Technological Attraction of FDI-Inward and Outward in Services and Knowledge-Intensive Services: a Regional Innovation System Perspective for Spain[1]

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ABSTRACT

An increasing body of literature has been generated regarding the role that services play in innovation systems, in which special attention has been paid recently to Knowledge-Intensive (Business) Services – KIS. As not only developed nations but also emerging economies and regions embedded in this country-level unit of analysis show an economic structure strongly based in the tertiary sector, it is mandatory for policymaking processes to better evaluate and understand the idiosyncrasies of these innovation-generating services and its relationships with National, Sectoral and Regional Innovation Systems. This article aims at approaching the dynamics of Foreign Direct Investment in services, and especially in KIS in Spain taking into account their interactions with the Regional Innovation Systems within the country by testing regressive models built upon technological and innovation systems' variables. Results suggest that technological variables do participate in the process of FDI attraction but not as main determinants in the process. As this situation unfolds more relevantly in the case of Outward investment than Inward, we can therefore expect that Spanish investment abroad is more oriented towards asset and knowledge seeking than the inflow of investments in services and in KIS in Spanish regions – which appear to seek cost-efficient operations and to follow FDI in manufactures.

Keywords: Regional Innovation Systems; Spain; Services sector; Knowledge-Intensive Services; Foreign Direct Investment.

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1. Introduction

Foreign Direct Investment can be seen as an important agent of interaction and integration between innovation systems. Multinational companies act not only as generators, but also as recipients of many kinds of spillovers, especially technological. As a matter of fact, efficiency and knowledge seeking can be seen – together with market seeking – as the main motives for the FDI phenomena (Dunning, 2006), and their relative importance interacts with the stage of economic development of countries (Narula & Dunning, 2000; Dunning & Narula, 1996).

This poses the hypothesis that there might be a complementary or competing – depending on the host market characteristics – interest in the internationalization process, which we might define in two broad dimensions: asset seeking (comprehending knowledge and efficiency seeking strategies) and market seeking (or asset exploitation). From this theoretical point of view we have drawn the framework of this analysis: market seeking strategies have been widely analyzed – for both trade and FDI – via the well-known gravity models and other market-oriented approaches. These models basically frame a markets' attraction power based on its economic size (GDP and Population) and the distance between geographical locations (measured in kilometers between capitals usually).

However, this leaves us uncomfortable with the non-consideration of an asset seeking (specifically technological-knowledge seeking) motivation for the internationalization process, meaning that FDI attraction may also be related to knowledge or technology sources, making that a region with a larger mass of skilled labour, patents and R&D investments will have larger inflows of investment than otherwise (Chung & Alcácer, J, 2002).

We believe that a competing model based on innovation systems' variables of "attraction power" can be developed and tested, thus gathering complementary information on FDI inward and outward. Furthermore, following our initial proposition, we will proceed to an analysis based on a regional context within Spain – the regional level in this case stands for the idea that it is not likely that countries perform as homogeneous unities (Krugman, 1992; Porter, 1990). Therefore, in order to better accomplish with geographical characteristics of regions within nations, analysing Regional Innovation Systems may allow a better representation of economic events and their evolution, especially since innovation is heterogeneously distributed among territories (Meliciani, 2002; Malerba, 2004; Asheim & Gertler, 2004).

This proposition will be applied to the Services Sector and the Knowledge-Intensive Sector – KIS. This is due to the growing interest and importance of this sector in developed nations' FDI in recent years (Van Welsum, 2007; Kolstad & Villanger, 2008; Ramasamy & Yeung, 2010; Roy, 2009; Head, Mayer & Ries, 2009), as well as the role KIS may play as we expect that this services' subsector due to its knowledge content will have an investment oriented to regions with greater innovative potential.

Thus, this article is structured in the following way: chapter 2 develops briefly on the literature regarding services internationalization and the specific role of KIS. Chapter 3 describes with data the trends in foreign direct investment in services and KIS- Inward & Outward according to each Spanish region. Chapter 4 offers a descriptive analysis of some variables that we believe might be workable in terms of evaluating an Innovation System attraction power. Chapter 5 brings a descriptive assessment of the role played by FDI in manufacturing in the attraction of Services/KIS FDI. Chapter 6 develops on the methodological approach of this article, setting the basis for the

technological determinants of FDI approach. Chapter 7 offers our empirical results and chapter 8 concludes with some implications for policy makers.

2. Internationalization of services and the role of KIS

The services sector is an active generator of productivity improvements in many developed nations (Metcalfe & Potts, 2007), affecting also international economic relations, and thus becoming of interest in the field of international trade and investment (Jenícek, 2007). This sector as a whole has been of growing importance in developed nations, reaching a participation of roughly 72% of EU-25's GDP in 2005 (Eurostat, 2007). A plausible hypothesis to explain this growth points to the externalization of business activities (Guerrieri & Meliciani, 2005), due to a process of industrial concentration in companies' core businesses (Koch & Strotmann, 2005).

Along with this comes a fast internationalization process: FDI in services has increased considerably in recent years – in 1970, they represented 25% of total investment and in 2005, 67% (UNCTAD, 2007). However, literature has not followed this trend and it is still focused on manufacturing companies, even though some studies regarding services started to emerge (Moshirian, 2001; Buch and Lipponer, 2004). This situation is especially true when dealing with innovation, since innovative output in services is still a blurry field with a lack of reliable indicators.

Focusing on this specific mode of internationalization (FDI) is a suitable strategy to approach the case of services. Because of the "Non-tradeability of the output in services" principle, which highlights the costs of trade in services and its intangible character, there is usually a need for direct interaction between supplier and consumer, making physical presence in a given market a must for these activities, especially when they are personalized and operate in an environment of high uncertainty and risk (Torbjörn & Netland, 2007; Guerrieri & Meliciani, 2005; De Bruijn, Kox & Arjan, 2008).

Thus, research on FDI has been trying to answer three basic questions: a) When does a firm make the decision to invest in a subsidiary abroad that serves the market with the same output that it does at its home country? b) Why does the firm do that? and c) Why does a firm choose a specific market?

Theories based on specific advantages and internationalization advantages have one way or another answered the first two questions (Hymer, 1960, Kindleberger, 1969, Caves, 1971, Dunning, 1973 and Williamson, 1975). The question regarding the motives of a specific location for FDI started to receive some valuable insights from the works of Porter (1992) which brought up the idea of market-seeking interests even though other authors may say that additional factors also play an important role in this process: resource seeking, efficiency seeking, capability seeking and strategic asset seeking.

Our goal in this study is to assess the importance that technological factors play in this location decision – to what extent does the need to acquire technology, to have access to skilled labor and to a pool of established knowledge, influence the orientation of FDI in services and, specifically, Knowledge-Intensive Services (KIS)?

In this regard, one might think that the approach we are about to develop may be more suitable to manufacturing companies, and that services providers are not as interested in innovation itself as usually measured. But we expect that there might be a synergy between FDI in these two sectors: many empirical studies have tried to establish a relationship between FDI attraction for manufactures and services. Nefussi (2010) for example has showed that the same factors that attract manufacturing FDI also attract services investments. Also, location of manufacturing investment seems to be the most influent aspect in the orientation of FDI in services (besides, many KIS are intermediate services, i.e., business services, so they seek their clients) (Alegría, 2007 & Defever, 2006: Ramasamy & Matthew, 2010).

3. Foreign direct investment in Services and KIS- Inward & Outward: Analysis of Spanish Regions

In this section we focus on some relevant aspects of the descriptive analysis of data in terms of regional differences between Spanish regions for the case of internationalization via FDI in services and KIS, both Inward and Outward. We also assess the origin and destination of these investments.

Inward FDI Analysis

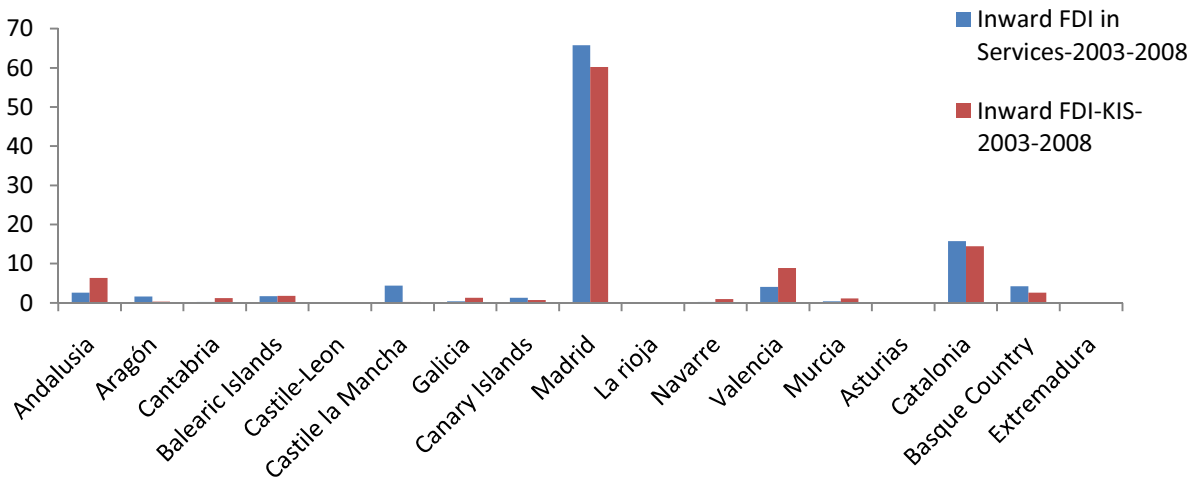
Spanish regions are very heterogeneous historically and culturally and this translates into different institutional environments, absorptive capacities and ability to innovate. De la Fuente (2001) even concluded that differences in the capacity of these regions to converge economically can be explained by idiosyncratic factors that are hard to identify, let alone measure.

These differences generated different development paths and levels, creating poles of investment. Durán and Ubeda (2005), using the Investment Development Path approach, classified Spain as a level 4 (developed country), but these results were only a representation of the cases of Madrid and Catalonia, since the remaining regions were not on the same stage, which in perfect accordance to our initial exposition in the introduction of this article. We, thus, should expect an analysis at the regional-level to provide us with more interesting, robust and useful information.

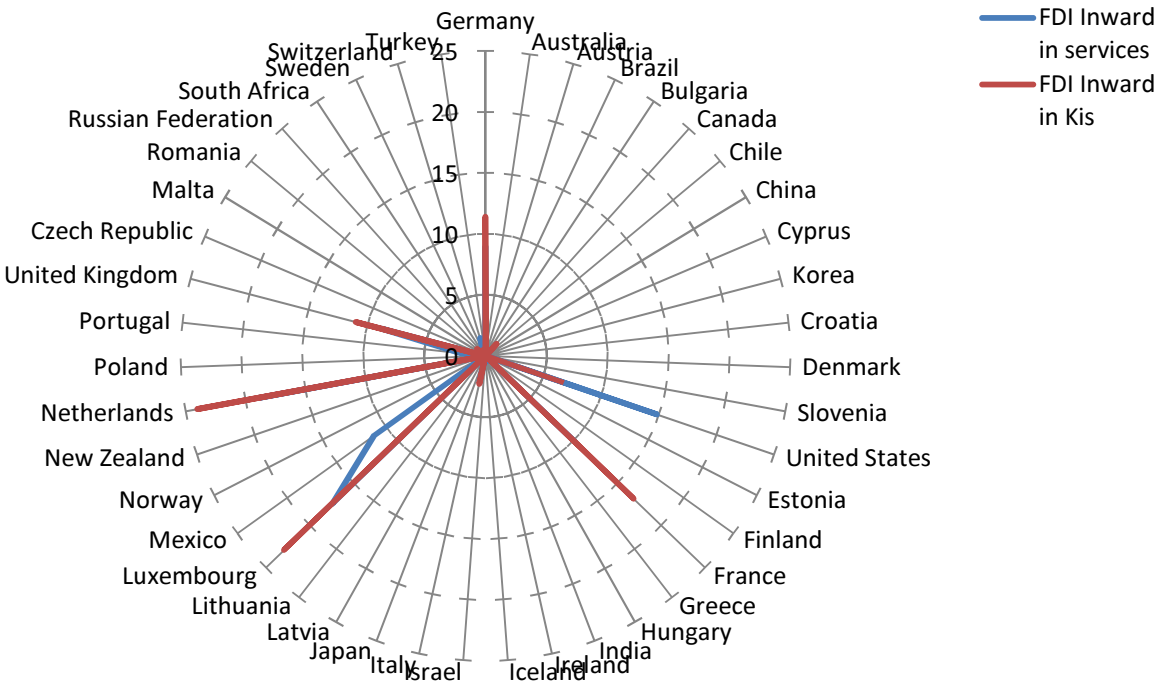
Graph 1 shows the investment inflows for the Spanish regions in services and in KIS as the mean of the values gathered from the period 2003-2008[4], where it can be seen that the majority of investment in both approaches (70% and 60% respectively) go to the country capital region, Madrid, followed by Catalonia (with approximately 16% in services and 15% of the total FDI in KIS). Nonetheless, the rest of the regions do not seem to be attractive for FDI in services and KIS in terms of an intra-national comparison. Investment in KIS[5] coincides with services as a whole in most regions: exceptions are Andalusia and Valencia, which show a higher participation of investment in KIS than in services.

Focusing on the analysis of the origin of Inward FDI in Spain in the tertiary sector (Graph 2) we have the predominance of the Netherlands, Luxembourg, France and Germany – for the case of the USA, we have a higher relative percentage of investment in KIS than in services in general.

[4] We gathered the data in this way in order to make our model operational. More details can be found in the methodological section (chapter 6).
[5] Appendix I



Graph 1. Regional participation from the total National Gross Inward FDI flows in Services and KIS 2003-2008 (mean).
Source: Datainvex

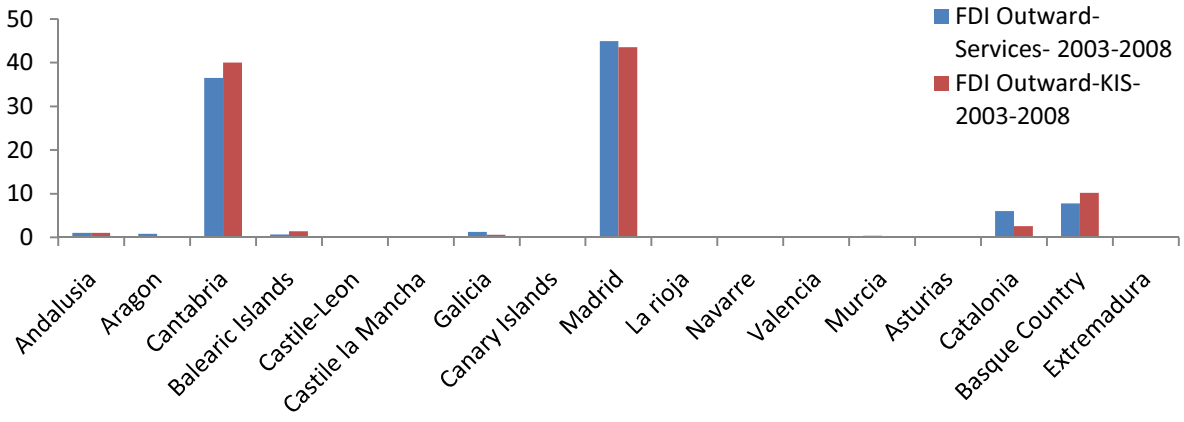


Graph 2. Origin of Gross Inward FDI flows in Spain – Participation in Services and KIS - 2003-2008 (mean).
Source: Datainvex

Outward FDI Analysis

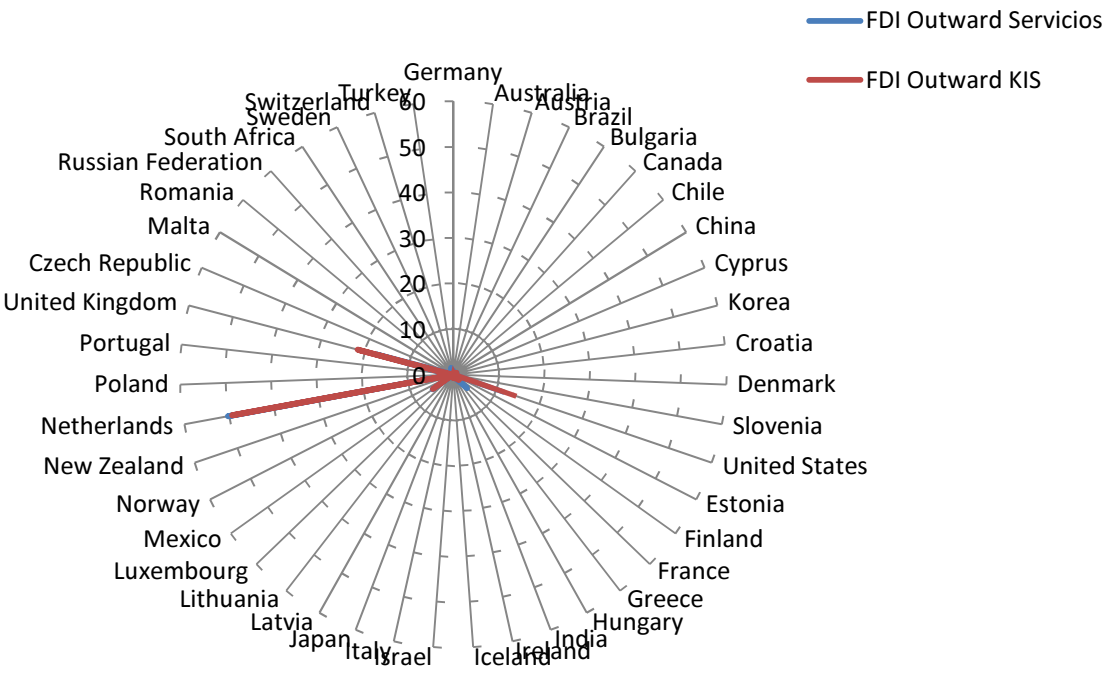
When analyzing the outward flows of FDI from the Spanish tertiary sector (graph 3) we can observe how the same regions that are leaders in terms of inflow of investments do not necessarily show larger participation in the opposite direction. Data for Inward FDI in services made it clear the predominance of Madrid and Catalonia, while Outward FDI is mostly concentrated in Madrid, Cantabria and the Basque Country. Madrid represents the leader in terms of both flows of

investment. It can be interesting to notice the role of Cantabria, but if we consider that this region is the home of Santander Bank, then the picture becomes clearer. This is possibly also de case for the Basque Country, home of BBVA bank. These propositions are supported by the higher weight these regions have in KIS (which include the financial sector) than in Services in general.



Graph 3. Regional participation from the total National Gross Outward FDI flows in Services and KIS 2003-2008 (mean).
Source: Datainvex

Regarding destination of Spanish FDI we can highlight the Netherlands, United Kingdom and the USA as most attractive host nations. In this case we cannot see remarkable differences between services in general and KIS – but we should point that there is a discrepancy between home and host nations of Spanish Inward and Outward investments.



Graph 4. Destination of Gross Outward FDI flows from Spain – Participation in Services and KIS - 2003-2008 (mean).
Source: Datainvex.

4. Innovation Systems6: A synthetic Regional and Country-level analysis

As previously seen, Spanish regions show different degrees of internationalization in services via FDI. Besides that, the innovative tradition of these regions generates distinct R&D expenditure levels, relative number of researchers or distance to the technological frontier (Vence-Deza & González-López, 2005).

Therefore, given that the main aim of our research is to verify the influence of technological variables (more specifically GERD, researchers per million inhabitants and technological heterogeneity) in the Inward and Outward flows of FDI in services, we believe it is useful to descriptively examine these indicators. Firstly we will analyze these technological variables at the Spanish regional level, aiming at providing information regarding peculiarities of the regions in Spain.

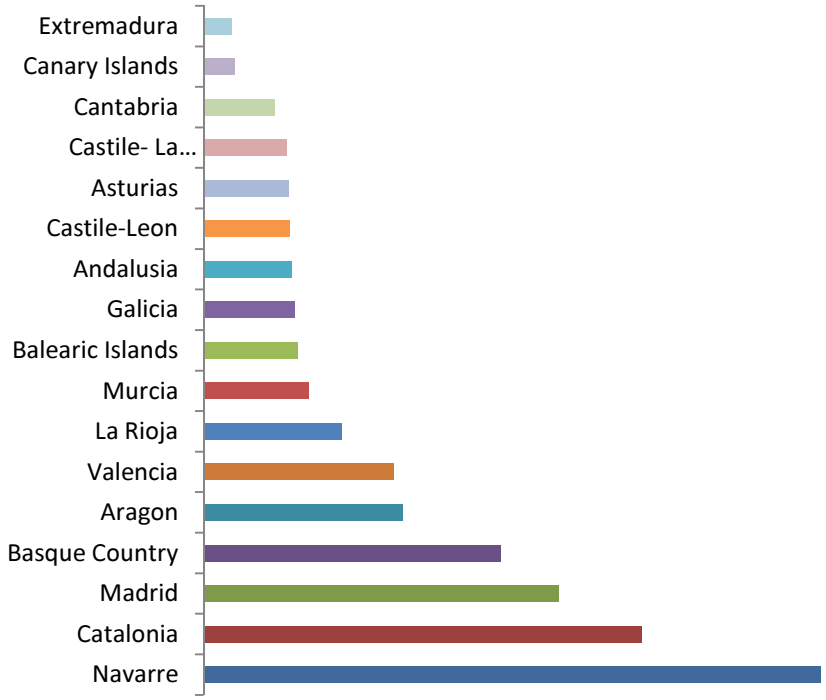
Graph 5 and 6 bring, respectively, regional GERD as a percentage of GDP and researchers per million for the Spanish regions – both measured as the mean of the period 2003-2008. Regions that have the largest GERD as % of GDP not surprisingly also have the largest number of researchers per million inhabitants: Madrid, the Basque Country, Catalonia and Navarre.

Graph 5. Gross Expenditures on R&D as % of GDP, 2003-2008 (mean).
Source: OECD Stat

Graph 6. % Number of Researchers per million inhabitants, 2003-2007 (mean).
Source: EUROSTAT

[6] The approach we propose is very limited in terms of Innovation System assessment – we are not dealing with institutional framework, educational context, etc.

The following variable we considered regard distance to technological frontier, which was built as a patent index controlled by population size (either regional or national). We will develop further on this index and its justification on the methodological section, but for now it is important to understand that it approaches innovative efficiency through patents[7]. Therefore, the leading regions in Spain regarding this indicator are (graph 6): Navarre, Catalonia, Madrid and the Basque Country. The main laggards are: Castile-la-Mancha, Cantabria, Canary Islands and Extremadura. We also can perceive a relationship of this variable with the previous ones, GERD as a percentage of GDP and researchers per million people. This can help us on creating a clearer picture of the heterogeneity of Innovation Systems within Spain.

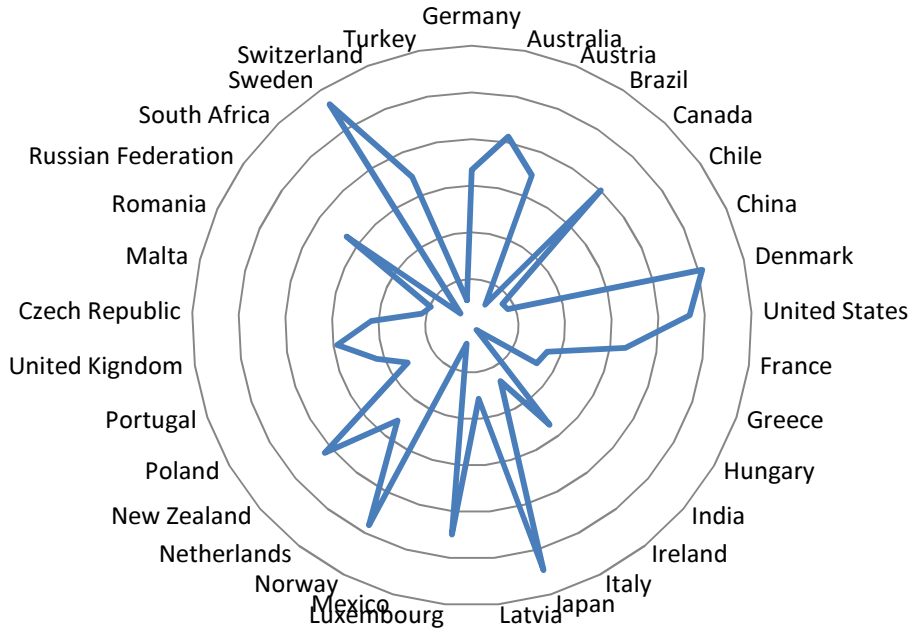


Graph 6: Patent Index by Spanish Region based on PCT applications – 2003-2008 (mean).
Source: OECD Stat

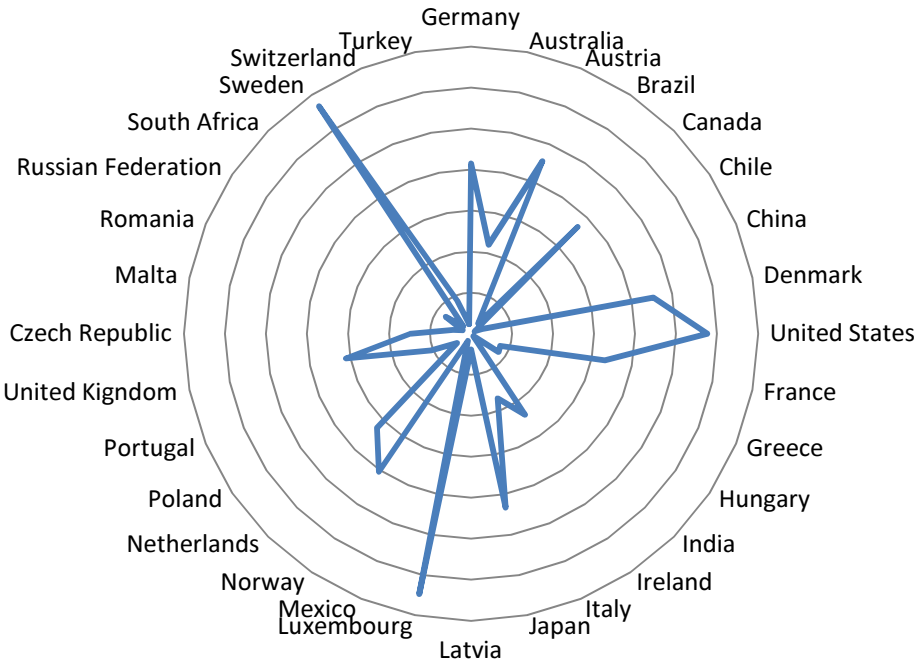
We now move to the analysis of these same variables for the case of the countries that Spain has FDI relationships within the services/KIS sectors. Graph 7 and 8 refer to the % expenditure in R&D controlled by the GDP and % of Research per million of habitants in the countries and the period included in the analysis. Countries with the highest share of GDP invested in R&D are Sweden, Japan, Denmark, Norway and Luxembourg.

When verifying which countries have the largest number of researchers per million inhabitants, we can highlight the positions of Sweden, Luxembourg and the United States. Analogously to the regional case in Spain, we can establish a close relationship of GERD as percentage of GDP and number of researchers per million inhabitants, as again geographical regions overlap in these two indicators.

[7] Obviously taking into account all of its limitations regarding innovation measurement, especially for the case of services.



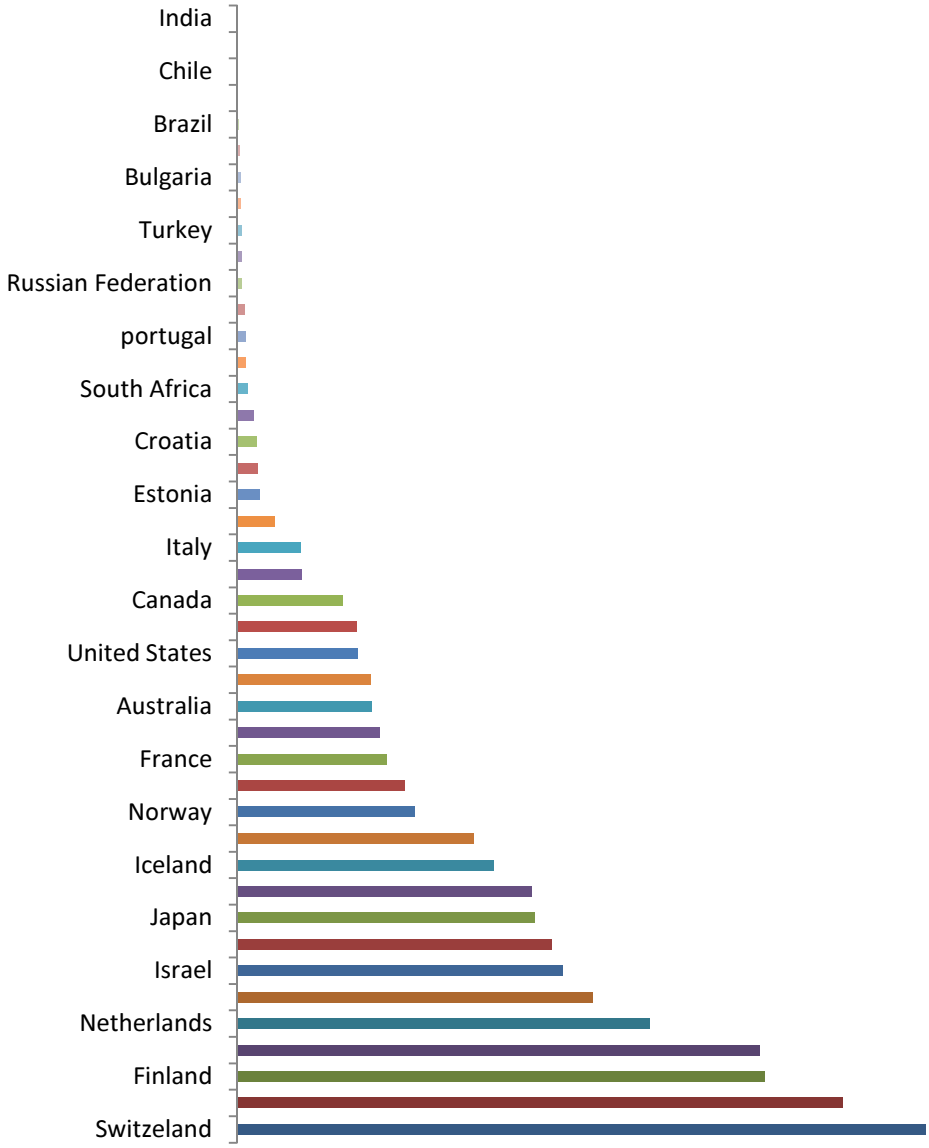
Graph 7: % expenditure in R&D controlled by the GDP, 2003-2008.
Source: OECD Stat



Graph 8: % of Researchers per million inhabitants, 2003-2007 (mean).
Source: OECD stat

Analyzing our patent index in the country-level (Graph 9) we also can see a close relationship with the two previously analyzed variables, since nations in leading positions in terms of GERD and researchers per million inhabitants are also in the forefront positions in patenting (Sweden,

Luxembourg and the United States) – nonetheless, we must highlight that this situation is by no means perfectly linear, and we see countries like France and Ireland, which did not outstand in the previous analyses and do show relatively high levels of patenting efficiency.



Graph 9. Patent Index by Countries based on PCT applications – 2003-2008 (mean).
Source: OECD stat

5. Impact of Manufacturing FDI in the Location choice of Services/KIS FDI

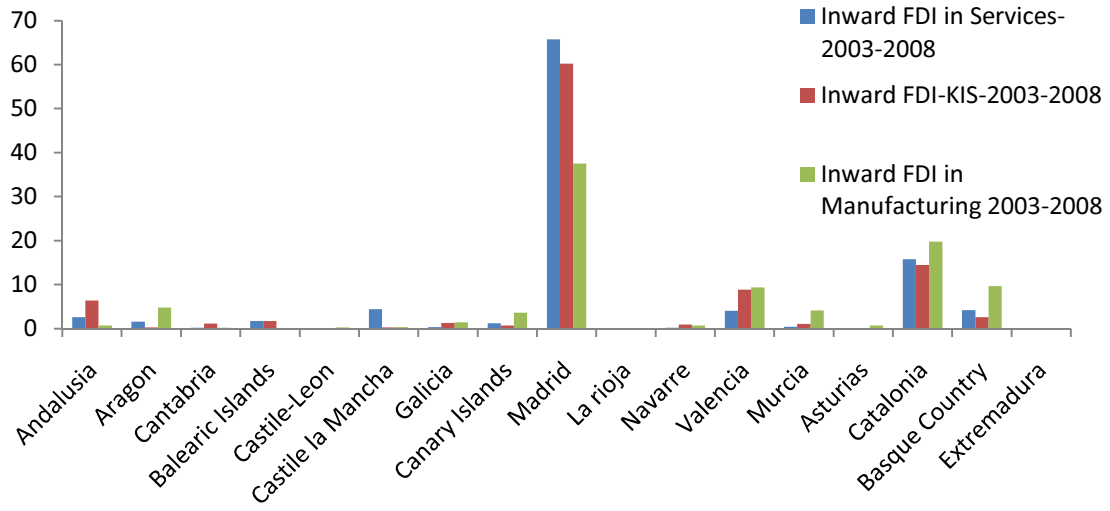
As exposed previously, there is a growing body of literature concerned in verifying if the location determinants of manufactures and services are the same – and even more than that, if FDI in services follow FDI in manufactures towards a given country/region (Nefussi, 2010; Alegría, 2007; Defever, 2006). We should point out that evidence suggests that the behavior of manufacturing

companies in foreign markets seem to play an important role, suggesting that these sectors may work in a complementary way (Kolstad & Villanger, 2008; Guerrieri & Meliciani, 2005; Ramasamy & Yeung, 2010; Kimura & Lee, 2006)[8].

The goal of this chapter is to bring a first approximation of the effects FDI in manufacturing might have on the Inward-Outward FDI flows in services/KIS regarding the Spanish regional case, i.e., if there is a relationship between incoming FDI in Spanish regions in terms of manufactures and services and if it also happens in the case of outgoing investment.

Inward FDI Analysis

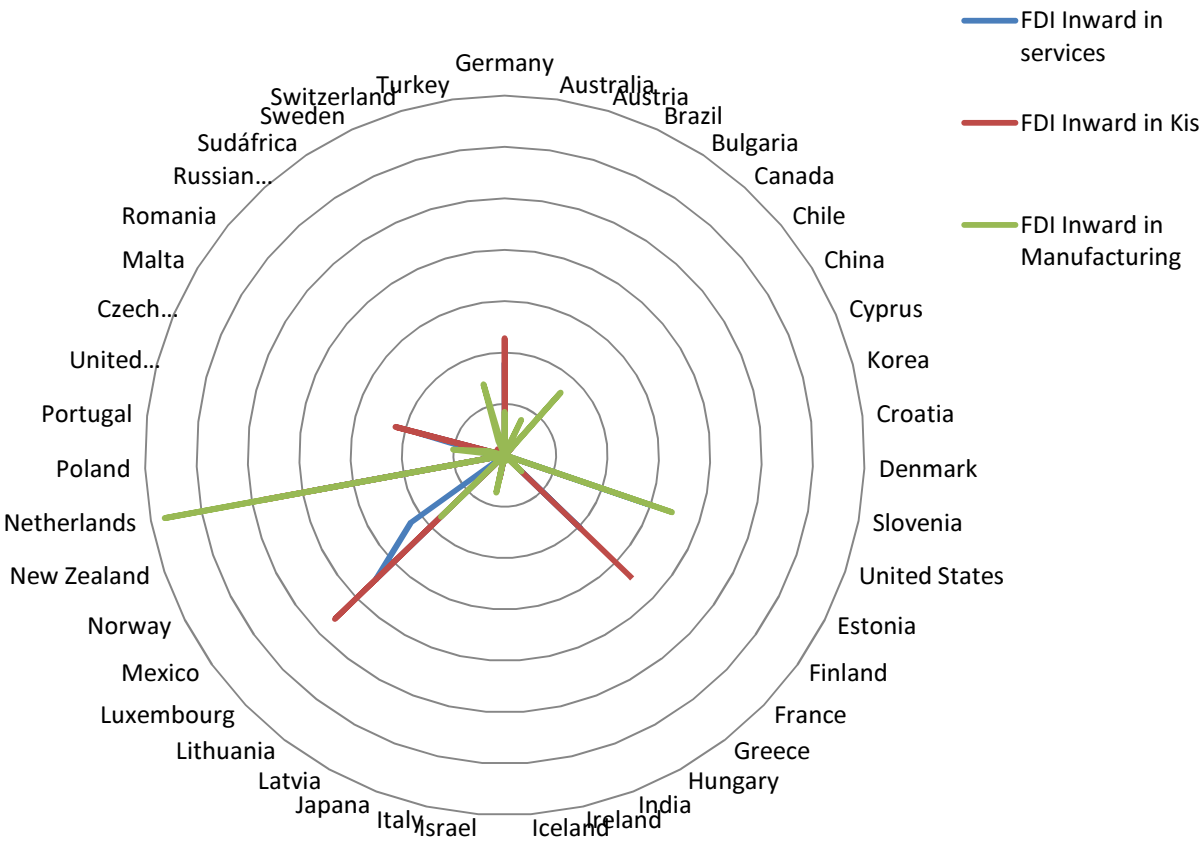
As we can see in graph 10, there is a correspondence between regions with higher levels of FDI in manufactures and the ones with higher levels of FDI in services and in KIS (inward): Madrid, Catalonia and the Basque Country. For the case of Madrid, it is interesting even noticing a higher level of investment in services and in KIS than in manufactures, which is the opposite case of most other regions in Spain. We should also point out the attractiveness of Madrid as a FDI hub in Spain, largely concentrating external investments from abroad.



Graph 10: % Inward FDI in Services, KIS and Manufacturing by Spanish Regions in the period 2003-2008 (mean).
Source: Datainvex

Main countries in terms of amount of FDI in services and in KIS that have invested in Spain in the analyzed period are the Netherlands, Luxembourg, Germany and the United States. For the case of investments in manufactures, we can highlight two of these countries: the Netherlands and the United States. This descriptive analysis gives us some hints that services and KIS do to some extent follow investment in manufactures (at least for the case under analysis). Correlation coefficients[9] indicate that this pattern exists (positive coefficient) moderately.

[8] Ramasamy & Yeung (2010) even conclude that manufacturing FDI is the most important determinant in OECD countries' investment in services.
[9] Appendix II

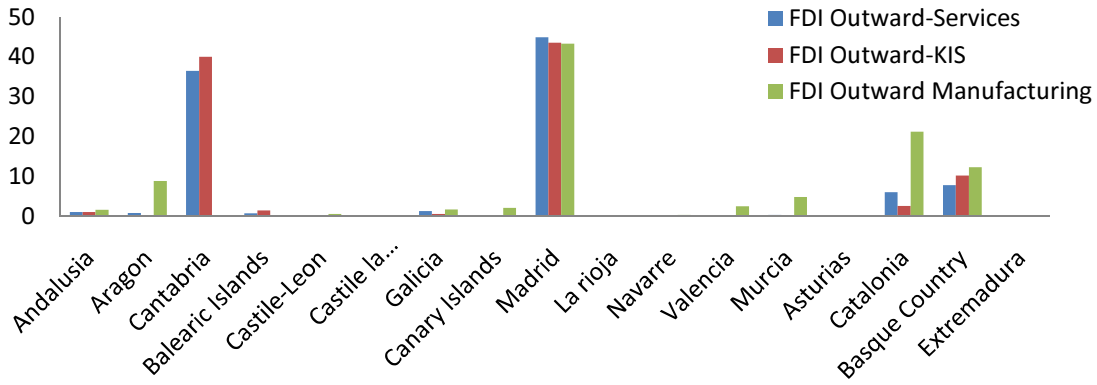


Graph 11. % Origin of Inward FDI in Services, KIS and Manufacturing by Countries in the period 2003-2008 (mean).
Source: Datainvex

Outward FDI Analysis

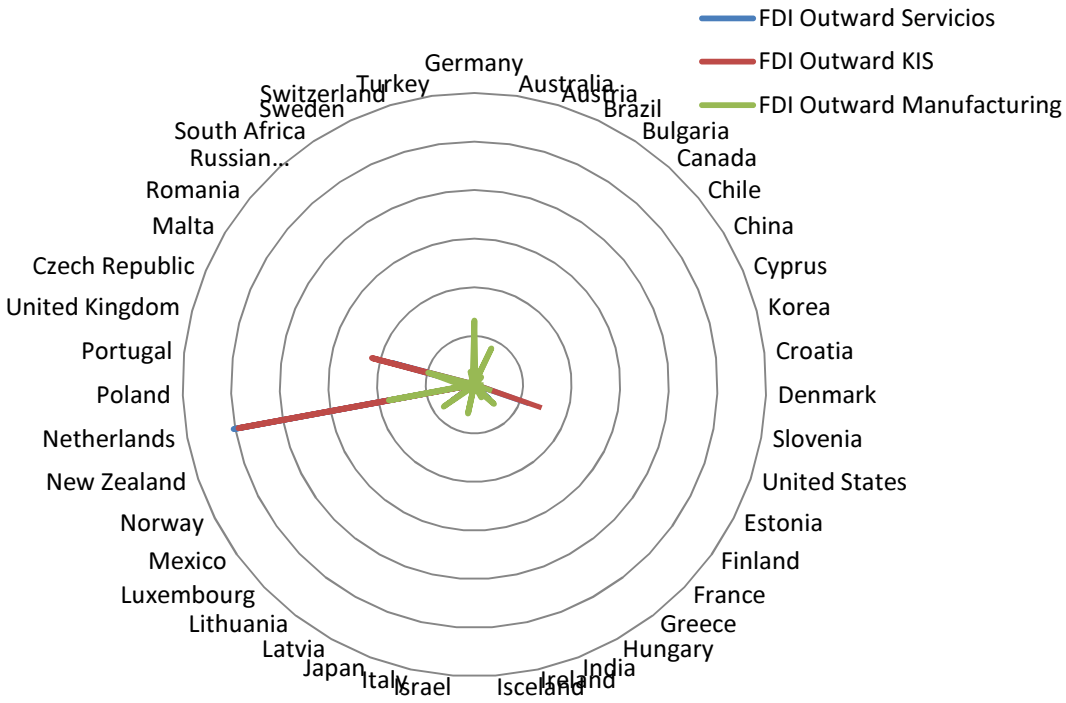
In section 3 we could observe how the leading Spanish regions in terms of inflow of FDI in services and in KIS were Madrid, Cantabria, the Basque Country and Catalonia. For the case of manufacturing FDI outflow, Cantabria plays a minor role, while Aragon joins Madrid, Catalonia and the Basque Country as main investors.

Therefore, for Spanish outward FDI, we cannot affirm that there is a clear picture of the coupling between FDI in services/KIS and manufactures – at least not as clear as the case of inward FDI. Correlation coefficients (appendix 2) support this idea.



Graph 11 : % Outward FDI in Services, KIS and Manufacturing by regions in the period 2003-2008 (mean).
Source: Datainvex

As for the destination of manufacturing FDI from Spanish regions, there are also some remarkable differences regarding investment in services and in KIS. In the latter, FDI was mainly located in the United Kingdom, the Netherlands and in the United States, while in the former, the Netherlands and the United Kingdom do not seem so predominant, the United States does not seem to play a major role and Germany appears as an important partner – even though in this case, FDI seems to be more diversified in terms of geographical locations.



Graph 12 : % Inward FDI in Services, KIS and Manufacturing by Countries in the period 2003-2008 (mean).
Source: Datainvex

6. Data and Methodology

Data

Data used in our estimations come from the sources described in table 1.

VARIABLES		DESCRIPTION	PERIOD	SOURCE
Ln IFDI	*Ln IFDI in Services* *Ln IFDI in KIS*	FDI inward and in million Euros for each region in Spain	Mean for the period 2003-2008	DATAINVEX
Ln OFDI	*LnOFDI in Services* *LnOFDI in KIS*	FDI Outward and in million Euros for each region in Spain	Mean for the period 2003-2008	DATAINVEX
LnGDP*GERD		GDP multiplied by the Gross expenditures in R&D	Mean for the period 2003-2008	WDI/OECD Stat
LnHR		Researchers in R&D per million of peoble	Mean for the period 2003-2007	OECD/Eurostat
LnTECHDIST		Difference between pair of countries' patent index[10]	Mean of patents and population for the period 2003-2008	WDI/OECD Stat
LnFDI Manufacturing	*Ln IFDI in Manufacturing* *Ln OFDI in Manufacturing*	FDI inward and in million Euros for each region in Spain FDI Outward and in million Euros for each region in Spain	Mean for the period 2003-2008	DATAINVEX

Table 1. Variables of analysis, sources and descriptions.

We have proceeded to a cross-section analysis, using natural logarithms of the original data. All models used mean values for the period 2003-2008, which allowed us to gather a larger number of observations, thus creating a more robust picture of the situation. This is so because of the discontinuity of FDI observations in single periods in time.

A special justification is needed for the use of patents as a component of analysis in the case of services, i.e., TECHDIST. The index we have built is based on the United Nation's TAI – Technology Achievement Index (UNDP, 2001). The use of patents as a proxy of technological distance between nations was also used by the ArCo Index (Archibugi & Coco, 2004) and by Fu and Yang (2007), among others.

Nonetheless, we structured data in a way to measure not technological distance *per* se, but technological *heterogeneity*. Since we are dealing with natural logarithms of the original observations, we had to transform these in order to have only positive "distances"[11]. Therefore, if a given country/region A lags behind country/region B in say .100 (patent index) and country/region C lags .100 (patent index) behind country/region A, we can say that B and C are equivalently heterogeneous regarding country/region A.

The use of a Technological Heterogeneity variable between countries gives us an approximation of Innovation Systems and Technological Capabilities. Furthermore, the use of this variable relies on

[10] The LnTECHDIST was built by the Patent index. The methodology has been used is the TAI based on the following formula: (Observed value – Minimum observed)/(Maximum observed – Minimum observed)

[11] Table 1 shows that these "distances" or measures of heterogeneity are calculated as a difference between the patent index from host and home economies in the FDI relationship.

the strong relationship between FDI in Manufacturing and in Services, suggesting that if patents can be used for the former, it should not provide distorted results for the latter. Also, since the focus of this paper lies on KIS, it must be pointed out that this specific subsector is strongly related to *productive services*, meaning that our analysis will be dealing mainly with services that seek industrial areas to perform their activity. Nonetheless, we recognize the limitation of this indicator, but insist that it can be useful given the lack of equivalent measures for innovation in services.

Methodological Outline

Aiming at analyzing the impact technological variables and, more specifically, Innovation Systems might have in Outward and Inward services/KIS's FDI for the case of Spanish regions, we have developed some regression models. Our goal is to obtain results that guide us in providing information regarding: a) how do Innovation Systems influence in the attraction of FDI; and b) to what extent the technological variables of foreign host countries influence in the investment decision (services/KIS) of Spanish regions.

We also have made a distinction between the aggregated data for services (including all of its subsectors) and KIS[12], given the heterogeneity among these subsectors and our interest in understanding the specific behavior for KIS.

In the models we have included also variables to control the effects of origin and destination of investment – if whether they come from EU-27 countries or not – and to control for the level of development of Spanish regions (for this we have considered Madrid, Catalonia and the Basque Country as developed regions and the remaining fourteen regions as "developing"). As previously indicated, these regressions sum to a total of four equations: 2 for Inward FDI and 2 for Outward FDI. The second model in both cases include the presence of the FDI in manufacturing as an explanatory variable in order to verify if they can be related to these FDI Inward and Outward flows.

The models can be described as follows:

(Model 1)[13]

$$\boldsymbol{IFDI_{ij} = GDPGERD_j + HR_j + TECHDIST_{ij} + Dummy\ Member\ of\ the\ UE27 + Dummy\ level\ of\ Development.}$$

Where:

$IFDI_{ij}$: refers to Inward FDI between country "i" to country"j";

$GDPGERD_j$: is the GDP of country "j" by its Gross Expenditures in R&D as a percentage of the GDP;

HR_j: is a measure of highly qualified workforce of country "j" measured by researchers in R&D per million people;

$TECHDIST_{ij}$: refers to a measure of technological heterogeneity between nations/regions measured by the absolute (no negative values) difference of countries/regions' patent index gathered from PCT patent applications.

[12] Appendix I

[13] We are thankful to Prof. Isabel Álvarez for her comments regarding the models.

Dummy Member of the UE 27: A measure of the influence of the UE as origin (or destination for the case of Outward investment) of the FDI.

Dummy level of development: as a measure of the level of development of Spanish regions

(Model 2)

$$\boldsymbol{OFDI_{ij} = GDPGERD_j + HR_j + TECHDIST_{ij} + Dummy\ Member\ of\ the\ UE27 + Dummy\ level\ of\ Development.}$$

Where;

$OFDI_{ij}$; refers to Outward FDI between country "i" to country "j".

$GDPGERD_j$; HR_j;$TECHDIST_{ij}$; and Dummies idem above.

(Model 3)

$$\boldsymbol{IFDI_{ij} = GDPGERD_j + HR_j + TECHDIST_{ij} + IFDI\ Manufacturing_{ij} + Dummy\ Member\ of\ the\ UE27 + Dummy\ level\ of\ Development.}$$

Where;

$IFDI\ Manufacturing_{ij}$: refers to the Inward FDI in Manufacturing between the region "j" to the country "i".

$IFDI_{ij}$; $GDPGERD_j$; HR_j;$TECHDIST_{ij}$; and Dummies idem above

(Model 4)

$$\boldsymbol{OFDI_{ij} = GDPGERD_j + HR_j + TECHDIST_{ij} + OFDI\ Manufacturing_{ij} + Dummy\ Member\ of\ the\ UE27 + Dummy\ level\ of\ Development.}$$

Where;

OFDI Manufacturing: refers to Outward FDI in Manufacturing between the country "i" to the region "j".

$IFDI_{ij}$; $GDPGERD_j$; HR_j;$TECHDIST_{ij}$; and Dummies idem above

7. Results

This section will be developed in two distinct sections: firstly we will present the results for the Inward and Outward FDI models with the use of the technological variables (models 1 and 2 according to methodology); and secondly, we will proceed to models 3 and 4, incorporating FDI in manufactures as an explanatory variable.

Inward-Outward FDI and Techological Variables

Results for Inward FDI (IFDI) in services and in KIS (investment inflows in the distinct Spanish regions) are presented in table 2. We had to proceed to a two-stage approach in order to comply with multicollinearity between the variables LnGDPGERD and LnHR.

As we can see, results do not indicate a strong influence of technology related variables in the attraction of FDI in Spain – which can be gathered from the variables' coefficients and models' R^2. It should also be noticed that we have a better fit for the models comprising services instead of those only for KIS. This is interesting, since we would expect that KIS would seek more developed Innovation Systems than services in general which does not happen in this case – taking into account our limited proxy variables for these systems. In a more general picture of this case, Spain does not seem to attract FDI in services/KIS at least directly because of the Regional Innovation Systems – one might think, though, that these influence in the general economic framework, which might indeed be more significant in this case.

TechDist, our measure of technological heterogeneity possesses positive and significant results, indicating a *positive* heterogeneity, meaning that incoming investments in Spanish regions are usually related to home countries that are in a different technological stage than the regions where they invest. Relating this to descriptive data shown before, we can point out the fact that Spanish regions are recipients of FDI in services from more advanced nations (like the Netherlands, Germany and France). This might indicate the presence of a cost-focused *offshoring* process, which would explain the low significance of the other IS variables – we find support for that in the significant and positive effect of the Dummy EU, which represents partners from within the European Union. Nonetheless, we must notice that services are more oriented towards more developed regions in Spain than KIS, which can be regarded as a surprising result.

	Services (1)	**KIS (1)**		**Services(1)**	**KIS (1)**
LnGDPGERD	(-).019	.029	***Ln HR***	(-).016	.047
Ln TechDist	.260***	.203***	***Ln TechDist***	.260***	.203***
	(.000)	(.000)		(.000)	(.000)
Dummy Level of Development	.368***	.227**	***Dummy Level of Development***	3.64***	2.16**
	(.000)	(.032)		(.000)	(0.14)
Dummy EU	.170***	.218***	***Dummy EU***	.170***	.216***
	(.000)	(.000)		(.000)	(.000)
Rsq	.232	.138	***Rsq***	.232	.138
*** Sig 1%			*** Sig 1%		
**Sig 5%			**Sig 5%		
*Sig 10%			*Sig 10%		

Table2: Results for Inward FDI – Model 1

Moving to the outflow of investments from Spanish regions towards countries included in our analysis[14] (table 3), we do not have a significant better fit for model 2 in comparison to model 1 as per the analysis of the R^2 coefficient. Again, Services couple better with our explanatory variables

[14] Appendix I

than KIS do. Nonetheless, it is interesting noticing that GDPGERD and HR (as technological variables) seem to play an important role in the attraction of FDI in services and in KIS from Spanish regions (in similar levels for both approaches), while TechDist, contributes little to the model, suggesting that the technological heterogeneity is not a relevant determinant on where Spanish firms decide to invest. Nonetheless, HR has a *negative* sign, suggesting that countries with *lower* rates of researchers per million inhabitants are more attractive for internationalizing Spanish firms. This can indicate that foreign Innovation Systems might not be determinant for the interests of these companies.

Also, we can see that, as expected, more developed regions invest more abroad, but Spain does not seem to be oriented towards the European Union in this regard. This might reflect its cultural and institutional bonds with Latin America, or its interest in exploring larger markets, like the United States – thus we should not think of this internationalization situation as a cost-driven *offshoring* process.

	Services(2)	**KIS(2)**
Ln GDPGERD	.783***	.761***
	(.000)	(.000)
Ln HR	(-).580***	(-).532**
	(.000)	(.004)
Ln Tech Distance	(-).087	(-).167*
		(.094)
Dummy level of Develpment	.429***	.345***
	(.000)	(.000)
Dummy EU member	.032	.108
Rsq	.250	.160

*** Sig 1%

**Sig 5%

*Sig 10%

Table 3: Results for Outward FDI – Model 2

Inward and Outward FDI and the effect of the investment in manufacturing

In model 3, both for services and for KIS, FDI in manufacturing is a significant determinant of investment in the Spanish regions – more strongly for KIS than for services in general, which might indicate how these KIS couple with industrial firms, since many of its subsectors correspond directly to business services.

The coefficients of the other variables change regarding model 1 (also for Inward FDI), as well as their significance in some cases when we include this control variable. For example, GDPGERD and HR become significant for services (but not for KIS). The interesting part of this story is to notice that for both, signs are *negative*. Thus, there is a contraposition between them and FDI in manufacturing, since we have seen in our descriptive analysis that the most developed IS also received more investment. Again, these results indicate that the influence of Innovation Systems is rather low in *direct* terms regarding attraction of FDI.

	Services(3)	KIS(3)		Services(3)	KIS(3)
Ln HR	(-).185**	(-).113	***GDPGERD***	(-).193**	(-).068
	.019			(.037)	
Ln TechDist	.135**	.067	***Ln TechDist***	.137**	.068
	(.016)			(.016)	
Ln FDI Manufacturing	.372***	.452***	***Ln FDI Manufacturing***	.367***	.448***
	(.000)	(.000)		(.000)	(.000)
Dummy Level of Development	.411***	.237**	***Dummy Level of Development***	.436***	.195**
	.000	(0.37)		(.000)	(.041)
Dummy EU Member	156***	.189**	***Dummy EU Member***	.155**	.199***
	(.005)	(.003)		(.006)	(.003)
Rsq	.332	.327	***Rsq***	.328	.325

*** Sig 1%
**Sig 5%
*Sig 10%

*** Sig 1%
**Sig 5%
*Sig 10%

Table 4: Results for Inward FDI with manufacturing – Model 3

In the analysis of Outward FDI, FDI in manufacturing does not seem to play a determinant role at all, even though this variable has a significant coefficient for services (not for KIS) – but its coefficient is rather small. Other variables remain in similar situations to those we showed previously in the model without investment in manufactures (model 2). However, TechDist now appears as significant (especially for KIS) and providing some contribution to the explanatory power of the models with a *negative* sign, suggesting that considering the variables included in the model, Spanish regions invest more in those countries that are in a technological situation more homogeneous in comparison to their own.

	Services(4)	KIS(4)
Ln GDPGERD	.606***	.735***
	(.000)	(.002)
Ln HR	(-).344**	(-).313
	(0.28)	
Ln Tech Distance	(-).138*	(-)2.97***
	(0.78)	(.009)
Ln FDI Manufacturing	.172**	(-).016
	(.012)	
Dummy level of Develpment	.410***	.449***
	(.000)	(.000)
Dummy EU member	.001	.011
Rsq	.312	.257

*** Sig 1%
**Sig 5%
*Sig 10%

Table 5: Results for Outward FDI with manufacturing – Model 4

7. Conclusion and Policy Implications

It cannot be denied that the development of a strong innovative environment acts in favor of a given region's development and growth. In this sense, our analysis in this article aimed at approaching the influence of some technological constructs in the process of regional internationalization of Spanish regions via FDI for the specific case of services and knowledge-intensive services. Results suggest that technological variables do participate in the process of FDI attraction but not as main determinants. As this situation unfolds more relevantly in the case of Outward investment than Inward, we can therefore expect that Spanish investment abroad is more oriented towards asset and knowledge seeking than the inflow of investments in services and in KIS in Spanish regions – which appear to seek cost-efficient operations and to follow FDI in manufactures.

In any case, our expectation and suggestion for future empirical developments is to consider Innovation Systems (Regional or National) as engines of economic growth which would affect *indirectly* the attraction of FDI by fostering stronger markets which could be more profitable for companies. Also, other structural variables might be added, such as wages, in order to verify the existence of *offshoring*.

It is also worth thinking about the possibility of a feedback loop regarding the presence of asset and knowledge-seeking FDI: if they locate their operations in geographical areas that have more developed Innovation Systems, and if they contribute positively to this system, they will foster the attraction of new FDI and so on. Following this logic, any variable that attracts FDI and that is also influenced by it may configure a virtuous circle of investment – any scientific quest in this direction might provide extremely beneficial policy implications.

Nonetheless, this is a very initial stage of the performed research and a wide range of corrections must be made as well as remarks on this approach's limitation. Firstly, we had to work with very strict models because of the number of gathered observations, not allowing for the incorporation of more control variables. Further tests with composite indicators that better represent the many dimensions of a Regional and National Innovation Systems must be taken into account. Also, better proxies for the case of technological heterogeneity in services must be found, since our approach deals only with patents and it is known that this does not necessarily represent the innovative capacity of the analyzed sectors.

Also, working with data from regions of different countries might be desirable. Descriptive data in our article showed that Madrid has an enormous weight regarding inflow and outflow of FDI, possibly distorting our results – since its power of attraction might be related to other non-economic variables such as central government location[15].

8. References

Alegría, Rodrigo(2007). The location of multinational firms in the UK: sectoral and functional agglomeration, *ERSA Conference Paper No.400, European Regional Science* Association.

Archibugi, D. and Coco,A (2004). A new indicator of Techonological Capabilities for developed and developing Countries(Arco). World development, pp.629-654.

Asheim, Bjorn, Gertler, Meric S. (2004). The Geography of Innovation: Regional Innovation Systems. In: Fagerberg, J.; Mowery, D. y Nelson, R. (eds). The Oxford Handbook of Innovation. Oxford University Press, New York.

Buch, C.M and A. Lipponer(2004). FDI versus Cross-border Financial Services: The Globalization of German Banks.

Caves, R.E. (1971). Industrial Corporations: The industrial Economics of Foreign investment. *Economica*, v. 38, n. 149, pp. 1-27.

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Chung, W., Alcácer, J(2002). Knowledge Seeking and Location Choice of Foreign Direct *Investment in the United States. Management Science. Vol.48, No12, December 2002. Pp.1534-1554.*

De Bruijn, Roland; Kox, Henk y Lejour, Arjan (2008). Economic benefits of an Integrated European Market for Services. *Journal of Policy Modeling*, v. 30, pp. 301-319.

Defever,D.(2006).Functional fragmentation and the location of multinational firms in Europe. *Regional Science and Urban Economics 36, pp.658-77.*

Dunning, J.H., (1973). The determinants of international production. *Oxford Economic Papers*, v. 23, n. 3, pp. 289-336.

Dunning, J.H., (2006). Towards a paradigm of development: implications for the determinants of international business activity, Transnational Corporations, n. 15, v.1, pp. 173-227.

Dunning, J.H., Narula, R. (1996). Foreign Direct Investment and Governments: Catalysts for Economic Restructuring, Routledge, Londres.

Durán , J & Úbeda, F. (2005). The investment development path of newly developed countries. *International Journal of Economics of Business*, v. 12, n. 1, pp.123-327.

Eurostat (2007). European Union international trade in services. Analytical aspects(data 1997-2005)

Fuente, A. De La (2001).On the Sources of Convergence: A Close look of the Spanish Regions, *European Economic Review, 46,569-599.*

Fu,X., Yang, Q.,(2007). Exploring the cross-country gap in patenting: A stochastic Frontier Approach. *Research Policy* ,v.38, pp. 1203-1213.

Guerrieri, Paolo y Meliciani, Valentina (2005). Technology and International competitiveness: the interdependence between manufacturing and producer services. *Structural Change and Economic Dynamics*, v. 16, n. 4, pp. 489-502.

Head, Keith; Mayer, Thierry y Ries, John (2009). How remote is the offshoring threat? *European Economic Review*, v. 53, pp. 429-444.

Hymer, S.H (1960). *The International Operations of National Firms: A Study of Direct Foreign Investment*. The MIT Press, Cambridge, MA.

Jenícek, V. (2007). World trade with services in globalisation processes. *Agric. Econ.*, v. 53, pp. 55-64.

Kimura, Fukunari y Lee, Hyun-Hoon (2006). The Gravity Equation in International Trade in Services. *Review of World Economics*, v. 142, pp. 92-121.

Kindleberger, C. (1969*). American Business abroad: six lectures on direct investment*. New Haven, Yale University Press.

Koch, Andreas y Strotmann, Harald (2005). The Impact of Functional Integration and Spatial Proximity on the Post-entry Performance of Knowledge Intensive Business Service Firms. *IAW Discussion Paper n. 18.*

Kolstad Ivar and Villanger Espen(2008). Determinants of foreign direct investment in services. *European Journal of Political Economy* , pp. 518-533.

Krugman, Paul (1992). Geografía y Comercio. Antoni Bosch. Barcelona.

Narula, R. and Dunning, J.H. (2000). Industrial development, globalisation and multinational enterprises: new realities for developing countries, Oxford Development Studies, 28, 2.

Nefussi, Benjamin and Schwellnus Cyrille (2010). Does FDI in manufaturing cause FDI in business services? Evidence from French firm-level data. *Canadian Journal of Economics,* pp.180-203.

Malerba, Franco (2004). Sectoral Systems: How and why innovation differs across sectors. In: Fagerberg, J.; Mowery, D. y Nelson, R. (eds). The Oxford Handbook of Innovation. Oxford University Press, New York.

Meliciani, Valentina (2002). The impact of technological specialisation on national performance in a balance-of-payments-constrained growth model. *Structural Change and Economic Dynamics*. v. 13, pp. 101-118.

Metcalfe, J. Stanley y Potts, Jason (2007). La internacionalización de los servicios: La perspectiva evolutiva. In: ICEX/ICEI (2007). *Claves de la Economía Mundial*, Madrid.

Moshirian, F, 1997. Foreign direct investment in insurance services in the United States. *Journal of Multinational Finance Management* 7, 159-173.

Porter, Michael E. (1990). The Competitive Advantage of Nations. The MacMillan Press, London.

Ramasamy, Bala and Yeung, Matthew (2010). The Determinants of Foreign Direct Investment in Services. *The World Economy*, pp. 573-596.

Roy, Martin (2009). Endowments, Power, and Democracy: Political Economy of Multilateral Commitments on Trade in Services. *WTO Staff Working Paper ERSD-2009-07.*

Szakálné Kanó, I. and Vas, Z. (2010). Do knowledge enterprises flock together? Evidence from Hungary at sub-regional level. Regional Studies Association Annual International Conference 2010. May 24th – 26th, Pécs.

Torbjörn H. and Netland (2007). Internationalization of professional services-A 1999-2005 Literature review- *College of Service Operation 2007 Conference.*

Van Welsum, Desirée (2007). Externalización y deslocalización de los servicios: frente al reto global. In: ICEX (2007). *Claves de la Economía Mundial*, Madrid.

Vence-Deza, Xavier y González-López, Manuel (2005). Los servicios intensivos en conocimiento, especialización y crecimiento en Europa. . *Información Comercial Española*, n. 824, pp. 117-137

Williamsom O.(1975). *Market and hierarchies: Analysis and Antitrust Implications: A study of the Economics of Internal Organization*. New York, Free Press.

APPENDIX I - Countries and Sectors

Countries

Germany, Australia, Austria, Brazil, Bulgaria, Canada, Chile, China, South Korea, Croatia, Denmark, Slovenia, United States, Cyprus, Estonia, Finland, France, Greece, Hungary, India, Ireland, Iceland, Israel, Italy, Japan, Latvia, Lithuania, Luxembourg, Mexico, Norway, New Zealand, Netherlands, Poland, Portugal, United Kingdom, Czech Republic, Malta, Romania, Russian Federation Sweden, Switzerland, and Turkey.

Services Sector

2 digit NACE Rev. 2
45,46,47,49,50,51,52,53,55,56,58,59,60,61,62,63,64,65,66,68,69,70,71,72,73,74,75,77,78,79,
80,81,82,84,85,86,87,88,90,91,92,93,94,95,96,97,98,99

KIS

2 digit NACE Rev. 2 :
50,51,59,60,61,62,63,64,65,66,69,70,71,72,73,74,78,80 (Based in Szakálné Kanó &Vas, 2010)

50 Water transport
51 Air transport
59 Motion picture, video and television programme production, sound recording and music publishing activities
60 Programming and broadcasting activities
61 Telecommunications
62 Computer programming, consultancy and related activities
63 Information service activities
64 Financial service activities, except insurance and pension funding
65 Insurance, reinsurance and pension funding, except compulsory social security
66 Activities auxiliary to financial services and insurance activities
69 Legal and accounting activities
70 Activities of head offices; management consultancy activities
71 Architectural and engineering activities; technical testing and analysis
72 Scientific research and development
73 Advertising and market research
74 Other professional, scientific and technical activities
78 Employment activities
80 Security and investigation activities

Manufacturing

2 digit NACE Rev. 2 10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32

APPENDIX II - Correlation Coefficients

Correlation coefficients between FDI in Services and KIS y FDI in Manufacturing for Inward and Outward FDI.

		FDI in Manufacturing
Inward	*FDI in Services*	.465
	FDI in KIS	.526
Outward	*FDI in Services*	.384
	FDI in KIS	.217