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Intellectual Property rights as determinant of Foreign Direct Investment entry mode: the case of Greece

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Abstract

Foreign direct investment continues to expand rapidly, enlarging the role of international production in the world economy. This expansion in business activity reflects trade and investment liberalization in many countries. The location decisions on FDI depend on a country's broader set of factors such as market openness and deregulation, competition regimes, development policies and intellectual property rights, that influence not only international foreign direct investment, trade but also the transfer of technology. Patents are one form of the exclusive intellectual property rights conferred by the state in order to promote science and technology. International technology transfer comes through three channels, FDI, joint ventures and licenses. The increase of international technological diffusion has enhanced the importance of intellectual property rights and particularly of patents. This paper aims at providing evidence linking the patent protection to technology transfer and inward foreign direct investment in different industry sectors in Greece. Strengthening Greece's IPR regime is seen as a prerequisite for the attraction of foreign multinationals to transfer technology, increasing the growth and the innovative activity. It also examines the role of other factors in attracting more FDI as the market openness, country risks and so on. A proper understanding of the above relationship will help firms and government to create appropriate intellectual property policy in order to encourage the growth and expansion of FDI in Greece.

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1. Introduction

Economic theory interprets foreign direct investment (FDI) by setting the criteria of selecting this particular mode of international operation among a set of alternative modes of servicing foreign markets such as international trade, licensing and other forms of contractual arrangements. Dunning (1981) developed an eclectic paradigm capitalizing on the interplay of the Ownership-Location- Internalization (OLI) advantages.

According to the eclectic paradigm firms engaged in international operations of any kind should be characterized by the possession of ownership advantages linked with market imperfections. Ownership advantages are tangible assets as well as intangible ones that may be grouped to: 1) those arising from market structure, e.g. product differentiation and large scale advertising, big firm size, access to input or product markets, trademarks, a reputation for quality, or a product or production process to which other firms do not have access. 2) Those arising particularly from multinationality, which offers a world wide information and scanning network capable of recognizing opportunities and providing data on inputs, markets, international trends, etc. 3) Those arising from the fact that already existing firms may draw on a pool of intangible assets not available to *de novo* firms, such as well established access to supply sources of inputs and product markets, and administrative, managerial, R&D, marketing, etc. capacity[1].

The ownership advantages constitute assets for the possessing firm providing to her market power and cost effectiveness. These assets are very much similar to public goods in character in the sense that since they are generated they may be used repetitively in several production facilities without reducing its availability for other potential users as is the case with labor and capital, at a low marginal cost and creating, at the same time a potential income flow. Therefore, the ownership advantages- assets are transferable across borders, though their origin may be linked to location-specific endowments of the home country[2]. (Maskus, 2000, p.120). These factors form a sufficient incentive for the possessing firm to undertake multinational operations.

The public good character of the ownership advantages generates market failure that either reduces or eliminates the potential stream of income accrued by the use of such advantages-assets. Most of the ownership advantages are connected to activities outside production per se i.e. R&D, marketing, labor training, building of management teams, etc. and they are considered to be interdependent and connected by flows of intermediate products. The latter are not just semi-processed materials, but also information incorporated in blueprints, software, chemical formulas, managerial or engineering manuals, and in human capital[3]. Although markets for the above intermediate products do exist, they are imperfect in the sense that there are non-negligible costs in using the markets, i.e. there are significant transactions costs, hence they do not meet the criteria for being Pareto optimal, and they unable to give the full economic rent to the possessing firm. Transaction costs arise primarily when strategic or opportunistic behavior is present among agents to an exchange; the products or services traded are ambiguously defined, both leading to the collapse of the mechanism for defining the optimal price; and contractual obligations extend in time not allowing the exact specification of the contract terms due to future uncertainty, the effective monitoring of the contract's execution, and the competitive renegotiation of the terms when this is necessary[4].

Magee (1977) argues that the emergence of a final product is based on a package of information consisted of product creation, product development, creation of production functions, and generation of markets. All four activities are mainly information intensive. The use of privately created information by second parties different from the party that discovers, although it is not precluded due to the public good character of information, reduces the private return on the information created by the first party. This is what Magee calls "appropriability problem". The answer to this is either the government creates the information and provides it freely to private markets or the legal system can be used to permit private firms to capture the returns on their information by creating temporary monopolies, through the patent system or by allowing other restrictions on free trade in information, through trade secrets[5].

The patent system is truly effective in protecting the appropriability of private returns to product creation only,

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[1]For an exhaustive classification see Dunning (1980)
[2]See Maskus (2000) p.120
[3]See Maskus (2000) p. 120.
[4]See Coase (1937) and Calvet (1981)
[5]See Johnson (1970)

and this is shown by the fact that in many occasions the generator of a new product does not necessarily coincides with the product commercial developer. Given the effectiveness of the patent system the proprietor of the new product is able to capture full economic returns in an external market transaction. On the contrary, property rights on all other types of information required for the commercial development of the new product are not effectively protected. Rivals can utilize the information incorporated into the product development if they are able to make a significant though inexpensive alteration in the product's characteristics; the appropriability problem for the production function becomes acute at later stages when patents begin to lapse eroding monopoly advantages through increasing competition. Advertising that is necessary for establishing a market for the product is able to create brand loyalty based on accumulated experience of the market as to the reliability of past information released by the advertising firm. If a firm sells differentiated products distinct from products sold by rival firms makes returns on advertising more firm specific easing the appropriability problem while advertising of homogeneous products and "search" goods, i.e. goods whose qualities advertised can be tested by visual inspection is not able to guarantee full returns.

Market failure to optimize returns on ownership advantages-assets makes the transfer of the information package connected to products through external markets and at arm's length prices less efficient than the transfer through an internal market at prices determined by the administrative fiat of the enterprise. In Dunning's terminology imperfect markets trigger internalization advantages. Internalization occurs up to the point that the marginal cost to the firm-owner of making the information available through an internal market equals the marginal benefit of creating an additional internal market. In the cases where individuals are deprived of strategic behavior and exchange well defined goods and services in discrete transactions, markets produce Pareto optimal results and they are superior compared to internal administrative structures[6]. There are alternative institutional arrangements for organizing transactions distinguished in discrete contractual forms including markets; in intermediate modes, i.e. contracts, franchises, licenses, and agents; and in hierarchical firms, which attenuate transaction costs. Choice and shifts between these alternative modes can be analyzed in terms of the alternative costs of competing organization forms. Multinational enterprises (MNEs) emerge when firms owning certain advantages-assets decide to exploit its advantages type (O) internally acquiring a subsidiary abroad, i.e. undertaking FDI, rather than through any other alternative organization arrangement[7]. FDI exists because firms acknowledge internalisation advantages accruing from the multinational exploitation of their ownership advantages.

Location decisions of MNEs' subsidiaries depend on the location advantages of particular countries. Such advantages make it profitable for the firm to produce abroad rather than stay at home and export the goods. Obvious examples of location advantages are market size and growth factors, local demand patterns, transport costs and distance from markets, low wage costs in relation to labor productivity, abundant natural resources, etc. Adequate and modern infrastructure and transparent government regulatory procedures are also important

The above discussion shows that firms transact abroad in order to transfer property rights in goods and to gain quasi-rents from firm specific assets, most importantly information related to technology and intermediate inputs mainly outside production. Markets for these information related inputs are imperfect failing to optimize returns on assets. Market imperfection is not identical in source and degree across all transactions, markets, and branches of industry. For a given legal system, the more competitive an industry is the more likely that investment by one firm on information will be copied by rivals. The monopolist does not face an appropriability problem. In highly concentrated industries the collusion on price and several other issues provides a useful framework in which to share the cost of private appropriability. The rational firm, in general, will invest in measures protecting appropriability and wishes to avoid free riders which affect negatively appropriability investments. Besides, subsequent innovators, although they benefit from appropriability investments made by the initial innovator for establishing proprietary rights do not share the cost of these investments. Products with rather standardized production functions and specifications and well established markets are less suffering from an appropriability problem leading to the use of contractual form of exploitation while sophisticated products with information intensive production functions and emerging markets is more likely to lead to internal modes of organizing transactions. Production by subsidiaries abroad is preferable to licensing or joint ventures since the two latter organization modes cannot benefit from the

[6]See Williamson (1975)
[7]See Rugman (1986)

internal market of the MNE unless foreign markets were segmented by effective international law or other protection devices. In general, the legal system is expected to influence transaction costs defining and implementing property rights, and thus to co-determine as an independent factor the choice between alternative organization modes of transactions in both the national and international level.

2. Intellectual Property Rights Protection

In this paper the term intellectual property rights (IPRs) is employed covering protection ofideas that are translated into intangible assets and they are protected by the state for a limited period of time from unauthorized commercial exploitation. They include patents, trademarks, trade secrets and copyright. Competitive advantage in the new world economy is based more on the development of new technologies rather than on the availability of natural resources and traditional production factors, i.e. capital and labor and for this reason cannot be sustained without adequate protection of intellectual property rights. The absence of adequate protection for such rights could make investment in innovation creative work less attractive, thus affecting economic growth and the expansion of world trade[8].

IPRs are positively correlated with a country's economic development and conferred by national governments and valid only within the relevant jurisdiction. With the globalization of markets and the resulting increases in trade and investment flows across borders, particularly flows of technology and technology- intensive products, the difference in national IPR standards has taken on additional significance. National governments have made efforts to harmonize national regulatory systems to the international IPR protection regime resulted from the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS), a product of the Uruguay Round (1986-1994) of negotiations for international trade liberalisation[9].

The TRIPS Agreement is the first comprehensive global set of rules that cover IPR protection[10]. It sets minimum standards for IPR protection to be provided by each World Trade Organization (WTO) member: according to Article 1, "*Nature and scope of Obligations"* of the TRIPS Agreement, members may, but shall not be obliged to implement more extensive protection in their law than is required by this Agreement, provided that such protection does not breach the provisions of this Agreement. It also requires countries to develop mechanisms to enforce these rights. Under the terms of TRIPS, current and future WTO members must adopt and enforce strong and non-discriminatory minimum standards of protection for intellectual property[11].

The TRIPS Agreement includes such IPR protection categories as copyrights, patents, trade secrets, trademarks and service marks, geographical indications and integrated circuit layout designs. These categories vary in nature and it is assumed that patents rights represent a barometer for an IPR system because of the distinctive features described below.

1. The importance of innovation and technology diffusion.

Patents encourage innovation by providing an incentive to invent a new technology or product. Through the publication of claims, patents add to the stock of public knowledge and can encourage technology diffusion. On the other hand copyrights, which protect literary and artistic ideas do not encourage industrial innovation.

2. Scopefor Protection.

Patent protection prevents someone else from developing and marketing a product by using the original novel idea of a patent holder, whereas copyright allows this as long as any aspects of the original work may not be copied directly.

3. Application procedure.

A patent application is a complicated and expensive process which requires a patent attorney's expertise. Copyright protection is given to creative works automatically and does not have accompanying expenses. Understanding the role of patent in FDI is important for firms and governments in devising appropriate international

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[8] See Seymour (1996) p.52
[9] See Stefanou (2001) p. 223
[10] Mc Calman P., 2005,p.576
[11] Greece signed the TRIPS Agreement on 1995. See Gortsos and Stefanou (2005) p.143.

business/intellectual property policy. Patent protection has peculiar importance in the global economy as a force driving economic and technological progress.

This paper contributes to better understanding the potential gains from stronger IPR protection by providing evidence from the impact of the level of statutory patent protection in Greece to the organization mode of inward foreign direct investments in this country by type of industry.

3. FDI Entry Mode and IPR Protection

The formal channels of technology diffusion are likely to be inter-depended, with firms making their decision through which channel to serve foreign markets based on the expected return to their technological assets. These channels are FDI, joint ventures, and licensing.

Because FDI aims largely to exploit proprietary technological advantages, it represents a critical source of technological trade. At the same time, intra-firm transactions balance the productivity advantages of MNEs and expand technology learning in host countries. MNEs may ship advanced material inputs to subsidiaries that help reduce production costs. They also share, in addition to blueprints and product designs, the inputs of skilled producer services, such as engineering and management. Joint ventures combine many of the properties of FDI and licensing and, hence, it also involves technology transfer.[12] Empirical research shows, innovation joint ventures are the optional forms that improve innovation rates through exchanging information and undertaking joint R&D between complementary product partners and substitute product partners[13]. Licensing involves the purchase of production and distribution rights for a product and the knowledge required to make effective use of these rights, and it is a further channel for technology diffusion[14]. The movement of skilled workers across borders can also act as a channel for international technology diffusion.

Informal channels of technology diffusion include imitation, the movement of personnel from one firm to another taking with them specific knowledge of their original firm's technologies,and that the temporary migration of people, such as scientists and students to universities and research institutes in advanced countries. What is specific to the informal channels, and that is part of their attraction, is that there is no formal compensation to the original owner of the technology transferred. But there will still be costs. Imitation, for example requires resources that may be drawn from local innovation[15].

The formal and informal channels are also related. It is likely that, in order to be able to reverse engineer and imitate advanced technology, some level of trade or temporary migration is required for example. The inter-dependence among formal channels and between formal and informal channel raises difficult issues for empirical studies[16].

IPRs are likely to take on different levels of importance in different sectors with respect to encouraging FDI. Investment in lower-technology goods and services, such as textiles and apparel, electronic assembly, distribution, and hotels, depends relatively little on strength of IPRs and relatively much on input costs and market opportunities. Investors with a product or technology that is costly to imitate may also pay little attention to local IPRs, though the fact that imitation has become markedly easier over time in many sectors points to the rising importance of IPRs[17]. Firms with easily copy able products and technologies, such as pharmaceuticals, chemicals, food additives and software are more concerned with the ability of the local IPR system to deter imitation. Firms considering investing in a local R&D facility would pay particular attention to local patent and trade secrets protection.

Innovative firms in all industrial sectors seek patents in all fields of technology. However, patent protection is seen as particular critical for capturing returns to basic invention in pharmaceuticals, agricultural and industrial chemicals and biotechnology. These industries have high R&D costs but considerable appropriability problems. It is

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[12]Maskus K. (2004), p.24

[13] See Zang and Wang (2007) p.4173, Menard (1996), Vonortas (1997), Winslow (1999).

[14] See UN (2006) p.23.

[15] Mansfield et al (1981) show that the costs of imitation, while lower than the cost of innovation are significant. Further, patenting innovation was found to raise the costs of imitation.

[16]See UN (2006), p.24.

[17]Favley and Foster (2006), p.22

not difficult for competitors to determine the molecular composition of pharmaceutical compounds or the genetic makeup of biotechnological inventions, and to develop imitative products[18]. Accordingly, drug manufacturers and biotechnology firms in the United States and Europe are in the forefront of programs to strengthen global patent protection. The situation is similar for new plant varieties, which typically entail substantial innovation costs that may not be recoverable if exclusionary limits are not placed on the ability to duplicate and resell seeds. At the same time, IPRs related to drugs, genetic inventions, and seed varieties are precisely the technologies that attract the greatest controversy.

Empirical research indicates that the choice between alternative modes of international production is affected by IPR protection to some extent. However, the evidence linking IPRs to FDI is mixed.

Smith (2001) considers the simultaneous impact of IPR protection on United States exports, affiliate sales, and licenses to unaffiliated foreign firms in a sample of 50 developed and developing countries using a variant of the gravity equation. The results suggest that stronger IPR protection increases the benefits of locating abroad and leads to increases in affiliate sales and licensing relative to exports, particularly in countries with strong imitative abilities.

Maskus and Konan (1994) relate several measures of US foreign presence to national characteristics in seven manufacturing industries in 44 countries in 1982 including IPR strength. In most cases a negative relationship between IPR protection and US FDI is found though the coefficient is rarely significant.

Lee and Mansfield (1996) relate the volume of US FDI in 14 countries to the strength of IPRs. Data is from a survey of 100 US firms in 1991 in six manufacturing industries assessing the importance of IPR protection for investment in 14 countries. They find that the FDI is lower in countries with weaker perceived IPR protection. The percentage of FDI devoted to final production and to R&D facilities is lower in countries with weak perceived IPR protection.

Smarzynska (2004) uses data collected from a firm-level survey in 1995 applied in a probit model examines the decision of a firm to invest in production facilities in 24 East European and Former Soviet Union countries. He finds that weak IPR protection discourage FDI, particularly in IPR sensitive industries. Weak IPR protection deters investors from undertaking local production and encourages them to focus on distribution.

Branstetter et al (2004) examine the relationship between intra-firm royalty payments of US MNEs, as an approximation of technology transfer through FDI and patent reforms in 12 countries. US MNEs respond positively to changes in IPR regimes abroad by increasing technology transfers to reforming countries. Increases in technology transfer are concentrated among MNEs that patent intensively. Stronger IPRs protection has been found to encourage FDI in certain industries, most notably chemicals and pharmaceuticals[19].

Mansfield (1994) based on survey evidence from 100 US firms in six manufacturing industries in 1991 found that strong IPR protection influences FDI decisions only for certain investments, such as R& D facilities. IPR protection is relatively unimportant in the decision to undertake FDI except in a small number of industries, notably chemicals and pharmaceuticals. Mansfield (1995) found similar evidence examining survey data from major US, German, and Japanese firms. Strong IPR protection was found to be more important for FDI uncertain investments, such as R&D facilities. IPR protection was found to be more important in encouraging FDI in certain industries, such as chemicals, machinery and electrical equipment.

Maskus and Penubarti(1995) using export data for 28 manufacturing sectors from 22 OECD countries to 71 developed and developing countries for the year 1984 find that stronger IPR protection encourages imports from OECD countries, with the impact being larger in countries with large markets. Fink and Primo Braga (2005) applied a gravity model on total non-fuel and high technology trade on a cross-section set of 89 by 88 countries in 1989 and found that stronger IPR protection encourages trade for the total non-fuel aggregate, but has no significant impact on trade for the high technology aggregate.

Kumar (2001) estimated a model relating FDI in R&D activity by US and Japanese MNEs and IPR protection for up to 77 countries in the years 1982, 1989, and 1994. He found that the strength of IPR protection has no significant impact on the extent of R&D spending overseas by both Japanese and US MNEs. Yang and Maskus (2001) examined the impact of IPR protection on the volume of unaffiliated royalties and license fees paid to US firms from 23 countries in 1985, 1990 and 1995. They found that stronger IPR protection has a positive impact on

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[18] See Maskus (2000) p. 51.
[19] UN, (2006), p.33

licensing. Eaton and Kortum (1996) found that countries providing stronger patent protection are more attractive destinations for foreign patents. In turn, foreign patenting is found to impact positively upon productivity growth. Park (1999) related the fraction of source country patents that are filed in destination country to the strength of IPR protection for a panel of 16 source and 40 destination countries. He found that an increase in the strength of IPRs protection had a strong positive impact on the rate of foreign patenting. Xu and Chiang (2005) examined the importance of IPR protection as a determinant of foreign patenting using data from 48 countries over the 1980-2000 period. Their findings show that the IPR protection has a positive impact on the foreign patenting decision. In turn, foreign patenting is positively related to Total Factor Productivity growth in low and middle income countries, but not in high income countries.

Ferrantino (1993) found no statistically significant relationship between membership in intellectual property protection treaties, i.e. Berne, Paris and Union for the Protection of Plant Varieties (UPOV) and US MNEs affiliate sales. Such sales are no higher or lower in member countries than in non-member countries. However, the location of production appears to be sensitive to treaty membership. The intuition is that firms are more willing to produce in regions that better protect production processes and know how.

Maskus (1998) related the strength of IPR protection to patent applications, affiliate sales, exports and affiliate assets using data on US majority owned manufacturing affiliates in 46 countries over the period 1989-1992. He found that stronger IPR protection positively influences all four channels of technology transfer. Stronger IPR protection has a weak impact on patent applications in developing countries, but positive impacts on developing countries through the other three channels.

Smith (2001) found that bilateral exchange reacts positively to stronger IPR protection, particularly in countries with strong imitative abilities. Strong IPR protection increases licensing and FDI at the expense of exports, and strengthens licensing at the expense of FDI. There is, though, little evidence of a relationship between IPR protection and exports.

4. The Model, Methodology, and Data

In this paper it is assumed that the choice of a MNE upon the type of subsidiary it intends to establish in order to enter a foreign market is influenced, among others, by the intellectual property protection regime prevailing in the market in question, and the technological intensity of the sector of the foreign direct investment. This assumption is specified as it follows: Sectors utilizing advanced technology of high information content require stronger IPR protection, and the probability of choosing internal solutions, i.e. FDI for undertaking the technology transfer abroad is also high. In this case the probability of choosing joint venture as the appropriate mode of entry to foreign markets is low as opposed to cases of transferring technology with low or medium information intensity, where the probability of utilizing joint venture schemes is expected to be increasing due to diminishing "appropriability problem" and to increasing capacity of local partners to absorb and use the transferred technology.

The above may be stylized in the following mathematical function:

Mode of Market Entry = f (IPR, Sector of Operation Technology Type)

Where:

The dependent variable is the **Mode of Market Entry,** whichdenotes the ownership structure of subsidiary established abroad. Two ownership options are distinguished, first, a wholly or majority owned subsidiary in which the parent company owns above the 50 per cent of the subsidiary's equity and, second, a joint venture or minority owned subsidiary in which the parent's equity participation is below 50 per cent of the equity capital.

The dependent variable is proposed to be approximated by the ratio of inward foreign capital invested in majority owned subsidiaries established in a sector of the Greek economy over the total inward FDI flowed to the same sector of the Greek economy for a specific time period. The dependent variable is symbolized by **"Ratio"**.

The independent variables are:

Intellectual Property Rights (IPR). IPRs are measurable but with difficulty, as they do not have obvious price based equivalents and they interact in complex ways with other policies in reaching their full effectiveness. Thus, identical laws may have quite distinctive effects in countries that differ in their market structures and preferences.

These difficulties render impossible a full accounting of the strength of IPRs , especially on a comparative basis. There have been numerous studies on patent systems in the past decades but a few have reflected the overall strength of the systems through such approaches as:1) dummy variables, 2) surveys of firms, 3) a composite index of

patent law indicators.

Bosworth (1980) and Ferrantino (1993) applied a dummy variable approach in developing various indicators of whether or not certain features of patent laws exist, but their method does not provide a composite index of those indicators. Mansfield (1994) applied a survey approach to sample the views of 94 U.S multinationals on the adequacy of patent rights in 16 countries during 1991. Rapp and Rozek (1990) aggregated patent law indicators into a composite index know as the Rapp and Rozek Index (RRI). RRI indicators focus on the standards proposed by the United States Chamber of Commerce (1987). These standards include guidelines for patent examination procedures, the terms of protection, compulsory licensing coverage of inventions transferability of patent rights and effective enforcement against infringement. The RRI measures patent rights protection on a zero to five scale, where zero represents a country with no patent rights protection laws, one is equal to seriously flawed laws, two is equal to flaws in laws, three, there are some enforcement laws, four is equal to generally good laws, and five represents a country with protection and enforcement laws fully consistent with minimum standards proposed by the US Chamber of Commerce.

Sherwood (1997) developed an index with subjective assessment of several components of IPRs, including patents, trademarks, trade secrets, protection of new life forms, copyrights, treaty adherence, and enforcement and administration in 18 developing countries in mid-1990s.

Ginarte and Park (1997) developed a new patent rights index known as the Ginarte and Park Index (GPI). They examined the patent laws of a comprehensive number of countries from 1960 to 1990, considering five components of the laws: duration of protection, extent of coverage, membership in international patents agreements, provisions for loss of protection, and enforcement measures. Each component was further broken down into important characteristics determining its effective strength. For example, patent coverage refers to patentability of pharmaceutical products and chemical products and the existence of utility models. Enforcement measures included the availability of preliminary injunctions, contributory infringement actions, and reversals of the burden of proof in process patent cases. Each of these subcomponents was assigned a value of one if present and zero if absent, with the component score being the sum of these values as a percentage of the maximum value. Thus the minimum possible national score was 0.0 and the maximum was 5.0. Although each subcomponent was binary, the aggregate score was more continuous than the unit-increment approach in the RR index. Also the GPI indicator compared to RRI are more finely defined so that the measuring of patent rights exhibits greater variability across countries.[20] (Maskus, 2000, p.96)

Thus, the Ginarte and Park Index (GPI) are more nuanced to reflect variations in patent laws. Moreover its computation for different years permits analysis of the index over time.

Concerning the effective IPR protection, a comprehensive approach is used to evaluate the implementation of law. The comprehensive approach incorporates the Transparency International's Corruption Perceptions Index (CPI)[21] into the nominal GPI in order to obtain an effective GPI. The CPI ranks countries in terms of the degree to which corruption is perceived to exist among public officials and politicians. It ranks countries on a scale from zero to ten with zero indicating high levels of perceived corruption and ten indicating low levels of perceived corruption.

However, the CPI is subject to bias because it is based on people's opinions and not on substantive facts[22]. In order to reveal whether or not there is any gap between statutory (or nominal) and effective protection the comprehensive approach measures possible deviation between the country's nominal GPI and effective GPI scores.

The comprehensive approach calculates the effective GPI using the following formula:

Effective GPI =Nominal GPIx (CPI/Maximum CPI score)

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[20] See Maskus (2000), p.76

[21] The CPI focuses on corruption in public sector and defines corruption as the abuse of public office for private gain. It is a composite index, drawing on corruption- related data in expert surveys carried out by variety of reputable institutions. It reflects the views of business people and analysts from around the world, including experts who are resident in the countries evaluated.

[22] Factors such as judicial independence, confidence in courts and political stability are based also on perceptions.

In addition to the indices of patent rights two other methods are commonly used in literature for IPR measurement: The IPR rating in the World Economic Forum's Global Report (GCR) and the International Property Rights Index (IPRI).

In this paper the GPI methodology is applied for patent rights in Greece. This method considered to be the most suitable because the index constructed serves the purpose of revealing the conformity of a country's legal framework with the requirements of the World Trade Organisation (WTO).

Table1 presents the estimation procedure of the GPI score, and the yearly estimated scores for Greece for the period 2002-2006 are reported in Table 2.

Table 1: The Ginarte and Park Index of patent rights in Greece for the years 2002-2006

Categories	Conditions	Score for Condition	Score for Category
Coverage	Patentability of pharmaceuticals	1	0,86
	Patentability of chemicals	1	
	Patentability of food	1	
	Patentability of plant and animal va	0	
	Patentability of surgical products	1	
	Patentability of microorganisms	1	
	patentability of utility models	1	
Duration*		1	1
Enforcement	Preliminary injuction	1	1
	Contributory infringement	1	
	Burden of proof reversals	1	
Membership in International Treaties	Paris convention and revisions	1	0,67
	Patent cooperation treaty	1	
	Protection of new varieties (UPOV 1	0	
Protection from restrictions on patent rights	Working requirements	0	0,33
	Compulsory licensing	0	
	Revocation of patents	1	
TOTAL			3,86

* x=20

Table 2: Effective GPI score for Greece

Year	*CPI score*	*Effective GPI score*
2002	4,2	1,62
2003	4,31,65	
2004	4,31,65	
2005	4,3	1,65
2006	4,4	1,69

It should be noted that for the period of investigation the effective GPI remains largely unchanged over the five year. In particular the effective GPI score remains constant for three years period i.e. 2003-2005. The effective IPR protection in Greece is much lower than in advanced countries.

Sector of Operation Technology Type (ST) denotes the technological intensity of the industrial sector foreign capital flows into in the case of Greece irrespectively of the ownership structure employed, i.e. majority vs. minority ownership subsidiary. Sectors are categorized in three technology intensity modules, namely High, Medium, and Low Technology, according to the methodology provided by Smarzynska (2000). The detailed categorisation of the Greek industrial sectors that have received foreign capital flows in the period of investigation is reported in Appendix I.

The statistical method used for testing whether the values of the dependent variable i.e. "Ratio" differentiate along the three categories of ST and the influence of the IPR on the variation of "Ratio" is the Analysis of Variance (ANOVA) technique. The Scheffe post hoc tests are also performed in order to investigate which levels of ST differentiate with each other. In order to have an additional confirmation of the findings, the Kruskal – Wallis (K-W) non-parametric test is applied. The K-W test examines differentiations of the dependent variable "Ratio" by levels of the ST.

The data for FDI inflows by sector and type of subsidiary, i.e. majority vs. minority owned subsidiary are annual and sourced by The Bank of Greece, and their values are expressed in billion euros.

Data necessary for estimating the IPR scores for Greece are derived from the Greek legislation for Trade and Civil Procedure, legal books, articles and databases, and International Agreements.

5. Results

Table 3 presents the levels of the IPR scores for Greece by sectoral technology type, while summary statistics of the variables included in the estimated model are reported in Table 4.

Table 3: Levels of IPR score

	Levels of IPR score	
ST	VALUE	**N**
Low	1.62	44
Medium	1.65	130
High	1.69	44

Table 4: Descriptive Statistics of "Ratio" by levels of ST and IPR Scores.

ST	**IPR Score**	**Mean**	**Std. Deviation**	**N**
Low	Low	.5596	.71407	20
	Medium	.6533	.47259	58
	High	.6402	.39286	19
	Total	.6314	.51366	97
Medium	Low	.5031	.40404	20
	Medium	.5517	.40073	60

	High	.4728	.72292	21
	Total	.5257	.48102	101
High	Low	.6789	.43395	4
	Medium	.8443	.28423	12
	High	.8741	.13096	4
	Total	.8172	.29050	20
Total	Low	.5448	.55960	44
	Medium	.6240	.43169	130
	High	.5816	.56933	44
	Total	.5995	.48795	218

The results of the ANOVA application on the mathematical model are reported in Table 5. The dependent variable, in general, differentiates along categories of the independent variables. However, only ST's effect on "Ratio" is statistically significant at the 10 per cent (p=0.076) level of significance. The Mean values of "Ratio" for levels of the Sectoral Technology Type demonstrate that FDI in high technology sectors have the highest mean value of "Ratio", i.e. 0.8172. FDI in low and medium technology sectors have mean values of "Ratio" equal to 0.6314 and 0.5257 respectively, as it is shown in Table 4. Both IPR score and the interaction of ST with IPR score do not seem to affect the values of "Ratio".

Table 5: Analysis of Variance of "Ratio" by ST and IPR score

Source	**Mean Square**	**F**	**Sig.**
Corrected Model	.242	1.017	.424
Intercept	40.839	171.631	.000
ST	.620	2.604	.076
IPR Score	.102	.427	.653
Interaction of ST and IPR Score	.029	.122	.974

Results of the Scheffe post hoc tests are shown in Table 6. According to the homogeneous subsets of Table 6, FDI in high technology sectors differentiate from FDI in medium technology sectors as far as the dependent variable, i.e. "Ratio" is concerned. The results of the (K-W) test are presented in Table 7. The (K-W) test proves the marginal statistical significance at the 10 per cent level of significance (p=0.011) of ST. Therefore, the (K-W) test supports the ANOVA findings.

Table 6: Scheffepost hoc Tests for the Effect of ST.

ST	**N**	**Subset**	
		2	1
2*	101	.5257	
1**	97	.6314	.6314

3***	20		.8172
Sig.		.606	.215

Notes,*Number 2 correspond to Low Technology Sector
**Number 1 correspond to Medium Technology Sector
***Number 3 correspond to High Technology Sector

Table 7: Kruskal-Wallis Test for the Comparison of Levels of IPR score by ST

ST	**N**	**Mean Rank**	
1	97	112.92	Chi-Square=8.985
2	101	99.34	Df=2
3	20	144.23	p=.011
Total	218		

Notes. *Number 2 correspond to Low Technology Sector
**Number 1 correspond to Medium Technology Sector
***Number 3 correspond to High Technology Sector

6.Conclusion

The statistical analysis indicates that the foreign investors' choice of the entry mode to the Greek market is influenced by the level of the industrial sector technological intensity, although the significance of this influence is rather low, as it is shown by the marginal statistical significance of the ST variable on "Ratio". The IPR regime prevailing in Greece offers low effective protection to the owner's property rights of the technologies transferred, especially if these technologies are compared to the advanced ones the standards attained in other economically advanced countries. The IPR effective protection has no direct influence on the foreign investment entry mode choice between wholly/majority owned subsidiaries and joint ventures as this entrymodevariates between industrial sectors of different technological intensity, i.e. high, medium, and low technology sectors.

This may be interpreted from the fact that IPR scores do not differentiate over time, foreign investors react to IPR score changes rather than their absolute levels ;and that IPR scores do not differentiate by industrial sector due to the method at their calculation showing a cyclical model at choosing ownership entry modes abroad.

Foreign investors entering high technology industrial sectors in Greece choose to solve any "appropriability problem" stemming from the low level of IPR effective protection establishing majority owned subsidiaries, thus assigning any property rights of the technology transferred to the transferring organisation via creating an internal market. This behaviour complies with empirical evidence of previous studies. Enterprises transferring abroad advanced and even medium level technologies in cases these technologies are easily imitated choose majority ownership structures of IPR. When imitation is different majority ownership structures may give way to joint ventures. The same strategy, i.e. majority owned subsidiaries is rather prevailing in low technology Greek industrial sectors. Although this finding seems to be a paradox indeed by the fact that in these sectors investments in technology have been depreciated and economic rents of the technology use have been almost fully appropiated, it may be partly explained by the low IPR effective protection level identified in Greece. Technology in these sectors is standardized but easy to imitate. Greece is a country with relative strong imitation abilities but with a level of IPR effective protection rather than low by advanced country standards that is unable to fully protect foreign investors from the danger of third party technology imitations. Foreign companies may choose to protect their technology property rights and expepnt flows of economic rents through internal market solutions, i.e. majority owned subsidiaries. Yet internal solutions to imitation risks are compatible with former empirical and theoretical findings. In medium technology sectors, the foreign investment mode of entry is also majority owned subsidiaries, i.e. internal market solutions to the appropriabiltiy problem, but the probability of this choice vs. probability of establishing of a joint venture is lower than it is in the case of low technology sectors.

A possible explanation may be that as empirical research in countries with rather than low IPR protection has shown internal market solutions through FDI are chosen as opposed to countries with stronger IPR protection where joint ventures and licensing are preferred as technology transfer modes.

Perhaps risks of imitation of medium technology are considered low in a country like Greece with rather medium to low technology skills and this may be the reason the probability of establishing majority owned subsidiaries is lower than its corresponding level in low technology sectors where imitation risks are considered high.

In general, the preferred vehicle by foreign investors for entering the Greek market is the majority owned subsidiary, It seems that the low protection provided by the IPR regime prevailing in the country leads potential foreign investors to the choice of firm internal solutions as an answer to any "appropriability problem" created by low IPR scores. The anticipation of a rather inadequate IPR protection serves as a determinant of the entry mode irrespectively of the industrial sector and its technological intensity.

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