

Location Choice and Host Country IPR Protection

Abstract

In this paper the effect of host country intellectual property rights (IPRs) protection on location choice is analyzed, by using firm-level panel data on Swedish multinational enterprises (MNEs). The data are separated into two sub-samples; for the 1970s and 1990s. The empirical model used is the conditional logit model. An index on patent strength is used as a measure of the host countries' level of IPRs protection. Other variables controlled for include country-specific variables such as GDP, GDP per capita, skills, taxes, as well as a distance variable and the parent-specific variables on R&D-intensity and an interaction between IPR index and R&D-intensity. The results for the measure of IPR protection differ between the two time periods, with statistically significant negative estimates for the 1970s, and positive but statistically insignificant estimates for the 1990s. A possible interpretation of the result may be that MNEs substitute FDI for arm's length agreements such as licensing.

Keywords: Multinational enterprises; Location choice; Intellectual property rights; Conditional logit

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Abbreviations and Notations

Abbreviations

CEPII	Centre d'Etudes Prospectives et d'Informations Internationales
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
ICTSD	International Centre for Trade and Sustainable Development
IFC	International Finance Corporation
IP	Intellectual Property
IPR	Intellectual Property Right
IUI	Industriens Utredningsinstitut (the Research Institute of Industrial Economics)
MNE	Multinational Enterprise
OECD	Organisation for Economic Co-operation and Development
OLI	Ownership – Localization – Internalization (Dunning; 1977, 1981)
R&D	Research and Development
TRIPS	Trade-Related Aspects of Intellectual Property Rights
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UPOV	Union for the Protection of New Varieties of Plants
USTR	United States Trade Representative
WIPO	World Intellectual Property Organization
WTO	World Trade Organization

Notations

i	Multinational Enterprise (MNE) performing FDI in country j
j	Host country

1. Introduction

1.1 Background

Intellectual property rights (henceforth IPRs) have in the past two decades gained increased economic and political importance. This is, among other reasons, due to the fact that the global economy is increasingly dependent on knowledge-based industries.¹ The growing interest in IPRs is being mirrored in IPRs being introduced as part of regional trading arrangements. The most important attempt to harmonize protection of IPRs across nations is the Agreement on Trade-Related Intellectual Property Rights (henceforth TRIPS). The TRIPS emerged from the Uruguay Round in 1995 and became one of the pillars of the World Trade Organization (henceforth WTO).² According to TRIPS, WTO members must adopt and enforce minimum standards of IPR protection.³ IPRs are national or territorial in nature and do consequently usually not operate outside the national territory where they have been settled. This implies that differences in IPR regulations may serve as a factor in the location choice of multinational enterprises (henceforth MNEs)⁴

MNEs have in theory been suggested to be highly dependent on some firm-specific assets (“knowledge capital”) in order to overcome the incumbent disadvantages of operating abroad. The firm-specific assets of MNEs possess the particular “jointness” feature, which implies that they are to some extent “public goods” and can be transferred at low marginal cost within the firm.⁵ When MNEs are to serve foreign markets through local subsidiaries, i.e. conducting foreign direct investment (henceforth FDI) and consequently are to transfer their firm-specific assets overseas, it is of vital importance for their survival that their knowledge capital are kept within the boundaries of the MNE. Hence, it is of greatest interest for the MNEs that they receive IPR protection of their knowledge assets in the country in which they operate.⁶

Efforts are being made all over the world by governments in attracting FDI, because of a widespread belief that MNEs will bring new technologies, management skills and marketing know-how into the country. In the strife of creating an investment-friendly environment, it has become of increasing importance knowing which factors influence FDI.⁷

One factor which has been found to be of great importance for attracting FDI is IPRs. This has been analyzed in empirical studies by e.g. Smarzynska (2002), Mansfield (1994, 1995), Maskus (1998), and Seyoum (1996). The objective of this study is to contribute new empirical evidence on whether IPR protection matters for FDI. The purpose of the study is to analyze whether the location choice of Swedish MNEs is affected by the host country’s system of protecting IPRs.

1.2 Method

In this thesis, I will use firm-level data on Swedish MNEs to study whether their choice of where to operate their foreign affiliates is affected by the host country’s system of protecting IPRs. By

¹ Dutfield, (2003, p. 1), Bellmann, and Meléndez-Ortiz (2003, p. x), Primo Braga (1996, p. 341).

² Maskus (2000a, p. 1), Nunnenkamp and Spatz (2004, p. 393).

³ Maskus (2000a, p. 1).

⁴ Dunning (1992, p. 3). Note that the term multinational enterprise will be used synonymously with the term transnational enterprise. The term “enterprise” will be applied instead of “company” in order to direct focus on the top level of coordination in the business decisions, since a multinational company may in itself be a controlled subsidiary of another firm (Caves (1996, p. 1)).

⁵ Markusen (2002, pp. 17-18).

⁶ Bently and Sherman (2004, p. 5).

⁷ Smarzynska (2002, p. 14).

applying firm-level data, the study differs from some earlier studies on the impact of IPR system in the decision process of an MNE, since these have focused on FDI inflows on an aggregate level.⁸ The data which is to be used is a panel firm-level dataset collected by the Research Institute of Industrial Economics (*IUI*). The data is on Swedish manufacturing firms with foreign production affiliates, covering six years between 1970 and 1998.⁹

As a measure of IPR protection, I will employ an index developed by Ginarte and Park (1997) on strength of patent rights. This index is one of the most commonly used measures of IPR protection. It is worth mentioning, however, that the measure only is based on laws on the books and does not measure their enforcement, which is a drawback of this index. Furthermore, the measure only confines the part of IPR protection that is covered by patents. Because of its large coverage, the Ginarte-Park index is despite these drawbacks considered to be the most useful measure of IPR protection for the purpose of this study. The years covered by the index are 1960-2000 in intervals of five years (1960, 1965, 1970 etc.).¹⁰ The features of the Ginarte-Park index will be discussed further in section 3.3.

The location choice of Swedish MNEs and the potential impact of host countries' patent regimes on this choice will be estimated with a conditional logit model with presence of Swedish affiliate activity as the dependent variable. In short, the purpose of the model is to define a probability for a Swedish MNE of executing FDI in a country given the host country's level of protection of IPR, which in the case of this study is mirrored in the host country's level of patent strength. The dependent variable will be a presence indicator that takes the value of one if there is at least one majority-owned Swedish manufacturing affiliate in the respective host country.¹¹ As independent variables, I will use location-specific variables, but will also include regressors such as geographical distance between host country and home country (Sweden) as well as a parent-specific variable and an interaction variable.

1.3 Delimitations

IPR protection and IPR regimes have been subject to vast investigation and criticism since they are perceived as serving the interests of developed countries rather than developing countries.¹²

This issue is of great importance, but will as such not be considered in this thesis. Indirectly, however, the thesis may contribute to this discussion by sorting out what impact the IPR protection of a country has on its potential of attracting FDI, which ultimately will be of importance for the countries' economic development.

Furthermore, studies have been made to investigate the impact of IPR on other forms of bilateral exchange such as trade and licensing. It is, however, beyond the scope of this paper to go into

⁸ This study can to some extent be seen as following the same approach as the one applied by Smarzynska (2002). Smarzynska applied, however, the probit model contrary to the conditional logit model to be applied in this study.

⁹ I am most grateful to the Research Institute of Industrial Economics (*IUI*) for access to the *IUI* database on Swedish MNEs.

¹⁰ I am most grateful to Walter G. Park, who most kindly provided me with the 1960-2000 data on the Ginarte-Park index with complementing data for the period 1995 and 2000. An important notice received from Mr. Park is that the data for the year of 2000 is tentative, which needs to be taken into consideration when interpreting the results.

¹¹ Method approach adapted from Becker, Ekholm, and Muendler (2005).

¹² See e.g. discussion carried out in UNCTAD and ICTSD (2003, p. 5). Although the politics surrounding the strength of IPRs in public discussion usually concerns different interests between developed and developing countries (or, as these categories often being referred to; North and South), it should not be forgotten that confrontations have existed also between developed countries (confrontations similarly often being referred to as North-North confrontations) as to diverging interests in level of strength of different forms of IPRs, and then especially as to geographical indications (with as relevant examples the U.S. against high level of protections and Europe in favor of high level of GI protection), (Watal (2001)).

any detailed discussion about the relationship between IPR and other modes of bilateral exchange than FDI.

Moreover, this thesis will not go into further detail in explaining the determinants behind patent rights and other IPRs instruments, although this is indeed an area of great interest in investigating the reasons why some countries are in favor of or oppose to stronger IPRs and for understanding “the political economy of global intellectual property law reform”.¹³

Furthermore, the economic and political features of international agreements, especially the TRIPS agreement, on IPRs will not be discussed in any greater detail.¹⁴ Nor will the study consider the economic and political implications of the international politics of strengthened IPRs.

What is more, even though FDI may be instrumental as a channel for technology transfer across borders and a source of technology trade, this study will not cover the vast discussion on a possible relationship between international technology transfer and IPRs.¹⁵

1.3 Outline

This thesis will be structured as follows. The second chapter will, firstly, give a background by presenting an overview of the rationale behind IPR and some central issues in connection with IPRs. Furthermore, it will present an overview of theories on MNE activities, of the different international agreements on IPRs, and of earlier empirical findings on the relationship between IPR and FDI. The third chapter will briefly present the econometric estimation model to be applied in the analysis and give a short outlook of the data used in the empirical analysis. In this chapter some of the most central and most frequently mentioned measures of IPR protection will be discussed, with emphasis on the measure applied in the study, the Ginarte-Park index. The fourth chapter will present the empirical results, starting with the 1970s sample followed by the 1990s sample. The final chapter will provide a summary and concluding remarks.

2. Background

2.1 Rationale of IPRs and the economics of ideas – an overview

The notions of intellectual property (henceforth IP) and IPRs can be perceived as rather complex in their definitions and the manner in which they are interrelated. In order to understand the rationale behind IPRs, an attempt to define the closely related matters of intellectual efforts, intellectual assets, intellectual property and intellectual property rights is called for and will therefore in the following briefly be given. The fact that the area of IPRs includes professionals with backgrounds in engineering and natural sciences, law as well as business and economics gives an idea of the complexity of IPRs. As all notions of institutional arrangements and frameworks, IPRs include indeed both the formal and informal issues, which should be taken into consideration when interpreting their effectiveness and enforcement.¹⁶ A deeper analysis of the institutional complexities of IPRs is, however, beyond the scope of this thesis.

¹³ Ginarte and Park (1997, p. 284). An overview discussion and of the determinants of IPRs is further covered by Maskus (2000b).

¹⁴ Readers interested in the emergence, implications, and features of the different international treaties on different forms of IPRs (with focus on the TRIPS agreement) are referred to Martin and Winters (1996) and especially Primo Braga (1996) as well as to Watal (2001).

¹⁵ A good overview of the effects of IPRs and technology transfer across borders is provided by e.g. Maskus (2000b).

¹⁶ For discussion of the political economy of institutions, see e.g. North (1990).

Intellectual efforts, which can be equalized with human thoughts, result in new technologies, products, and services, new ways of doing things etc. These results of intellectual efforts do in turn result in *intellectual assets*, which are pieces of information that may have commercial value if they are put into use in the marketplace. When proprietary ownership of these intellectual assets is recognized, they are called *intellectual property* (IP). The intellectual property is essentially creations of the human mind¹⁷, which can be incorporated in creative or inventive works, such as works of art, literature, inventions, trademarks, and designs.¹⁸ *Intellectual property rights* (IPRs), in turn, can be defined as the legal and institutional devices or formal mechanisms that provide the owners of intellectual property with the legal rights to control its use.¹⁹

IPRs represent the system of legal devices, which can take many different forms. It can be patents, copyright and related rights, industrial designs, trademarks, trade secrets, plant breeders' rights, geographical indications, rights to layout-designs of integrated circuits, etc.²⁰ The different forms of IPRs serve different purposes, have different effects and differ in scope and duration. Common for all the IPR forms is that they, in general, all serve to exclude third parties from using intellectual property (for a certain specific duration of time, which for trademarks, geographical indications and trade secrets in some case may imply unlimited time) without preceding permission from the owner.²¹

IPRs can be said to be bestowed under national law in order to either encourage inventive or creative activity *or* preventing information asymmetries, unfair competition and consumer sham. Two categories of IPRs can be identified from this categorization. The first category is represented by patents, copyrights, industrial designs and layout-designs, which together can be said to represent the inventive or creative activity encouraging IPRs. The second category, on the other hand, is represented by trademarks and geographical indications, which can be said to represent a consumer sham and information asymmetries category. The first category of IPRs aims at providing temporary monopoly power authorized by national law and is as a result subject to stricter provision of protection than the latter category, since market power indeed is perceived as having welfare decreasing effect on society, whereas trademarks and geographical indications only aims at defeating consumer asymmetries by prohibiting the application of the same distinctive sign of a good, but yet does not prohibit the production of similar goods.²²

It is worth mentioning that the legal instruments, represented by the different forms of IPRs, are only one part of what constitutes a national system of IP protection. Other crucial parts of the national system of IP protection vital for its effectiveness are represented by the institutions in charge of the administration of the system and the mechanisms at hand for enforcing the IPRs.²³

IPR protection is generally supported as a governmental intervention to support the production of IPs, since without such protection there would be an underproduction of IPs. The reason for this is that the production of IPs generally is characterized by fixed production costs and zero

¹⁷ The term "creations of the human mind" is being applied instead of "ideas", since copyright protects the expression of ideas rather than the idea itself (Watal (2001, p. 1)).

¹⁸ Watal (2001, p. 1). Bellmann, Dutfield, and Meléndez-Ortiz (2003, p. 1).

¹⁹ Maskus (1998, p. 186). Maskus (2000b, p. 27). In an attempt to get a cognitive picture of the relationship between the different elements behind the emergence of IPRs, I have personally adapted the following (which indeed can be subject to my personal misinterpretation and oversimplification) cognitive inter-linkage over time between the different elements (with attention being made that the arrows do not necessarily represent : $t+0$: *Intellectual efforts* $\rightarrow$ $t+1$: *Intellectual assets* $\rightarrow$ $t+2$ *Intellectual property* (IP) $\rightarrow$ $t+3$ *Intellectual property rights* (IPRs))

²⁰ UNCTAD and ICTSD (2003, p. 2).

²¹ Watal (2001, p. 1).

²² Watal (2001, pp. 291-292).

²³ Primo Braga (1996, p. 342).

marginal cost. There are accordingly increasing returns to scale and imperfect competition involved in the production of IPs.²⁴ The inefficiency in the market (prices do not equal marginal cost) is in the case of production of ideas motivated by the presence of a fixed cost and consequently increasing returns to scale, since if prices would equal marginal cost, there would be negative profits and the producer of ideas would lose incentive to produce.²⁵

Once produced and made available for the public, IPs are further easily imitated and copied and subject to free riding by second comers. IPs possess in this sense the property of being unexcludable, since it is hard for their creators to exclude others from producing and distributing the same good.²⁶ IPs are furthermore nonrivalrous in use since additional parties can use the IPs without paying any additional cost to the creator of the IPs in question.²⁷ IPs characterized by being nonrivalrous and unexcludable in this sense are identified as public goods and are as such producing spillovers (externalities) that are not captured by their producers. This inability of the market to provide the investor with the right to exclude and regain its investments is in this setting a market failure.²⁸ Hence, intellectual property rights can be seen as governmental attempts to employ the legal system to intervene into the market to influence the extent to which ideas are to be excludable by providing innovators periods of exclusive distribution rights as incentive to invest in innovation.²⁹ The rationale behind the protection of IPRs is simply to sustain an incentive for the developers (likely firms intensive in R&D) to invest in further production of IPs, by granting them the right to reap the benefits of their investments. In short, intellectual property rights provide the owner of an idea, i.e. the holder of intellectual property such as an inventor, the right to charge for the use of her ideas.

There exists an essential trade-off between two types of efficiencies, which are both in the interest of the public but are in conflict with each other, in the deciding upon IPRs. *Static efficiency*, on the one hand, demands wide access to users at a social marginal cost that may be low. *Dynamic efficiency*, on the other hand, requires incentives for investment in developing new intellectual property, which in turn have a social value exceeding the development costs. IPRs are generally considered to function on a combination of these two market distortions: Very low IPRs are in line with conditions for static efficiency, but at the same time not in line with the conditions for dynamic efficiency and consequently not creating enough incentives for creative and inventive activities, i.e. creation of intellectual property, which in turn has negative effects on economic growth and development. Very strong IPRs, on the other hand, satisfies the dynamic goal but not the static goal, as it creates enough incentives for creative and innovative activities but disfavors the public interest of information access and dissemination. An alternative description of the trade-off in the setting of IPRs is that IPRs create monopoly powers that have consumer welfare reducing effect in the short run, but has an encouraging effect on innovation, which has a positive effect on consumer welfare in the long run.³⁰ The institutions of IPRs, such as copyrights and patents, have been developed in order to strike a balance between the two types of efficiencies, i.e. between the ensuring of public access to the product or expression subject to protection (in the case of patents and copyrights, respectively) and the incentives to innovation and creative activities.³¹

²⁴ Jones (2002, pp. 80-86).

²⁵ Jones (2002, pp. 80-86).

²⁶ OECD (2003, p. 5).

²⁷ OECD (2003, p. 6).

²⁸ Bently and Sherman (2004, p. 5).

²⁹ Jones (2002, p. 86), Ryan (1998, p. 22).

³⁰ Maskus (2000b, p. 29).

³¹ Maskus (2000b, p. 29), Ryan (1998, p. 7).

The institutions of patent and copyright monopoly attempt to resolve the appropriability problem, which arises when the cost of developing a product is high, but the cost of product imitation is low. In order to stimulate people to risk investing in product development, grants the state innovators protection through IPRs in the form of limited periods of exclusivity. The innovator is in exchange for this protection to disclose the innovation's underlying technology to society. In brief, the innovator can be seen as receiving a temporary monopoly from the state on the condition that the technologies and creations is eventually put into the hands of the public.³²

According to Article 7 in the TRIPS agreement, the protection and enforcement of intellectual property rights should contribute to the promotion of technological innovation and contribute to the transfer and dissemination of technology. Moreover, the protection and enforcement of intellectual property rights should be to the mutual advantage of producers and users of technological knowledge, as well as be in a manner conducive to social and economic welfare and function as a balance of rights and obligations.³³

2.2 The location choice of MNEs - a theoretical overview

When deciding on how to serve a foreign market, firms have to decide whether to export, set up an affiliate abroad and/or license knowledge assets to an unaffiliated foreign firm.³⁴ MNEs are, according to the definition of Markusen (1995, 2002) firms that engage in foreign direct investment (henceforth FDI), which in turn are “investments in which the firm acquires a substantial controlling interest in a foreign firm or sets up a subsidiary in a foreign country”.³⁵ MNEs may choose to undertake either horizontal or vertical FDI. Horizontal FDI refers to a situation where a foreign subsidiary produces products and/or services similar to those produced by the firm at home. Vertical FDI, on the other hand, refers to a case where the foreign subsidiary production of inputs or the activity of assembling components.³⁶ The motives also tend to differ between horizontal and vertical FDI.³⁷

When a firm decides to undertake FDI, it must have advantages that offset the costs and incumbent disadvantages of doing business abroad. A framework often applied when investigating this issue is the ownership-location-internalization (OLI) paradigm, developed by Dunning (1977, 1981), which in turn has been developed further by Markusen (1995, 2002). According to the OLI paradigm, three conditions all have to be fulfilled for firms to have sufficient incentives to perform FDI.³⁸

In conformity with the first of these conditions, the firms (i.e. the MNEs) must have an *ownership advantage*, which implies that they must be in possession of some firm-specific assets that will give the firm some degree of market power in foreign markets. The firm-specific asset can be a tangible asset and thus a proprietary product or production process know-how such as a patent, blueprint, or trade secret that the firm has unique access to. More often, however, the firm-specific asset has proven to be an intangible asset such as a trademark or reputation of quality, trademarks, blueprints or a patent-protected asset, which the firm has unique access to. MNEs have from a micro perspective proven to be of importance in industries in which these intangible,

³² Ryan (1998, p. 5), OECD (2003, p. 6)

³³ UNCTAD and ICTSD (2003, p. 47).

³⁴ Smith (2001, pp. 411-412).

³⁵ Markusen (1995, p. 170), Markusen (2002, p. 5).

³⁶ Markusen (2002, p. 5), Maskus (2000b, p. 119).

³⁷ Maskus (2000b, p. 119).

³⁸ Markusen (2002, p. 17), Maskus (2000b, p. 120).

firm-specific assets are important. These firm-specific assets are, in turn, often characterized as and referred to as “knowledge capital”.³⁹

In conformity with *localization advantage*, the MNEs must have a reason to undertake production in a foreign subsidiary rather than concentrate production in the home country and serve the foreign market through exports. The sources of localization advantages differ between horizontal and vertical firms. Localization advantages for horizontal firms arise when the host market is large and trade costs are fairly high. For vertical firms, localization advantages is when trade costs are low, there are differences in factor intensities between stages of production and countries monitor differences in relative factor endowments.⁴⁰

In conformity with the *internalization advantage*, MNEs must gain from making use of their knowledge-based assets within the boundaries of the firm instead of licensing or selling its products to a foreign firm, since there is a risk that the knowledge-based assets as a consequence of their “public good” characteristics, may be dissipated by the agent in question, e.g. the licensee.⁴¹ As Markusen (2002) has pointed out, internalization advantages often emerge from the same public good, joint-input characteristics of knowledge assets that constitute ground for the ownership advantage.

Markusen (2002) presents, based on the OLI framework, an approach known as the knowledge-capital approach, which provides a developed theoretical framework in analyzing the rationale and motives behind MNE activities. The knowledge-capital approach is in its developed form in the following being referred to as the knowledge-capital model.⁴² What may be considered to be an indeed influential contribution of the knowledge-capital model is that it considers the potentially different motives behind horizontal and vertical FDI. The knowledge-capital model is based on three assumptions, namely fragmentation, skilled-labor intensity, and jointness.⁴³ The MNEs are in the settings of the knowledge-capital model considered to be intensive in the use of knowledge capital because of three different characteristics of this type of capital, namely fragmentation, skilled-labor intensity, and jointness.

First, according to the fragmentation assumption, services of knowledge capital can be relatively easily transferred to production facilities outside the home country. Second, knowledge-based assets are intensive in skilled labor, relative to production, which argues in favor of geographical fragmentation of production and vertical MNEs. Third, knowledge-based assets are often characterized by jointness or “public goods” property within the boundaries of the firm. Blueprints and a reputation for quality can, for example, be costly to produce but can at the same time be provided to additional plants and consequently to foreign production facilities at low cost without causing a decrease in value of them in existing plants. This “public good” property of knowledge-based assets give rise to multiplant economies of scale of MNEs, according to which it is cheaper for a firm with two plants to produce than it is for two identical firms that are independently owned (this is sometimes referred to as economies of scope).⁴⁴ Irrespective if the knowledge-based firm-specific asset of the firm is tangible or intangible, it provides the firm with sufficient market power or cost advantages to make the advantages outweigh the disadvantages with establishing a subsidiary overseas.⁴⁵

³⁹ Markusen (1995, p. 172), Markusen (2002, pp. 17-18).

⁴⁰ Markusen (2002, pp. 19-20).

⁴¹ Markusen (2002, pp. 19-20).

⁴² Markusen (2002, p. 20).

⁴³ Markusen (2002, p. 129).

⁴⁴ Markusen (2002, pp. 17-20), Maskus (2000b, pp. 120-121), Horstmann and Markusen (1987, pp. 464-465).

⁴⁵ Markusen (1995, p. 173).

When investigating and explaining the different motives behind MNE activities, these different assumptions serve to explain different kinds of MNE activities. The fragmentation and skilled-labor intensity assumption of the model explain the motive behind vertical firms, i.e. MNEs with plant and headquarters in different countries and with investments that are fragmenting the production process by different production stages and outputs produced at foreign plant are usually not produced by the firm in the parent-country, whereas the jointness assumption motivates horizontal firms, i.e. MNEs that have plants that are producing final good in several countries. The distinction between the fragmentation and jointness properties have been subject to confusion, yet the importance in differing the two has been emphasized.⁴⁶

2.3 International agreements on IPRs

IPRs are national or territorial and created by national laws and countries. Countries do consequently have to reach agreements when their residents seek protection for their intellectual assets in other countries.⁴⁷ The interest in reaching agreements on an international level as to strengthening IPR protection in the developing world has been of high political priority and has been pushed forward by business interests and lobbying in the developed world with the U.S. as leading proponent.⁴⁸

A.3 in *Appendix* gives an overview of the different instruments and agreements for protecting IPRs.⁴⁹ The international treaties in place prior to the TRIPS agreement generally covered different types of IPRs and aimed at establishing and maintaining minimum standards for IPRs for member countries.⁵⁰ There is a fairly long history of the emergence of international agreements on IPRs. Most of the international conventions have been managed by the World Intellectual Property Organisation (henceforth the WIPO), which was established in 1967.⁵¹ The Paris Convention for the Protection of Industrial Property dates as far back as 1883 and the Berne Convention for the Protection of Literary and Artistic Work was made in 1886.⁵² Both the Paris Convention and the Berne Convention were supported and observed by many countries and considered to be the major international treaties on IPRs.

Problems that emerged with the Paris and Berne Conventions and sources of criticism of the WIPO in its role of administrating party, were that 1) some of the standards were weak and not clearly specified with conventions only requiring from their member countries to follow national treatment and lacking minimum standards for either levels or coverage of protection; 2) the conventions lacked effective procedures for IPRs dispute settlement and could therefore be interpreted as statements of intention of the members; 3) it was hard to renegotiate and adjust the conventions to handle the rapid technical development and emerging new technologies.⁵³

⁴⁶ Markusen (2002, pp. 129-130). Markusen underlines the difference between the two properties by explaining that “fragmentation relates to supplying services to a foreign plant, regardless of whether the or not the firm has a domestic plant as well” whereas jointness refers to the ability to use a headquarters knowledge-based asset (such as an engineer) in several production locations without reducing the services served to any single location (p. 130).

⁴⁷ Primo Braga (1996, p. 342).

⁴⁸ For an extensive discussion about the politics surrounding the institutional framework of IPRs, please see Ryan (1998).

⁴⁹ The terms intellectual property (IP) and intellectual property rights (IPRs) are used interchangeably, which could be perceived as confusing and inconsistent. However, the meaning in their application is the same; namely to mirror different countries’ levels of IPR protection, which essentially implies the same as saying their different regimes in protection of IP.

⁵⁰ Maskus (2000b, p. 15).

⁵¹ Primo Braga (1996, p. 342).

⁵² Primo Braga (1996, p. 342).

⁵³ Maskus (2000b, pp. 15-16), Primo Braga (1996, p. 342).

The shortcomings of the existing IPR conventions were getting serious in the 1980s and the developed and industrialized countries started to argue in favor of including IPRs into the multilateral trade negotiations. IPRs were consequently introduced into the negotiations of trade liberalization at the GATT Uruguay Round meeting in Punta del Este in 1986 under the name Trade-Related Aspects of Intellectual Property Rights (TRIPS), which was finally concluded in 1994 at Marrakesh, Morocco. The TRIPS agreement was, together with the launch of the WTO at last brought into force in 1995 and is considered to be the most comprehensive international treaty on intellectual property present today.⁵⁴

2.4 Previous findings

The impact of IPRs on cross-border goods and capital flows is as of scope and direction very ambiguous.⁵⁵ From a theoretical viewpoint, there are equivocal effects from a strengthening of IPRs on bilateral exchange in the form of FDI, licensing and international trade.⁵⁶ In the field of investigating the relationship between IPRs and innovation, a strengthening of IPR protection has also shown to similarly have an ambiguous theoretical effect, which the empirical studies conducted have had a hard time refuting.⁵⁷ From the empirical studies performed, no unambiguous effect has similarly been detected from IPR protection on FDI, although a positive and significant influence is frequently drawn as conclusion.⁵⁸

In the last decades an empirical literature on the effect of IPR protection on bilateral exchange including FDI has emerged, which is of interest for the purpose of this paper. In the following, an overview will be provided on some of the most relevant empirical literature which examines the relationship between IPR protection and location choice of MNEs. The different studies will be mentioned in chronological order.

Ferrantino (1993) uses data on U.S. exports and foreign affiliates' sales by country and flows of payments and receipts for intellectual property into and out of the U.S. foreign affiliates. The study subsequently analyzes the effects of a country's obedience to international IP standards on flows of international economic activity. The results reveal, firstly, that there is "at best" a weak relationship between a country deciding to adhere to IPR agreements and it deciding on following "open" policies as to trade and FDI. Second he concludes that arms'-length exports or foreign affiliate sales by U.S. MNEs do not seem to be clearly affected by a country's decision on obeying or not obeying to IPR agreements. Third, exports from U.S. parent firms to their foreign subsidiaries are considerably higher to foreign subsidiaries in countries without IPR memberships than with. Fourth, U.S. subsidiaries adhering to the Paris Convention are likely to have higher license fees etc. than subsidiaries in non-member countries.

Mansfield (1994) uses interviews to find how U.S. firms perceive the strength or weakness of a country's IPR protection to estimate its effect on the transfer of technology to that country through FDI. Mansfield finds that the perceived level of strength of a country's IPR protection appears to have a significant effect especially in high-technology industries on the kinds of technology transferred by U.S. MNEs to the country in question. The perceived level of IPR protection also appears to have impact on the composition and extent of U.S. FDI in that country although the size of the effects seems to differ between industries.

⁵⁴ Watal (2001, pp. 1, 11).

⁵⁵ Pfister (2004, p. 205).

⁵⁶ Combe and Pfister (2001, pp. 74, 76).

⁵⁷ Combe and Pfister (2001, p. 78). This example of the impact of IPRs strength on innovation made only to underline the ambiguity prevalent in the field of both theoretical and empirical research on the economic implications of different IPRs strategies, and will not be considered to any further extent.

⁵⁸ Combe and Pfister (2001, p. 76).

Mansfield (1995) extends the research from U.S. MNEs (1994) to include also Japanese and German firms. Mansfield finds that a country's system of IPR protection often has a considerable effect on the amount and kinds of technology transfers and direct investments that Japanese, German, and U.S. firms in high-technology industries (such as chemicals, pharmaceuticals, machinery, and electrical equipment) choose to conduct.

Seyoum (1996) uses findings from a study of 27 countries where the data on the level of IPR protection is gathered from a questionnaire distributed to intellectual property experts/practioners in these countries. The study supports the previous finding that the level of IPR protection is an important determinant of inward investment.

Lee and Mansfield (1996) employ data collected from almost 100 U.S. MNEs on how they perceive the strength of intellectual property protection in different countries and find that a country's system of IPRs influences the volume and composition of U.S. FDI and a system of weak IPRs have a negative effect on U.S. FDI location decisions.

Maskus (1998) finds indications that FDI conducted by U.S. firms and measured by the asset stock is positively related to patent strength in developing countries.

Smarzynska (2000) uses a firm-level data set from Eastern Europe and the former Soviet Union for examining the impact of intellectual property protection on the composition of FDI inflows (rather than the impact on intellectual property protection on the volume of FDI). Smarzynska finds that a weak protection impedes MNEs in technology-intensive sectors that depend on IPRs.

Smith (2001) analyzes how foreign patent rights affect US exports, affiliate sales and licenses applying the OLI paradigm. Smith estimates the relative effects on foreign patent rights on the different types of bilateral exchange and finds empirical indications that strong foreign patent rights increase US affiliate sales and licenses. Moreover, foreign patent rights are found to have a larger effect on US knowledge transferred outside the US and the MNE relative to knowledge located inside the US and internalized inside the firm.

Nicholson (2002) finds that stronger IPRs in the developing countries in the South lead to a general increase in technology transfer from the developed and innovating North to the South but may change mode from an internalized MNE to arms-length licensing.

Nunnenkamp and Spatz (2004) use sectorally disaggregated FDI data of host countries and find the threat of an unauthorized use of assets related to IP and FDI being dependent on industry as well as host-country characteristics. Stronger IPR protection is also found to facilitate FDI of higher quality. The authors employ two different measures of IPR protection, namely the index on IPR protection developed by the World Economic Forum and the index on patent strength developed by Ginarte and Park (1997). This type of measurement proved to be less relevant than the authors had expected.

3. Empirical model and data overview

3.1 The conditional logit model

In the modeling of FDI decisions it has been found appropriate to apply the conditional logit model. This has been done in order to be able to analyze the impact of host-country effects on FDI decisions, which would not be possible in less complex binomial choice models.⁵⁹ The conditional logit model fits what is called fixed-effects logit for panel data and is therefore well suited for the purpose of this study.⁶⁰ The model fits maximum likelihood models with a dichotomous dependent variable taking the value of 0 or 1. Unlike other logistic analysis, however, the data in the conditional logistic regression are grouped and the probability (likelihood) is not calculated for the individual observations but instead in relation to each group, i.e. conditional likelihood is being applied.⁶¹ In general, all terms, such as intercepts and variables that do not vary and therefore have a constant within-group effect on the unconditional probabilities cancel in the formation of conditional probabilities and are not estimated in the conditional logit model.⁶²

In modeling the location choice of a firm (an MNE) it has been found appropriate to apply the framework of utility maximization according to which the firm chooses the location that maximizes its utility.⁶³ The firm (the decision maker) i ($i = 1, \dots, I$) has the option to locate in up to J countries ($j = 1, \dots, J$) and the location choices are treated as individual and independent of one another. The utility that firm i derives from the locating in country j can be represented by U_{ij} in the following

$$U_{ij} = V_{ij} + \varepsilon_{ij}$$

and is consequently a function of a deterministic part, V_{ij} , and a stochastic part, ε_{ij} .⁶⁴ The deterministic component V_{ij} can moreover be written as

$$V_{ij} = \mathbf{x}_{ij}\boldsymbol{\beta} + \mathbf{z}_j\boldsymbol{\gamma}$$

where $\mathbf{z}_j$ represents a vector of the location-specific variables (i.e. variables capturing host country characteristics) that are specific to the location and have nothing to do with the nature of the firm. A corresponding vector of firm characteristics interacted with country characteristics j is included in order to capture how firm characteristics impact on the choice of different types of location the relative attractiveness of the alternatives, is $\mathbf{x}_{ij}$. A firm will in a multinomial choice model, like the conditional choice model, choose the location alternative j out of the J mutually exclusive alternatives if, and only if, it is the alternative that offers the highest utility for the firm.

⁵⁹ Becker, Ekholm, and Muendler, (2005, pp. 7-8).

⁶⁰ Other logit models subject to application when it comes to logit models for panel data, besides the fixed-effects logit model, are the random effects logit model and the population-averaged model. Providing an explanation for the features of these models are, however, beyond the scope of this study.

⁶¹ StataCorp (2005, pp. 216-218).

⁶² Stata Technical Bulletin (2000, p. 22).

⁶³ The description of the location choice model and its application through the conditional logit model is adapted from (if nothing else stated) Becker, Ekholm, and Muendler, (2005, pp. 7-9) and Borooah (2001, pp. 45-76).

⁶⁴ As has been described in Borooah (2001, p. 46) there is no exact relationship between utility and its determinative variables and there may be factors influencing the utility level that is not captured by the variables in the model, the error term ε_{ij} is included in the equation to account for this.

If y_i is an observed random outcome variable whose value indicates the choice made by firm i , the probability that firm i will be observed choosing location alternative j is the following

$$\begin{aligned} P_{ij} &= P(y_i = j) = P(U_{ij} > U_{im}) \text{ for all } m = 1, \dots, J : m \neq j \\ &= P(\varepsilon_{im} - \varepsilon_{ij} \leq V_{ij} - V_{im}) \text{ for all } m = 1, \dots, J : m \neq j \end{aligned}$$

according to which the probability P_{ij} to observe the outcome j for the firm (the decision maker). i is decided by the distribution of the distribution of the random error term $\varepsilon_{i1}, \dots, \varepsilon_{iJ}$ given the deterministic parts $V_{i1}, \dots, V_{iJ}$.

According to the conditional logit model, the estimation could be interpreted according to the following:

As to the location- (country-) specific variables $\mathbf{z}_j$ the *odds ratio* (the relative probability ratio) of firm i choosing host country m relative to not choosing location in country m is given by:

$$\Lambda_{m|m' \neq m}(\mathbf{x}_{ij}, \mathbf{z}_j) = \frac{P(y_i = m | \mathbf{x}_{ij}, \mathbf{z}_j)}{1 - P(y_i = m | \mathbf{x}_{ij}, \mathbf{z}_j)}$$

Closely related to the odds ratio are the *relative risk ratios* (RRR) as ratios of the calculated odds ratios. In the case of RRR the variable of interest is increased by a factor of η in the numerator. Applying for example the location-specific variable IPR protection (IPR) in country m (i.e. IPR_m) would generate the following RRR:

$$RRR = \frac{\Lambda_{m|m' \neq m}(IPR_m + \eta, \mathbf{x}_{ir}, \mathbf{z}_j)}{\Lambda_{m|m' \neq m}(IPR_m, \mathbf{x}_{ir}, \mathbf{z}_j)} = \exp(\hat{\gamma}_{IPR} \cdot \eta)$$

where $\hat{\gamma}_{IPR}$ represents the estimated coefficient for the location-specific variable IPR. Interpreting the calculated RRR an increase of η in IPR_m , i.e. a strengthening of the IPR protection in country m with η , would imply that the probability of firm i investing in country m versus not investing in country m changes by a factor of $\exp(\hat{\gamma}_{GDP} \cdot \eta)$, given that everything else is held constant (*ceteris paribus*). If a logarithmic variable such as GDP_m would have been applied, the interpretation would instead have been that an increase in GDP_m by one percent would imply a change in the relative probability of investing in country m versus not investing in country m by a factor of $\exp(\hat{\gamma}_{GDP} \times 0.01)$. The RRR of the estimated results will be provided in the following section.

3.2 Data overview

The empirical analysis uses a firm-level panel dataset that are part of a database on Swedish manufacturing firms with production affiliates abroad. The data have been collected by the Research Institute of Industrial Economics (IUI) in Stockholm, Sweden.⁶⁵ The information applied from the dataset is information on manufacturing parents and their majority-owned

⁶⁵ The Research Institute of Industrial Economics (IUI) has conducted surveys on Swedish MNEs in 1965, 1970, 1974, 1978, 1986, 1990, 1994, 1998, and 2003. For a description of the data collection procedure and for description of 2003 data in particular, please see Hakkala and Zimmerman (2005).

affiliates.⁶⁶ The panel has been separated into two sub-samples covering three years' observations from the 1970s and the 1990s, respectively. The years covered in the samples are 1970, 1974, 1978 and 1990, 1994, 1998. The total number of parent firms covered in the survey is 374 and the number of countries subject to FDI is 161.⁶⁷ *A.1* and *A.2* in *Appendix* present the summary statistics of the logit data for the 1970s and 1990s sample, respectively.

3.3 Measures of IPR protection

The variable of greatest interest for this study is a proxy for the strength of host country IPR protection. IPRs are, unlike other country characteristics such as tariffs, not easily measurable and are likely to be interrelated with other policies and regulations why laws that on the paper may appear identical can have sharply different impact in different countries, depending on these countries' different market structures and preferences.⁶⁸ Given these difficulties, two different approaches of measuring the relevant aspects of IPRs have emerged. The first approach has been to make qualitative rankings of IPRs as measures of input into production. The second approach has been to consider market outcomes (commonly an estimation of the extent to which IPRs are violated in different countries) that are likely to correlate with underlying IPR regimes as output measures of the strength of IPRs.⁶⁹ It has been argued that out of these approaches, it is for analytical purposes best to view IPRs as legal entities that serve as inputs into production, given that IPR infringement cannot uniquely be explained by lack of IPR enforcement but also on other local market conditions.⁷⁰

There are three different approaches to evaluate input measures focusing on the laws promoting IPR adapted in the different countries. A first way to assess a country's IPR legislation is to list the country's *membership in different international conventions promoting IPRs*, such as the TRIPS agreement, different conventions under the WIPO such as the Paris Convention for the Protection of Industrial Property, the Berne Convention for the Protection of Literary and Artistic Works, the Patent Cooperation Treaty and the UPOV.⁷¹ Considering most countries are part of these conventions, however, it is hard to use them as indicators of countries' different IPR regimes. Moreover, these conventions and agreements generally (with possible exception for the TRIPS agreement) allow for relatively many degrees of freedom in their adaptation and enforcement.⁷² The application of country membership in international agreements on IPRs has been applied in econometric analysis by e.g. Ferrantino (1993)⁷³ and is by Ginarte and Park (1997) referred to as a "dummy variables" approach.⁷⁴

Secondly, different *numerical and composite indices of IPR protection* have been developed in order to be able to carry out comparisons between many countries and perform statistical analysis. The indices have, in turn, been developed based on analysis of the different components of the legal structures underlying the construction of IPR legislation.⁷⁵ The most central and most frequently

⁶⁶ Information on affiliates only used to identify the countries in which the parents have affiliates.

⁶⁷ The numbers referring to numbers of parent firms and countries covered in the panel. The effective number of observations may, however, divert due to missing values and lack of data for certain observations. Due to the relatively extensive panel, however, it has of practical purposes not been possible to taking this into consideration when estimating the model.

⁶⁸ Maskus (2000b, p. 88).

⁶⁹ Maskus (2000b, pp. 88, 100).

⁷⁰ Maskus (2000b, pp. 88, 102).

⁷¹ Watal (2001, p. 15), Maskus (2000b, p. 89). See section 2.3 for further descriptions of the international agreements and conventions on IPRs.

⁷² Maskus (2000b, p. 91).

⁷³ Ferrantino (1993). Ferrantino applies as two dummy variables equalling one if countries are members of the Paris Convention and the Berne Convention, respectively.

⁷⁴ Ginarte and Park (1997, p. 284).

⁷⁵ Maskus (2000b, p. 94).

mentioned and applied measures of IPR protection are the Rapp and Rozek index and the Ginarte and Park indices, which will be described in the following.

Rapp and Rozek index (RR): the first cross-country IPR index was developed by Richard T. Rapp and Richard P. Rozek.⁷⁶ The RR index focused on the pharmaceutical industry in 1984 and covered a sample of 116 countries. The construction of the index was based on surveys among business and government officials and examined the patent laws. It measured to what extent the patent regulations and the enforcement of these for each country complied with the minimum standards set out in the “Guidelines for Standards for the Protection and Enforcement of Patents” of the US Chamber of Commerce Intellectual Property Task Force in 1984.⁷⁷

According to the RR index, the level of patent protection in each country is ranked on a scale from zero to five, with zero reflecting absence of patent legislation and five assigned to countries with patent laws that are in full conformity with the minimum standards.⁷⁸ Criticism raised against the applicability of the RR index has been that the index can be considered to be subjective since the designation of each unit increase on the scale from zero to five is supposed to reflect a wide range of differences in many complex legal issues and many developing countries have strong patent laws on the paper, but lack the required enforcement and effectiveness of the laws, which are not captured by the index.⁷⁹

Ginarte and Park index (GP): the RR index was further developed by Juan C. Ginarte and Walter G. Park.⁸⁰ Ginarte and Park examined in the construction of their index the patent laws of 110 countries quinquennially from 1960 to 1990.⁸¹ Five components of the patent laws were considered: 1) extent of coverage, 2) membership in international patent agreements, 3) provisions for loss of protection, 4) enforcement mechanisms, and 5) duration of protection. These components were further broken down into characteristics that were considered important in deciding upon the effective strength of the components in question. These subcomponents were given a value of zero if absent and one if present. The score of each of the components counted as the sum of these values counted as a percentage of the maximum value. The procedure was performed for each country and for each year. The country score of the index ranged from 0.0 to 5.0.⁸²

Compared to the RR index, the GP index took to greater extent variations in patent laws into consideration. The GP index was further calculated for several years, which allowed for analysis over time.⁸³ Thus, the advantages of the GP index is that it takes into account many details associated with a country’s IPR protection as well as treatment by foreigners. It is worth mentioning, that even though there are few least-developed countries that score high in the Ginarte and Park data, many of these countries have very weak IP enforcement mechanisms. The main disadvantage of the GP index is that it does only consider laws on the books and does not consider the actual enforcement of the laws⁸⁴, and an IPR regime without a well-functioning enforcement mechanism is, as mentioned by Kallanje (2002); “like a car without an engine, i.e. it

⁷⁶ Rapp and Rozek (1990).

⁷⁷ Maskus and Penubarti (1995, p. 235).

⁷⁸ Rapp and Rozek (1990, p. 79), Maskus, and Penubarti (1995, p. 235).

⁷⁹ Maskus (2000b, pp. 94-95). Maskus and Penubarti (1995, p. 236).

⁸⁰ Ginarte and Park (1997).

⁸¹ These data have, as previously mentioned, been updated and I am most grateful to Walter Park for providing me with the data for 1995 and 2000, although Mr. Park noted that the data for 2000 must be viewed as tentative.

⁸² Ginarte and Park (1997, p. 284), Maskus (2000b, p. 96).

⁸³ Maskus (2000b, p. 96).

⁸⁴ OECD (2003, p. 17), Smarzynska (2002, p. 8), Maskus (2000b, p. 96).

will simply not work”.⁸⁵ The fact that the GP index does not capture the enforcement of the IPR laws and since the issue of enforcement indeed can be considered to be of vital importance for foreign investors’ investment decision, complementary indices capturing the aspect of enforcement have in some cases have been applied.⁸⁶

Moreover, the GP index is developed only for patents and does not consider other types of IPRs, why applying the GP index in a study like this one as a proxy for IPR regimes in general can be considered as a weakness of the study itself. Nevertheless, the role of patent protection has generally in the academia been considered to be the most relevant form of IPR seen to technology creation and diffusion. It has been observed that the correlation between these three different indices is fairly high, which is why there is reason to believe that countries exhibiting a strong protection of one of the types of IPRs should also have a strong protection of the other two, although there are important exceptions.⁸⁷

Thirdly, different *survey measures* have been developed where IPR regimes are treated as measures of input into production. One central advantage with survey measures is that they, unlike e.g. the GP index, take into account the actual effectiveness of the IPR laws and to what extent they indeed are executed, i.e. the enforcement of the IPR laws. The most important weakness of the survey measures is their subjectivity and the fact that their findings are not always easily compared.⁸⁸ Some of the most central survey measures will be covered in the following.

One survey measure often mentioned is presented in the World Economic Forum’s annual **Global Competitiveness Report**. In the construction of the index, respondents are to provide a subjective answer to if they consider IPRs in each country being satisfactory to meet their requirements and needs for security and exploitation of technical information in the property of their company. The answers are consequently put together into a numerical index ranging from 0 to 100, with 100 representing full faith in the IPRs system. For analytical purposes over time and as in this study, the IPR index presented in the Global Competitiveness Report is not really applicable as it was not reported until 1989 and many developing countries do not appear in the index until the mid-1990s.⁸⁹ For concluding, it has been found that the patent rights index is highly correlated with survey measures, which indicates that patent laws in countries with strong patent systems also tend to be enforced.⁹⁰

What has further been mentioned as a survey approach by Ginarte and Park (1997)⁹¹ is the approach employed in **Mansfield (1994)** and **Mansfield (1995)**. Mansfield (1994) based his work on replies from 94 US MNEs as to if they perceived the IPR regimes in 16 countries satisfactory in order for them to conduct investment in these countries. Mansfield (1995) did similarly base his work on replies from 20 German and 32 Japanese firms as to their perception of the adequacy of the IPR regimes in 14 countries for them to invest in these countries.⁹²

⁸⁵ Kalanje (2002, p. 123).

⁸⁶ See e.g. Smarzynska (2002, p. 8). Due to lack of availability, this particular index with IPR enforcement included in its construction will not be applied in this study.

⁸⁷ OECD (2003, p. 17). An example of a significant exception from this “rule” is India, which has fairly strong copyright protection but in some areas weak patent protection.

⁸⁸ OECD (2003, p. 17).

⁸⁹ The author is much grateful to Keith E. Maskus for making this clarification.

⁹⁰ OECD (2003, pp. 17, 36).

⁹¹ Ginarte and Park (1997, p. 284).

⁹² The respondents in the survey were usually patent attorneys, specialists in firms’ international operations, and top executives. The countries subject to discussion were Argentina, Brazil, Chile, Hong Kong, India, Indonesia, Japan, Mexico, Nigeria, Philippines, Singapore, Rep. of Korea, Spain, Thailand and Venezuela and Taiwan, China. Japan and Spain were not covered in the 1995 survey.

Seyoum (1996), similar to Mansfield, performed his econometric analysis on the relationship between FDI and effectiveness of IPR protection based on questionnaire responses from IP experts from 27 less-developed, newly industrialized, and developed countries.

Sherwood (1997) did further develop something Braga and Fink (1998) calls “a hybrid of an ‘on the books’ analysis and a survey-based index for eighteen developing countries”.⁹³ The index starts with a score of 100 and points are thereafter subtracted for weaknesses in the areas of enforceability, administration, treaties, and separate laws for copyrights, patents, trademarks, trade secrets, and life forms. When deciding upon a country’s ranking, Sherwood examined the country’s IPR laws and complemented with information collected from local agents involved in the country’s IPRs system. Sherwood’s index may be considered to be the most complete approach for ranking IPR regimes in different countries. Nevertheless, the degree of subjectivity in the construction of the index is an important weakness.⁹⁴

In investigating IPR regimes in different countries, there is also the approach where different kinds of *outcomes* that may be related with the strength of the IPR regimes are evaluated. Commonly, it is the extent to which IPRs are violated in countries that is being appraised.⁹⁵ This approach has, however, been criticized since estimated rates of infringements of different kinds of IPRs may well be influenced by other factors than poorly enforced IPRs, such as local market conditions and business strategies.⁹⁶

From the above mentioned reasons, the law-based input measure GP index will be employed in this study, whereupon also all the presented weaknesses of this measure can be considered to be weaknesses of this study and reasons as to why the results need to be interpreted with caution.

3.4 Model specification and variables

As covered in section 3.1 and 3.2, the location choice of MNEs will in the following be estimated with a dependent variable as a presence indicator for each country taking the value of one if the host country in question resides at least one majority-owned Swedish manufacturing affiliate.

Besides the Ginarte and Park index on patent strength as proxy variable for the host countries’ patent regimes other independent variables to be included in the regression are the location-specific variables GDP, GDP per capita, relative skill endowments, and corporate taxes. Moreover, a variable for geographical distance will be included, in line with a general gravity model approach. The parent-specific variable to be included in the regression is the intensity of research and development (henceforth R&D) in the parent firm (calculated as the ratio between R&D expenditures and the sales volume). Furthermore, an interaction variable between the IPR variable and the parent-specific R&D intensity will be included. Time dummy variables for the different years in each sample will also add to the other regressors in order to control for time-specific effects. A short justification for the inclusion of the different variables will be given in the following, together with an anticipation of the expected signs of their estimated coefficients.⁹⁷

⁹³ Primo Braga and Fink (1998, p. 183).

⁹⁴ Primo Braga and Fink (1998, p. 183).

⁹⁵ Examples of institutions publishing estimates of piracy rates and revenue losses are the Business Software Alliance, the Software and Information Industry Association and the International Intellectual Property Association.

⁹⁶ Maskus (2000b, p. 102).

⁹⁷ No variable attempting to capture any potential “tariff jumping” motive behind FDI activity will be included in the model specification. The main reason for omitting any such variable is data limitations. Nevertheless, it is indeed possible that the inclusion of such a variable, in e.g. the form of tariff rates, would have contributed additional explanatory power to the model.

GDP ($\ln GDP$) is included as an approximate for the host country's market size and is considered to be an important determinant of FDI inflows and applied in gravity equations. The expected sign of the estimated coefficient of GDP on FDI location is consequently positive. Data on GDP is obtained from the World Bank Economic Indicators and is measured at constant USD 2000 values.

GDP per capita ($\ln GDP_{cap}$) is being included in order to some extent capture several location-specific characteristics, such as the host country's relative abundance of physical and human capital, the host country's level of technology and infrastructure, and possibly also income effects on consumer demand, as well as the host country's quality of political and economic institutions.⁹⁸ The expected sign of GDP per capita is ambiguous. Data on GDP per capita is obtained from the World Bank Economic Indicators and is measured at constant USD 2000 values.

Skills ($SKILLS$), or rather, countries' relative skill endowments, are approximated by a country's share of population with completed higher education. The data on share of population with completed higher education is obtained from Barro and Lee (2001) for the group of the population over age 25.

Taxes (TAX), or rather corporate taxes, are likely to have a discouraging effect on FDI.⁹⁹ The data on tax rates are obtained from the University of Michigan Database and the rates being referred to are the top marginal tax rate on corporations. According to Devreux and Griffith (2002) the most relevant measure of tax rate when analyzing its impact on the location choice is the average tax rate and not the marginal tax rate, which instead gets of greater importance in deciding on how much is to be invested, conditional on the location choice already having been decided.¹⁰⁰ Due to data availability, however, the marginal corporate tax rate is employed in this study.

Geographical distance ($\ln DIST$) is likely to be positively correlated with increased costs such as transport costs in supplying a foreign market and is therefore anticipated to have a negative effect on FDI decisions. Geographical distance is measured as weighted distances, which is an extension of the most frequently applied distance between capital cities (i.e. in this case between Stockholm and the capital city of host country), applying the great circle formula.¹⁰¹ The strength of using the weighted distances instead of the distances between capital cities is that the latter assumes all trade to depart and arrive in the capital.¹⁰² The data on the weighted distances is obtained from the CEPII.

R&D intensity ($R\&D_{int}$) represented by the ratio between R&D expenditure in the international parent group and total sales is included in order to capture the differential effect of R&D intensity of MNEs on establishing foreign affiliates. The essential purpose of including the variable is to identify its potential interactive effect with host country's IPR regime on the FDI decision, since any meaningful interpretation of the variable itself is not possible. The variable is, however, included in the regression as a controlling variable.

⁹⁸ Becker, Ekholm, and Muendler (2005, p. 13).

⁹⁹ See e.g. Devreux and Griffith (2002).

¹⁰⁰ Devreux and Griffith (2002, p. 89).

¹⁰¹ The basic idea is with the weighted distances is to calculate distance between two countries based on bilateral distances between the biggest cities of those two countries, those inter-city distances being weighted by the share of the city in the overall country's population.

¹⁰² The author is most grateful to Mr. Thierry Mayer at the CEPII for clarifying this matter.

Interaction (*INTERACT*) variable between the host country's IPR level of patent strength and the R&D intensity of the international parent group is of interest since it may capture the differential effect of IPR protection between high- and low-tech firms. Theory would suggest that firms that are well endowed with knowledge-based assets and consequently possess the ownership advantage of going abroad as well as the jointness feature speaking in its favor (such as high tech firms) would consequently be likely to be positively related to MNE location choice. Previous empirical studies furthermore also suggest a positive sign, indicating that the more intensive MNEs are in R&D activities, the more likely they are to conduct FDI in a country as the country strengthens its IPR protection.

In summary, the conditional logit regression model subject to estimation is the following (with j representing the host country, i the parent firm, and DY_n the different dummy variables covered in the two samples):

$$P(FDI_{ijt} = 1) = F \left(\gamma_1 IPRprot_{jt} + \gamma_2 \ln GDP_{jt} + \gamma_3 \ln GDPcap_{jt} + \gamma_4 SKILLS_{jt} + \gamma_5 TAX_{jt} + \gamma_6 \ln DIST_{jt} + \beta_1 R \& Dint_{it} + \beta_2 INTERACT_{ijt} + \sum_{n=1}^2 \partial_n DY_n \right)$$

where F is the cumulative logistic distribution¹⁰³:

$$F(z) = \frac{\exp(z)}{1 + \exp(z)}$$

4. Empirical results

4.1 1970s sample

Table 1 presents the conditional logit estimates for the 1970s sample and *Table 2* presents the conditional logit estimates for the 1990s sample. Since there may be reason to believe that the investment decisions made by the same Swedish MNE in different countries might not be independent from one another, potential correlation between error terms is being controlled for by clustering over the MNE parent group observations.¹⁰⁴

Starting with the 1970s sample and the (1) column in *Table 1*, the location-specific variable of particular interest for the purpose of this study, i.e. the regressor capturing the host-country level of IPR protection (*IPRprot*), is highly significant at the one percent level. The sign of the estimated *IPRprot* coefficient is, however, negative, which is not fully in line with previous findings but yet subject to further investigation. The estimated coefficient suggests that for a unit increase in a country's level of IPR protection (i.e. an increase in the patent index by one unit), ceteris paribus, the log of the odds in favor of a Swedish MNE conducting FDI in the country decreases by about 0.563 units. A more appealing interpretation of the estimated results is, however, obtained by applying the relative risk ratios (RRR) covered in section 3.1.¹⁰⁵ Calculating the RRR, a unit increase in a country's IPR protection, ceteris paribus, would decrease the relative probability of a Swedish MNE locating an affiliate in the country versus not locating an affiliate in the country by a factor of about 0.5695 or 43.05 percent according to the following:

$$\begin{aligned} RRR &= \exp(\hat{\gamma}_{IPRprot} \cdot \eta) \\ &\Rightarrow \exp(-0.5629928 \times 1) \approx 0.5695 \end{aligned}$$

¹⁰³ StataCorp. (2005, p. 224).

¹⁰⁴ If not mentioned otherwise, the results referred to are the ones with Huber/White/sandwich estimator of variance applied (reported within parentheses $()$ and marked with pound $\#$ in *Table 1* and *Table 2*).

¹⁰⁵ Gujarati (2003, pp. 600-602).

Table 1 *Conditional Logit Estimates of Swedish FDI Presence*
Year sample 1970, 1974, 1978

Coefficient, (β)	Case 1: including <i>ipr, fouint, interact</i>	Case 2: including <i>ipr, fouint</i> (excluding <i>interact</i>)	Case 3: including <i>ipr, interact</i> (excluding <i>fouint</i>)
<i>IPRprot</i>	-0.5629928 (0.1289991)*** (0.1377433) _# ***	-0.4498662 (0.1147093)*** (0.113091) _# ***	-0.4899148 (0.1218342)*** (0.1300599) _# ***
<i>lnGDP</i>	0.493668 (0.0427799)*** (0.0407098) _# ***	0.4943798 (0.0427654)*** (0.0408372) _# ***	0.4943329 (0.0427678)*** (0.0408179) _# ***
<i>lnGDPcap</i>	0.0787731 (0.0764143) (0.1040284) _#	0.0764438 (0.0763601) (0.1037788) _#	0.0768214 (0.0763598) (0.1037908) _#
<i>SKILLS</i>	0.0399525 (0.0130703)*** (0.0127654) _# ***	0.0401215 (0.0130642)*** (0.0128109) _# ***	0.0401237 (0.0130655)*** (0.0128114) _# ***
<i>TAX</i>	0.006318 (0.0043846) (0.0051954) _#	0.0062484 (0.0043836) (0.0052028) _#	0.0062717 (0.0043837) (0.0051977) _#
<i>lnDIST</i>	-0.738265 (0.0549444) (0.0901626) _# ***	-0.7370768 (0.0549368)*** (0.0899523) _# ***	-0.7373387 (0.0549347)*** (0.0900015) _# ***
<i>Rc&Dint</i>	-20.44103 (12.45398) (8.180533) _# **	-3.502872 (8.217327) (5.186883) _#	
<i>INTERACT</i> (<i>IPR</i> * <i>Rc&Dint</i>)	5.176698 (2.838858)* (2.448918) _# **		1.752005 (1.816999) (1.592291) _#
<i>Y2</i>	0.1755083 (0.1248701) (0.0817051) _# **	0.1649932 (0.124758) (0.0832072) _# **	0.1486441 (0.1237301) (0.0829468) _# *
<i>Y3</i>	0.0757312 (0.1132651) (0.0673164) _#	0.0712627 (0.1132378) (0.0682903) _#	0.0788642 (0.1133024) (0.0704566) _#
<i>Y4</i>	¹⁾	¹⁾	¹⁾

Notes: Standard errors reported in parentheses () and robust standard errors estimates (Huber/White/sandwich estimator of variance applied) reported within parentheses () and marked with pound#. Significance: *, significance at ten, **; five, ***; one percent. ¹⁾ Y4 (dummy variable for year 1978) dropped due to collinearity.

Source: IUI data.

However, considering that the GP IPR index ranging from 0.0 to 5.0, a one unit (1.0) increase in a country's level of IPR protection may be a larger increase than can be regarded as probable. A more probable assumption may therefore be an increase of five percent, i.e. by a unit value increase of 0.133 (with a mean value of 2.66, derived from *A.1* in *Appendix*).¹⁰⁶ The estimate suggests that a five percent unit increase in a country's level of IPR protection (i.e. a unit value increase of about 0.133), *ceteris paribus*, would decrease the relative probability for a firm to conduct FDI in a country versus not doing so by a factor of 0.9279 or 7.21 percent according to the following:

$$\begin{aligned} RRR &= \exp(\hat{\gamma}_{IPRprot} \cdot \eta) \\ &\Rightarrow \exp(-0.5629928 \times 0.133) \approx 0.9279 \end{aligned}$$

Moreover, other location-specific variables proven to be highly significant different from zero (at the one percent confidence level) are the standard gravity type variables GDP and geographical distance. The estimated coefficient for the GDP variable is furthermore positive, which is in line with anticipation since a larger market size is supposed to attract FDI. When quantifying the estimated coefficients, a one percent increase in a country's GDP, *ceteris paribus*, would increase the relative probability of choosing a location versus not conducting FDI in the country in question by about 0.495 percent according to the following RRR calculation (adapted from section 3.1)¹⁰⁷:

$$\begin{aligned} RRR &= \exp(\hat{\gamma}_{GDP} \cdot \eta) \\ &\Rightarrow \exp(0.493668 \times 0.01) \approx 1.00495 \end{aligned}$$

Similarly, the estimated coefficient of geographic distance does moreover also have the expected negative sign, which indicates that geographic distance acts as a deterring factor for FDI. When interpreting the estimated coefficient, an increase by one percent in the geographical distance between a location and Sweden, *ceteris paribus*, would decrease the relative probability (i.e. the odds) of a Swedish MNE locating in the country versus not locating in the country in question by about 0.736 percent according to the following:

$$\begin{aligned} RRR &= \exp(\hat{\gamma}_{DIST} \cdot \eta) \\ &\Rightarrow \exp(-0.738265 \times 0.01) \approx 0.99264 \end{aligned}$$

Furthermore, the variable approximating the host country's relative factor endowments (*SKILLS*) has a significant and positive estimated coefficient. This implies that as a larger proportion of countries' population attains a higher level of education, i.e. the countries increase their amount of skilled factor endowments, the probability for a Swedish MNE to conduct FDI in the country in question increases.¹⁰⁸ More precisely, interpreting the estimated results, a unit increase in a

¹⁰⁶ Five percent increase taken as a probable value for the 1970s sample since the percentage mean increase was approx. 0.8 percent between the years 1970 and 1975, and 4.8 percent between the years 1975 and 1980. The average increase for the whole 1970s sample period, 1970-1980 was approx. 5.7 percent.

¹⁰⁷ The interpretation of the estimated results for the GDP and geographic distance variables is somewhat different due to these coefficients being in natural logarithm format and consequently estimating elasticities instead of unit changes.

¹⁰⁸ Since Sweden is considered to be relatively abundant in skilled labor, and as the difference between the home- and host country as to skill endowments would decrease, theory would suggest that the type of FDI would shift away from vertical to horizontal investments. Yet, the discussion of the different impact of parent- and country characteristics on the location choice of MNEs as to the distinction between horizontal and vertical investments is beyond the scope of this study.

country's skill level (i.e. an increase in the higher school completion by one percentage point in the country's total population over the age of 25), ceteris paribus, would increase the relative probability of a Swedish MNE conducting FDI in the country versus not conducting FDI in the country in question by about 4.076 percent according to the following:

$$\begin{aligned} RRR &= \exp(\hat{\gamma}_{SKILLS} \cdot \eta) \\ &\Rightarrow \exp(0.0399525 \times 1) \approx 1.04076 \end{aligned}$$

Neither one of the location-specific variables GDP per capita ($\ln GDP_{cap}$) or tax rates (TAX) have any significant impact on the location choice of MNEs. The time dummy variable $DY1$ is positive and significant at a five percent level. $DY2$ is positive but insignificant.

As to the parent-specific variable capturing the firm-specific R&D intensity ($Re\&Dint$), however, its estimated coefficient is negative and significantly different from zero, but yet only at a five percent level. An interpretation of the result is, however, not possible (see section 3.4).

The estimated coefficient of the interaction variable between the host country IPR protection and the parent firm R&D intensity ($INTERACT$), is furthermore positive and significant at the five per cent level. This result is, however, somewhat contradictory since the estimated coefficients of both IPR and $Re\&Dint$ are positive. This result raises question of potential prevalence of multicollinearity, which then needs to be tested for. *Table 3* presents auxiliary regressions with the different independent variables being applied as dependent variables. *A.4* in *Appendix* does furthermore present the pair-wise correlations between the different regressors. It is clear that the variables $Re\&Dint$ and $INTERACT$ are highly collinear. Aware of the present problem of multicollinearity, column (2) and (3) in *Table 1* presents the estimated coefficients (and their standard errors) without the $INTERACT$ and $Re\&Dint$ variable, respectively. Although the estimated coefficients do not change signs as a consequence of the omitted variables, they change in magnitude. In general, the interpretation of the $INTERACT$ and $Re\&Dint$ variables should be treated with caution.

The results generated from the 1970s sample would imply that as a country increases its level of IPR protection, ceteris paribus, the less the relative probability that a Swedish MNE would conduct FDI activities in the country. The results are contrary to the empirical literature aiming at proofing that a country's strengthening of its IPR protection should encourage MNE to locate subsidiaries in the country (e.g. Maskus, 1998; Mansfield, 1994 and 1995). Nevertheless, taking into consideration the literature analyzing the impact of strengthened IPR protection on different modes of bilateral exchange, including FDI as well as licensing and trade introduces the possibility for substitution effect between the different modes of bilateral exchange (Maskus, 2000b, Smith, 2001). The estimated results are in accordance with line of reasoning presented by Smith (2001) implying that strengthened host country IPR protection confers an internalization effect, which implies that licensing is encouraged and increases more than FDI activities and exports.¹⁰⁹

4.2 1990s sample

Table 2 presents the conditional logit estimates for the 1990s sample and displays results that are somewhat different from the ones generated by the 1970s sample. From the estimation results, it is possible to state that the country-specific variable of particular interest for the purpose of this

¹⁰⁹ Smith (2001, p. 434).

study, i.e. the regressor capturing the host countries' different levels of IPR protection (*IPRprot*), has a positive, yet insignificant (at any relevant level of significance) coefficient. The positive coefficient is, however, more in line with a large part of the empirical literature on the subject, unlike the results from the 1970s sample. Yet, considering the insignificance, any interpretation should be made with caution. Applying the insignificant estimated coefficient for IPR protection would imply that a unit increase in a country's level of IPR protection would increase the relative probability of an MNE locating an affiliate in the country versus not doing so by about 3.36 percent.¹¹⁰ However, following the same reasoning as in the interpretation of the 1970s sample, a more probable increase in the level of a country's level of protection would be 15 percent, i.e. an increase of 0.432 units.¹¹¹ The estimate suggests that a unit value increase of 0.432 in a country's level of IPR protection, *ceteris paribus*, would increase the relative probability for a firm to conduct FDI in the country versus not doing so by a factor of 1.0144 or 1.44 percent.¹¹²

The location-specific variables with the highest level of significance (one percent) are, however, similar to the 1970s sample, the standard gravity type variables GDP and geographical distance, whose coefficients also have the expected signs. A one percent increase in a country's GDP would imply that the relative probability that a firm would locate in the country, *ceteris paribus*, would increase by 0.54 percent.¹¹⁴ A one percent increase in the geographical distance between Sweden and host country would decrease the relative probability that a Swedish firm would conduct FDI in the country in question by 0.74 percent.¹¹⁵

Moreover, the variable approximating the host country's relative factor endowments (*SKILLS*) has a significant and positive estimated coefficient (five percent), implying that as a country increases its share of skilled factor endowments, the relative probability for a Swedish MNE to conduct FDI in the country in question versus not doing so increases. Calculating the RRR implies that a unit increase in a country's skill level (i.e. an increase in the higher school completion by one percentage point), *ceteris paribus*, would increase the relative probability of a Swedish MNE conducting FDI in the country versus not doing so by about 0.0289 percent.¹¹⁶

GDP per capita (*lnGDPcap*) as well as tax levels (*TAX*) are similarly not significant at any relevant level. The time dummy variables *DY1* and *DY2* are, moreover, positive and statistically significant.

As to the parent-specific variable *Re&Dint*, the estimated coefficient is positive and statistically significant at the five percent level. This result contrasts, similar to the case with the *IPR* variable, the result from the 1970s sample. The interpretation that increased R&D intensity in a parent firm would be positively related to the probability of the firm conducting FDI is, however, in line with the internalization approach. As to the interaction variable *INTERACT* it is, once again, hard to explain its negative and statistical significance (at the five percent level), given *IPR* and *Re&Dint* both are positive. Consequently, suspicion of multicollinearity is raised. *A.4* and *A.5* in *Appendix* present auxiliary regressions with the different independent variables being applied as dependent variables and pair-wise correlations (intercorrelations) between the different regressors. It is clear that the variables *Re&Dint* and *INTERACT* are highly collinear. Aware of

¹¹⁰ $\exp(0.033075 \times 1) \approx 1.0336$

¹¹¹ With a mean value of 2.88, derived from *A.2* in *Appendix*.

¹¹² $\exp(0.033075 \times 0.432) \approx 1.0144$

¹¹⁴ $\exp(0.5384083 \times 0.01) \approx 1.00540$

¹¹⁵ $\exp(-0.7467849 \times 0.01) \approx 0.9926$

¹¹⁶ $\exp(0.0289035 \times 0.01) \approx 1.000289$

the present problem of multicollinearity, column (2) and (3) in *Table 2* presents the estimated coefficients (and their standard errors) without the *INTERACT* and *R&Dint* variables, respectively. Although the estimated coefficients do not change signs as a consequence of the omitted variables, they change in magnitude. In general, considering the prevalent multicollinearity, any interpretation of the *INTERACT* (and *R&Dint*) variables should be treated with caution. Nevertheless, calculating the RRR with respect to the *INTERACT* variable when the *R&Dint* variable is excluded from the regression (column 3), generates some interesting results. Starting by assuming an increase in the IPRs protection by ten percent in a country from its mean 2.88 (derived from *A.2* in *Appendix*) and that the MNE in question is in the upper tail of as to R&D intensity (*R&Dint* mean + 2 Std. Dev.), the relative probability that a Swedish MNE would conduct FDI in the country versus not doing so would decrease by a factor of about 0.972 or 2.8 percent according to the following:

$$\begin{aligned} RRR &= \exp[0.288(\hat{\gamma}_{IPRprot} + \hat{\beta}_{INTERACT} \times 0.09)] \\ &\Rightarrow \exp[0.288(-0.0061 - 1.050 \times 0.093)] \\ &\Rightarrow \exp(-0.02829) \approx 0.97211 \end{aligned}$$

The estimated results would imply that a firm that is relatively not intensive in R&D activities is practically unaffected by host country levels of IPRs protection in its location decision. But as the firms become increasingly intensive in R&D activities, they become increasingly *negatively* affected by the host countries' levels of IPRs protection. A firm does in this sense become the less and less likely to conduct FDI in a country as the country's level of IPRs protection increases the more intensive the firm is in R&D activities.

The results generated from the 1990s sample would imply that the higher the level of R&D intensity in a Swedish MNE, the more negatively affected is the likelihood that the firm would conduct FDI in a country as the country in question strengthens its IPR protection. This result adds information to the results generated by the 1970s sample. More precisely, the substitution effect mentioned in the literature (Maskus, 2000b, Smith, 2001) and exemplified by the 1970s sample between different types of bilateral exchange is emphasized the higher the level of R&D intensity in the parent firms. Further, theory suggests that as the industry innovativeness (an indicator of the extent to which firms in the industry engage in R&D activities) increases, technology transfer and bilateral exchange in general is more likely to take place through licensing than through FDI (Maskus et al, 2004).

Table 2 *Conditional Logit Estimates of Swedish FDI Presence*
Year sample 1990, 1994, 1998

Coefficient, (β)	Case 1: including <i>ipr, fouint, interact</i>	Case 2: including <i>ipr, fouint</i> (excluding <i>interact</i>)	Case 3: including <i>ipr, interact</i> (excluding <i>fouint</i>)
<i>IPRprot</i>	0.033075 (0.0766711) (0.109322)#	-0.0369456 (0.0698952) (0.1053271)#	-0.0061145 (0.0730674) (0.1055621)#
<i>lnGDP</i>	0.5384083 (0.0271283)*** (0.0368758)#***	0.5394532 (0.0271331)*** (0.0369466)#***	0.539164 (0.0271298)*** (0.0369125)#
<i>lnGDPcap</i>	-0.0045213 (0.0557666) (0.054921)#	-0.004672 (0.055719) (0.0544701)#	-0.0050183 (0.0557338) (0.0545591)#
<i>SKILLS</i>	0.0289035 (0.0070274)*** (0.0127032)#**	0.0293057 (0.0070227)*** (0.012695)#**	0.0291809 (0.0070236)*** (0.0127003)#**
<i>TAX</i>	-0.0063909 (0.0042256) (0.004002)#	-0.0064137 (0.0042242) (0.0039902)#	-0.0064191 (0.0042246) (0.0039917)#
<i>lnDIST</i>	-0.7467849 (0.0426911)*** (0.0981196)#***	-0.7476234 (0.0426813)*** (0.0980625)#***	-0.7473454 (0.0426823)*** (0.0980733)#***
<i>ReDint</i>	8.635488 (4.915024)* (3.500204)#**	0.4227821 (3.51705) (0.6232186)#	
<i>INTERACT</i> (<i>IPRprot*ReDint</i>)	-2.294982 (0.9870412)** (0.9053541)#**		-1.049555 (0.7186359) (0.4722046)#**
<i>Y2</i>	0.4048903 (0.1051482)*** (0.0404486)#***	0.3983969 (0.1050658)*** (0.0409419)#***	0.4062591 (0.1052902)*** (0.042876)#***
<i>Y3</i>	0.2166021 (0.0927443)** (0.0242228)#***	0.2084533 (0.092707)** (0.023102)#***	0.2182875 (0.0927104)** (0.0267627)#***
<i>Y4</i>	1)	1)	1)

Notes: Standard errors reported in parentheses () and robust standard errors estimates (Huber/White/sandwich estimator of variance applied) reported within parentheses () and marked with pound#. Significance: *, significance at ten, **, five, ***; one percent. ¹⁾ Y4 (dummy variable for year 1998) dropped due to collinearity.

Source: IUI data.

5. Conclusions

The results generated in the study add information into the field of IPRs and bilateral exchange, such as in this case in the form of FDI. Whilst the estimated coefficient for the IPR variable generated by the 1970s sample revealed a negative and highly statistical relationship between the level of host country IPR strength and probability of Swedish MNE conducting FDI in the country question, the result from the 1990s sample was a positive, yet insignificant estimated IPR coefficient. Although the results generated from the 1970s sample may certainly be questioned for different reasons, they nevertheless highlight that host countries' level of patent protection and other kinds of IPR protection may well have a negative impact on the probability of FDI being conducted in the country in question. The theoretical foundation for such a finding could be that strong host country IPRs confer an internalization effect that increases arm's length agreements such as licensing relative to FDI and exports and may eventually lead to a substitution effect with MNEs replacing FDI with licensing agreements. This finding is contrary to several other studies in the area. Nevertheless, the uncertain and non-obvious relationship between IPR regimes and bilateral exchange within the prevalent theoretical as well as empirical framework does provide support for these findings.

More specifically, the combined results for the 1970s and the 1990s would indicate that as the global economy has moved in a direction increasingly dependent on knowledge, MNEs have increased in importance on the global agenda on international trade, investments and bilateral exchange in general. The interconnection between these developments is the particular feature of MNEs being intensive in "knowledge capital" as their firm-specific assets. This development is likely to be reflected in the results generated by the two samples used in the study.

The results for the 1970s indicate that the likelihood that the MNEs would conduct FDI in a country was negatively affected by the host country's level of IPR protection. Moreover, the results from the 1990s indicate that MNEs are merely unaffected in their location choice on the host country level of IPR protection unless the MNEs in question are intensive in R&D activities, and the impact is consequently negative between host country IPR protection and the parent firm R&D intensity. Theory would suggest that according to the internalization effect licensing increases more compared to FDI and exports among the different modes through which MNEs can serve foreign markets as a consequence of increased foreign IPR protection. Further, as the industry innovativeness (an indicator of the extent to which firms in the industry engages in R&D activities) increases, theory does suggest that technology transfer and bilateral exchange in general is more likely to take place through licensing than through FDI.

In general, what should be emphasized in the debate surrounding the pros and cons with strengthening IPR protection, in particularly developing countries, in order for the countries to attract foreign capital and know-how is that MNEs have more than one option when deciding upon serving a foreign market. The reason is that just because a strengthening of IPR protection may be found to have negative impact on one mode of channel for technology transfer (such in the present study, FDI), may not function as a discouraging factor for other modes of serving the foreign market (such as exports and licensing) at hand for the MNE. Rather, the strengthening of the IPR protection may encourage a different form of technology transfer.

Subject to future research would be to compare the above presented results and presented possibility of substitution effect of FDI in favor of licensing with measures of de facto performed licensing activities by Swedish MNEs. This does furthermore also encourage others for further empirical as well as theoretical research within the complex field of IPRs.

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Appendix

A.1 Summary Statistics of Logit Data

Year sample 1970, 1974, 1978

Variable	Mean	Std. Dev.
Location choice	0.0186726	0.1353681
<i>IPRprot</i>	2.659807	0.8037821
<i>lnGDP</i>	24.03943	2.483206
<i>lnGDPcap</i>	7.951212	1.639926
<i>SKILLS</i>	3.21962	3.504235
<i>TAX</i>	38.08358	11.78267
<i>lnDIST</i>	8.434149	0.9506666
<i>RcDint</i>	0.0239001	0.0250615
<i>INTERACT</i> (<i>IPRprot</i> * <i>RcDint</i>)	0.063577	0.0721947
<i>DY1</i>	0.3529038	0.4778803
<i>DY2</i>	0.3728475	0.4835694
<i>DY3</i>	0.2742487	0.4461417

Note: Variables *DY1*, *DY2*, and *DY3* representing dummy variables for the years covered in the sample, i.e. 1970, 1974, and 1978, respectively.

Source: IUI data.

A.2 Summary Statistics of Logit Data

Year sample 1990, 1994, 1998

Variable	Mean	Std. Dev.
Location choice	0.013105	0.1137253
<i>IPR_{prot}</i>	2.882543	0.9538229
<i>lnGDP</i>	24.48607	2.084562
<i>lnGDP_{cap}</i>	8.060348	1.515732
<i>SKILLS</i>	6.871355	4.924918
<i>TAX</i>	34.62672	8.869361
<i>lnDIST</i>	8.562023	0.9019877
<i>R&D_{int}</i>	0.026573	0.0335032
<i>INTERACT</i> (<i>IPR</i> * <i>R&D_{int}</i>)	0.0755708	0.1026879
<i>DY1</i>	0.3314196	0.4707262
<i>DY2</i>	0.3594651	0.4798463
<i>DY3</i>	0.3091153	0.4621314

Note: Variables *DY1*, *DY2*, and *DY3* representing dummy variables for the years covered in the sample, i.e. 1990, 1994, and 1998, respectively.

Source: IUI data.

A.3 Instruments and agreements for protecting intellectual property rights (IPRs)

Types of intellectual property	Instruments of protection	Protected subject matter	Primary fields of application	International agreements
Industrial property	Patents and utility models	New, nonobvious inventions with industrial utility	Manufacturing, agriculture	Paris Convention Patent Cooperation Treaty Budapest Treaty Strasbourg Agreement TRIPS
	Industrial designs	Ornamental designs of products	Automobiles, apparel, construction tiles, others	Hague Agreement Locarno Agreement TRIPS
	Trademarks	Identifying signs and symbols	All industries	Madrid Agreement Nice Agreement Vienna Agreement
	Geographical indications	Identifying names place	Wine, spirits	Lisbon Agreement TRIPS

A.3 Instruments and agreements for protecting intellectual property rights (IPRs) (cont.)

Types of intellectual property	Instruments of protection	Protected subject matter	Primary fields of application	International agreements
Artistic and literary property	Copyrights and neighbouring rights	Original expressions of authorship	Publishing, electronic entertainment, software, broadcasting	Berne Convention Rome Convention Geneva Convention Brussels Convention WIPO Copyright Treaty WIPO Performances and Phonograms Treaty Universal Copyright Convention TRIPS
<i>Sui generis</i> protection	Integrated circuits	Original designs	Computer industry chip	Washington Treaty TRIPS
	Database protection	Databases	Information processing	EC Directive 96/9/EC
	Plant breeders' rights	New, stable, distinct, varieties	Agriculture, food	UPOV TRIPS
Trade secrets	Laws against unfair competition	Business information held in secret	All industries	TRIPS

Source: Adapted from Primo Braga, C. A. (1996, p. 343); Primo Braga, C. A., Fink, C. and Sepulveda, C. (2000, p. 4); Maskus, K. E. (2000b, pp. 37-38).

A.4 R² values from the auxiliary regressions. Year sample 1970, 1974, 1978.

<i>Dependent variable</i>	<i>R²adj value</i>	<i>R² value</i>	<i>Tolerance (TOL) = 1-R²adj</i>
<i>IPR_{prot}</i>	0.6542	0.6541	0.3458
<i>lnGDP</i>	0.6301	0.6302	0.3699
<i>lnGDP_{cap}</i>	0.7104	0.7104	0.2896
<i>SKILLS</i>	0.5715	0.5716	0.4285
<i>TAX</i>	0.3173	0.3174	0.6827
<i>lnDIST</i>	0.3186	0.3187	0.6814
<i>Re_{Dint}</i>	0.9167	0.9167	0.0833
<i>INTERACT</i>	0.9223	0.9223	0.0777

Note : Time dummy variables (*DY1*, *DY2*, *DY3*) for the years covered in the sample (i.e. 1970, 1974, 1978) omitted due to all R² values equal to one.

A.5 R² values from the auxiliary regressions. Year sample 1990, 1994, 1998.

<i>Dependent variable</i>	<i>R²adj value</i>	<i>R² value</i>	<i>Tolerance (TOL) = 1-R²adj</i>
<i>IPR_{prot}</i>	0.5955	0.5955	0.4045
<i>lnGDP</i>	0.4764	0.4765	0.5236
<i>lnGDP_{cap}</i>	0.6970	0.6971	0.3030
<i>SKILLS</i>	0.5090	0.5090	0.4910
<i>TAX</i>	0.2210	0.2211	0.7790
<i>lnDIST</i>	0.3526	0.3527	0.6474
<i>Re_{Dint}</i>	0.9009	0.9009	0.0991
<i>INTERACT</i>	0.9055	0.9055	0.0945

Note : Time dummy variables (*DY1*, *DY2*, *DY3*) for the years covered in the sample (i.e. 1990, 1994, 1998) omitted due to all R² values equal to one.

A.6 Intercorrelations. Year sample 1970, 1974, 1978.

	<i>IPR_{prot}</i>	<i>lnGDP</i>	<i>lnGDP_{cap}</i>	<i>SKILLS</i>	<i>TAX</i>	<i>lnDIST</i>	<i>R&D_{int}</i>	<i>INTERACT</i>	<i>DY1</i>	<i>DY2</i>	<i>DY3</i>
<i>IPR_{prot}</i>	1.0000										
<i>lnGDP</i>	0.5841	1.0000									
<i>lnGDP_{cap}</i>	0.5705	0.7057	1.0000								
<i>SKILLS</i>	0.5039	0.6614	0.6421	1.0000							
<i>TAX</i>	0.3151	0.1466	-0.1289	0.1682	1.0000						
<i>lnDIST</i>	-0.3369	-0.4035	-0.4817	-0.1474	0.0827	1.0000					
<i>R&D_{int}</i>	0.0003	-0.0074	0.0003	-0.0084	-0.0089	-0.0039	1.0000				
<i>INTERACT</i>	0.2594	0.1444	0.1483	0.1211	0.0722	-0.0906	0.9248	1.0000			
<i>DY1</i>	0.0038	-0.0876	0.0040	-0.0996	-0.1050	-0.0416	0.0847	0.0793	1.0000		
<i>DY2</i>	-0.0204	-0.0040	0.0270	0.0265	0.0609	0.0107	-0.0488	0.0502	0.5702	1.0000	
<i>DY3</i>	0.0181	0.0981	-0.0336	0.0779	0.0463	0.0377	-0.0377	-0.0305	0.4518	-0.4752	1.0000

Note: Variables *DY1*, *DY2*, and *DY3* representing dummy variables for the years covered in the sample, i.e. 1970, 1974, and 1978, respectively.

Source: IUI data.

A.7 Intercorrelations. Year sample 1990, 1994, 1998.

	<i>IPR_{prot}</i>	<i>lnGDP</i>	<i>lnGDP_{cap}</i>	<i>SKILLS</i>	<i>TAX</i>	<i>lnDIST</i>	<i>R&D_{int}</i>	<i>INTERACT</i>	<i>DY1</i>	<i>DY2</i>	<i>DY3</i>
<i>IPR_{prot}</i>	1.0000										
<i>lnGDP</i>	0.4529	1.0000									
<i>lnGDP_{cap}</i>	0.5713	0.6504	1.0000								
<i>SKILLS</i>	0.4727	0.5583	0.6377	1.0000							
<i>TAX</i>	-0.0330	-0.0936	-0.2907	-0.2152	1.0000						
<i>lnDIST</i>	-0.4227	-0.3635	-0.4890	-0.1667	-0.0541	1.0000					
<i>R&D_{int}</i>	-0.0294	-0.0005	-0.0002	-0.0178	0.0186	0.0023	1.0000				
<i>INTERACT</i>	0.2140	0.1084	0.1367	0.0937	0.0119	-0.1014	0.9204	1.0000			
<i>DY1</i>	-0.2187	-0.0244	0.0059	-0.1329	0.1870	0.0213	0.0593	0.0034	1.0000		
<i>DY2</i>	0.0119	0.0185	-0.0062	0.0075	-0.0507	-0.0050	0.0865	0.0912	-0.5212	1.0000	
<i>DY3</i>	0.2086	0.0055	0.0004	0.1265	-0.1364	-0.0164	-0.1493	-0.0977	-0.4716	-0.5068	1.0000

Note: Variables *DY1*, *DY2*, and *DY3* representing dummy variables for the years covered in the sample, i.e. 1990, 1994, and 1998, respectively.

Source: IUI data.