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What do we know about the impact of intellectual property rights on the foreign direct investment location (country) choice? A review and research agenda

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Abstract. Despite a longstanding debate, at both a theoretical and empirical level, research on the relationship between foreign direct investment (FDI) and intellectual property rights (IPRs) remains scant and ambiguous. As a result, the link between IPR strength and multinational enterprises' (MNEs) propensity to invest is unproven and seemingly dependent on a number of factors. We critically review the theory and evidence of the influence of IPRs on FDI and MNEs' investment location (country) decisions both to 'take stock' of existing knowledge of this relationship and, by identifying gaps in, and shortcomings of prior work, develop a fruitful research agenda. We find that existing empirical work on the IPR-FDI nexus, though skewed in favour of a positive relationship between IPR protection and FDI, is fragmented, inconclusive and unable to square the conflicting theoretical predictions on how the strength of IPRs can affect MNEs' FDI location decisions. Several issues and challenges are highlighted to explain the difficulties of the collective body of past empirical work to provide a definite answer to the question of the impact of IPRs on FDI, from which valuable recommendations are proposed to guide future applied research.

Keywords. Foreign direct investment; Intellectual property rights; Multinational enterprises; Investment location choice; Critical literature review

1. Introduction

As a foreign market entry strategy at the heart of the process of globalisation, international business and economic integration, and a phenomenon widely recognised as a catalyst for economic development and growth, foreign direct investment (FDI) by multinational enterprises (MNEs) remains one of the most widely researched areas in the fields of international business and international economics.

FDI refers to a category of cross-border investment made by a resident in one economy (direct investor) to acquire a lasting management interest in an enterprise operating in a foreign economy. The 'lasting interest' is classified according to an ownership threshold of at least 10% of voting power (OECD, 2008). The mode of FDI entry in a foreign economy entails two decisions by MNEs: the investment mode and the ownership mode. The decision on the investment mode is the decision between establishing a new venture (Greenfield investment) and merging with or acquiring an existing firm (M&A), while the ownership mode decision relates to choosing to establish a wholly-owned affiliate or a joint venture (partially-owned affiliate).[1] These decisions, based on both firm-specific and country-specific characteristics, interact with the FDI location (country) choice.

Of the vast literature on FDI over past decades, a large amount has investigated its country determinants alongside the many motivations expected to influence MNEs' FDI location (country) choice. Yet, only a relatively small proportion of this literature has paid attention to the role of intellectual property rights (IPRs).[2] Suffice to say that the most recent and comprehensive survey on "The location choice of foreign direct investments" by Nielsen *et al.* (2017), essentially ignores the specific IPR-FDI link. This is striking given both the constant expansion of cross-border transactions involving knowledge-intensive products and IP-related assets, and the proliferation in recent years of international, regional and bilateral agreements on minimum standards of IPR protection[3] along with national reforms aimed at strengthening IPR regimes to increase FDI attraction, particularly in developing and emerging economies.

Equally striking is that despite a recent surge of interest in the role that IPRs play in technology flows from advanced to developing countries (Dhar and Joseph, 2012), with the sole exception of the excellent, early reviews by Braga and Fink (1998) and Maskus (2000), and Park's (2011) insightful book chapter discussion of related literature in the context of the Dominican Republic–Central American Free Trade Agreement region, no study has provided an up-to-date, comprehensive critical review of what is known, and what is still unclear about the IPR-FDI nexus.

Our aim is to fill this important gap and, in so doing, identify profitable avenues for further empirical investigation to advance our understanding of this complex and still ambiguous relationship. Our review covers both theory and evidence of the debate over the impact of IPRs on FDI. The period considered spans nearly half a century, taking as our point of departure Dunning's (1976, 1977, 1979a, 1979b) development of the ownership (O),

location (L), and internalisation (I) advantages 'OLI' paradigm; a framework identifying country-, industry- and firm-level structural characteristics determining FDI, used by many subsequent studies to explore the IPR-FDI relationship.

Our review shows that past empirical work, though skewed in favour of a positive relationship between IPR protection and FDI, is fragmented, inconclusive and far from being able to resolve the conflicting theoretical predictions stemming from the many different channels hypothesised on how the strength of IPRs can affect MNEs' FDI location decisions. Several issues and challenges are highlighted to explain the difficulties of the collective body of past empirical work to provide a definite answer to the question of the impact of IPRs on FDI, from which valuable recommendations for empirical analysis are proposed.

The rest of the paper is structured as follows. Section 2 describes the search methodology. Section 3 gives a critical synthesis of the theoretical channels postulating a link between IPRs and FDI. Section 4 surveys the empirical literature covering both econometric studies and prominent qualitative or mixed-methods studies that draw evidence from surveys of foreign investors. Section 5 concludes by discussing the gaps in, and shortcomings of prior work from which a fruitful research agenda is developed.

2. Methodology

This section discusses the approach used to *search for*, and *select* relevant literature. We should be clear from the outset that we did not set out to conduct a quantitative 'meta-analysis' but rather an up-to-date, systematic, critical review of the most influential studies on the subject, as a much needed opportunity to 'take stock' and evaluate what is of value from previous work on the relationship between IPRs and FDI. Accordingly, in our first *search stage*, we did not focus on a limited set of journals but rather strived to be as comprehensive as possible in our initial identification of relevant studies. With this aim in mind, we searched for pertinent contributions published in a variety of management, international business, economics, and law peer-reviewed journals, books and chapters, reports and working papers of note that are already in the public domain via institutional archives or databases widely considered repositories of valid knowledge. However, we did exclude editorials and commentaries, interviews, dissertation abstracts and conference proceedings.

To begin our search – beyond a substantial set of publications already in our knowledge domain - an initial list of keywords was developed as part of discussions within the research team. We explored electronic databases and archives with a variety of such search terms, their abbreviations and various combinations. This initial search generated over

six hundred hits. Because formal search techniques entering index terms in electronic databases may miss relevant essential studies, we also consulted the few review articles already published and, more generally, utilised the (backward) snowball technique by searching the bibliographies of all the useful papers already retrieved to identify additional work of relevance. The *EBSCO* host (Business Source Premier) was the main database used for the literature search. Journals not available on EBSCO were searched manually via Scopus, ScienceDirect, EconPapers open RePEc, and ResearchGate.

The hundreds of references collected in this first *search stage* were considerably reduced in the subsequent *selection stage*, as two members of the research team independently reviewed the publications retrieved and then cross-checked and discussed further selections following exclusion and inclusion criteria, mainly based upon direct relevance, quality, rigour, originality and *influence*. During this *selection stage* our prioritisation of high-quality papers was aided by the use of the *ISI Web of Knowledge* database, which includes all journals in the *Social Science Citation Index*, and the *SCImago* journal rank database to cross-check source reliability and establish whether such outlets were to be deemed worthy of inclusion, thus excluding obscure journals or those with a very low rank indicator or five-year impact factor. The *quality* and *influence* criteria were inevitably based on the authors' own understanding and appraisal of this literature so as to ensure that selected materials possessed some degree of permanence, either proven or likely, in terms of influence on the work of others and ability to withstand the test of time. This task was also aided by the use of 'forward citation searching' (via Google Scholar) for the purpose of assessing the importance of the studies identified and how they shaped/influenced subsequent research and scholarship.

We should emphasise that we deliberately excluded articles focusing on FDI determinants in general, albeit some of these studies included some form of institutional or legal framework proxy as an independent variable, focusing instead on studies which specifically took as their explicit unit of analysis the role of IPRs on FDI determination. This means that we rule out, for example, the many studies by Globerman and Shapiro on the role of governance infrastructure on FDI (see, e.g., Globerman and Shapiro 2002; and Globerman and Shapiro, 2003) since - though relevant insofar as the political and legal environment of a country may through its institutions and policies influence FDI flows - these studies did not isolate the measurement of IPRs using, instead, aggregate measures of governance such as the indicators estimated by Kaufmann et al. (1999a, b) that include measures of political

instability, terrorism and violence, rule of law, graft and corruption, regulatory burden, voice and political freedom, and government effectiveness/efficiency, and the legal classification systems developed by La Porta et al. (1998a, b).

In the final selection stage, more difficult decisions had to be made with regard to the inclusion or exclusion from our review of contributions from contiguous research domains as in this literature boundaries can become somewhat fuzzy. In this respect, we decided to exclude theoretical and empirical studies focusing primarily on the IPR-trade nexus (e.g., Fink and Braga, 2005), on the role of IPRs in maximising economic growth or global welfare (e.g., Gould and Gruben, 1996), or on whether strengthening IPRs induce more technology transfer between countries (e.g., Yang and Maskus, 2009), unless it was deemed that the analysis of such studies helped shed some light on our research question, which specifically concentrated on the IPR-FDI link. Although FDI establishment and ownership decisions can indeed be related to IPR issues, we also ruled out studies concentrating on how IPR protection affects the mode of FDI in terms of the proportion of equity invested, i.e. wholly-owned investment or equity joint-venture (see, e.g., Leahy and Naghavi, 2010; Chen, 2013; Kyrkilis and Koboti, 2015), and of establishment, i.e. Greenfield FDI or M&As, since the focus of our review is on how IPRs affect the FDI location (country) choice.

The coverage of our review takes as its point of departure Dunning's (1976) development of the OLI paradigm; a framework adopted by many subsequent studies to explore the IPR-FDI link. No significant empirical work has investigated the IPR-FDI nexus prior to the mid-1970s. Our coverage ends at the end point of our search, which started in May 2017 and concluded in November 2017. The final selection comprises 68 studies, of which 33 are empirical in nature (four of them mainly survey-based), all written in English language, with the sole exception of Mayer and Pfister (2001). Following Callahan's (2014) advice as to what constitutes a good literature review, we aimed to be concise, clear, critical, convincing, and contributive. To avoid lengthy and overly descriptive discussions of the empirical contributions reviewed within the text, a comprehensive table summarising in detail the key features of the applied studies subjected to our critical scrutiny is provided as an online Appendix.

Unlike quantitative meta-analyses, our transparency in acknowledging the search and selection methods of our systematic, critical review is not for the purpose of facilitating replication by other researchers as subjective judgements - as explained above - were, admittedly, an intrinsic element of our selection process and inherently part of our critical

endeavours in reviewing the selected material. That said, whilst our conclusions may inevitably be deemed somewhat subjective, we paid special attention to avoiding the risk of omitting significant sections of the literature, disregarding influential contributions or of not questioning the validity of evidence, implicit assumptions or dubious statements of published work. Indeed, in the absence of clear and up-to-date surveys on the subject, our endeavour was genuinely motivated by our desire to gauge as objectively as possible what the literature can tell us about the impact of IPRs on FDI, without any preconceptions, or predispositions to lend biased credence to any preferred hypothesis. Suffice to say, as with any critical review, we do not purport to provide the last word on the subject. The outcome of our review ought to be considered the starting point for further critical scrutiny, not an endpoint in itself.

3. A Synthesis of Theoretical Channels Postulating a Positive, Negative or Non-significant Relationship

There is no ready-made, full-blown theory that offers a comprehensive framework for analysing the relationship between FDI and IPRs or how firms' FDI location choice may be induced or deterred by host environments which provide, or may be perceived to provide, strong or weak IPR protection. However, some complex (partial- or dynamic general-equilibrium) economic models have been developed, mostly concerned with the effects of IPRs on FDI-driven technology transfer from Northern MNEs into the developing world (the South). Moreover, across the wider theoretical or conceptual literature on FDI and frameworks of international production, there are a number of propositions that can be distilled to shed some light on the contrasting views of how the strength of IPRs may affect FDI attraction and thus influence the FDI location decision of foreign investors.

Despite the limited theoretical work, it can be safely stated that there is little agreement on the impact of strengthened IPR protection on FDI. The OLI model, also known as the 'eclectic paradigm'[4], emphasises the existence of intangible assets that provide a competitive advantage to the investing firm. 'Ownership advantages' allow a firm to engage in FDI by transferring these assets to new markets. The OLI paradigm further suggests that if an MNE is approaching FDI to secure access to lower wages, specific resources or improve its proximity to markets, then stronger IPR regimes – by reducing the risk of local imitation (piracy) of the MNE's ownership advantages (arising from assets that confer a cost advantage in servicing a foreign market, including IP-related assets) – would support taking advantage of these benefits (Dunning, 1976). It follows that weaker IPRs would work against the

intention to invest in those locations through FDI as it would be more difficult for the MNE to maintain protection across the whole production and selling cycle. As eloquently summarised by Smith (2001), strong IPR protection enhances the ownership advantage of the source firm in the foreign market by providing legal recourse against violations of its IP-related assets. This protection increases the cost of imitation thereby reducing the incentive to imitate and increasing the firm's control of and returns to its IP-related assets. This postulation predicts a positive relationship between a country's strength of IPR protection and inward FDI.

IPR protection can also be interpreted as a 'location advantage', as it is territorial in nature and hence differs across countries, thereby constituting a locational determinant of FDI (Braga and Fink, 1998). This explains why in recent years many developing and emerging economies have reformed their IPR legislation to reduce the FDI attractiveness gap vis-à-vis countries already providing strong IPRs, to avoid the risk of being left behind in the global competition for capital and technology (Maskus, 2000).[5] Dunning (1994) himself, emphasised that in an era of globalisation, the need for governments to consider their regulatory environments carefully is acute, because different levels of IPR protection across countries may influence where an MNE chooses to locate.

Nevertheless, the theoretical case for a positive impact of IPR protection on FDI remains ambiguous. Mansfield *et al.* (1981) argue that FDI decreases with a strengthening of IPRs, hence postulating a negative relationship. IPRs give MNEs a security from imitation in absolute terms, but no more security than that offered to innovators not involved in FDI. They argue that IPR protection increases the costs of imitation bringing such costs closer to the cost of innovation. As the cost of imitation increases, innovation is stimulated hence reducing the monopolistic market held by FDI holding IP. Effectively, the high cost of imitation crowds out FDI.

A negative effect of strong IPRs on FDI can also be framed within the 'internalisation' element of the OLI framework, in terms of how IPR protection may influence a firm's decision to internalise or externalise its IP-related assets. Several scholars have theorised that strong IPRs affect negatively FDI by inducing MNEs to choose licencing agreements with producers in developing countries over FDI (Braga and Fink, 1998; Maskus *et al*., 2005).[6] MNEs would prefer FDI over licensing under weak IPR protection because internalised foreign production would allow them to maintain greater direct control over their IP-related assets (Ferrantino, 1993).

The literature also suggests that the impact of IPRs on FDI is dependent on the stage of development of the host country. In the poorest countries, where capacity to imitate is low, the MNE should be able to exploit the location benefits without much concern of imitation. In developing countries, where imitative capacity is high, the requirement for strong IPRs is important. According to this school of thought (e.g., Ginarte and Park, 1997), weak IPRs in developing countries may not only damage FDI but also the willingness of MNEs to trade, particularly their most innovative products.

The choice between exporting and FDI is specifically considered by Markusen (2001), who models the relationship between MNEs and agents acting as subsidiary companies in a simple product-cycle model where the MNE introduces a new product every two time periods. Because of the costs of exporting, FDI generates the most rents. A product is economically obsolete at the end of the product cycle. However, the agent can defect at the end of the first time period to set up a competing company based on the knowledge learnt during the first time period. The MNE can also dismiss the agent. In this context, IPRs are effectively a cost to defection. Markusen (2001) shows that too high a level of IPRs gives the MNE too much monopolistic power to the detriment of the agent. Too little IPR protection and the MNE will not invest and just choose to export despite the higher cost of exporting. This is an inefficient outcome for both parties so Markusen (2001, p. 190) concludes that "the optimal policy for a developing country is to set the level of contract enforcement just high enough to induce entry". While the model captures some of the policy debate over IPRs, and the trade-off between exporting and FDI, it is very simplistic and does not account for the plethora of drivers for foreign investment or the type of innovation.

Drawing on earlier product-life-cycle models of FDI and international technology transfer from an innovating region, the North, to an imitating region, the South, which treated imitation as exogenous (e.g., Helpman, 1993; Lai, 1998), Glass and Saggi (2002) develop a model with endogenous innovation, imitation, and FDI to determine how stronger IPR protection in the South affects innovation, imitation and FDI. Their model suggests that low IPR protection in the Southern country deters a company from exporting to, or producing in that country for fear of pirates diminishing profitability. On the other hand, stronger IPRs allow a company to sell above marginal cost thereby taking advantage of a monopolistic position. This reduces the prevalence of exports and increases the amount of FDI and licensing as the MNE is assured of IPR protection. They also suggest that stronger IPRs keep MNEs safer from imitation, but no more so than Northern firms. Instead, the increased

difficulty of imitation generates resource wasting and disincentive effects (as stronger IPRs increase imitation costs with a consequential increase in labour costs) that ultimately reduce both FDI and innovation. The greater resources absorbed in imitation effectively crowd out FDI. This result runs contrary to Lai (1998) who, using a model of variety-expanding-type innovation, concludes that stronger IPRs promote both innovation and FDI.

In Glass and Wu's (2007) quality-improvement-type R&D model (similar to Glass and Saggi, 2002), Northern firms innovate to improve the quality of existing products and may later shift production to the South through FDI. Southern firms may then imitate. Glass and Wu (2007) assume costless imitation, as did Lai (1998), and examine how increasing the probability of imitation affects innovation and FDI. They show that imitation can increase FDI and innovation for quality improvements, whereas the opposite occurs when innovators develop new varieties. This study helps reconcile the discrepant findings between Lai (1998) and Glass and Saggi (2002), seemingly dependent on whether innovation is treated as either the 'variety expanding' or 'quality improving' type. However, Branstetter and Saggi (2011) find that in a North-South product-cycle model in which innovation, imitation and FDI are all endogenously determined, while a strengthening of IPRs in the South decreases imitation (by making it less efficient), it increases the flow of FDI.

Aiming to provide a reason for the negative relationship between stronger IPRs in a developing country and FDI, Mathew and Mukherjee (2014) develop a model in which a Northern firm can sell its product to the South either through export or FDI, and the Southern firm decides whether or not to innovate. They show that stronger IPRs in the Southern country increase the incentive for FDI if imitation occurs only under FDI by the Northern firm. However, if imitation occurs under both export and FDI by the Northern firm, the effect on the Northern firm's incentive for FDI is ambiguous. If either the cost of Southern innovation is low or moderate, a stronger Southern IPR regime may reduce the Northern firm's incentive for FDI. However, their model is based on several simplifying assumptions, as only the case of a duopoly where demand for the product is only in the Southern market is considered, and imitation is costless (as in Helpman, 1993, and Lai, 1998).

With the aim of explaining why China and other emerging economies could have had such a phenomenal growth in inward FDI despite weak IPRs, Yang's (2013) model incorporates complexity into a Dixit-Stiglitz framework based on a world with three regions: a developed North, a developing South, and a third developing country. The model assumes that imitation costs are positively related to complexity, and that such costs are higher when

imitating a product designed only for the foreign market. All consumers prefer to consume diversified and complex products, but in the developed North, firms can produce and sell to all regions while in the South and the third country they can only produce and sell in their home market. Yang's model generates several conclusions. First, strengthening of host IPR protection promotes the MNE's FDI in the host country. Second, given that local imitators will charge a higher price under strong IPR protection, stronger IPRs increase the MNE's profit. Third, stronger IPRs make the MNE invest in higher complexity sectors because this increases the penalty income for the MNE and also maintains the common price index (the price of a product from multiple producers, including imitators who produce and sell at a lower price). Weaker IPRs are likely to shift FDI from manufacturing (including complex products) to export-supporting investments like sales, marketing and distribution. Finally, cost-oriented FDI is less sensitive to host country IPR protection than market-oriented FDI. While Yang's (2013) model provides an explanation of why emerging host countries with low IPR protection attract a large amount of FDI manufacturing products destined solely for exporting, it relies on stringent and fairly implausible assumptions, including zero transportation costs.

Tanaka and Iwaisako (2014) examine how IPR protection affects innovation and FDI using a North-South quality-ladder model developed by Glass and Wu (2007), itself based on Grossman and Helpman (1991). Tanaka and Iwaisako (2014) build on previous models by introducing two types of subsidies, one for FDI and one for R&D. In the North there are companies defined as 'leaders', with the ability to develop technology and new products, and then sell them in the South, all other companies are 'followers'. Stronger IPRs enable leaders to earn monopolistic rents in the South earlier (weaker IPRs might mean they export or do not sell in the South) and benefit from lower labour costs in the South earlier.[7] Their model, which incorporates the exogenous and costless imitation of technology, suggests that strengthening IPRs promote innovation and FDI both in the short- and long-run. This finding contrasts with Glass and Wu (2007) but is the same as Lai (1998), who employed a variety-expansion-type North–South model. This result is important because it shows that innovation, whether treated as a 'quality improvement' or 'variety expansion', does not play a key role in determining the effects of IPRs on FDI, and that such distinction does not, in itself, help reconcile the conflicting predictions arising from these different models.

It bears reminding at this point that IPRs are just one amongst many factors considered in FDI location decisions by MNEs. Market size, trade barriers, access to low cost

resources or production factors, low tax rates, exchange rates, among others, may well override particular concerns about IPR protection. Hence, it has also been hypothesised that IPR protection may be a relatively insignificant factor for attracting FDI due to more important location advantages influencing foreign investors' location decision (e.g., Yu, 2007). As put boldly by Maskus (1998a, p. 128), "it must be emphasized that strong IPRs alone do not sufficiently generate strong incentives for firms to invest in a country".

To muddy the waters further, it has been hypothesised that the strength of the IPR-FDI relationship may depend on the type of FDI and the industry receiving the investment (Mansfield, 1995). Without strong protection, firms may be deterred to invest in stages of production that have high IP-related content such as R&D and technology-intensive manufacturing processes (Braga and Fink, 1998). This justifies Maskus (2000, p. 15) when he writes, "the need is acute for sectoral breakdowns of investment" to increase our understanding of the role of IPRs. Maskus (2000) observes that FDI in lower technology goods and services, such as textiles and apparel, electronic assembly, and distribution, depends much less on the strength of IPR protection than on input costs and market opportunities. FDI in products or technology that entail a high cost of imitation may also reduce the importance of IPR regimes in FDI location decisions. On the other hand, FDI in easily 'copyable' products and technologies, such as pharmaceuticals, chemicals and software, is more sensitive to the strength of IPR regime.

Three main, general conclusions can be drawn from our synthesis of the main IPR-FDI hypotheses discussed above:

(i) Economic models studying the effects of strengthened IPRs in the developing world (the South) on FDI by Northern MNEs are divided as to whether developing countries would attract greater FDI. In the absence of a full-blown theory on the relationship between FDI and IPRs, the OLI paradigm remains a useful albeit not exhaustive framework to examine the channels of how firms' FDI may be induced or deterred by the strength of IPR regimes of host environments but it does not, in itself, lead to determinate predictions.

(ii) Given the many different theoretical channels postulated and conflicting effects hypothesised, positive as well as negative, the aggregate net effect of the strength or weakness of IPR protection on FDI by MNEs remains ambiguous. Yet, as noted by Nunnenkamp and Spatz (2004, p. 395), "there are various reasons to suspect that the

impact of IPR protection on FDI is blurred unless industry characteristics and host-country conditions are taken into account."

(iii) The strength of the impact of IPRs on FDI, and hence their importance in influencing MNEs' investment location decisions relative to other factors or country determinants influencing FDI location choice, may depend on the stage of development of the country likely to host the investment, the type of FDI undertaken and the technological intensity of the industry receiving the investment. However, as originally observed by Braga and Fink (1998), the importance of these moderating effects on the relationship between IPRs and FDI, is, at source, linked to MNEs' perception of their ability to maintain control over their IP-related assets (given the nature of MNEs' ownership advantages and their intrinsic level of imitability) in the absence of legal protection (in terms of the absence of IPRs and, in countries where such rights are legislated for, their inadequate enforcement). Moreover, the benefits of the FDI choice are relative to the comparative advantages of other foreign entry modes such as exporting and licencing. Changes in IPR regimes may induce a firm to switch between these different foreign market-entry modes.

Against this backdrop, the challenging task of disentangling the actual, independent effect of IPRs on FDI is one best left to empirical research. In the next section, we review the applied literature covering both influential econometric studies as well as prominent qualitative or mixed methods studies that draw evidence from surveys of foreign investors.

4. Empirical Evidence on the Impact of IPR Protection on FDI

4.1 *Econometric Studies*

4.1.1 *Negative or Non-significant Effects*

One of the earliest econometric studies focusing on the effect of IPRs on FDI is that by Ferrantino (1993), who investigates the effects of membership in IPR treaties in the context of US exports, foreign affiliate sales, and flows of royalties and license fees. He concludes that US MNEs export more to subsidiaries in countries that do not adhere to such treaties, but their impact on arms-length exports and FDI is minimal. A similar result of 'no statistically significant relationship' between measures of IPR protection and US MNEs' FDI was found by Mansfield (1993) and Maskus and Eby-Konan (1994).

Maskus (2000) dismisses the early studies cited above arguing that their models employed "crude measures" of IPRs and were plagued by misspecification. He concludes that their results should be discounted; and so do we, whilst also dismissing Maskus (1998a), as it is based solely on stylised facts and does not report an econometric analysis as such.

It is important to note that empirical analyses failing to detect a significantly positive relationship between IPR protection and FDI, or even unveiling a negative one, are not confined to early and rather rudimentary studies. Aiming to challenge the proposition that strong patent protection is one of the important characteristics of an attractive investment climate, Kondo (1995) analyses US outward FDI to 33 European, Asian and Latin American countries between the mid 1970s and 1990. He finds that US outward FDI is not significantly affected by the patent regimes of destination countries.

Kumar (1996) analyses the determinants of location of R&D investments by US MNEs in over 40 countries in 1977, 1982 and 1989. Kumar's (1996) results suggest that the relative strength of patent regime affects the direction rather than the magnitude of R&D investments. The overall strength of a country's IPR regime favourably affects the probability of attracting R&D investments only in the full and industrialised countries samples. For developing countries, IPR protection does not appear to influence MNEs' R&D investments.

Seyoum (1996) tests the distinct effects of patents, trademarks, trade secrets and copyrights on FDI inflows to 27 developed (DCs), newly industrialising (NICs) and less developed countries (LDCs) from 1975 to 1990, claiming support for the proposition that protection of certain IPRs may be conducive to inward FDI. The results also suggest that for certain IPRs, the stage of economic development of the host country is important. He finds no significant relationship between patents and FDI for LDCs. For DCs, there is a significantly negative relationship between patent protection and inward FDI. Trademarks are significantly positive for LDCs and DCs but significantly negative for NICs. Trade secrets are significant for all country groups but with a negative coefficient for LDCs and DCs. The copyright variable is significantly positive for all country groups.

Braga and Fink (1998) estimate the joint effects of stronger IPR protection on US arms-length exports and overseas sales by US affiliates in 42 countries, pooling data across three manufacturing industries. Overall, their results suggest "At best [..] a weakly negative relationship" (p. 178). They also report estimations of the effects of IPRs on German MNEs' exports and FDI decisions in 25 countries, with data pooled across four industries. The IPR

estimated coefficient has a statistically significant positive impact for total exports but is close to zero (-0.026) and insignificant for German FDI stock.

Using data for 1981-1983 and 1988-1992, Mayer and Pfister (2001) find that stronger IPRs have a negative effect on French MNEs' location decisions. After disaggregation between developed and developing host countries, they find that the strength of a developing country's IPRs has a statistically insignificant impact on the likelihood that French MNEs locate their investment in that country. They also find that the strength of a developed country's IPR protection has a quadratic (inverse-U) effect on the firm's probability of locating in the developed country; that is, increasing the probability and then decreasing it after some tipping point of IPR strength is reached. However, Mayer and Pfister's (2001) study focuses on 'investment location decisions', not FDI flows (or FDI stock) as such. Such location data cannot capture the level of FDI and/or intensity of technology transfer in response to changes in IPR strength of MNEs already operating in the host country.

Less clear cut results are obtained by Pfister and Deffains (2005) who observe that, on one hand, the reduced competition that follows greater patent protection can attract foreign subsidiaries. On the other hand, FDI can 'strategically' deter local competitors. If so, FDI and patent protection are substitutes and stronger IPR enforcement may reduce the strategic incentives to invest in a country, especially in large markets. On average, IPRs exert only a negligible influence on the location choices of French MNEs. If the market potential of a host country is sufficiently large or if expenditures on R&D are sufficiently small, a greater effectiveness of patents decreases the probability of location in that country. Yet, this study only compares locations at a given time point. For a given economy, FDI may increase with IPR protection as years go by. Moreover, Pfister and Deffains (2005) were unable to test for the importance of the subsidiary: countries combining stronger IPRs with a large market size or low R&D intensity may attract fewer subsidiaries, but those established there, may be associated with greater investments, higher employment, more R&D or more affiliate sales.

Using a large database on investments in chemical plants by 153 MNEs from up to 75 countries, Fosfuri (2004) finds that patent protection does not play a significant role in fostering international activity or in influencing its mode in terms of wholly-owned subsidiary, joint-venture, or technology licensing. Nevertheless, the study only analyses data from one industry, thus limiting the generalisability of the findings. Moreover, as observed by Park (2011), chemical plants largely consist of firms with process innovations. For such innovations, patents may not be the most effective mechanism for appropriating the returns to

innovation. The results, therefore, do not preclude the importance of other types of IPRs. Finally, although alternative foreign entry market modes that imply the transfer of production are considered, the FDI trade-off with a firm's ability to exploit its technological advantage abroad simply by serving the foreign market through exports, is ignored.

You and Katayama (2005) carry out a survey of Japanese firms that had invested in China to evaluate, using probit estimation, the impacts of strengthening IPRs on their profitability and the levels of imitation of their products. They sought to understand why despite increasing IPRs in China, 27% of all imitations of Japanese products worldwide originated from China. They chose to study patents and trademarks, using 412 randomly sourced companies from the Toyokeizai Shinposha database, a directory of foreign subsidiaries of Japanese firms. They received 98 responses, which covered multiple sites for a total of 228 subsidiaries, and several sectors and investing cities across China. Each of the companies rated the level of IPR protection in China on a five-point scale with '5' being top ranked. The average score was 2.6. Interestingly, 62% of the companies stated that their products had been patented or trademarked registered. On average, nearly 30% of the products had been imitated in China. Nearly half of the Japanese subsidiaries had not met their profit expectations. The probit estimation results showed no strong evidence that IPRs are a significant determinant of FDI. Patents and imitation were not found to affect the profitability of Japanese subsidiaries in China, possibly because of competition from imports of imitated goods. There was little evidence that local production of similar goods in the same category influenced the profits of Japanese subsidiaries, perhaps because the quality of these goods meant they were not competitive. The most alarming finding was that product patenting or trademarking actually increased the likelihood of imitation. You and Katayama (2005) believe that patents may be used as a source of information to copy products, and that trademarks, by signaling the value of products, focused imitation efforts. These are disturbing findings. The very system used to protect IP may be used to undermine the ownership of that property, and the lack of credible enforcement is likely to exaggerate these impacts.

Watkins and Taylor (2010) test the effect of IPRs on US FDI in 22 emerging economies from 2006 to 2008. They use the Ginarte and Park (1997) index and the survey-based IPR index of the World Economic Forum (WEF). The analysis benefits from a disaggregation of FDI data across nine industries, and eight sectors within the manufacturing industry (see online Appendix). The results of the various multivariate models consistently fail to support the hypothesis that emerging economy IPRs strongly

affect the level or distribution of advanced country FDI, "Instead, the results support the hypotheses that no relationship or an ambiguous relationship exists" (Watkins and Taylor, 2010, p. 427), in particular, that "IPR protection may simply not be important for a large majority of the industries involved in FDI [or] be marginalized within a broader set of factors that influence firm's investment decisions" (ibid, p. 427). However, these results should be taken with caution given the very short sample period of only three years.

4.1.2 *Positive Effects*

Notwithstanding the findings of the studies reviewed so far, the evidence that has emerged to date is skewed in support of the view that stronger IPRs favour inward FDI.

Lee and Mansfield (1996) employ OLS and Tobit regressions using data obtained from almost 100 US firms regarding their perceptions of how weak or strong IPR protection was in 14 developing countries, as perceived by managers in Mansfield's (1994) survey. They regress the volume of US FDI on this index over 1990-1992, and include a number of controls. They find that, if the percentage of firms regarding protection in a particular country as inadequate falls by 10 points, US FDI in that country increases by about $140 million per year. Lee and Mansfield's (1996) results have been criticised for a country selection bias in favour of the role played by IPRs on FDI due to a disproportionate representation of countries with some technological capabilities and in which IPR disputes are not uncommon (Braga and Fink, 1998). Data limitations, the short sample period and possible specification errors also limit the reliability of the results. Heald (2004) also questioned their survey-based IPR measure, arguing that it is wrongly built and has been misinterpreted.

Using the same endogeneity corrected index of patent laws of Maskus and Penubarti (1995), Maskus (1998b) estimates a set of simultaneous equations on a panel of 46 destination countries over 1989-1992 for the joint impacts of US firms' patent applications filed in the host country, sales of foreign affiliates of US parents, US exports shipped to affiliates, and assets of foreign affiliates of US parents. His equations control for several factors including investment incentives and disincentives provided by local authorities. The level of average patent strength across countries is strongly associated with patent applications, though the effect is fairly weak in developing countries. Exports to affiliates are positively affected by patent strength in developing economies. While average patent strength has little effect on affiliate sales, the impact is significantly positive in developing countries. Also, the patent variable coefficient is negative and significant in the assets equation, but the

impact in developing countries is significantly positive. These results are revisited by Maskus (2000), with coefficients transformed into elasticities. From this fresh interpretation of Maskus' own (1998b) results, FDI reacts positively to patent strength in developing countries, with a 1% increase in the degree of patent protection expanding the stock of US FDI in that country by 0.45%. However, the sample period used is far too short to draw reliable inferences, especially in the absence of robustness tests to alternative IPR measures.

Smith (2001) applies Dunning's OLI concepts to link the relative effects of foreign patent rights (FPRs) on exports, affiliate sales (FDI), and licenses. She finds that stronger FPRs have a positive effect on all technology transfer activities considered. The effect is more pronounced for licensing and stronger in countries with developed imitative capabilities. Yet, subsequent literature is not consensual on the view that as the strength of IPRs increases, licensing is preferred to FDI. For example, McCalman's (2004) analysis of the behaviour of Hollywood studios in 40 countries reveals that although moderate IPRs are associated with a high degree of market-based relations such as licensing, both high and low standards of IPRs encourage more integrated governance structures that entail equity-based investments such as FDI.

The impact of IPR policy on MNEs' choice between FDI and licensing is also examined by Nicholson (2007) who considers the role of industry characteristics. He uses cross-sector, cross-country count data on the number of US companies engaging in FDI and licensing for 1995 in 42 countries. Industry data are disaggregated into three digit industry sectors, allowing him to distinguish between manufacturing and non-manufacturing MNEs. Nicholson (2007) finds that companies in industries with high capital costs are more likely to maintain control over production knowledge in countries with weaker IPRs by engaging in FDI. When IPR protection is strong, companies in industries with high investment in R&D "are more likely to enter a market by licensing to an unaffiliated host firm" (p. 27). This evidence is consistent with Dunning (2012), who argued that if the costs of setting up in the country are excessive, firms may be induced to seek market entry through exporting or licensing as long as IPR protection is sound. However, Nicholson's (2007) results may be driven by the nature of the count data used.

Nunnenkamp and Spatz (2004) test the impact of IPRs on FDI decisions at a sectoral, disaggregated level. They sought to understand if IPRs impact not only the *quantum of FDI* but also the *quality of FDI*, and conclude that host-country and industry characteristics play a significant role in the relationship between IPR protection and FDI stocks held by US

companies in the manufacturing sector of developing and developed countries. IPR protection has weaker effects in countries with dominating pull factors for FDI. The role of IPRs in attracting FDI is limited to countries with a very high population or an abundance of natural resources. This result could explain the dichotomy of China receiving large amounts of FDI while still having a relatively weak IPR system by virtue of its large market size (Wang and Swain, 1995). They also find that imitative capacity, measured through a rudimentary proxy based on average years of schooling, is a key determinant of whether IPRs made a difference to investment decisions. Specifically, IPR protection significantly increases FDI only where local imitative capacity is regarded sufficiently high to represent a threat. This suggests that if there is limited capacity to imitate, there is little requirement for laws to prevent it. In assessing the impact of IPRs on the quality of FDI, they find a positive correlation between stronger IPRs and an improvement in local R&D expenditure, value added, and exports, but little correlation on licence fees paid to the parent or employment. They conclude that IPRs are more critical to firms with high levels of human capital and in technology intensive industries. However, the use of disaggregated FDI-related data prevented them from analysing substitution effects between FDI and other internationalisation strategies or entry modes such as licensing.

Javorcik's (2004) study is of particular significance since it focuses on the composition of FDI not merely its presence in relation to IPRs, and uses company level data rather than aggregate data as seen in many studies listed in the online Appendix. Javorcik (2004) uses a data set compiled from a foreign investment survey conducted by the European Bank for Reconstruction (EBRD) in 1995 that surveyed about 9,500 companies located in more than 50 countries about their FDI behaviour in 24 economies in Eastern Europe and the former Soviet Union. Given that there was little FDI inflow to these countries before 1989 because of the communist regime, Javorcik could be confident that the data obtained related to the period between 1989 and 1995. They received 1,405 responses to questions about actual and planned investments, and the nature of these investments. Javorcik (2004) tests two hypotheses. First, whether MNEs in IPR sensitive sectors (see online Appendix) are more affected by the strength of IPRs than companies in general (Mansfield, 1994). Second, whether the strength of IPRs impacts the nature of companies' investments (Mansfield, 1995). Javorcik discounted the Rapp and Rozek (1990) IPR measure (as it was out of date) in favour of the Ginarte-Park index supplemented by her own enforcement data. She also accounts for variables such as market size, the corporate tax rate as a proxy for Dunning's location

advantages, and R&D intensity. Javorcik (2004) finds that weaker IPRs deter FDI flows from technology intensive firms that rely heavily on IPR protection. Weaker IPRs encourage investors to undertake lower level FDI in sales and distribution. In five out of six regressions, IPR protection impacts the probability of investments from high-technology companies, but not other industries. But in four regressions the impact of stronger IPRs seems relevant to all industries. She explains this pattern in the data through the idea of signaling (Lall, 1997); higher IPRs signal to MNEs the openness of a market even where it is less important to their investment decisions. Javorcik's (2004) work confirms that firms make different decisions based on IPRs in target countries. However, it would have been interesting to see these choices broken down beyond company structure into the type of operation set-up as in Mansfield (1994). Also, the sample is restricted to host countries in Eastern Europe, leaving open the question of whether similar results apply in other world regions.

Seyoum (2006) tests the impact of IPRs on FDI across a random sample of 63 (developed and developing) countries for two time periods, 1990 and 1995. His model includes many theory-based variables as controls. The impact of IPR protection is positive and significant in both 1990 and 1995 (results partially contradicting those of Seyoum, 1996). Seyoum's (2006) study would have benefited from the use of more granular data to establish if there is a difference in the importance of IPRs by sector or technological intensity, or to detect the impact of IPR protection on FDI driven by contrasting motives (e.g., market- or asset-seeking). Moreover, the use of the Ginarte-Park index constitutes a limitation since, being based on statutory provisions (the laws on the books), it fails to capture the real strength of patent protection.

Park and Lippoldt (2003) investigate the relationship of an IPR index with FDI and trade using national data as well as data disaggregated by industry for the period 1990-2000. The index takes into account membership in relevant international treaties, IPR restrictions, means of enforcement, duration and sectoral coverage of patent rights. They find that patent rights are associated positively with FDI and moderately with trade but the strength of these effects varies by level of development and by industry. The variation in FDI as a result of strengthened IPRs is largest for the least developed countries (where IPR regimes are weakest), and second largest for developing countries (where IPR regimes are next weakest), suggesting that IPRs have a positive but diminishing association with increased FDI as the strength of those rights increases. In industries such as metals, machinery, and transportation, FDI is not affected by IPRs. IPRs seem to have an effect on FDI in computer services,

finance, and chemicals (including pharmaceuticals), industries based on technologies that are, they argue, relatively easy to copy.

Park and Lippoldt (2008) assess the relationship between measures of local innovation and IPR indexes using a data set covering a broad international panel of developing countries. To complement the statistical analysis, they employ regression analysis and case studies of the BRIC (Brazil, Russia, India, and China) countries. They show that between 1995 (when TRIPS came into force) and 2005, developing and least developed countries, collectively, experienced a greater percentage increase in IPR strength than did developed countries. Compared to developed countries, developing and least developed countries experienced a large growth in FDI inflows, merchandise and service imports, patent applications by foreigners, as well as increases in their R&D to GDP ratios and patenting by local residents. Their estimation results broadly confirm the extent to which these patterns can be attributed to IP reforms in the developing world, *ceteris paribus*. The main results show that: (i) Patent rights tend to be positively associated with inward FDI; (ii) This relationship holds for all groups of countries, though the statistical association is strongest in developed countries; (iii) Copyrights and trademark rights are less strongly associated with technology transfer than patent rights; (iv) Stronger patent protection is positively associated with the inflows of high-tech products. Park and Lippoldt's (2008) case study evidence corroborates the findings from regression analysis that the technology content of inward FDI and foreign trade has been substantial, especially in the BRIC countries, and that this has occurred in association with significant IPR reforms.

Some studies specifically investigated whether the TRIPS agreement had any effect on FDI flows. Adams (2010) includes the square of IPR (IPRSQ) in his regression model to capture any nonlinearities, and an interaction term (IPR*TRIPS) to investigate whether there is a differential IPR effect before and after the TRIPS agreement. He finds that IPR is significant and positively correlated with FDI, but when both IPR and IPRSQ are included in the regression, both coefficients become insignificant, suggesting the absence of a nonlinear relationship or diminishing returns of IPRs on FDI for developing countries as a whole. He also finds that the average IPR for both 1985 and 1990 is considerably lower than that in 1995 and 2000, after the TRIPS agreement. When interpreted in conjunction with a significantly positive IPR*TRIPS interaction term, Adams (2010) takes this evidence to suggest that the effect of IPRs on FDI in the post-TRIPS era was far and above the pre-TRIPS period. Adams (2010, p. 206) concludes that "if developing countries establish strong

IPR regimes supported by measures aimed at improving the investment climate [..], they are likely to benefit from an increased flow of the right type of FDI essential for stimulating economic growth." Nevertheless, several shortcomings should be highlighted. First, the study focuses on the effect of IPRs on the total volume of FDI thus neglecting its composition. It follows that any conclusions on "the right type of FDI" are unsubstantiated. Second, by first-differencing the data, Adams effectively removes its long-run properties, making the analysis one that at best reflects the short-run. Third, the inclusion of the squared IPR variable does not, by itself, test for the many forms of potential nonlinearity that may characterise the IPR-FDI relationship. Finally, Adams does not disaggregate the data by country and, as observed by Lesser (2002), determinate results of the effect of IPRs on FDI may only be possible on a country-by-country basis.[8]

The specific impact of TRIPS is also tested for by Zhang and Yang (2016) who find that TRIPS impacted positively on the prevalence of FDI in each of the developing countries considered (see online Appendix) with the exception of Indonesia, Philippines, Thailand, Malaysia and Turkey. They argue that these countries' instability, military involvement in politics and ethnic tensions significantly countered the associated increase in FDI they would have expected to see. The impact in Nigeria and UAE was also insignificant, a result attributed to these economies being dominated by the oil industry where IPRs are not as important. R&D in Brazil, China, Indonesia and the Philippines was negatively correlated to TRIPS. Zhang and Yang (2016) argue that the high imitation capacity of these economies may have dampened the expected increase in innovation. However, overall, TRIPS was positively correlated to both FDI and R&D.

Branstetter *et al.* (2007) is one of the few studies testing directly theoretical predictions on the effects of increased Southern IPR protection on Southern industrial development in a product-cycle model of international trade and FDI. They extend the model by Helpman (1993) by allowing the level of FDI in the South to respond endogenously to changes in Southern IPR strength (with Northern MNEs shifting production to their Southern affiliates) and by treating Southern firms' imitative effort as a costly and endogenously determined activity. They test the model's prediction that FDI accelerates Southern industrial development by analysing responses of US MNEs to IPR reforms in the 1980s and 1990s. Several measures of the scale of US MNEs' activity serve as dependent variables to capture indirect evidence of production shifting (see online Appendix). Their results indicate that

MNEs expand the scale of FDI after IPR reform and that stronger IPRs in the South accelerate the rate at which MNEs' production is transferred there.

Of the empirical studies examining the IPR-FDI nexus, a small and fairly recent subset focuses on how this relationship fares in the context of China and other Asian countries. This is striking not only because China has experienced a tremendous surge of inward FDI over the past two decades but also because of the infamous record of China in terms of IPR enforcement (and the policy reforms to China's IPR laws over the last 10 years). Awokuse and Yin (2010) investigate the impact of China's IPR laws on its ability to attract FDI, and whether such impact may vary by the level of economic development in partner countries. Unlike most studies based on cross-section data for a single year, they use panel data for 38 countries over 1992-2005. They specify a standard bi-lateral gravity model that includes several FDI determinants, and measure the strength of IPR protection in China using annual foreign patent applications and the Ginarte-Park index. Their results indicate that strengthening IPR protection in China has a positive effect on inward FDI. However, FDI from Hong Kong and Taiwan behaves differently from FDI originating in other high-income countries. Awokuse and Yin (2010) take this result to signify that "'other factors' (e.g., ethnic and language similarities) beyond China's large domestic market motivates such FDI" (p. 223). Despite the significance of the study insofar as it offers evidence about China, Awokuse and Yin's (2010) claim that IPRs might "thus promote technology transfer" (p. 223) is debatable since they do not specifically test for spill-over effects from inward FDI to technologically-driven domestic firms.

More recently, Hsu and Tiao (2015) test the IPR-FDI relationship using panel data for 11 Asian countries over 1985-2010 using a general gravity model estimated using OLS, fixed and random effects, and SYS-GMM. They find that stronger IPR protection increases Asian countries' global FDI inflows. However, whilst their model accounts for many factors such as GDP, trade volume, R&D, openness, etc., many other FDI determinants are omitted, including exchange rates and free trade agreements. Furthermore, the study is based solely on country-level data with no industry disaggregation.

With the notable exception of the contributions by Braga and Fink (1998), who also report estimations of the effects of IPRs on German MNEs' FDI decisions, Mayer and Pfister (2001) and Pfister and Deffains (2005), who consider the investment location choices of French MNEs, and You and Katayama (2005), who considered Japanese FDI in China, none of the econometric studies discussed above has focused on a country other than the US as the

source of FDI. This may constitute an important source of bias since as Watkins and Taylor (2010, p. 427) argue, "The United States may have unique historical or strategic relationships with several of the recipient states that skew the results". This consideration makes the study by Ushijima (2013) a particularly useful addition to this literature. Ushijima (2013) estimates the link between Japanese FDI and foreign IPRs with a non-standard gravity-type cross-country regression based on aggregated data, and a logistic regression based on firm-level data. Ushijima uses FDI data from the Toyokeizai Shinposha database, with a final sample of 5,378 subsidiaries of Japanese firms in 58 countries over 1985-2004. Regressions on data aggregated and disaggregated in a variety of ways reveal three key findings. First, the positive IPR–FDI link is only present in countries with a high ability to imitate foreign technology. Second, the link with foreign IPR is positive and significant only for FDI in technology-intensive industries. Finally, the sensitivity of a firm's FDI to foreign IPRs increases with its patent intensity relative to industry peers. The effect diminishes considerably when a firm has previous investment experience in the same country.

4.2 *Survey-based, Qualitative or Mixed Methods Studies*

There is paucity of rigorous and reliable survey-based, qualitative or mixed methods studies [9] on how the strength of IPR protection affects FDI location decisions and it can be safely stated that very few researchers have examined the impacts of IPRs on the investment decisions of MNEs through the use of a combination of survey data, interviews and statistical analysis, in the way that Edwin Mansfield did in his pioneering work of 1994. It follows that Mansfield (1994) deserves special coverage in this review.

In 1991, Mansfield chose a random selection of 100 US MNEs in six different industries (chemicals, including pharmaceuticals; transportation equipment; electrical equipment; machinery; food; and metals). He obtained an astonishingly high response rate (from 94 companies). His respondents were generally patent attorneys who worked in the firms, specialists in the MNEs' international operations, and top executives. Mansfield followed up through interviews with a cross section of the companies. Each company was asked to provide information about the importance of IPRs on their FDI decisions. Mansfield (1994) chose 16 countries to ask the MNEs about (see online Appendix). Although Hong Kong and Taiwan were included, China was not because it was considered to have such weak IPRs in 1991 that there was little chance of US companies setting up joint-ventures with Chinese companies. Mansfield also asked about the nature of the companies' FDIs and the

impact of IPRs on their specific modes of investing. The five different types of investment were sales and distribution outlets, rudimentary production and assembly facilities, facilities to manufacture components, facilities to manufacture complete products, and R&D facilities. This enabled Mansfield to identify the differing requirements for IPRs based on sector and nature of investment. Mansfield developed his own measure of the MNEs' perceptions of IPRs in the countries considered by his survey, and found a high correlation between his IPR measure and the Rapp-Rozek index. He also surveyed the MNEs on recent (1991) changes in IPR regimes of three countries, namely, South Korea, Mexico, and Taiwan. Mansfield (1994) found that the importance of IPRs on firms' FDI decisions varied markedly across industries, with it being much greater for firms in the chemical, pharmaceutical, machinery, and electrical equipment industries. Some companies whose technology was relatively easy to copy, would not consider investing at all. There was also evidence that firms may look to transfer older technology to countries with weaker IPRs. This is consistent with Contractor (1981), who found that US firms tend to transfer older technologies to unaffiliated parties in developing countries more than they transfer to agents in industrial economies. The changes in IPRs in the Republic of Korea, Mexico and Taiwan had made an impact on the perceptions of companies intending to invest in these countries. Despite its ground breaking significance, Mansfield's work ignored companies from the service sector and he did not ask firms about the separate relevance of different IP categories (patents, trademarks, copyrights, etc.) or enforcement of such different IPR categories. The regression results reported are based on Lee's unpublished dissertation, in which he estimated, by OLS, a very basic model that only controls for market size, and the special case of Mexico through a dummy variable. Mansfield (1995) extends his 1994 study in two ways: the survey is expanded to include Japanese and German MNEs; an econometric model is used to estimate the effects of the strength or weakness of IPR protection in a developing country on the amount of US FDI. The empirical findings confirm that in relatively high-technology industries a country's system of IPR protection often has a significant effect on the amount and kinds of FDI to that country by Japanese and German as well as US MNEs.

Zhao (2006) highlights a paradox: despite weak IPRs, countries like China and India are receiving FDI from countries like the US and in specifically sensitive areas such as R&D. Zhao (2006) interviewed managers and researchers in China finding that MNEs were investing in vertical R&D developing products and services to be used internally within the company and integrated into wider enabling technologies held centrally by the MNE. This

gives the MNE access to talented researchers at a significantly lower cost than in their home country. Zhao then evidences this phenomenon by looking at the patent data of 1,567 US-headquartered innovating firms, showing that patents originating in weak IPR countries receive a proportionally higher level of self-citations. Zhao (2006) hypothesises that there are three pre-conditions for imitation: a motivation to imitate, the ability to imitate and exploit the imitation, and the possibility of circumventing the law. Imitation is costly (Mansfield *et al.*, 1981) hence, for there to be motivation, the imitator needs to be able to make a profit from the imitation. Zhao (2006) suggests that when the technology is highly dependent on a company's own proprietary knowledge, the motivation to innovate is low as the cost of achieving a profitable outcome is high. The MNE also benefits from maintaining its own knowledge in a stronger IPR jurisdiction adding further challenges of distance and legal risks to the act of imitation. This is an interesting finding and questions many of the orthodoxies suggesting that weak IPRs may be a barrier to the most sensitive types of FDI. Zhao (2006, p. 1185) concludes that MNEs "may use internal organizations to substitute for inadequate external institutions. By doing so, they are able to take advantage of the arbitrage opportunities presented by the institutional gap across countries". Zhao's observations offer a sensible response to the real world paradox he proposes, and a structural framework that protects the most important IP in the MNE seems an effective solution for allowing it to benefit from knowledge endowments and lower wages in developing countries.

5. Concluding Discussion and Research Agenda

A critical evaluation aimed at taking stock of our knowledge of the IPR-FDI relationship requires us to answer two main questions. The first pertains to attempting to explain the highly conflicting evidence emerging from empirical work to date, and draw relevant implications for empirical analysis. The second, to formulating appropriate recommendations to guide future applied research on the role that IPRs play in influencing FDI location choice.

Dealing with the first question first, the evidence to date, though mixed, is skewed in support of the view that stronger IPR protection favours inward FDI but, overall, evidence of the strength of this effect is not conclusive and seemingly dependent on a number of factors such as type of investment, sector/industry of provenance, technological content of FDI, host-country characteristics, and whether firms would be able to maintain control over their IP knowledge/assets (e.g., through their internal organisations) in the absence of IPR protection, to name but a few.

Moreover, it is worth highlighting that, taken collectively, there is a considerable disconnect between theory and empirics in this literature. This can be partly attributed to the very nature of econometric work across panels of countries which, exceptions due to modelling sophistication notwithstanding, is capable of identifying the presence or absence of a statistically significant directional effect (positive or negative) but not the underlying reason or reasons why, on average, such an effect emerges. For example, by and large, it remains unproven if the negative or non-significant results of some empirical analyses subjected to our scrutiny are providing any support to specific hypotheses suggesting such predictions. In an attempt to square such ambiguity, we consider it plausible to suggest that such negative or non-significant results may partly stem from the fact that for a large number of industries involved in FDI, IPR protection is not important, even though for those industries in which it is (industries with high R&D and IP content), strong IPRs provide a positive incentive for attracting FDI. This explanation could possibly help reconcile the conflicting findings by, say, Mansfield (1994) vs. Watkins and Taylor (2010). Alternatively, there may be many countries in which the strength of other FDI country/location determinants may heavily outweigh the significance of IPR protection; after all, as originally argued by Maskus (2000) and empirically shown by many of the studies reviewed, it should be borne in mind that IPR protection is only one of the many factors that influence firms' FDI country location decisions.

That said, there are other reasons that we wish to put forward to rationalise the mixed evidence to date. On this account, we should start by noting that the advances in our knowledge of the links between IPRs and FDI made from the ground breaking survey of Mansfield (1994) to the state-of-the-art econometric contributions for the time particularly by Javorcik (2004), Nunnenkamp and Spatz (2004), Nicholson (2007), and Park and Lippoldt (2008), have not been followed by equally innovative research over the last decade. Indeed, in spite of recent developments in data availability, survey design and sampling techniques, and econometric methods, much of subsequent applied work has been fraught with similar limitations suffered by earlier studies thus failing to add significantly to previous knowledge and square extant mixed findings in order to provide a definite answer to the question of the impact of IPRs on FDI and FDI country location decisions.

The empirical evidence to date suffers from three main problems. First, scarcity of quality data on both FDI and the strength of IPR protection, has led to systematic inconsistencies in measurement across most of the papers listed in the online Appendix, and

often plagued the reliability of the results reported. FDI has typically been measured in three different ways: (i) as flows (in monetary terms); (ii) as stocks (in monetary terms); and (iii) as counts of countries entered or subsidiaries (or units) owned abroad. For each of these three main approaches, there are numerous different ways of measuring and hence choices to be made. For example, whether to use historical or current values, and which currency to use. As discussed extensively in the literature – see, for example, Bellak and Cantwell (1996), Cantwell and Bellak (1998), and Beugelsdijk, Hennart, Slangen and Smeets (2010) – such choices are anything but straightforward, often entailing measurement trade-offs that have serious implications for research results, and hence for any conclusions from research findings. Specifically, we regard aggregate FDI measures based on (episode) count data or the accumulated stock of FDI (which includes the *net* position of the accumulation of investment at a certain point in time), insufficiently informative to deal with the question of the impact of IPRs on inward FDI *over time*, especially when limited sample periods - which in many papers listed in the online Appendix are restricted to one, two or three years - are considered. Surveys of foreign investors too are, by their very nature, based on MNEs' investment activities at one point in time. Although several studies have considered the flows of FDI over time as a suitable dependent variable, given that firms' FDI location decisions are ultimately influenced by considerations pertaining to the profitability of their FDIs rather than their volumes, it is surprising that no study to date has attempted to employ a country's firms earnings from FDI in another country as a measure of FDI that would more closely reflect the extent to which IPR enforcement might affect firms' profitability from their foreign investments.[10] Similarly, the measurement of the strength of IPR protection has been a thorny issue. The Rapp-Rozek index only considers one type of IP, patents. The Ginarte-Park index extends the mapping of IPRs to different categories but its composite score of IPR strength still relies on how IPR laws are written 'on the books' thereby neglecting the all-important element of the actual enforcement of such laws, an element also neglected in studies using counts of IPR legislation reform crudely captured by the use of dummy variables (e.g., Branstetter *et al.*, 2007). Survey-based measures of IPR protection such as Lee and Mansfield's (1996) index, attempt to account for IPR enforcement but they are intrinsically hampered by their subjective character, potential reporting biases, and the inherent ambiguity surrounding which type of IP the responses of the thus constructed survey-based index refer to.

A second problem is that econometric model specifications and estimation methods have been inadequate in ensuring reliable inference, and investigating in more depth the true nature of the functional form governing the data generation process (DGP) underlying the IPR-FDI relationship. For example, very few studies listed in the online Appendix have tested for the integration and cointegration properties of the time series entering IPR-FDI regressions on the unwarranted assumption that all the variables are level stationary while others have removed the long-run properties of the data altogether by first-differencing the data, such as Adams (2010). Yet, in general, regression models for nonstationary variables give spurious results. Granger and Newbold (1974) were the first to draw attention to the deleterious consequences of estimating a 'spurious regression'. They argued that the 'levels' of many economic variables are non-stationary, and if such data are used in a regression model, misleading statistical evidence is found. Similarly, with very few exceptions, previous econometric studies have not controlled for the likely endogeneity problem. This is a significant shortcoming in the context of the relationship in question since, whilst the strength of IPRs may affect FDI, the level of inward FDI too may be expected to influence the extent of imitation and the perceived need to better legislate for and/or enforce IPRs in developing countries. Not to mention the simultaneity bias or feedback effects likely to be present among other FDI determinants and the IPR measure used, most notably market size, the level of educational attainment, and the quality of technological and scientific infrastructure, all of which have been found to correlate with imitative capacity in developing countries. Also, prior analyses of panel data IPR-FDI models have hardly ever been concerned with the problem of cross-section dependence. Cross-section dependence can arise due to spatial or spill-over effects (or unobserved common factors), problems likely to apply across the units of panel data made up of countries or firms considered in IPR-FDI regressions, with non-trivial consequences for estimation and hypothesis testing. As Baltagi and Pesaran state (2007, p. 229), "the first generation panel unit root and cointegration tests developed in the 1990's, which assumed cross-sectional independence, are inadequate and could lead to significant size distortions in the presence of neglected cross-section dependence". Additionally, the number of papers listed in the online Appendix that have considered any form of nonlinearity can be counted on one hand, and in the few studies that have done so, the analysis is limited to investigating the restrictive case of an inverse-U relationship or diminishing returns by including a squared IPR term in the regression (e.g., Adams, 2010). If the DGP of the IPR-

FDI relationship is, in fact, nonlinear, the use of linear modelling leads to misspecification, and subsequently, estimation and associated tests become unreliable.

Finally, it should be recognised that despite the value in estimating average net effects across countries and over time, econometric studies are incapable of delving into the processes through which different firms (managers) make their FDI location decisions in light of the strength of IPRs while accounting for firm-specific characteristics and the match between motives, resources, capabilities and location choice, aspects better captured by qualitative analysis based on survey or interview data. As shown by Mansfield's pioneering work, qualitative research can provide invaluable insights into the role of managerial perceptions, experiences and actions with regard to the way in which different firms (managers) make FDI location decisions based on the perceived strength of IPRs in host markets, the importance they attribute to IPR protection in particular locations and how such perceptions induce or deter FDI vis-à-vis alternative entry modes given the firm-specific investment motives, type of FDI, technological intensity, ownership and internalisation advantages, and firm level strategy processes. Unfortunately, despite the laudable ideal of combining the strengths of both qualitative and quantitative research methods, the few attempts to accomplish such an ambitious task by applying mixed methods, have not produced the expected synergistic benefits of such disciplinary integration mostly due to the very basic and unsophisticated econometric model specifications accompanying the survey findings (Mansfield, 1994, is a case in point).

A challenging but highly rewarding research agenda naturally arises from attempting to address many of the limitations, gaps and shortcomings highlighted above. With respect to data and measurement issues, the need is paramount for analyses investigating how the flows of FDI, or even better, earnings from FDI by firms in one country investing in another, respond to changes in IPR regimes over a long time span, with such FDI data broken down at industry level. Concomitantly, the measurement of the strength of IPRs should prioritise the aspect of enforcement. Enforcement is important because the actual strength of IPR protection at country level hinges on the efficiency and effectiveness of administration and enforcement of IPRs (Maskus, 2015). Future studies should attempt to make use of the more sophisticated measures that have emerged from recent literature such as the patent index proposed by Papageorgiadis *et al.* (2014), which places particular emphasis on the effectiveness of enforcement practices as perceived by managers, together with the overall administrative effectiveness and efficiency of the national patent system.

In terms of dealing better with model specification and estimation issues, future econometric studies should give greater consideration to issues concerned with asymmetry and other possible nonlinearities that have yet to be investigated. For example, there is no reason to assume that an increase in the strength of IPRs (positive change) would have the same effect on FDI as an equally-sized decrease (negative change) in IPR protection. The recent non-linear autoregressive distributed lag (NARDL) model developed by Shin *et al.* (2014) could be usefully employed to test this assumption (which is ubiquitous in prior studies), as it incorporates asymmetries both in the long- and short-run relationships and, at the same time, captures the asymmetries in the dynamic adjustment whilst also allowing the regressors to be of mixed order of integration in testing for cointegration. Similarly, no previous study has investigated whether the strength of IPRs has a different effect along the conditional distribution of FDI. Powell's (2016) quantile panel estimator, which is designed to estimate varying effects at different points in the conditional distribution of the dependent variable, could be profitably used for this purpose since it is plausible to expect that the coefficients that characterise the elasticity of earnings from FDI to changes in IPRs may vary over time, possibly due to the fact that the influence of the strength of IPRs on FDI may be a function of shocks, an interpretation of quantile regression discussed by Xiao (2009). Such developments should complement model specifications attempting to address many of the theoretically-charged questions on the IPR-FDI nexus that are still subject to debate. For example, by accounting for the multiple, simultaneous channels through which competing decisions in serving foreign markets (via FDI, trade or licencing) in countries with high IPR protection are made, and testing for such substitution effects. This approach could pave the way for a better integration of theory and empirical analysis and thus allow future empirical evidence to offer insights that may better facilitate the further refinement of theory.

Notwithstanding the above, albeit valuable to unveil average net effects, it should be borne in mind that econometric evidence can shed no light on *how* exactly IPRs influence the FDI decision making process of different firms (managers) to invest or not invest in specific overseas markets. Accordingly, it seems reasonable to suggest that significant advances from both qualitative and quantitative studies are more likely to emerge from focused research designs, either, and exclusively, qualitative or quantitative, that leverage on the inherently different levels of analysis of what the best qualitative and quantitative research methods can offer given their complementary nature. These distinct empirical strategies are best developed by considering data stemming from FDI firms' decisions or FDI flows/earnings from one

specific country to another whilst accounting for industry specific factors. For example, from a qualitative point of view, we have yet to find out if and how the strength of IPR protection actually influences US or UK firms' investments in China; an analysis that is lacking and which would provide a particularly informative country-dyad setting for the study of how the perceived strength of IPR protection influences the FDI location decision of US or UK companies. Despite the inherently subjective character of survey evidence based on managerial perceptions, the complementary value of such data remains important since unless managerial perceptions and 'decision making' shift as a result of IPR regime change in developing and emerging economies, legislative IPR reforms in such countries are likely to fall short of their objectives. As such, a comprehensive survey and follow up interviews advancing on Mansfield's original blueprint and providing deep insights of how the current Chinese IPR environment affects firms' decisions to invest or not to invest in China would constitute a significant contribution to knowledge.

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Notes

1. For a thorough coverage of the nature of FDI and its multifaceted theoretical rationalisation, we refer the interested reader to the survey article by Faeth (2009), published in this journal.

2. The World Trade Organisation (WTO) defines IPRs as "the rights given to persons over the creations of their minds" (https://www.wto.org/english/tratop_e/TRIPS_e/intel1_e.htm). Such rights, which include patents, trademarks, copyright and trade secrets, protect the creator from unauthorised commercial exploitation. IPRs are often contextualised theoretically by referring to Arrow's (1962) seminal work, where he states that "In an ideal socialist economy, the reward for invention would be completely separated from any charge to the users of the information. In a free enterprise economy, inventive activity is supported by using the invention to create property rights; precisely to the extent that it is successful, there is an underutilization of the information." (p. 617). It follows that the use of IPRs is a second best, government-mediated solution to the rewarding of inventors, to maintain the

incentive to innovate (Braga and Fink, 1998). Arrow's rationale for the protection warranted by IPRs can be regarded as a second best solution to the problem stemming from the quasi-public good nature of knowledge because while IPRs, by enhancing 'appropriability', can foster investment in R&D, innovation and technological progress, they constrain the consumption of knowledge by enabling the market power of patent holders (Arrow, 1962). Thus framed, IPRs entail a government-driven mediation between the producers of knowledge and society since distortions in the societal consumption of knowledge due to monopolistic practices may overcome the dynamic benefits of R&D (Braga and Fink, 1998).

3. In addition to the baseline IP standards created by The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) between all WTO member nations in 1994, many countries have established bilateral agreements to adopt higher standards of IPR protection.

4. Over forty years since its inception, the 'OLI' paradigm remains the approach to the study of FDI that still commands benchmarking significance. The OLI triad emphasises three sources of advantage that motivate a firm to become an MNE. Ownership advantages address why some firms go international by highlighting the possession of advantages that allow firms to overcome the costs of operating in a foreign country. Such advantages include monopolistic advantages (such as privileged access to input and output markets, patent rights, licenses, rare and unique resources), technological advantages (including knowledge embedded in innovation activities), and economies of scale and scope or advantages of common governance (e.g., international diversification of risks and assets, and wider access to financial capital across the MNE). Location advantages refer to the factors that favour production abroad, where an MNE chooses to locate. Finally, internalisation advantages affect how a firm chooses to operate in a foreign country. The choice is based on trading off the savings in transactions and monitoring costs of conducting particular operations internally in the firm (through FDI) against the advantages of other internationalisation strategies such as exports or licensing.

5. Maskus (2000) also notes that the trend of harmonisation of IPR legislation across countries could ultimately reduce the relative effectiveness of IPR protection as a locational determinant of FDI.

6. This is consistent with Yang and Maskus (2001), who find that licensing is more likely to take place in countries with strong IPR protection.

7. This view is consistent with Mansfield (1994), who suggested that companies may look to invest with older technology should there be a concern about IPRs.

8. Lesser (2002) analysed the effect of improved IPRs in a sample of 44 developing countries, finding a positive and significant association. His results suggest that a one point rise in the IPR score he developed is associated with a US$1.5 billion increase in FDI.

9. We label section 4.2 "*Survey-based, Qualitative or Mixed Methods Studies*" to distinguish them from the exclusively econometric studies reviewed earlier, even though many of the latter studies use quantitative, survey-based IPR measures themselves based on insights/judgements of respondents/informants.

10. Although, admittedly, as pointedly noted by an anonymous reviewer, the lack of studies on firms' earnings from FDI, can be partly accounted for by issues such as data availability, transfer pricing, and taxes, to explain their paucity.

References

Adams, S. (2010) Intellectual property rights, investment climate and FDI in developing countries. *International Business Research* 3(3): 201–209.

Arrow, K. (1962) Economic welfare and the allocation of resources for invention. In *The Rate and Direction of Inventive Activity: Economic and Social Factors* (pp. 609–626). Princeton: Princeton University Press.

Awokuse, T.O. and Yin, H. (2010) Intellectual property rights protection and the surge in FDI in China. *Journal of Comparative Economics* 38(2): 217–224.

Baltagi, B.H. and Pesaran, M.H. (2007) Heterogeneity and cross-section dependence in panel data models: theory and applications. *Journal of Applied Econometrics* 22(2): 229–232.

Bellak, C. and Cantwell, J. (1996) Foreign direct investment: how much is it worth? Comment on S.J. and A.M. Rugman. *Transnational Corporations* 5(1): 85–97.

Beugelsdijk, S., Hennart, J-F., Slangen, A. and Smeets, R. (2010) Why and how FDI stocks are a biased measure of MNE affiliate activity. *Journal of International Business Studies* 41(9): 1444–1459.

Braga, P.C.A. and Fink, C. (1998) The relationship between intellectual property rights and foreign direct investment. *Duke Journal of Comparative & International Law* 9: 163–187.

Branstetter, L., Fisman, R., Foley, C.F. and Saggi, K. (2007) *Intellectual Property Rights,*

Imitation, and Foreign Direct Investment: Theory and Evidence. NBER Working Paper, No. 13033. Cambridge, MA: National Bureau of Economic Research.

Branstetter, L. and Saggi, K. (2011) Intellectual property rights, foreign direct investment and industrial development. *Economic Journal* 121(555): 1161–1191.

Callahan, J.L. (2014) Writing literature reviews a reprise and update. *Human Resource Development Review* 13(3): 271–275.

Cantwell, J. and Bellak, C. (1998) How important is foreign direct investment? *Oxford Bulletin of Economics and Statistics* 60(1): 99–106.

Chen, P.L. (2013) Modes of foreign direct Investment and intellectual property rights protection: Wholly-owned or joint venture? Firm-level evidence from Taiwanese multinational manufacturing enterprises. *Review of International Economics* 21(3): 549–561.

Contractor, F. (1981) *International Technology Licensing*. Lexington, MA: D.C. Heath.

Dhar, B. and Joseph, R. (2012) *Foreign Direct Investment, Intellectual Property Rights and Technology Transfer. The North-South and the South-South Dimension.* UNCTAD and South Centre.

Dunning, J.H. (1976) *Trade, Location of Economic Activity and the MNE: A Search for an Eclectic Approach*. University of Reading, Department of Economics. Mimeo.

Dunning, J.H. (1977) Trade, location of economic activity and the MNE: a search for an eclectic approach. In B. Ohlin, P.O. Hesselborn and P.M. Wijkman (Eds.), *The International Allocation of Economic Activity* (pp. 395–418). London: Macmillan.

Dunning, J.H. (1979a) Explaining changing patterns of international production: in defence of the eclectic theory. *Oxford Bulletin of Economics and Statistics* 41(4): 269–295.

Dunning, J.H. (1979b) Toward an eclectic theory of international production: some empirical tests. *Journal of International Business Studies* 11(1): 9–31.

Dunning, J.H. (1994) *Globalization, Technical Change and the Spatial Organization of Economic Activity*. Paper presented at the Bertil Ohlin Symposium, Stockholm, Sweden.

Dunning, J.H. (2012) *International Production and the Multinational Enterprise (RLE International Business).* London: Routledge.

Faeth, I. (2009) Determinants of foreign direct investment – a tale of nine theoretical models. *Journal of Economic Surveys* 23(1): 165–196.

Ferrantino, M.J. (1993) The effect of intellectual property rights on international trade and

investment. *Weltwirtschaftliches Archiv* 129(2): 300–331.

Fink, C. and Braga, P.C.A. (2005) How stronger protection of intellectual property rights affects international trade flows. In C. Fink and K.E. Maskus (Eds.), *Intellectual Property and Development - Lessons from Recent Economic Research* (pp. 19–40). Washington: World Bank Publications.

Fosfuri, A. (2004) Determinants of international activity: evidence from the chemical processing. *Research Policy* 33(10): 1599–1614.

Ginarte, J.C. and Park, W.G. (1997) Determinants of patent rights: a cross-national study. *Research Policy* 26(3): 283–301.

Glass, A.J. and Saggi, K. (2002) Intellectual property rights and foreign direct investment. *Journal of International Economics* 56(2): 387–410.

Glass, A.J. and Wu, X. (2007) Intellectual property rights and quality improvement. *Journal of Development Economics* 82: 393–415.

Globerman, S. and Shapiro, D. (2002) Global foreign direct investment flows: the role of governance infrastructure. *World Development* 30(11): 1899–1919.

Globerman, S. and Shapiro, D. (2003) Governance infrastructure and US foreign direct investment. *Journal of International Business Studies* 34(1): 19–39.

Gould, D.M. and Gruben, W.C. (1996) The role of intellectual property rights in economic growth. *Journal of Development Economics* 48(2): 323–350.

Granger, C.W.J. and Newbold, P. (1974) Spurious regressions in econometrics. *Journal of Econometrics* 2(2): 111–120.

Grossman, G.M. and Helpman, E. (1991) *Innovation and Growth in the Global Economy*. Cambridge, MA: MIT Press.

Heald, P. (2004) A sceptical look at Mansfield's 1994 survey. *Information Economics and Policy* 16(1): 57–65.

Helpman, E. (1993) Innovation, imitation and intellectual property rights. *Econometrica* 61(6): 1247–1280.

Hsu, J. and Tiao, Y.E. (2015) Patent rights protection and foreign direct investment in Asian countries. *Economic Modelling* 44: 1–6.

Javorcik, B.S. (2004) The composition of foreign direct investment and protection of intellectual property rights: evidence from transition economies. *European Economic Review* 48(1): 39–62.

Kaufmann, D., Kraay, A. and Zoido-Lobaton, P. (1999a) *Aggregating Governance*

Indicators. World Bank Working Paper No. 2195. Washington, DC: The World Bank.

Kaufmann, D., Kraay, A. and Zoido-Lobaton, P. (1999b) *Governance Matters*. World Bank Working Paper No. 2196. Washington, DC: The World Bank.

Kondo, E.K. (1995) The effect of patent protection on foreign direct investment. *Journal of World Trade* 29(6): 97–122.

Kumar, N. (1996) Intellectual property protection, market orientation and location of overseas R&D activities by multinational enterprises. *World Development* 24(4): 673–688.

Kyrkilis, D. and Koboti, S. (2015) Intellectual property rights as determinant of foreign direct investment entry mode: the case of Greece. *Procedia Economics and Finance* 19: 3–16.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A. and Vishny, R. (1998a) Legal determinants of external finance. *Journal of Political Economy* 106: 1113–1155.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A. and Vishny, R. (1998b) *The Quality Government*. NBER Working Paper No. 6727. Cambridge, MA: National Bureau of Economic Research.

Lai, E.L.-C. (1998) International intellectual property rights protection and the rate of product innovation. *Journal of Development Economics* 55(1): 133–153.

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

Leahy, D. and Naghavi, A. (2010) Intellectual property rights and entry into a foreign market: FDI versus joint ventures. *Review of International Economics* 18(4): 633–649.

Lee, J.-Y. and Mansfield, E. (1996) Intellectual property protection and US foreign direct investment. *The Review of Economics and Statistics* 78(2): 181–186.

Lesser, W. (2002) The Effects of intellectual property rights on foreign direct investment and imports in developing countries. *IP Strategy Today* 5(1): 1–16.

Mansfield, E. (1993) Unauthorized use of intellectual property: effects on investment, technology transfer, and innovation. In M. Wallerstein, M. Mogee and R. Schoen (Eds.), *Global Dimensions of Intellectual Property Rights in Science and Technology* (pp. 107–145). Washington, DC: National Academy Press.

Mansfield, E. (1994) *Intellectual Property Protection, Foreign Direct Investment, and*

Technology Transfer. International Finance Corporation, Discussion Paper No. 19. Washington, DC: The World Bank.

Mansfield, E. (1995) *Intellectual Property Protection, Foreign Direct Investment, and Technology Transfer – Germany, Japan, and the United States*. International Finance Corporation, Discussion Paper 27. Washington, DC: The World Bank.

Mansfield, E., Schwartz, M. and Wagner, S. (1981) Imitation costs and patents: an empirical study. *Economic Journal* 91(364): 907–918.

Markusen, J.R. (2001) Contracts, intellectual property rights, and multinational investment in developing countries. *Journal of International Economics* 53(1): 189–204.

Maskus, K.E. (1998a) The role of intellectual property rights in promoting foreign direct investment and technology transfer. *Duke Journal of Comparative and International Law* 9(1): 109–161.

Maskus, K.E. (1998b) The international regulation of intellectual property. *Weltwirtschaftliches Archiv* 134(2): 186–208.

Maskus, K.E. (2000) *Intellectual Property Rights and Foreign Direct Investment*. Policy Discussion Paper No. 0022. Centre for International Economic Studies. University of Adelaide.

Maskus, K.E. (2015) Intellectual property in a globalizing world: issues for economic research. *Asia-Pacific Journal of Accounting and Economics* 22(3): 231–250.

Maskus, K.E., Dougherty, S.M. and Mertha, A. (2005) Intellectual property rights and economic development in China. In C. Fink and K.E. Maskus (Eds.), *Intellectual Property and Development: Lessons from Recent Economic Research* (pp. 295–332). World Bank and Oxford University Press.

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

Maskus, K.E. and Penubarti, M. (1995) How trade-related are intellectual property rights? *Journal of International Economics* 39(3): 227–248.

Mathew, A.J. and Mukherjee, A. (2014) Intellectual property rights, southern innovation and foreign direct investment. *International Review of Economics and Finance* 31: 128–137.

Mayer, T. and Pfister, E. (2001) Do stronger patent rights attract foreign direct investment?

Evidence from French multinationals' location. *Region et. Developpement* 13: 99–122.

McCalman, P. (2004) Foreign direct investment and intellectual property rights: evidence from Hollywood's global distribution of movies and videos. *Journal of International Economics* 62(1): 107–123.

Nicholson, M.W. (2007) The impact of industry characteristics and IPR policy on foreign direct investment. *Review of World Economics* 143(1): 27–54.

Nielsen, B.B., Asmussen, C.G. and Weatherall, C.D. (2017) The location choice of foreign direct investments: empirical evidence and methodological challenges. *Journal of World Business* 52(1): 62–82.

Nunnenkamp, P. and Spatz, J. (2004) Intellectual property rights and foreign direct investment: a disaggregated analysis. *Review of World Economics* 140(3): 393–414.

OECD (2008). *Benchmark Definition of Foreign Direct Investment* (4th Ed.). Available at: https://www.oecd.org/daf/inv/investmentstatisticsandanalysis/40193734.pdf

Papageorgiadis, N., Cross, A.R. and Alexiou, C. (2014) International patent systems strength 1998–2011. *Journal of World Business* 49(4): 586–597.

Park, W.G. (2001) *Do Intellectual Property Rights Stimulate R&D and Productivity Growth?* Department of Economics Working Paper. Washington, DC: American University.

Park, W.G. (2008) International patent protection: 1960–2005. *Research Policy* 37(4): 761–766.

Park, W.G. (2011) Intellectual property rights and foreign direct investment: lessons for Central America. In R. Shankar (Ed.), *Getting the Most Out of Central America's Free Trade Agreements* (pp. 275–308). Washington, D.C.: World Bank.

Park, W.G. and Lippoldt, D. (2003) The impact of trade-related intellectual property rights on trade and foreign direct investment in developing countries. *OECD Papers* 3(11): 1–40.

Park, W.G. and Lippoldt, D. (2008) *Technology Transfer and the Economic Implications of the Strengthening of Intellectual Property Rights in Developing Countries*. OECD Trade Policy Papers, No. 62. Paris: OECD Publishing.

Pfister, E. and Deffains, B. (2005) Patent protection, strategic FDI and location choices: empirical evidence from French subsidiaries' location choices in emerging economies. *International Journal of the Economics of Business* 12(3): 329–346.

Powell, D. (2016) *Quantile Regression with Nonadditive Fixed Effects*. RAND Working Paper. Available at: https://works.bepress.com/david_powell/1/

Rapp, R.T. and Rozek, R.P. (1990) *Benefits and Costs of Intellectual Property Protection in Developing Countries.* Working Paper No. 3. White Plains, NY: National Economic Research Associates, Inc.

Seyoum, B. (1996) The impact of intellectual property rights on foreign direct investment. *Columbia Journal of World Business* 31(1): 51–59.

Seyoum, B. (2006) Patent protection and foreign direct investment. *Thunderbird International Business Review* 48(3): 389–404.

Shin, Y., Yu, B. and Greenwood-Nimmo, M. (2014) Modelling asymmetric cointegration and dynamic multipliers in an ARDL framework. In W.C. Horrace and R.C. Sickles (Eds.), *Festschrift in Honor of Peter Schmidt* (pp. 281–314). New York: Springer Science and Business Media.

Smith, P.J. (2001) How do foreign patent rights affect US exports, affiliate sales, and licenses? *Journal of International Economics* 55(2): 411–439.

Tanaka, H. and Iwaisako, T. (2014) Intellectual property rights and foreign direct investment: a welfare analysis. *European Economic Review* 67: 107–124.

Ushijima, T. (2013) Patent rights protection and Japanese foreign direct investment. *Research Policy* 42(3): 738–748.

Wang, Z.Q. and Swain, N.J. (1995) The determinants of foreign direct investment in transforming economies: empirical evidence from Hungary and China. *Weltwirtschaftliches Archiv* 131(2): 359–382.

Watkins, J.M. and Taylor, M.Z. (2010) Intellectual property protection and US foreign direct investment in emerging economies. *Journal of Intellectual Property Rights* 15(6): 415–428.

Xiao, Z. (2009) Quantile cointegrating regression. *Journal of Econometrics* 150(2): 248–260.

Yang, G. and Maskus, K.E. (2001) Intellectual property rights and licensing: an econometric investigation. *Weltwirtschaftliches Archiv* 137: 58–79.

Yang, L. and Maskus, K.E. (2009) Intellectual property rights, technology transfer and exports in developing countries. *Journal of Development Economics* 90(2): 231–236.

Yang, Z. (2013) *Intellectual Property Rights Protection, Complexity and Multinational Firms.* Munich Personal RePEc Archive, MPRA Paper No. 46734.

You, K. and Katayama, S. (2005) Intellectual property rights protection and imitation: an empirical examination of Japanese FDI in China. *Pacific Economic Review* 10(4): 591–604.

Yu, P.K. (2007) Intellectual property, economic development, and the China puzzle. In D.J. Gervais (Ed.), *Intellectual Property, Trade and Development: Strategies to Optimize Economic Development in a TRIPs Plus Era* (pp. 173–220). New York: Oxford University Press.

Zhang, H. and Yang, X. (2016) Trade-related aspects of intellectual property rights agreements and the upsurge in foreign direct investment in developing countries. *Economic Analysis and Policy* 50: 91–99.

Zhao, M. (2006) Conducting R&D in countries with weak intellectual property rights protection. *Management Science* 52(8): 1185–1199.

Online Appendix. Selected studies.

Author(s) and year	Countries considered	Sample period	Method	IPR measure	FDI measure	Industry/sector disaggregation	Other variables considered
Ferrantino (1993)	OECD (Belgium, Canada, Denmark, Finland, France, Italy, Japan, Netherlands, Norway, Sweden, Switzerland, UK, W. Germany); Small Ports (Jamaica, Liberia, Panama, UAE); Southern NICs (Argentina, Australia, New Zealand, Singapore, South Africa); Latin America (Chile, Colombia, Mexico, Philippines (SIC), Peru, Thailand (SIC), Trinidad & Tobago); Euro NICs (Greece, Ireland, Israel, Spain); Africa (Egypt, Indonesia (SIC), Nigeria); Asian NICs (Ecuador (SIC), Malaysia, South Korea); "Empire" (Brazil, Portugal, Turkey); and India. Cluster names for identification only.	Single point in time: year 1982.	Adaptation of the gravity model.	Uses a series of dummy variables to capture whether or not a country belongs to an international patent or copyright convention.	Four dependent variables: Total exports to country; sales of US overseas affiliates in local market (FDI proxy); exports of US firms to their overseas affiliates; and royalties and license fees (payments and receipts of US overseas affiliates to/from affiliated and non-affiliated firms).	No industry disaggregation.	Economic distance variables (geographic distance, persons per telephone, political risk, and dummies for 'colony', 'landlocked' and 'European continent' countries), policy distance variables (tariff, incentives and restrictions regime, FX regime, dummies for Paris and Berne convention membership, number of memberships, duration of patent) and other independent variables (labour costs, population, and GDP).

Mansfield (1993)	15 developing countries: Argentina, Brazil, Chile, Hong Kong, India, Indonesia, Mexico, Nigeria, Philippines, Singapore, Republic of Korea (South Korea), Spain, Taiwan (China), Thailand, and Venezuela.	Four periods: 1988; 1989; 1990; and the mean of the three years.	Simple OLS.	Own IPR strength index, also by industry (and compared to two other measures). Used the average over his six industries of the mean of the three measures of the weakness of *j* country's IPR protection. Same in regressions disaggregated by industry but in *i* industry in *j* country.	Change in US FDI position in *j* country, and US capital outflow to *j* country. In regressions disaggregated by industry, he uses the change in US FDI position in *i* industry in *j* country in 1990, change in 1989, and sum of the changes in both years.	An aggregate country regression and a regression disaggregated by industry: chemicals (including pharmaceuticals); transportation equipment; electrical equipment; food; metals; and machinery.	Population, GDP, corporate taxation level, exports to imports ratio; urbanisation; percentage of *j* country's GDP attributable to wholesale and retail trade, transport & communications; frequency of change of the national executive of *j* country; six industries' average of the mean of three IPR measures.
Maskus & Eby-Konan (1994)	Relates several measures of US foreign presence in seven broad manufacturing sectors in 44 countries to those countries' national characteristics.	Single point in time: year 1982.	Tobit estimation.	Rapp & Rozek (1990) index.	Foreign presence is measured by the US investment position abroad, net property, plant & equipment of US affiliates, net FDI flows, employment of US affiliates, and net royalties and licence	Data on industry characteristics (proxies for strategic competition, multi-plant economies, and so) are not available.	Change in bilateral exchange rate (1975-1982), change in share of manufacturing in GDP (1965-1985), growth in GNP (1965-1984), debt-service ratio, dummies for the EC and Canada, incentives measure (percentage of affiliates that

					fees associated with FDI.		received some tax concessions), and disincentives measure (percentage of affiliates subject to a requirement to transfer technology).
Mansfield (1994)	Random selection of 100 US MNEs using a list of major firms listed in Business Week of June 1990; MNEs were asked about 16 countries: Argentina, Brazil, Chile, Hong Kong, India, Indonesia, Japan, Mexico, Nigeria, Philippines, Singapore, Republic of Korea (South Korea), Spain, Taiwan (China), Thailand, and Venezuela.	Single point in time (1991). Regression results reported have a sample period from 1989 to 1992.	Questionnaire achieving complete or partial returns from 94 firms (23.8% response rate); follow-up interviews with a cross-section of firms. Also reports estimation results by Lee's unpublished doctoral thesis.	Own measure of MNEs' perceptions of IPRs in the countries considered by his survey, and then compared against Rapp & Rozek's (1990) index of patent protection; finding a high correlation between the two.	Five different types of investment by US MNEs: sales & distribution outlets, rudimentary production & assembly facilities, facilities to manufacture components, and complete products, and R&D facilities.	US MNEs' FDI in six different industries: chemicals (including pharmaceuticals); transportation equipment; electrical equipment; machinery; food; and metals.	The regression results reported relate to OLS estimation of a basic model of the change in US outward controlling for market size and a dummy for Mexico.
Mansfield (1995)	Survey of a random sample of 45 Japanese MNEs and 35 German MNEs.	Single point in time. German & Japanese data relate to 1994,	Questionnaire. The response rate was 71% in Japan and 57% in Germany (hence lower than the 94% figure for the	Two survey-based measures of MNEs' perceptions of IPRs: (i) mean percentage of US firms regarding IPR protection as	Survey based information. For the econometric model, the stock of FDI prior to year *t*.	For the survey: chemicals, pharmaceuticals, electrical equipment, and machinery, transportation equipment, metals, and food industries. For the econometric model, only	Size of a country's market, the stock of prior FDI, a dummy variable for Mexico.

		US data to 1991. Model for US manufacturing FDI into 14 countries estimated over 1990-1993.	US). The econometric model for the US is estimated using OLS.	too weak to invest in JVs where they contribute advanced technology; (ii) mean percentage of US firms regarding protection as too weak to transfer advanced technology to wholly-owned subsidiaries.		aggregate US FDI in manufacturing is considered.	
Kondo (1995)	Country sample: Belgium, Sweden, Hong Kong, UK, Singapore, Japan, Italy, Philippines, Germany, Netherlands, Portugal, France, Australia, Greece, Switzerland, Denmark, Ireland, Malaysia, Taiwan, Austria, Chile, Argentina, Rep of Korea, Brazil, Ecuador, Spain, India, Thailand, Columbia, Venezuela, Mexico, Peru, Indonesia.	1979-1987.	Survey of 172 firms from a range of sectors to gauge the relative importance of each of the 15 scope provisions to the firm's decision to invest in a host country. Multiple regression analysis of FDI stock averaged	Own measure of IPRs based on a numeric representation of 23 patent law features subdivided into three dimensions that are then combined into indicators reflecting the relative strength of a particular patent law. Also used a	The stock of FDI, and rate of change of FDI.	Two digit SIC Chemical and Allied Products (49), Electric and Electronics Equipment (11), Food and Kindred Products (11), Industrial Machinery and Equipment (11), Primary and Fabricated Metals (12), Transportation Equipment (16), Other Manufacturing (43**).**	GDP per capita, population, information cost variable (English *vs.* Non English), factor production variable, percentage of school age children enrolled in secondary school, tariff /non-tariff (membership or not of GATT), political risk variable (member or not of ICSID.

			over the sample period. Regression analysis on rate of change of FDI over time. Regressions based on FDI level before and after patent law changes.	survey of 172 firms with in-house patent counsel to measure the relative weights of patent provisions in particular patent laws.			
Kumar (1996)	R&D investments by US MNEs in up to 44 industrialised and developing countries on the basis of the Benchmark Survey data on US Direct Investment Abroad in 1977, 1982 and 1989.	Only three years are considered. The effect of the time dimension is detected by including dummy variables for 1977 and 1989, using 1982 as a benchmark .	OLS.	Rapp & Rozek (1990) index.	Expenditure on R&D by majority-owned affiliates of US enterprises in different host countries in the industrialized and developing countries.	Full sample is disaggregated by chemical and food products industries. The full sample is also disaggregated between industrialised and developing economies.	Expenditure on R&D; sales of nonbank US affiliates; GNP of *j* country; FDI royalties and technical fees received by US parents from affiliates divided by affiliate sales; host country sales of majority-owned affiliates; exports by majority-owned affiliates to countries other than the US; exports by majority-owned affiliates to US; total national expenditure on R&D in *j* country; No. of patents granted in *j* country to residents; enrolment ratio for

							HE in *j* country; average wage in *j* country; expenditure on R&D by majority-owned affiliates in *j* country divided by R&D employment; informational infrastructure in *j* country.
Lee & Mansfield (1996)	US MNEs' perceptions of IPR strength and the volume and composition of US FDI in 14 developing countries: Argentina; Brazil; Chile; Hong Kong; India; Indonesia; Mexico; Nigeria; Philippines; Singapore; South Korea; Taiwan; Thailand; and Venezuela.	Three years only: 1990; 1991; and 1992.	OLS and Tobit estimations.	Mansfield's survey index.	US capital outflows in millions of dollars (source: US Department of Commerce).	Disaggregation across six manufacturing industries: Chemicals (including drugs); electrical equipment; machinery: transportation equipment; metals; and food.	Market size, stock of past investment, measures of industrialisation and trade openness, and a dummy for Mexico. Some regressions also included R&D expenditure, education level and energy usage.
Seyoum (1996)	A sample of 30 countries was randomly selected from five geographic clusters: North America, Latin America, Europe, Africa, the Middle East and Asia. Complete data was collected for 27	Data covering the period from 1975 to 1990.	Regression equations for FDI rates for the 27 countries in the sample estimated using pooled-time series (1975-90), cross-sectional (27	Level of IPR protection data obtained from a questionnaire to IPR experts and practitioners in the 27 countries. Questionnaire	The dependent variable is FDI inflows, total direct investment flows into 27 countries (1975-1990) computed as a percentage of GDP.	No industry disaggregation. Regressions disaggregate 'ALL' countries into 'Less Developed Countries' (LDCs), 'Newly Industrialising Countries' (NICs) and 'Developed	Eight independent variables are used: four IP variables (patents, trademarks, trade secrets and copyrights) and four economic policy variables (market size, ratio of public investment to GDP, ratio of external debt

	countries.		countries) analysis.	mainly based on guidelines for minimum standards of IPR protection and enforcement, developed by the US Chamber of Commerce IP task force in 1987. Questions based on a scale of 0 to 3, with 0 as the lowest level.		Countries' (DCs).	to exports, and the exchange rate).
Braga & Fink (1998)	Reports evidence of two distinct studies: one to jointly estimate the effects of stronger IPR protection on US arms-length exports and overseas sales by US affiliates in 42 countries; and one of the effects of IPRs on German MNEs' exports and FDI decisions in 25 countries.	Single point in time (1992).	Gravity-type model estimated using OLS.	Ginarte & Park (1997) index.	Overseas sales by US affiliates; and the stock of German FDI.	In estimations of US FDI, data are disaggregated across chemicals & allied products; non-electrical machinery; and electrical & electronic equipment. In estimations of German MNEs' FDI, across chemicals; non-electrical machinery; electrical engineering; and transportation equipment.	Controls are GNP, GNP per capita, distance, tariffs, border, and language. Interaction terms of IPRs with industry also included.
Maskus (1998b)	US FDI in a panel of 46 destination countries.	1989-1992.	A set of simultaneous	Uses the patent strength from	Dependent variables capture joint impacts	No sectoral or industrial disaggregation. A dummy	Controls for market size, tariff protection, the level of

			equations in a SUR framework corrected for autocorrelation and heteroskedasticity.	Maskus & Penubarti (1995), who adopted an instrumental variable approach to correcting (for endogeneity) the raw Rapp & Rozek (1990) patent index.	of four MNEs' commercial flows: No. of US patent applications filed in host country; total sales of foreign affiliates of US parents; US exports shipped to affiliates; and total assets of foreign affiliates of US parents.	variable is used to account for the separate effect in developing countries.	local R&D by affiliates, distance from the US, and investment incentives and disincentives provided by local governments. An interaction dummy accounts for patent strength in developing countries.
Maskus (2000); Revisits results from Maskus (1998b)	As above	As above	As above	As above	As above	As above	As above
Mayer & Pfister (2001)	The study considers 755 FDI location choices of French MNEs in 36 countries.	Periods considered are: 1981, 1982 and 1988-1992.	A conditional logit model is estimated.	Ginarte & Park (1997) index.	A dummy variable taking value 1 if firm *i* chooses country *j* as an FDI host location at date *k*.	No industry/sector disaggregation. Sample disaggregated by developed and developing countries.	Variables include consumer prices, openness, R&D, education, membership of the EU, corruption, and political freedom.
Smith (2001)	Cross-sections on US outward bilateral exchange, including	Year 1989.	A gravity equation using cross-country data. The	Rapp & Rozek (1990) index; Ginarte & Park	Dollar value of sales in manufacturing of (majority-owned	No industry/sector disaggregation.	GDP per capita, population, distance, openness to trade, tax rate. Many interaction

	exports, affiliate sale, and licenses to unaffiliated foreign firms across 50 countries.		SUR approach is also employed.	(1997) index; and No. of patent lawyers by country.	nonbank) affiliates of US parents.		effects are also considered using dummies.
Lesser (2002)	Analyses the effects of improved IPR protection in a sample of 44 developing countries.	Post-TRIPS data for 1998.	Simple cross-section OLS analysis.	Own IPR strength index to generate an IPR score for each developing country considered.	FDI inflows.	No industry/sector disaggregation.	FDI inward stock; GNP; Risk; Real exchange rate; Degree of industrialisation; Manufacturing tariff; Internal prices.
Park & Lippoldt (2003)	Many developing and least developed countries (further disaggregated by membership of WTO).	1990-2000.	Fixed effects estimations.	Ginarte & Park (1997) index and Park (2001). Data on trademark rights, copyrights, and USTR ratings, are also in Park (2001).	Global inward and outward FDI stocks (source: UNCTAD); US outward FDI by industry (source: US Department of Commerce, BEA).	Disaggregation by industry (Food & kindred products; Transportation equipment; Chemicals & allied products; Petroleum; Primary & fabricated metals; Wholesale trade; Industrial machinery & equipment; Finance, excluding banks, insurance & real estate; Electronic & other electric equipment; Services) and by sector (Agricultural chemicals; Industrial chemicals; Computer & office equipment).	GDP per capita (which proxies for purchasing power on the demand side and for productivity on the supply side), mean tariff rate, and country risk.
Fosfuri	The chemical industry	1981–96,	Results are	Ginarte & Park	All chemical firms	OLS estimations also	Income per capita,

(2004)	geographical areas considered are: Africa; Eastern Europe; Far East (including Australia); Japan; Middle East; North America; South America; and Western Europe. A set of up to 75 countries is considered. Countries are also divided in two groups: countries with strong imitative abilities and countries with weak imitative abilities.	disaggregated in four time periods: 1981–83; 1984–87; 1988–91; 1992–96.	estimated by OLS, Tobit, GLS and by means of SUR techniques.	(1997) index.	from developed countries which had, by 1988, more than $1 billion in sales. Of this set, 153 firms had at least one international plant reported in Chemintell during sample period. Firms cover about 50% of all FDIs and more than 30% of international technology licensing.	disaggregate into chemical industry sub-sectors: Oil refining; Petrochemicals; Plastics and rubber; Gas; and Organic chemicals.	population, distance, the country level of education, and the country openness to trade. Experimentation with several other variables (including barriers to trade of capital goods, financial openness, dummies for major oil/non-oil exporter/producer, capital account restrictions, etc.) did not show statistical significance hence they were dropped and not reported.
Javorcik (2004)	Firm-level data compiled from a worldwide foreign investment survey conducted by the EBRD in 1995 that asked companies about their FDI behavior in 24 countries in Eastern Europe and the former Soviet Union.	The information collected pertains mostly to the period 1989-1994.	Probit with sample selection equations are estimated simultaneously by ML.	Ginarte & Park (1997) index supplemented by Javorick's own enforcement data drawn from the IIPA recommendations for countries to be placed on the US Special 301 Watch List. Countries	FDI is measured by a dummy taking value 1 if firm *i* has invested in country *c*, and zero if a firm has not undertaken FDI in country *c*.	Separate coefficient for high tech sectors in which IPRs are expected to play a key role by interacting country specific regressors with a dummy for these sectors. These sectors are: drugs, cosmetics & health care products; chemicals; machinery & equipment; and electrical equipment. Disaggregation of 'project	GDP per capita; Population; Progress in reform; Corporate tax rate; Legal effectiveness; Corruption; Privatization; and Openness. Some estimations also control for firm size, R&D intensity, advertising intensity, production diversi6cation, and regional experience.

				scored between 1 and 3: '1' indicates inadequate IPR legislation, '2' close to adequate legislation but no enforcement; '3' close to adequate legislation with some enforcement.		function' is also undertaken in terms of the choice of setting up production facilities (manufacturing FDI) or solely on building distribution networks.	
McCalman (2004)	The FDI or licensing behaviour of Hollywood studios in both the feature film and video markets in 40 foreign countries.	Single point in time. Most data refer to 1997 (Ginarte & Park index to 1995).	ML estimates of a bivariate probit model, to account for potential correlation between errors of the feature film model and the video model.	The IPR index described in Ginarte & Park (1997) extended for the year 1995 (unpublished series made available by Walter Park).	No. of cases of FDI and licensing in both the feature film and video segments in 1997 (source: Screen Digest, 1998).	The exclusive focus is on the film and video distribution segment of the movie industry.	GDP per capita, population, growth rate, regional dummies, language dummy, share of population less than 14 years old, fraction of population that has completed secondary education, distance and domestic film production.
Nunnenkamp & Spatz (2004)	Sectorally disaggregated FDI data for a large sample of host countries.	Two single points in time: 1995 and 2000.	Gravity-type model, and left-censored tobit models. For the estimation of 'higher-quality FDI' regressions, 2SLS approach.	The degree of IPR protection is measured by the Ginarte & Park (1997) index, and the 2002 WEF survey results.	Current FDI stocks. FDI data restricted to manufacturing. Also considers 3 quality-related dependent variables: US affiliates' local R&D expenditure, US	FDI data are restricted to manufacturing, disaggregated into 7 industries in 1995 and 5 industries in 2000. Food, chemicals, metals, machinery, electronic equipment (the last two	Host countries' GDP per capita, population, distance between the US and the host country, the cost of investing abroad, and average years of schooling. In some regressions they also interact IPR protection with other

					affiliates' value added in host country, US affiliates' exports.	subsectors are aggregated in 2000), transport equipment, and other manufacturing (not available in 2000).	regressors using multiplicative interaction terms.
Pfister & Deffains (2005)	The FDI location choices of French MNEs in 17 developing countries. Sample consists of 209 choices of localisation. The countries included and the corresponding No. of localisations are: Brazil (8), Chile (3), Colombia (3), Greece (10), India (9), Indonesia (3), Ireland (18), Malaysia (12), Mexico (17), Nigeria (0), Pakistan (2), Portugal (28), South Africa (3), Spain (45), Thailand (12), Turkey (31) and Venezuela (5).	Only compares locations at a given time point. Data drawn from the DFERFMF dataset 'Subsidiary companies' (1994). From 1959 to 1994, it has collected 2,756 location decisions by French	A conditional logit model is estimated.	Ginarte and Park index, constructed in 1995 and going back, in five year periods, until 1960.	The dependent variable takes on the value 1 if country *j* has been chosen as an FDI host location at date *k*.	Uses the industry mean patent propensity and overall median patent propensity (25%) and consider all industries with a patent propensity of more (resp. less) than 25% to be patent sensitive (resp. patent insensitive). Former group: electrical & electronic equipment, cars, cosmetics & drugs, transport equipment, electric & electronic components, household equipment, steel, utilities & oil raffineries. Latter group: mechanical equipment, chemicals & plastics, publishing & printing, wood & paper, textile & leather & clothes.	Measures of demand (GDP of each country), production costs (labour costs), trade openness (ratio of the sum of exports and imports over GDP), and agglomeration effects (proxied by the number of French firms of the same sector already located in the host country). They also control for: GDP per capita, the R&D intensity of the host country (RD/GDP), secondary schooling enrolment rates (Education), the level of corruption of the host country, and the extent of political rights granted to its inhabitants.

		MNEs abroad.				Also, they approximate the host country's ability to imitate through its R&D intensity and define two dummies, for high (HRD) and low (LRD) research intensity countries. The interaction variables IPR*HRD and IPR*LRD measure the impact of a change in IPRs for each of the two country groups.	
You & Katayama (2005)	Japanese MNEs that invested in China. From answers to questionnaire they obtained data on 228 of the Japanese firms' Chinese subsidiaries. Data covered 188 subsidiaries of the responding firms which had received Japanese FDI, in 13 cities: Peking, Shanghai, Tianjing, Shenyang, Dalian, Qindao, Suzhou, Guangzhou, Shenzhen, Dongguan, Zhuhai,	Japanese MNEs investing in China in the year 2000. Survey answering period set from mid of July to end of Aug. 2001.	Probit estimation of a structural model using survey data from 412 randomly chosen companies that invest in China from Toyokeizai Shinposha database. They received 98 responses (23.8% response rate).	Two measures: (i) Constructed own survey-based IPR measure on a 5-point index scale to capture the overall state of IPRs in China; (ii) used a dummy variable taking value 1 if the products of the surveyed firm were patented or trademark registered, and	Investments by Japanese MNEs in China, covering multiple sites and subsidiaries giving a total number of subsidiaries in the data set of 228	Firm-level data disaggregated by seven manufacturing industries: Glass; Fibre; Vehicles, Food; Chemistry; Machine; and Electronics.	Responses covered several sectors and investing cities across China. Questions probed on location, sector, partner set-up, level and length of investment, imports that competed with the production in China, from Japan or elsewhere. Various trade-related variables, local production and multiple instruments were included as additional controls in probit models. Dummies for city/industry

	Xiamen, and Fuzhou.			value 0 otherwise.			added.
Seyoum (2006)	Random sample of 63 developed/developing countries (3 countries left out of the 1995 dataset).	Two time periods: 1990 and 1995.	OLS.	Ginarte & Park (1997) index.	FDI is the annual inflow of total direct investment flows to a host country.	No industry / sector disaggregation.	Population, exchange rate, corruption, trade/GDP, unemployment, scientific infrastructure, GDP growth.
Zhao (2006)	48 countries (of which 31 countries with weak IPR protection).	1993-2003.	Mixed methods: (i) interviews with managers/researchers in China and qualitative analysis; (ii) within- & cross-firm variances (zero-inflated negative binomial regressions); patent data of 1,567 innovating US MNEs.	Composite index based on Rapp & Rozek (1990), Ginarte & Park (1997), US Trade Representative's Special 301 Watch List (1999), a Rule of Law index, and piracy index from an annual BSA Global Software Piracy Study.	US patents developed in foreign countries.	No industry / sector disaggregation.	Other firm characteristics, including assets, sales and lines of business.
Branstetter *et al.* (2007)	Analyses the effects of discrete changes in patent regimes in 16 countries: Argentina, Brazil, Chile, China, Colombia, Indonesia, Japan, Mexico, Philippines, Portugal, South Korea, Spain,	Over the 1980s and 1990s in 16 countries.	Numerical simulations. Plus a difference-in-differences approach to estimate several multivariate models (including	Based on timing of major IPR reforms (15 discrete changes) a post-reform dummy is used, also interacted with a Tech variable to	Data on US MNEs from the US BEA annual Survey of US Direct Investments Abroad and the quarterly BoP Survey. To capture evidence of	Specifications that test if affiliates expand their operations at the time of IPR reform, are not disaggregated at industry level. However, most specifications control for "Tech" goods, denoting the	Controls include time invariant FEs for the affiliate, FEs for the entire sample, and country-specific time trends. Time-varying parent and host country characteristics are also accounted for: total sales of

	Taiwan, Thailand, Turkey, and Venezuela.		Poisson and negative binomial specifications).	reflect the extent to which parents transfer technology to affiliates in countries that do not reform IPRs.	production shifting, uses affiliates' capital stock, employment compensation, use of technology from parent, and R&D expenditures.	set of 10-digit commodity categories associated with innovation intensive 4-digit ISIC industries, industries in ISIC codes 351, 352, 383, 384, and 385.	the parent system as well as the level of parent firm R&D spending, per capita GDP, measures of trade and FDI openness, real exchange rates and corporate tax rates.
Nicholson (2007)	Number of US firms engaged in FDI in 42 countries, also split by OECD membership.	Cross-sector, cross-country count data for 1995.	Generalised version of the Poisson. Negative binomial model estimated via FEs. When FEs not used robust standard errors are derived by clustering residuals by country.	Ginarte & Park (1997) index.	Count data on the number of US companies engaging in FDI and licensing (source: US BEA census).	Industry data disaggregated into three digit industry sectors, allowing to distinguish between manufacturing and non-manufacturing MNEs.	Measures of corruption, the effectiveness of competition policy, industry aggregate costs of property, plant and equipment as a ratio of industry sales, R&D, exports, GDP, population, aggregate R&D, exports, GDP, population, human capital, and distance from US.
Park & Lippoldt (2008)	A data set covering a broad international panel of developed, developing and least developed countries.	1990-2005.	Mixed method: (i) FGLS regression analysis; (ii) Case study analysis of the BRIC countries.	Four IPR measures: index of patent rights; index of copyrights; index of trademark rights; WEF survey.	The stock of inward FDI and US Foreign Direct Investment Assets.	Chemicals; Machinery; Electrical appliances & components; Service; Computers & electronics; Information.	General physical property rights, effectiveness of legal regime, quality of governance, cost of doing business, freedom to trade, and per capita GDP.
Adams (2010)	Panel data for a cross-section of 75 developing	Four separate	System of four equations	Ginarte & Park (1997) index.	The net FDI inflows share in GDP	No industry / sector disaggregation.	Real GDP per capita growth rate, inflation, openness,

	countries.	periods: 1985-1989, 1990-1994, 1995-1999, and 2000-2003.	estimated using SUR method. To eliminate country-specific effects, data are first-differenced.		(source: WDI CD-ROM 2006)		population, infrastructure, return on investment, risk, square of IPR (IPRSQ) to capture nonlinearity, and interaction term (IPR*TRIPS) to investigate a differential effect of IPRs before and after TRIPS.
Awokuse & Yin (2010)	Panel data for 38 countries that include 24 high-income countries and 14 low-income countries.	1992-2005.	Bi-lateral gravity model estimated using FGLS on a random effects model.	Annual foreign patent applications to measure IPR strength in China; and Ginarte & Park (1997).	FDI is measured as the FDI flow from various (38) nations into China.	No industry/sector disaggregation but separate estimates for pooled, high- and low-income countries.	GDP in both source country and China, average trade cost and investment cost in China, distance, and a proxy for China's level of industrialisation.
Watkins & Taylor (2010)	US MNEs' FDI in 22 emerging economies: Brazil, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Israel, Malaysia, Mexico, Morocco, Peru, Philippines, Poland, Russia, South Africa, South Korea, Taiwan, Thailand, and Turkey.	2006-2008.	Multivariate models estimated by OLS.	Ginarte-Park index and the WEF IPR index from Global Competitiveness Reports 2006 to 2008.	Volume of US FDI to the *i* country, measured in millions, US dollars (source: US BEA, years 2006-2008). In the disaggregated models the study also uses the industry composition of FDI based on US stocks in various countries considered (source:	Disaggregation across nine industries (mining; manufacturing; wholesale trade; information; depository industries; finance and insurance; professional, scientific and technical services; holding companies except banks; and other industries), and eight sectors within the manufacturing industry	Labour costs, corporate tax rates, population, lagged FDI, industrialisation, political instability, education level, and a dummy variable for Mexico. Year dummies are also included for 2007 and 2008.

					US BEA).	(food; chemicals; primary & fabricated metals; machinery; computers & electronic products; electrical appliances & components; transportation equipment; other manufacturing).	
Ushijima (2013)	Japanese FDI, measured as the creation of a new subsidiary, with a final sample of 5,378 subsidiaries operating in 58 countries (5,378 FDI events).	1985-2004.	Two alternative methods: (i) a non-standard gravity-type cross-country regression (specified in the negative binominal framework and hence nonlinear) based on aggregated data; and (ii) a logistic regression based on firm-level data.	Ginarte & Park index, and Park (2008).	No. of new subsidiaries in a host country. FDI during the 5-year interval [t, t+4] in which t=1985, 1990, 1995, 2000. In firm-level regressions, dependent variable is a dummy coded 1 if firm *i* invests in country *j* by forming a subsidiary in the 5-year period beginning in t (t=1985, 1990, 1995, 2000) and 0 otherwise.	Disaggregated across 15 two-digit industries: Foods; Textile products; Paper and pulp; Chemicals; Petroleum products; Rubber products; Ceramic products; Iron and steel; Non-ferrous metal; Metal products; Machineries; Electric machineries; Transportation equipment; Precision instruments; Other manufacturing.	Control variables include: population, GDP per capita, distance from Japan, the market orientation of government policies and institutions, human capital, and the stock of past Japanese FDI.
Hsu & Tiao	Panel of 11 Asian countries: Taiwan, Japan,	1985-2010.	Gravity model estimated using:	Ginarte & Park (1997) index, and	Global FDI inflows in each country	No industry/sector disaggregation.	Factors such as GDP, trade volume, R&D, openness, but

(2015)	Korea, Singapore, Malaysia, India, Indonesia, Thailand, Saudi Arabia, Turkey, and Vietnam.		OLS, fixed and random effects, SYS-GMM.	Park (2008).	considered (measured in US dollars, taken from UNCTAD).		many other factors are omitted, e.g., exchange rates and FTAs.
Zhang & Yang (2016)	Inward FDI in 20 developing countries: Argentina; Brazil; Chile; China; Columbia; Egypt; India; Indonesia; Malaysia; Mexico; Nigeria; Peru; Philippines; Saudi Arabia; Singapore; South Africa; Thailand; Turkey; UAE; and Vietnam.	1985-2012.	A standard gravity model estimated using OLS, FEs and SYS-GMM techniques.	A dummy variable to capture the TRIPS agreement.	FDI flows from home country *i* to host country *j* in year *t* (measured in US dollars, taken from UNCTAD).	No industry / sector disaggregation.	GDP of home and host country, total trade volume of host country, R&D level of home and host country, openness of host country, country risk of host country, investment costs of host country.

Source: Prepared by authors.

Abbreviations: BRIC (Brazil, Russia, India, and China); Bureau of Economic Analysis (BEA); Direction of Foreign Economic Relations of the French Ministry of Finance (DFERFMF); European Union (EU); Feasible Generalised Least Squares (FGLS); Fixed Effects (FEs); International Centre for the Settlement of Investment Disputes (ICSID); International Intellectual Property Alliance (IIPA); Joint Ventures (JVs); Maximum Likelihood (ML); Ordinary Least Squares (OLS); Seemingly Unrelated Regressions (SUR); System Generalised Methods of Moments (SYS-GMM); Trade Related Aspects of Intellectual Property Rights (TRIPS); United Arab Emirates (UAE); World Economic Forum (WEF); World Trade Organisation (WTO).