 14 developing host countries. This contrasts with Ferrantino (1993) as well as Maskus and Eby-Konan (1994) who do not obtain statistically significant results. Maskus (1998: 198) argues that the insignificant findings

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[14] Ginarte and Park (1997: 289-291) come to this conclusion by examining business complaints against national systems of patent protection. They find that the main complaints are not about the execution of patent laws, but about statutory and institutional deficiencies which are covered by their index. See also Park (2001: 13), who argues that "the correlation between statutory protection and actual enforcement, while not perfect, tends to be high. Countries that have strong laws on the books tend to be the ones that also actually carry out the laws."

may be due to the crude measures of IPR protection applied in the latter studies. In addition, however, the lack of consensus on this topic is, probably, due to the fact that previous empirical studies typically do not account for industry and host-country characteristics.

Multinational enterprises have several options to exploit their intellectual-property-related assets beyond national borders. Apart from FDI, international trade and cross-border licensing represent the most important internationalization strategies (Nunnenkamp et al. 1994: Sections III and V). The relationship between IPR protection and FDI is, thus, affected by substitution effects between FDI and other internationalization strategies. More specifically, an increase in IPR protection can have a negative impact on FDI if stronger IPR protection (a) encourages exports and/or licensing, and (b) makes FDI less attractive for multinational enterprises relative to one or both of the two alternative internationalization strategies.

The first condition seems highly likely to be fulfilled. Maskus and Penubarti (1995: 244) find that "exporting firms discriminate in their sales decisions across export markets, taking account of local patent laws". Licensing should also be sensitive to IPRs as stronger protection reduces the contracting costs in arm's-length licensing and allows for better monitoring and disciplining of licensees (Maskus 1998). Yang and Maskus (2001) support this proposition empirically by showing that royalties and license fees received by US companies rise with

stronger IPR protection in 23 partner countries once the Ginarte-Park index exceeds a critical level (which is the case for almost every country in their sample).

With respect to the second condition, theoretical reasoning based on Dunning's (1977; 1981) so-called OLI framework[15] suggests that the impact of IPR protection on the relative attractiveness of the three internationalization strategies depends on industry and host-country characteristics. Maskus (1998; 2000) posits that IPR protection is not a major driving force of FDI in services as well as in the manufacturing of fairly standardized, labor-intensive and low-technology goods. FDI in these sectors is supposed to depend primarily on market opportunities and input costs. By contrast, in industries with considerable intellectual-property-related ownership advantages, FDI is most likely to increase when IPR protection is strengthened because IPRs allow for the efficient exploitation of ownership advantages through internal organization structures (Maskus 2000: 7). The internalization motive for FDI is probably strongest if those industries produce goods and apply processes that – once they are invented – are easy to copy (Maskus 1998: 197).

Additionally, host-country characteristics are likely to shape the relationship between IPR protection and FDI. First, we argue that IPR protection plays only

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15 OLI stands for ownership, location, and internalization.

a minor role for host countries with large markets or abundant natural resources. For host countries which do not possess these characteristics, strong IPR protection may be a more important pull factor for FDI. Second, the sensitivity of FDI to IPR protection is influenced by host countries' capacity for local imitation. IPR protection may matter only in host countries with a certain level of development.[16] Once this threshold is reached, an increase in IPR protection, starting from a low level, should induce more FDI as licensing still does not offer a reasonable option. If a strong level of IPR protection is achieved, however, the replacement of FDI by licensing may become significant (Horstmann and Markusen 1997).

The relevance of host-country characteristics is supported by Maskus (1998; 2000). Regressing sales and assets of foreign affiliates of US parents, inter alia, on a patent variable, its coefficient is *negative* for the overall sample of 46 host countries, but significantly *positive* for the subsample of developing countries. In other words, US direct investors were attracted by stronger IPR protection in developing countries, whereas substitution effects between FDI and licensing appear to have dominated once the level of development exceeded a particular level. Smith (2001) uses sales of US affiliates as an FDI-related dependent variable and finds a positive effect of stronger patent rights, particularly in host

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16 However, frequent complaints about insufficient IPR protection in countries such as China suggest that the threat of local imitation is considerable even in developing countries with low per-capita income.

countries with better local capacity for imitation. The effects of patent rights on FDI are more pronounced than the effects on US exports, but less pronounced than the effects on licensing by US firms.[17]

Survey results presented by Mansfield (1995) as well as Lee and Mansfield (1996) suggest that the effects of IPR protection on FDI differed considerably across industries in 1991 (Figure 3).[18] The percentage of 94 major US firms which considered IPR protection too weak to either transfer most recent technology to wholly-owned subsidiaries in 14 developing host countries or to engage in joint ventures with local partners was highest in the chemical industry (including pharmaceuticals) and lowest in the metals industry. These differences are attributed to industry characteristics such as human capital intensity and R&D intensity, which will be discussed in detail in Section V below.

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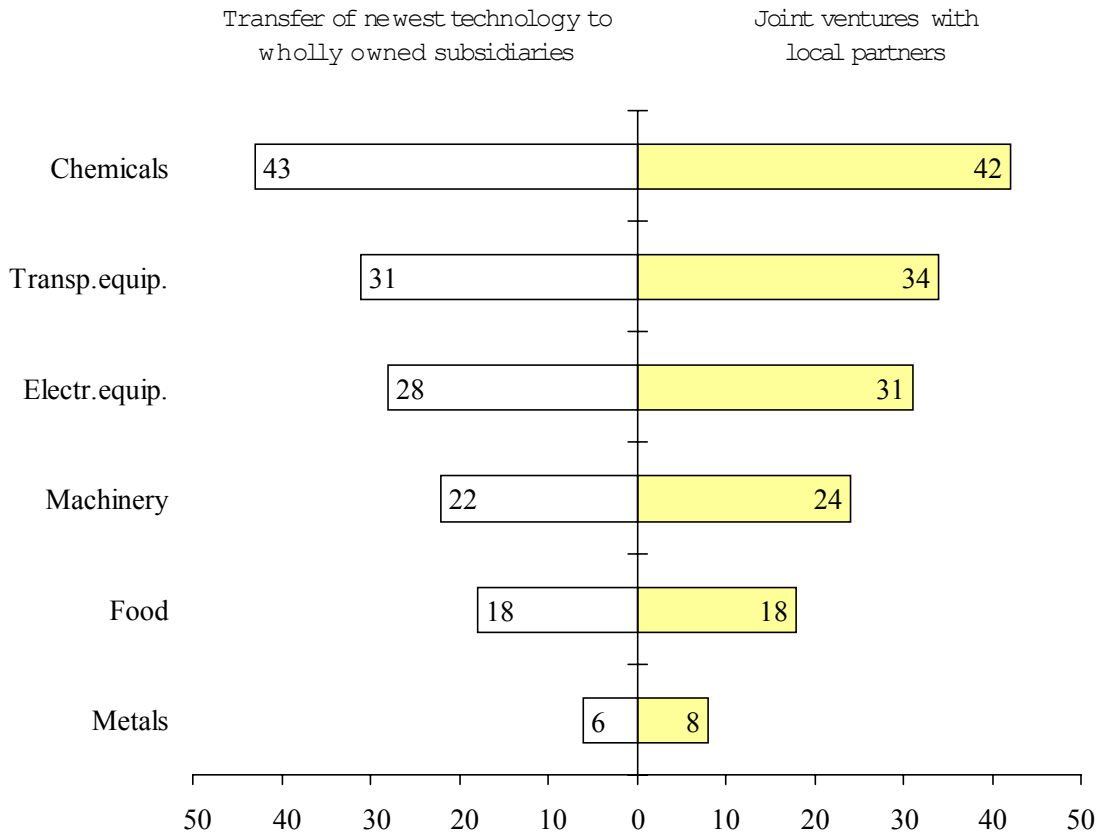
17 It is striking that the cross-section analysis is performed for the year 1989 in the recently published paper of Smith (2001). The reasons given in the paper are not convincing. For example, as noted in Section II above, information on IPR protection is available for 25 years, rather than "for only one year" (Smith 2001: 421). The cross-time variability of variables, considered to be minor by Smith, would increase considerably if more recent developments in IPR protection and booming FDI were taken into account. Furthermore, in contrast to the argumentation of Smith, there are good reasons to expect substantial cross-industry variability, which can be explored with publicly available sectorally disaggregated data.

18 In addition, the survey results of Mansfield (1995) as well as Lee and Mansfield (1996) support the view that IPR protection needs to be stronger for licensing than for FDI. Particularly in the chemical and machinery industries, the percentage of survey respondents stating that IPR protection is too weak to permit them to license their newest technology is significantly higher than the percentages reported in Figure 3. Likewise, Oxley (1999) shows that stronger IPR protection encourages US companies to prefer contract-based alliances over equity joint ventures.

Figure 3 — Weak IPR Protection as a Deterrent to FDI: Survey Results for 94 US Firms in Six Industries[a], 1991



[a]Percentage of US firms in the sample reporting that IPR protection is too weak to undertake the indicated activity; mean for 14 host countries (Argentina, Brazil, Chile, Hong Kong, India, Indonesia, Mexico, Nigeria, Philippines, Singapore, South Korea, Taiwan, Thailand and Venezuela).

Source: Lee and Mansfield (1996).

Despite these revealing survey findings, FDI is typically considered in aggregated terms in regression analyses on the determinants of FDI. We are aware of only two studies which, at least partly, allow for industry-specific effects of IPR protection on FDI. Primo Braga and Fink (2000) report results for

the sales of US affiliates in 42 countries and for German FDI stocks in 25 countries. Some of their estimates allow for industry-specific intercepts and industry-specific coefficients of IPR protection. The latter coefficients remain insignificant with the notable exception of the chemical industry in which, in contrast to the survey results of Lee and Mansfield (1996), stronger IPR protection had a *negative* effect on the sales of US affiliates. We presume that this is because host countries where strong IPR protection led to a substitution of licensing for FDI figure prominently in the sample (which is not specified). Note also that the results of Primo Braga and Fink (2000) refer to 1992 only, i.e., they fail to capture the recent boom of FDI. Furthermore, the sales of US affiliates are considered for just three industries (chemicals, machinery, and electrical equipment).

In contrast to Primo Braga and Fink (2000), Smarzynska (2002) finds that weak IPR protection deters foreign direct investors mainly in technology-intensive industries that rely heavily on IPRs. The following industries are subsumed under this category: drugs, cosmetics and health care products; chemicals; machinery and equipment; and electrical equipment. Rather than considering specific industries separately, Smarzynska (2002) interacts several explanatory variables, including IPR protection, with one dummy variable for all four technology-intensive industries. The study makes use of a firm-level data set based on the Foreign Investment Survey by the European Bank for

Reconstruction and Development (EBRD). While this source covers about 1400 investors from various source countries, the destination of FDI flows in 1989–1994 is restricted to host countries in Eastern Europe and the former Soviet Union. Hence, it remains open to question whether similar results apply to host countries in other regions.[19]

In summary, previous research provides some support to the hypothesis that the impact of IPR protection on FDI is context dependent. However, it remains true that "the need is acute for sectoral breakdowns of investment" (Maskus 2000: 15) in order to allow for a better understanding of the role of IPR protection. The data situation is much better than some authors argue and does permit an industry-specific analysis. Moreover, none of the aforementioned studies applies alternative measures of IPR protection, in order to check the appropriateness of the commonly used Ginarte-Park index. As shown in the subsequent sections, it is also possible to extend the analysis beyond the quantity of FDI and assess the effects of stronger IPR protection on the quality of FDI. The latter issue, though figuring high on the agenda of policymakers, particularly in developing countries (Nunnenkamp and Pant 2003), is hardly addressed in previous empirical studies.

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19 Note that various countries in Central Europe and the former Soviet Union were preparing for full membership in the EU and had, thus, to implement EU laws on IPR protection.

IV. APPROACH AND DATA

The empirical analysis mainly draws on the BEA (2003) online data base. It provides sectorally disaggregated data on US FDI stocks in 166 countries, as well as FDI flows and detailed supplementary information on FDI-related economic activities of US affiliates in 58 countries. From the latter data we take sales, value added, employment, total employee compensation, total exports, exports to and imports from the parent company, local R&D expenditure, and license fees paid to the parent company. The BEA (2003) data are supplemented by World Bank (2002) data on GDP per capita and population of the host country, by the average years of schooling taken from Barro and Lee (2000), and by the country risk indicator of Euromoney (var. iss.). To capture the degree of IPR protection we use the Ginarte-Park index and the World Economic Forum index.[20] Our sample is restricted to manufacturing, which is disaggregated into seven industries in 1995 and five industries in 2000.[21]

In the BEA (2003) data there are three variable values which deserve special attention: (a) zero observations, (b) * observations, which denote a value of less than one half of the respective reporting unit, and (c) D observations to avoid the

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20 The definitions and data sources of the variables are given in the Annex.

21 Food, chemicals, metals, machinery, electronic equipment (the last two subsectors are aggregated in 2000), transport equipment, and other manufacturing (not available in 2000).

disclosure of data of individual companies. To take account of the zero and * observations, we make use of tobit models censoring the distribution at one half of the respective reporting unit. D observations are excluded from the empirical analysis. The standard errors of the regression coefficients are corrected using White's (1980) heteroskedastic-consistent covariance matrix estimator.

The empirical analysis is carried out in several steps. In the base run, we simply include the degree of IPR protection into a list of more traditional FDI determinants and run censored regressions thereon. As dependent variables we use current FDI stocks and – to account for possible path dependencies and endogeneity problems – lagged FDI flows.

We then turn to non-linearities in the relationship between the degree of IPR protection and FDI. We start by analyzing how this relationship is shaped by host-country characteristics. To this end, we group our observations into geographic regions as well as according to host-country GDP per capita, population, average years of schooling, and country risk. For each selection criterion, we run a modified censored regression, where, in contrast to the base run, both the intercept and the coefficient of the IPR protection index are allowed to differ across the respective subgroups.

We proceed by assessing the role of industry characteristics. Similar to above, we estimate the industry-specific coefficients of the IPR protection index jointly

in one pooled censored regression over the entire sample. We then classify the industries according to five indicators – technology intensity, human capital intensity, labor intensity, export intensity and the degree of vertical integration – and link the outcome of this excercise to the industry-specific estimates on the sensitivity of FDI to IPR protection.

Finally, we address the issue of whether higher IPR protection helps attract not only a higher quantity but also a higher quality of FDI. With our data, we can consider five quality indicators: the technology content of FDI as captured by (a) local R&D expenditure and (b) license fees paid to the parent company, as well as (c) the value added, (d) the employment, and (e) the exports of the U.S. affiliates in the host country. Using each quality indicator as dependent variable, we run five regressions on the IPR protection index with FDI stocks as controlling variable.

V. EMPIRICAL RESULTS

The specification of the base run is fairly conventional. We regress either current FDI stocks or lagged cumulative 3-year FDI flows (both in logs) on host countries' log per-capita income (GDPPC), log population (POP), average years of schooling (SCHOOL), and country risk (RISK). To capture the degree of IPR protection, we add the Ginarte-Park index (GP) and, alternatively, the World Economic Forum index (WEF). All estimates also include a constant term and

regional and industry dummies that are not shown in the subsequent tables. The results of the base run are reported in Table 1. For GP, they refer to the year 1995, i.e., the most recent year for which the Ginarte-Park index is available, whereas the results for WEF refer to 2000 as comparable WEF data are not available for earlier years.

The control variables reveal the expected sign and are highly significant with few exceptions. In particular, the results support the conventional wisdom that FDI is attracted by large markets (POP) and high per-capita income (GDPPC) in the host countries.[22] FDI stocks, though not lagged FDI flows, are positively related to host countries' educational attainment. Higher country risk reduces the quantity of FDI in 1995, but not in 2000.[23]

Turning to the impact of IPR protection, the Ginarte-Park index (GP) turns out to be insignificant in equation (1) for FDI stocks in manufacturing in 1995. This result may be interpreted in different ways. First, it may be due to collinearity between IPR protection and per-capita income of host countries. A second interpretation is that equation (1) supports previous findings according to which non-traditional determinants of FDI continue to play a marginal role

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22 For a discussion on the persistent relevance of market-related determinants of FDI, see Nunnenkamp and Spatz (2002).

23 Note that higher values of RISK denote lower country risk; see Annex for details.

Table 1 — IPR Protection and FDI in Manufacturing[a]: Base-run Results

	Dependent variable:			
	(1)	(2)	(3)	(4)
	FDI stocks			FDI flows 1996-98
	1995		2000	
	full sample	reduced sample		
GDPPC	0.61 (0.04)	1.39 (0.00)	1.67 (0.00)	0.53 (0.21)
POP	1.44 (0.00)	1.55 (0.00)	1.68 (0.00)	0.89 (0.00)
SCHOOL	1.99 (0.00)	1.14 (0.06)	1.35 (0.08)	–0.32 (0.71)
RISK	0.08 (0.00)	0.04 (0.01)	-0.02 (0.38)	0.10 (0.00)
GP	0.23 (0.25)	0.01 (0.95)		–0.44 (0.26)
WEF			0.58 (0.06)	
Observations	545	356	249	188
Uncensored	278	262	191	151
Left-censored	267	94	58	37
LR chi²	743.3	479.9	309.8	170.6
Prob > chi²	0	0	0	0
Pseudo R²	0.35	0.29	0.26	0.20

[a] For detailed information on variables and data sources, see Annex; constant term as well as regional and sectoral dummies included, but not reported; p-value in parentheses.

Source: BEA (2003); WEF (2002); data on GP index provided by Walter G. Park.

(Nunnenkamp and Spatz 2002; Jost and Nunnenkamp 2003). Put differently, IPR protection may resemble other transaction-cost-related variables in that it does not provide additional explanatory power to market-related driving forces of FDI. Both interpretations are hardly compelling, however, as IPR protection turns out to be a relevant driving force of FDI stocks in manufacturing if WEF data are used instead of the Ginarte-Park index (equation (3)). Several factors may account for the striking difference between the results for GP and WEF:

- Sample selection may play a role as, due to data availability, the number of observations differs considerably between equations (1) and (3) in Table 1.
- IPR protection may have become more relevant in recent years.
- WEF may be superior to GP in measuring IPR protection.

We can check for the first two possible explanations and find them not convincing. If sample selection played an important role, the difference between WEF and GP for FDI stocks in manufacturing should fade when equation (1) is re-run for a reduced sample, including only those countries for which WEF data are available. However, GP is completely insignificant in equation (2).[24] If the

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24 Note that the number of observations still differs between equations (2) and (3). This is because the sector classification of FDI is not fully comparable in 1995 and 2000. Machinery and electrical equipment constitute a single sector in 2000, and other manufacturing is not available for this year.

impact of IPR protection on FDI was only a recent phenomenon, the effect of GP on cumulative FDI flows of 1996-1998 should turn out to be stronger than the effect of GP on path-dependent FDI stocks in 1995. This is not the case. If anything, equation (4) shows that the impact of GP becomes even weaker if lagged FDI flows replace FDI stocks as the dependent variable. Taken together, this invites the conclusion that WEF data provide a better indicator of IPR protection than the Ginarte-Park index. As discussed in Section II, this superiority may stem from that WEF covers more than patent laws on the books.

A major qualification of the results reported in Table 1, independently of whether IPR protection is measured by GP or WEF is that the impact of IPR protection on FDI may be blurred as long as host-country characteristics and industry-specific factors are ignored. Host-country characteristics are expected to be relevant in that they reflect (a) host countries' alternative pull factors for FDI, and (b) their capacity to imitate inventions and make unauthorised use of ownership advantages. At the same time, varying industry characteristics within the manufacturing sector are supposed to blur the impact of IPR protection as long as FDI is considered in aggregated terms. We refine our estimations in the following to explore these possibilities.

In order to identify differences related to host-country characteristics, we estimate the impact of the WEF index (Table 2) and the Ginarte-Park index

Table 2 — IPR Protection and FDI Stocks in Manufacturing:[a] Results for the Year 2000 According to Host-Country Characteristics

	(1)	(2)	(3)	(4)	(5)
GDPPC	1.49	1.48	1.67	1.53	1.55
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
POP	1.70	1.61	1.69	1.65	1.65
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
SCHOOL	1.67	0.85	1.26	2.24	1.08
	(0.04)	(0.26)	(0.12)	(0.02)	(0.16)
RISK	−0.01	0.01	−0.02	−0.02	0.00
	(0.64)	(0.66)	(0.47)	(0.43)	(0.92)
WEF-Europe	0.24				
	(0.47)				
WEF-South America	1.79				
	(0.00)				
WEF-Rest of America	0.35				
	(0.47)				
WEF-Africa/Middle East	−0.86				
	(0.24)				
WEF-Asia/Pacific	0.82				
	(0.07)				
WEF-GDPPC1		1.44			
		(0.00)			
WEF-GDPPC2		0.16			
		(0.63)			
WEF-POP1			0.77		
			(0.02)		
WEF-POP2			0.43		
			(0.19)		
WEF-SCHOOL1				1.00	
				(0.01)	
WEF-SCHOOL2				0.44	
				(0.15)	
WEF-RISK1					1.13
					(0.01)
WEF-RISK2					0.17
					(0.63)
Observations	249	249	249	249	249
Uncensored	191	191	191	191	191
Left-censored	58	58	58	58	58
LR chi²	323.9	321.2	312.0	319.1	315.7
Prob > chi²	0	0	0	0	0
Pseudo R^2	0.27	0.27	0.26	0.27	0.26

[a] For detailed information on variables and data sources, see Annex; constant term as well as regional and sectoral dummies included, but not reported; p-value in parentheses.

Source: BEA (2003); WEF (2002).

(Annex Table A1) on FDI stocks in the manufacturing sector for specific host-country subgroups. The sign and size of the controlling variables in Table 2 are similar to the base-run of equation (3) in Table 1. The result that SCHOOL remains insignificant in several equations is consistent with mixed empirical results of recent studies on the determinants of FDI.[25] It should also be noted that average years of schooling, used here and in other studies for lack of better data, reflect at best partly the human capital endowment of host countries.

We begin the disaggregated analysis by grouping the observations into five regions. The regional coefficients of IPR protection support the proposition that its impact on FDI differs across host countries. Important findings for WEF are:

- The coefficient of WEF is highest and most significant for South America which comprises only developing countries. This is consistent with Maskus (1998, 2000) who shows the impact of IPR protection to be stronger in developing countries than in developed countries.

- Asia/Pacific, which includes Japan and Australia, represents the second region where WEF reveals a positive impact on FDI stocks in

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25 Noorbakhsh et al. (2001) find that the availability of local skills has become a relevant pull factor of FDI in the process of globalisation. However, Nunnenkamp and Spatz (2002) show that schooling lacks additional explanatory power once per-capita income and population of host countries are controlled for. Jost and Nunnenkamp (2003), while supporting the findings of Noorbakhsh et al. (2001) for the most recent past, report insignificant results for schooling as a determinant of German FDI stocks in 1995.

manufacturing. This underscores the widely held view of a strong imitative capacity of many host countries in this region.

- The coefficient of WEF remains insignificant for all other regions. For Europe, it is hardly surprising that positive effects of stronger IPR protection on FDI appear to have been compensated by substitution effects, i.e., licensing replacing FDI.[26] To some extent, this may also apply to the rest of America, which includes Canada. More importantly, however, both WEF and GP are unlikely to account for important commonalities most countries in this region share in their relation with the United States. Apart from their geographical closeness to the United States, various preferential agreements on economic cooperation have been concluded by the United States with neighboring countries. For example, the NAFTA agreement with Canada and Mexico, two important hosts of FDI from the United States, contains, apart from its comprehensive treatment of investment issues, substantive provisions against infringements of IPRs and an elaborate dispute settlement mechanism (Nunnenkamp and Pant 2003: 10). In other words, US direct investors enjoy a higher degree of IPR protection than reflected in the indicators applied here.

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26 Note that average IPR protection in the European subsample is particularly high, but there is still considerable variation since this region includes countries such as Turkey and Greece with low values of the WEF index.

- Finally, a full information set of WEF and complementary data is available for only four countries in Africa/Middle East, including economically advanced Israel. By contrast, results for GP reported in equation (1) in the Annex Table A1 are dominated by low-income African countries. This explains the considerable difference between the coefficients of WEF and GP for this region.

In addition to the regional disaggregation, the overall sample is grouped into two equally sized subgroups according to four host-country characteristics in equations (2)-(5) of Table 2 and the Annex Table A1, namely the per-capita income of host countries (GDPPC), their size (POP), average years of schooling (SCHOOL) and country risk (RISK). Again the group-specific coefficients of WEF and GP are estimated jointly over the entire sample rather than separately over the respective subsample. For all host-country characteristics, suffix 1 denotes the subgroup with relatively low attractiveness for FDI (low per-capita income, small size, low schooling, high risk). The group-specific coefficients provide considerable support for the hypothesis that the impact of IPR protection on FDI depends on the characteristics of the host country. Moreover, the differences between the groups are always significant when IPR protection is measured by WEF. The observation that the differences are less pronounced in the case of GP may be taken as another indication of the superiority of WEF over GP.

The coefficients of WEF are high and significant for the less attractive subgroups and low and insignificant for the more attractive subgroups. This result corroborates the proposition that the impact of IPR protection on FDI matters more in host countries with weaker alternative pull factors for FDI. China represents the most compelling case for this line of reasoning. Foreign direct investors were eager to engage in this country even though they kept complaining about the lack of IPR protection.

We also find some evidence in favor of the hypothesis that host countries' capacity for local imitation plays a role in shaping the relationship between IPR protection and FDI. Taking SCHOOL as a proxy for the capacity of local imitation, we explored its interaction with IPR protection further by dividing the sample into three subgroups (Annex Table A2). For WEF we do not gain new insights compared to our previous specification. This can be attributed to the fact that the World Economic Forum index is not available for many developing countries with particularly low educational attainment. However, in line with our argumentation in Section III, the interaction with IPR protection is hump-shaped for the Ginarte-Park index. Its coefficient is positive but insignificant where average years of schooling and, thus, the threat of local imitation were lowest, significantly positive for the intermediate schooling group, and insignificantly negative for countries with the highest educational attainment where the replacement of FDI by licensing is most likely.

After having found ample evidence that host-country characteristics have an important say in the relationship between IPR protection and FDI, we now turn to the role of industry characteristics. We focus on factors that are supposed to reflect the significance of ownership advantages and, thus, the benefits imitators may derive, and accordingly, the costs foreign direct investors may suffer, from infringements of IPRs in the particular industry. Table 3 reports the results for the interaction of WEF and GP with dummies for specific manufacturing industries. Taking into account that the industry classification differs slightly between the years 1995 and 2000, the industry-specific coefficients of WEF and GP as alternative indicators of IPR protection reveal a high degree of conformity. This is hardly surprising as both indicators provide only an economy-wide assessment of IPR protection in the host country. If IPR protection differed between specific industries, both indicators would fail to capture such differences.[27] Hence, when it comes to industry characteristics, WEF is not necessarily superior to GP.

We find the strongest impact of IPR protection on FDI stocks in machinery and transport equipment. The estimate for 1995, in which electrical equipment can be separated from machinery, shows that IPR protection had also a positive,

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27 Mansfield (1995:13) argues that "a country's laws often affect different industries in quite different ways". Argentina, for example, denied patent protection for pharmaceutical products, whereas foreign direct investors regarded IPR protection in Argentina as relatively strong in the machinery and electrical equipment industries.

Table 3 — IPR Protection and FDI Stocks in Manufacturing:[a] Results for Specific Industries

	2000		1995
GDPPC	1.69 (0.00)	GDPPC	0.61 (0.04)
POP	1.67 (0.00)	POP	1.45 (0.00)
SCHOOL	1.38 (0.06)	SCHOOL	2.02 (0.00)
RISK	–0.02 (0.34)	RISK	0.08 (0.00)
WEF-Food	0.01 (0.98)	GP-Food	–0.18 (0.57)
WEF-Chemicals	0.37 (0.26)	GP-Chemicals	–0.16 (0.58)
WEF-Metals	0.45 (0.16)	GP-Metals	–0.16 (0.64)
WEF-Machinery[b]	0.96 (0.01)	GP-Machinery	1.05 (0.02)
		GP-Electrical equipment	0.61 (0.06)
WEF-Transport equipment	1.22 (0.00)	GP-Transport equipment	0.94 (0.07)
		GP-Other manufacturing	0.38 (0.29)
Observations	249	Observations	545
Uncensored	191	Uncensored	278
Left-censored	58	Left-censored	267
LR chi²	328.9	LR chi²	756.5
Prob > chi²	0	Prob > chi²	0
Pseudo R²	0.27	Pseudo R²	0.35

[a] For detailed information on variables and data sources, see Annex; constant term as well as regional and sectoral dummies included, but not reported; p-value in parentheses. – [b] Includes electrical equipment and computers.

Source: BEA (2003); WEF (2002); data on GP index provided by Walter G. Park.

though somewhat weaker, impact on FDI stocks in electrical equipment. By contrast, the coefficients of WEF and GP in all other industries remain insignificant. By and large, these results were to be expected once the industry characteristics listed in Table 4 are taken into account:

- The technology intensity as well as the human capital intensity are relatively high in machinery and transport equipment. This points to strong ownership-specific advantages in these industries, which means that the potential benefits of host countries and the costs of foreign direct investors resulting from IPR infringements are high.

- The opposite case applies to the food and metals industries, for which the technology intensity is clearly below the average for total manufacturing and the human capital intensity is moderate at best. The same holds for other manufacturing, which is only available for the year 1995.

Electrical equipment and the chemical industry deserve closer inspection. Ownership-specific advantages in electrical equipment are moderate when technology intensity is considered, and still weaker according to human capital intensity. Nonetheless, US direct investors appear to be concerned about insufficient IPR protection in this industry. This is, possibly, because electrical equipment stands out in two respects: The operations of US affiliates in the host countries are extremely employment intensive, and US affiliates are closely integrated in production sharing with their parent companies via intra-firm

trade.[28] While the latter characteristic may reveal insights into the global operations of US parents, the first characteristic may add to the threat of local imitation through dissemination of knowledge acquired by the employees working in US affiliates abroad.

Table 4 — Industry Characteristics: Selected Indicators[a]

	Technology intensity[b]	Human capital intensity[c]	Labor intensity[d]	Export intensity[e]	Vertical integration[f]
Food	6.5	28.3	15.6	20.7	3.9
Chemicals	13.9	42.5	11.1	32.4	10.2
Metals	3.1	33.4	17.6	26.4	11.7
Machinery	19.5	42.4	13.6	38.9	25.9
Electrical equipment	7.7	18.4	30.6	23.4	41.4
Transport equipment	8.7	36.9	15.7	25.8	45.2
Other manufacturing	5.3	31.9	12.2	26.9	13.4
Total manufacturing	9.8	32.5	15.1	28.8	23.1

[a] Based on data for US affiliates in all host countries in the year 1995 – [b] Sum of R&D expenses of US affiliates plus license fees paid to US parents in percent of value added. – [c] Wages and salaries per employee of US affiliates (US$ 1000). – [d] Number of employees of US affiliates per million US$ of value added. – [e] Export sales of US affiliates in percent of total sales. – [f] Sum of exports of US affiliates to, and imports from US parents in percent of sales of US affiliates. For detailed information on variables and data sources, see Annex.

Source: BEA (2003).

Foreign employment and vertical integration may also help explain why IPR protection does not appear to have affected FDI stocks in the chemical industry. In both regards, chemicals represent the opposite extreme to electrical equipment. Stand-alone operations of foreign subsidiaries of US chemical

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28 In both regards, electrical equipment reveals indicator values in Table 4 that are about twice as high as the average for total manufacturing.

producers and the relatively small number of workers employed in the host countries seem to have diminished the threat that ownership-specific advantages could be copied easily. However, there may be another reason why we have to reject the hypothesis advanced by Maskus (2000:4), who considers IPR protection to be highly relevant for foreign direct investors in the chemical industry, and, rather, support empirical findings by Primo Braga and Fink (2000). US FDI stocks in the chemical industry are strongly concentrated in industrialized host countries.[29] Taking into account that IPR protection is stronger in industrialized countries than in developing countries (Section II), a substitution of licensing for FDI seems more likely in chemicals than in other manufacturing industries.

In the final step of our analysis, we consider five quality indicators of FDI as independent variables.[30] We assume that FDI delivers higher benefits to host countries if foreign direct investors apply advanced technologies, as evidenced by (a) local R&D expenditure and (b) license fees paid to the parent companies, and create (c) value added, (d) employment and (e) exports. Table 5 reports the results of regressing these indicators on WEF, our preferred measure of IPR protection, controlling for FDI stocks as well as regional and industry

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29 In 2000, developing countries in Africa, Asia, Latin America and the Middle East hosted just 18 percent of US FDI stocks in the chemical industry. Their share in US FDI stocks in total manufacturing was considerably higher at 27 percent (BEA 2003).

30 All quality indicators are expressed in US$, except employment (number of employees).

affiliation.[31] In other words, the question is whether, given a certain FDI stock, host countries with strong IPR protection receive higher benefits from FDI than host countries with weak IPR protection.

For three out of five quality indicators, the coefficient of WEF is significantly positive. This suggests that host countries can not only attract more FDI, but also derive more benefits from FDI by strengthening IPR protection. Yet, policymakers seeking to attract high-quality FDI may be well advised not to read too much into the results of Table 5. Several qualifications have to be taken into account. While the effects of WEF on R&D expenditure of US affiliates appear to be particularly strong, this may be due to omitted variable problems, i.e., R&D expenses and WEF being driven by a third factor; both R&D expenses and IPR protection tend to increase with higher economic development of host countries. It fits into this picture that WEF does not have a significant impact on the second technology-related indicator, i.e., license fees paid by US affiliates to their parent companies. Omitted variable problems are less obvious in the case of exports. It cannot be ruled out, however, that WEF captures host-country characteristics that are more important in shaping the export orientation of US affiliates. For instance, open host countries, in terms of foreign trade policies,

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31 Again, the coefficients of the regional and industry dummies are not shown.

Table 5 — IPR Protection and Quality Indicators of FDI in Manufacturing:[a] Results for the Year 2000

	Dependent variable:				
	R&D expenses	License fees	Value added	Employ-ment	Exports
FDI stock	0.93 (0.00)	0.86 (0.00)	0.78 (0.00)	0.72 (0.00)	1.00 (0.00)
WEF	0.46 (0.00)	0.09 (0.44)	0.13 (0.10)	–0.25 (0.00)	0.42 (0.08)
Observations	159	171	173	187	102
Uncensored	107	127	172	186	88
Left-censored	52	44	1	1	14
LR chi^2	217.7	211.2	270.0	259.8	154.5
Prob > chi^2	0	0	0	0	0
Pseudo R^2	0.34	0.31	0.37	0.36	0.30

[a] For detailed information on variables and data sources, see Annex; constant term as well as regional and sectoral dummies included, but not reported; p-value in parentheses.

Source: BEA (2003); WEF (2002).

tend to protect IPRs more strongly than relatively closed host countries.[32] Most reasonably perhaps, IPR protection has a positive, though barely significant, effect on the value added of US affiliates in the host countries. Even this benefit may come at a cost, however, namely negative employment effects once FDI stocks are controlled for. Taken together, the results for value added and employment indicate that outsourcing by US companies to host countries with strong IPR protection is mainly in relatively sophisticated stages of the

[32] Note that industrialized countries, on average, have lower import barriers than many developing countries.

production process, which require relatively advanced complementary factors of production in the host countries (e.g., qualified labor and capital).

VI. SUMMARY AND CONCLUSIONS

This paper aims at overcoming several shortcomings of previous empirical studies on the relationship between IPR protection and FDI. First of all, FDI is analyzed on a sectorally and regionally disaggregated level since the threat of an unauthorized use of intellectual-property-related assets is expected to depend on industry as well as host-country characteristics. Second, we address the proposition that stronger IPR protection raises not only the quantity of FDI, but also the quality of FDI in terms of its technology content as well as the value added, employment and exports created by FDI. Third, we check to which extent the relationship between IPR protection and FDI is affected by applying alternative measures of IPR protection.

As concerns the measurement of IPR protection, we find that survey results presented by the World Economic Forum (2002) are superior to the widely used index developed by Ginarte and Park (1997), even though the latter measure covers more host countries and a longer time span. A major advantage of the WEF survey data is that this source allows us to assess the relevance of IPR protection in the most recent past, i.e., when FDI soared in many host countries.

The empirical findings underscore the need to consider FDI in disaggregated terms. Both, host-country characteristics and industry characteristics have an important say in the relationship between IPR protection and FDI stocks held by US companies in the manufacturing sector of developing and developed host countries. The impact of IPR protection differs significantly across regions. Host-country characteristics matter in that IPR protection has weaker effects in countries with strong market-related pull factors for FDI. We also find some evidence that FDI is significantly increased by stronger IPR protection only where local imitative capacity, proxied by schooling, can be regarded as moderate. The effects remain insignificant for countries with insufficient local capacity for imitation as well as for advanced countries in which particularly strong IPR protection induces a substitution of licensing for FDI.

Industry characteristics reflect the significance of ownership-specific advantages which, in turn, reveal the benefits host countries can derive, and the costs foreign direct investors suffer from infringements of IPRs. It fits into this reasoning that the impact of IPR protection turns out to be strongest in the human-capital and technology intensive machinery and transport equipment industries. By contrast, IPR protection does not play an important role in the food and metals industries, which are characterized by a particularly low technology intensity. In the chemical industry, stand-alone operations of US affiliates and the relatively small number of workers they employed in the host

countries tend to have diminished the threat that ownership-specific advantages could be copied easily.

Finally, we find that host countries can not only attract more FDI, but also derive more benefits from FDI by strengthening IPR protection. R&D expenditure by US affiliates as well as the value added and exports created by them tend to rise with stronger IPR protection. Several qualifications are warranted, however. For instance, the positive effect on value added comes at the cost of lower employment when FDI stocks are controlled for. In other words, relatively advanced complementary factors of production appear to be required in the host countries for them to attract higher-quality FDI.

All in all, our findings suggest that policymakers, who are increasingly eager to lure foreign direct investors, should not expect too much from strengthening IPR protection as a stimulus to more and higher-quality FDI. The effects on the quantity of FDI are likely to remain limited where market-related pull factors are the dominant motive for FDI. The same applies where the local capacity for imitation is lacking. Furthermore, in advanced host countries with strong IPR protection, FDI may increasingly be replaced by licensing. Several quality aspects of FDI, though positively correlated with stronger IPR protection, are likely to be driven in the first place by factors that could not be captured in the present analysis. The export orientation of FDI is a case in point: The openness

of host countries, in terms of their trade policy, seems to be more important by far than IPR protection in stimulating FDI-related exports.

Policymakers should also be aware that sufficient IPR protection may be taken for granted by foreign direct investors in the future. The trend towards a harmonization of IPR protection will, probably, continue due to unilateral measures and the implementation of multilateral obligations. As a consequence, host countries would no longer be able to distinguish themselves from other competitors for FDI by strengthening IPR protection. Similar to the liberalization of other regulatory and administrative measures of host countries with regard to the activities of foreign direct investors, the expected convergence of national IPR regimes will have as an effect that adequate IPR protection is a necessary condition for FDI, at least for host countrieslacking other strong pull factors, while strengthening IPR protection suffers from diminishing returns in inducing more and better FDI.

ANNEX:

DEFINITION OF VARIABLES AND DATA SOURCES

The subscript i refers to the industry and j to the host country. All monetary variables are in million current US $.

EMP_{ij}	Total number of employees of majority-owned non-bank US affiliates. BEA (2003).
FDI_{ij}	US direct investment position abroad on a historical-cost basis. BEA (2003).
$FLOW_{ij}$	Lagged cumulative 3-year US direct investment outflows. BEA (2003).
$GDPPC_j$	Gross domestic product per capita. World Bank (2002).
GP_j	Ginarte-Park index on IPR protection. Data provided by Walter G. Park. See also Ginarte and Park (1997).
HCI_{ij}	Average human capital intensity of majority-owned non-bank US affiliates, defined as $HCI_{ij} = \frac{WAGE_{ij}}{EMP_{ij}}$. BEA(2003).
LI_{ij}	Average labor intensity of majority-owned non-bank US affiliates, defined as $LI_{ij} = \frac{EMP_{ij}}{VALUE_{ij}}$. BEA(2003).
LIC_{ij}	Royalties and license fees paid by US affiliates to parent company. BEA (2003).
MP_{ij}	Total imports of majority-owned non-bank US affiliates from parent companies. BEA (2003).
POP_j	Population. World Bank (2002).
RES_{ij}	Expenditure for research and development of majority-owned non-bank US affiliates. BEA (2003).

$RISK_j$	Country risk indicator (0 = high risk, 100 = low risk). It is defined as the risk of non-payment of goods and services, of not servicing loans and other liabilities, and of obstacles to the repatriation of capital. Euromoney (var. iss.).
$SALES_{ij}$	Total sales of majority-owned non-bank US affiliates. BEA (2003).
$SCHOOL_j$	Average years of schooling of the total population aged 15 and above. Barro and Lee (2000).
$VALUE_{ij}$	Total value added of majority-owned non-bank US affiliates. BEA (2003).
$VERT_{ij}$	Degree of vertical integration of majority-owned non-bank US affiliates, defined as $VERT_{ij} = \frac{XP_{ij} + MP_{ij}}{SALES_{ij}}$. BEA(2003).
$WAGE_{ij}$	Total employee compensation of majority-owned non-bank US affiliates. BEA (2003).
WEF_j	World Economic Forum index on IPR protection. World Economic Forum (2002).
X_{ij}	Total exports of majority-owned non-bank US affiliates. BEA (2003).
XIN_{ij}	Average export intensity of majority-owned non-bank US affiliates, defined as $XIN_{ij} = \frac{X_{ij}}{SALES_{ij}}$. BEA (2003)
XP_{ij}	Total exports of majority-owned non-bank US affiliates to parent companies. BEA (2003).
Regional dummies	Europe, South America, rest of America, Africa & Middle East, and Asia & Pacific.
Industry dummies	Food, chemicals, metals, machinery, electronic equipment (the last two industries are aggregated in 2000), transport equipment, other manufacturing (not available in 2000).

Table A1 — IPR Protection and FDI Stocks in Manufacturing:[a] Results for the Year 1995 According to Host-Country Characteristics

	(1)	(2)	(3)	(4)	(5)
GDPPC	0.22 (0.52)	−0.02 (0.96)	0.62 (0.05)	0.62 (0.04)	0.58 (0.05)
POP	1.38 (0.00)	1.42 (0.00)	1.35 (0.00)	1.45 (0.00)	1.41 (0.00)
SCHOOL	2.42 (0.00)	1.73 (0.00)	1.89 (0.00)	1.72 (0.01)	1.91 (0.00)
RISK	0.10 (0.00)	0.09 (0.00)	0.08 (0.00)	0.08 (0.00)	0.06 (0.00)
GP-Europe	0.01 (0.97)				
GP-South America	3.32 (0.00)				
GP-Rest of America	−0.79 (0.02)				
GP-Africa/Middle East	1.33 (0.01)				
GP-Asia/Pacific	0.43 (0.14)				
GP-GDPPC1		0.52 (0.14)			
GP-GDPPC2		0.06 (0.82)			
GP-POP1			0.18 (0.48)		
GP-POP2			0.22 (0.41)		
GP-SCHOOL1				0.15 (0.64)	
GP-SCHOOL2				0.23 (0.36)	
GP-RISK1					0.13 (0.71)
GP-RISK2					0.44 (0.06)
Observations	545	545	545	545	545
Uncensored	278	278	278	278	278
Left-censored	267	267	267	267	267
LR chi²	765.8	774.0	744.3	743.9	748.8
Prob > chi²	0	0	0	0	0
Pseudo R²	0.36	0.36	0.35	0.35	0.35

[a] For detailed information on variables and data sources, see Annex above; constant term as well as regional and sectoral dummies included, but not reported; p-value in parentheses.

Source: BEA (2003); data on GP index provided by Walter G. Park.

Table A2 — IPR Protection and FDI Stocks in Manufacturing:[a] Refined Estimates with Schooling as a Host-Country Characteristic

	2000	1995
GDPPC	1.26 (0.00)	0.62 (0.05)
POP	1.62 (0.00)	1.52 (0.00)
SCHOOL	0.27 (0.82)	0.93 (0.16)
RISK	0.01 (0.73)	0.09 (0.00)
GP-SCHOOL1		0.17 (0.65)
GP-SCHOOL2		0.71 (0.02)
GP-SCHOOL3		-0.32 (0.30)
WEF-SCHOOL1	1.79 (0.00)	
WEF-SCHOOL2	0.34 (0.32)	
WEF-SCHOOL3	0.08 (0.81)	
Observations	249	545
Uncensored	191	278
Left-censored	58	267
LR chi²	324.9	763.9
Prob > chi²	0	0.00
Pseudo R²	0.27	0.36

[a] For detailed information on variables and data sources, see above; constant term as well as regional and sectoral dummies included, but not reported; p-value in parentheses.

Source: BEA (2003), WEF (2002); data on GP index provided by Walter G. Park.

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