Foreign direct investment spillover for “late investor” economies. A Threshold Regression Analysis for Spanish case.

Abstract

The demonstration effect allows the transfer of knowledge from MNCs to domestic companies with a corresponding effect on productivity. This flow is determined by both absorption capacity and geographical proximity. Our analysis for Spanish case provides two conclusions. First, we contrast the existence of differentiated effects of inward FDI on Total Factor Productivity (TFP), according to absorption capacity and geographical distance. Second, the domestic companies with a greater absorption capacity benefit from spillovers, and those of lesser technological capacity are seen as negatively affected by the presence of the MNC.

Keywords: FDI, productivity, spillover, absorption capacity, multinationals corporations

1. Introduction

Inward Foreign Direct Investment (FDI) has been perceived as a source of knowledge for host economies, and in many cases it has been an essential element in strategies for economic development. The empirical evidence is not conclusive, since it presents a strong methodological heterogeneity, provides partial results of the analysed phenomenon, and is greatly determined by the available statistical information (Blomström and Kokko 1998, Ben Hamida and Gubler 2009, Smeets 2008).

The generation of spillover may occur through three channels of knowledge transfer: the demonstration effect (Saggi 2006), labour mobility (Fosfuri et al. 2001, Ben Hamida and Gubler 2009), and vertical relationships (Blomström and Kokko 1998, Resmini and Nicolini 2007, Kugler 2006). Furthermore, the presence of the MNC can increment competitive pressure with its consequent effects on productivity (Aitken and Harrison 1999, Kokko 1996, Smeets 2008).

In this paper we focus on the role that absorption capacity and geographical proximity have in the generation of spillovers within industries, through the demonstration effect and competition (Jaffe and Trajtenberg 2002, Girma 2005, Barrios et al. 2007, Girma and Wakelin 2007).

The domestic company's technological backwardness makes the knowledge provided by the MNC especially valuable. Correspondingly, the similarity in the endowment of intangible assets between the two types of company substantially reduces the value of knowledge and the magnitude of spillover (Findlay 1978, Wang and Blomström 1992). However, knowledge transfer requires absorptive capacity, which implies that the domestic companies situated at the knowledge frontier possess a greater potential for generating spillover, than those with a greater technological gap (Wang and Blomström 1992, Nakamura 2002, Narula and Marin 2003, Ben Hamida 2007, Ben Hamida and Gubler 2009). Faced with this problem, Girma (2005), Girma and Görg (2007) and Criscoula and Narula (2008) suggest a nonlinear U shaped relationship between the intensity of the spillover and learning capacity.

In this paper we consider whether the level of economic development determines the relationship that exists between absorptive capacity and spillover (Criscoula and Narula 2008, Meyer and Sinani 2009). Specifically, we question if this U shaped relationship is transferable to economies that have a technological gap in comparison with the economies embedded in the knowledge frontier.

The Spanish economy has been considered a “late investor” (Campa and Guillen 1996). That is characterised as being developed, but having a technological gap in comparison with the most advanced economies. In addition, it has been a major recipient of FDI at world level; in fact, we have estimated that 43% of employment in the manufacturing industry is generated by MNCs; in some sectors such as the chemical industry, the ratio reaches 85%. We therefore believe that these conditions combine to contrast the hypotheses raised in this paper. We use a sample of 2,274 Spanish manufacturing companies, for the period between 1993 and 2006, to verify the role played by absorption capacity and geographic proximity in the generation of spillover for a developed economy, which has a technological gap with respect to the international technology frontier.

The percentage of employment generated by the MNCs is the proxy regularly used for FDI. However, the calculation of this variable, made with data from companies and not production centres, incorporates a bias. We propose two alternative proxies that allow us to estimate each company’s level of exposure to FDI, both in region and outside region, considering the regional location of its subsidiaries, and allowing us to incorporate the effects of geographic proximity into the analysis.

It has been opted to use the methodology proposed by Hansen (2000), known as threshold models, for the specification of nonlinear relationships. Identifying thresholds allows us to create groups of companies that have a behaviour that is homogeneous intra-group, and differentiated between-group.

Our analysis provides two conclusions. First, we contrast the existence of differentiated effects of inward FDI on Total Factor Productivity (TFP), according to absorption capacity and geographical distance. Second, the domestic companies with a greater absorption capacity benefit from spillovers, and those of lesser technological capacity are seen as negatively affected by the presence of the MNC. This result confirms our hypothesis on the effects of the technological gap in the relationship established between spillover and absorption capacity.

In section two we review the literature focused on the role developed by absorption capacity and geographic distance in the generation of spillover. In section three the threshold estimation is described and justified. In section four, the variables used are described. Section five explains the obtained results, and finally conclusions are proposed.

2. A review of literature

The presence of the multinational company (MNC) is perceived by an important part of the literature as a source of knowledge to the domestic company. The very existence of the MNC is based on the possession of a competitive advantage in comparison to domestic companies, which allows it to assume the costs of contextualisation (Hymer 1976, Dunning 1988.) It should therefore be expected that the technological, managerial and marketing assets that shape their competitive advantage can be partially transferred to local companies (Blomström and Kokko 1998).

Distinct channel of knowledge transfer have been identified, the demonstration effect that facilitates learning by imitation (Saggi 2006), the mobility of workers trained in MNCs, who constitute a source of formal and tacit knowledge for the domestic company (Fosfuri et al. 2001, Ben Hamida and Gubler 2009), and finally the vertical relationships established with customers and suppliers (Blomström and Kokko 1998, Resmini and Nicolini 2007, Kugler 2006)[1].

The presence of the MNC increases the level of competition in the domestic market, which can lead to an increase in local productivity[2], but can also be associated with a crowding out effect (Aitken and Harrison 1999, Kokko 1996). Similarly, the presence of the MNC expands the range of intermediate and final inputs, which are favourable to increases in productivity (Rodríguez-Clare 1996). In any case, these spillovers are not caused by the transfer of knowledge (Smeets 2008).

The available empirical evidence is abundant, controversial, incomplete and inconclusive. This heterogeneity reflects the need to integrate complex and interdependent channels of spillover generation. In addition, it is common to use an indicator that retrieves the net effect of the interactions of the various sources of spillover generation (Kinoshita 2000, Görg and Strobl 2005, Smeets 2008). This complicates the econometric specification of the study, and its subsequent interpretation (Blomström and Kokko 1998, 2003; Hanson 2001; Lipsey 2002, De Mello 1997, Kumar 1996, Görg and Strobl 2005, Smeets 2008).

The presence of the MNC does not automatically generate spillover, and is dependent on factors endogenous to the domestic company, to the industry sector, to the

[1] Specifically Kugler (2006) demonstrates that, in the case of Venezuela, the main source of knowledge transfer is of the vertical nature.

[2] The work carried out by Kokko (1996) differentiates between demonstration effects and competition in the case of Mexico, demonstrating that both generate positive spillovers.

host economy, and on the MNC's own objectives (Kinoshita 2000, Kokko 1996, Ben Hamida and Gluber 2009). Thus, Smeets (2008) emphasises two elements that determine the intensity and sign of spillover: Absorption capacity and geographic proximity.

The transfer of knowledge can be especially limited (Jaffe and Trajtenberg 2002), which would geographically restrict the impact of the demonstration effect. Likewise, if labour mobility is scarce, the spillovers associated with this channel are limited to a specific geographical area (Girma 2005). The available empirical evidence seems to confirm the relevance of geographical proximity in the determination of the intensity of spillover (Barrios et al. 2007, Girma and Wakelin 2007).

The value of knowledge depends on the domestic company's technological backwardness; when this is high, foreign technology will provide a greater improvement to productivity. Correspondingly, the similarity in the endowment of intangible assets between the two types of company reduces the value of knowledge, and therefore the magnitude of the spillover (Findlay 1978, Wang and Blomström 1992). However, the transfer of knowledge requires absorptive capacity[3] (Cohen and Levinthal 1989, 1990), and this depends on the endowment of intangible assets, and the learning made by the company. In accordance with the above, the domestic companies that are on the frontier of knowledge possess a greater potential for generating spillover than those that have a higher technological backwardness (Wang and Blomström 1992, Nakamura 2002, Narula and Marin 2003, Ben Hamida 2007, Ben Hamida and Gubler 2009).

The empirical evidence that analyses the moderating role of technological backwardness and absorption capacity in the process of spillover generation, presents a certain level of methodological heterogeneity. We have evidence that it only incorporates one of the aspects of the learning process. Thus, the works that have focused on the study of technological backwardness, measured as the difference between the technological frontier and the level of knowledge of the company[4], confirm that the companies with a greater technological gap are those that generate more spillovers (Griffith et al. 2002, Castellani and Zanfei 2002). On the other hand, the

[3] For a sample of less-developed economies, Borensztein et al. (1998) demonstrate that the level of qualification of human resources is one of the determinants of the positive impact of direct investment on growth.
[4] The technological frontier is estimated at sectoral level using the maximum level of TFP, associating the level of TFP to the knowledge of the company.

evidence that has only considered absorption capacity, defined by the level of TFP, the expenditure on R&D, the level of qualification of human resources, or the level of exportation activity, do not obtain conclusive results. As such, Kinoshita 2000, Barrios and Strobl 2002, Barrios et al 2004, Blomström and Sjöholm 1999, among others, contrast a positive relationship between learning capacity and spillover generation; however, Damijan et al (2003) do not obtain a statistically significant relationship.

The work of Castellani and Zanfei (2003) analyses both technological backwardness and learning capacity, arguing that they are two realities that are necessarily interrelated, and that when technological backwardness is greater, the absorption capacity should be less and vice versa, the complex result is dissociated from effects on spillover.

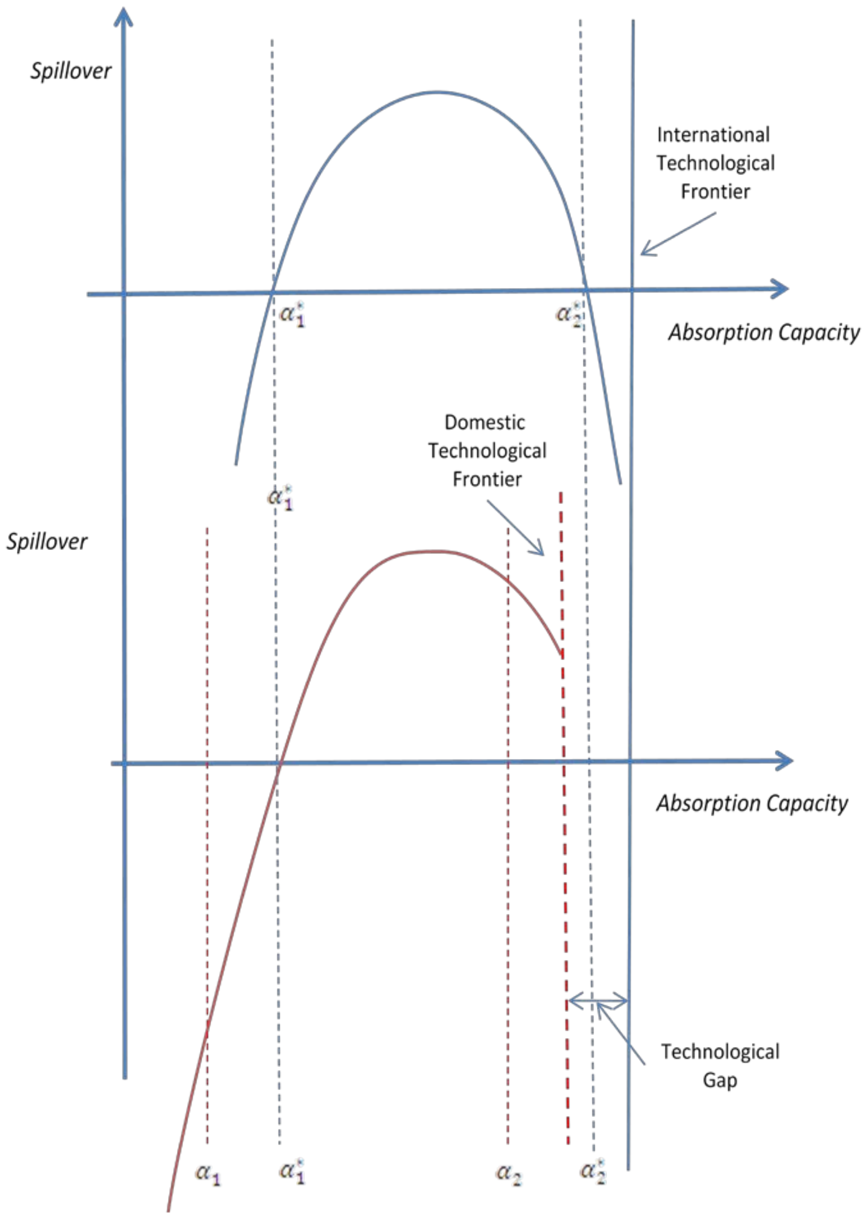
Faced with this problem, Girma (2005) and Girma and Görg (2007) propose using only one indicator, called absorption capacity, for both realities. Likewise, they suggest a nonlinear U shaped relationship between the intensity of spillover and learning capacity. That is to say, the presence of MNCs should not have an impact on the more productive companies, as the MNCs may not provide distinguishing knowledge. On the other hand, the domestic companies with less learning capacity could be negatively affected by FDI, due to learning difficulties as well as their vulnerability in the face of increased competition (Girma and Wakelin 2001). Finally, the domestic companies of average productivity are the potential generators of spillovers, since despite their technological gap, they possess sufficient capacities to internalise the knowledge provided by the foreign company. These results are contrasted by Girma (2005) for a sample of companies from the United Kingdom and Ben Hamida and Gugler (2009) working with Swiss companies.

If we consider that the level of economic development determines the intensity and sign of spillover (Meyer and Sinani 2009), we suggest that if the nonlinear U shaped form exists between spillover intensity and learning capacity, it would be transferable to economies that have a technological gap in comparison with economies imbedded in the frontier of knowledge.

In Figure 1 we represent the spillover in terms of learning capacity. The top of the figure represents an economy that is at the frontier of international knowledge, and has the expected U shaped relationship. The lower part of the figure represents an economy with a technological gap. In this case the companies that find themselves close to the domestic frontier of knowledge are not in the international frontier. That is to say, the level of knowledge of these companies would be equivalent to international companies of average productivity. This implies that MNC companies are able to provide knowledge to domestic companies with high productivity, and which have sufficient learning capacity. This would explain the positive spillovers identified for those companies with greater absorptive capacity in Spain, Ireland, Indonesia and the Czech Republic (Barrios and Strobl 2002, Barrioset al 2004, Kokko 1994 and Kinoshita 2000). It is expected that the companies with lower learning capacity would see their productivity reduced by the intensification of competition.

Figure 1

Relationship between absorption capacity and spillover



3. Methodology

The response of the domestic company against inward FDI is not homogeneous, absorption capacity being one of the main causes of this heterogeneity. Moreover, the relationship between this factor and the intensity of spillover is not linear (Girma 2005, Ben Hamida and Gugler 2009) Quantile regression methodology allows us to deal with nonlinear relationships. It consists of dividing the sample in quintiles and subsequently estimating the model for each of the groups, which allows us to analyse the differences between the groups having a similar level of absorption capacity (Koenker and Basset 1978, Girma and Wakelin 2007). The problem with this methodology is that we do not know, a priori, if the groups actually have a shared distinction with each other, or if the heterogeneity in each of the groups is eliminated. An alternative methodology is the one developed by Hansen (2000), called threshold estimation, which permits the identification of groups of companies that have homogeneous behaviour within the group, and distinctions from other groups[5].

Hansen's proposal (2000) comes from the specification of Tong's model (1983, 1990) known as the Threshold Autoregressive model (TAR), in which nonlinearities are handled through the identification of the threshold values defining the groups. Other models in this line are the exponential AR (EXPAR) model of Haggan and Ozaki (1981) and the smooth transition AR (STAR) model of Granger and Teräsvirta (1993).

Thus, we use this methodology to contrast the specification proposed by Girma (2005):

$$\Delta TFP_{it} = \beta_0 + \beta_1^{'} X_{it-1} + \gamma_l^{'} FDI_{ijt-1} I(ABC_{it-1} \geq \alpha) + \gamma_2^{'} FDI_{ijt-1} I(ABC_{it-1} > \alpha) + \mu_{it} \qquad (3)$$

where ΔTFP_{it} is the increase in productivity[6] of the company *i* at the time *t*;; X_{it} is a vector that collects the control variables, within which we include the age and export intensity of company *i*, in the same manner we include two measures of the level of sector competition, the Herfindhal Index and the penetration of imports; *I(.)* is the indicator function; FDI_{ijt-1} represents the inward FDI for company *i* that belongs to

[5] The works of Girma and Görg (2002) and Chernozhukov et al. (2009) use the quantile methodology. However, Girma (2005) applies Hansen's methodology (1996), to analyse the impact of absorption capacity in the generation of spillover.

[6] The TFP is expressed in logarithmic terms.

sector j at the time *t-1*, ABC_{it-1} is the absorption capacity of company i in *t-1*; α is the vector of n threshold and μ_{it} is the error term.

The vector FDI_{ijt} is two-dimensional as it includes the following variables:

- $\mathrm{IFDI_{ijt}}$ which represents foreign presence in sector *j* pertaining to company *i*, taking into account all the regions in which that company has establishments, at time *t*.
- $\mathrm{OUTFDI_{ijt}}$ represents the foreign presence in sector *j* pertaining to company *i*, taking into account all the regions in which that company doesn't have establishments, at time *t*.

If we don't incorporate the thresholds, the condition of linearity and therefore the parameters estimated with *Ordinary Least Square (OLS)*, are not efficient. If we incorporate a threshold α_0 we divide the sample in two groups based on the company's absorptive capacity. However, we don't know if α_0 resolves the problem of heterogeneity, and as such if the estimation with *OLS* minimizes the errors to the square $\{S_n[\hat{\beta}(\alpha_0), \hat{\gamma}(\alpha_0)]\}$. If we add, step by step, the distinct values of absorption capacity (α_i), we can identify the α_i that generate minimums in the sum of the square's errors. That is to say, we will look for the following thresholds:

$$\hat{\alpha} = \arg\min_{\alpha} S(\alpha) \qquad (4)$$

Having identified the possible thresholds we need to determine how many α we should incorporate into equation (3). To this end, we propose the following null hypothesis:

$$H_0: \gamma_1 = \gamma_2$$

In accordance with the contrast method developed by Hansen (1996, 2000), we propose three steps to contrast the null hypothesis and determine the adequate number of thresholds:

First. Estimate the threshold model (3) and use the errors $(\hat{\mu}_{it})$ to obtain the Lagrange Multiplier (LM) test statistic under the null hypothesis of no threshold effects, the result we designate LM^*.

Second. Estimate a panel data model with fixed threshold effects without restrictions, with the following linear equation:

$$Logs\ \Delta TFP_{it}^{'} = \beta_0 + \beta_1^{'} X_{it-1} + \gamma_1^{'} FDI_{ijt-1} + \mu_{it}^{'}$$

where $\mu_{it}^{'}$ permits us to obtain the Lagrange multiplier (LM) test statistic under the null hypothesis of no threshold affects, the result we designate $LM^{'}$.

Third. Generate through the bootstrapping technique[7], repeating steps one and two, the statistics $LM^{'}$ and LM^{*}.

To reject the null hypothesis $H_0\colon \gamma_1 = \gamma_2$ means to confirm that $LM^{'} > LM^{*}$, for this the Likelihood Ratio Test (LR)[8] is used:

$$LR_n(\alpha) = n\frac{S_n(\alpha) - S_n(\hat{\alpha})}{S_n(\hat{\alpha})}$$

We repeat the procedure progressively incorporating additional thresholds until the LR Test ceases to be significant. However, in the threshold model $LR_n(\alpha)$ is not distributed as a chi-square, for this Hansen (2000) derives the function of adequate distribution. The homoscedasticity has been verified according to the procedure developed by Hansen (2000).

4. Database, variables and statistics

The Survey on Business Strategies (ESEE) has been the main source of information used in the estimation of the models, previously used in Studies that analyse the effect of inward FDI on productivity (Barrios and Strobl 2002, Barrios et al. 2004, Castellani and Zanfei 2002). Temporal variability covers the period between 1993 and 2006. As such, the sample incorporates 2,274 of 4,357 initial companies, of which 1,790 are domestic and 484 are MNCs; with these we configure our incomplete pool.

For the estimation of productivity at company level we use the production function $y_{it} = f(l_{it}, m_{it}, k_{it}, r_{it}, TFP_{it})$ with four inputs. Where y_{it} represents the production of company *i* at the time *t*, l_{it} is determined by the cost of work factor, m_{it} the consumption of intermediate goods, k_{it} is the endowment of capital measured by the countable value of the fixed asset and r_{it} represents the endowment of intangible assets, determined by the sum of expenditure on R&D and publicity (Girma 2005).

The Cobb-Douglas function is used to estimate the production function, the variables incorporated into the model are expressed in logarithms:

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_m m_{it} + \beta_k k_{it} + \beta_r r_{it} + TFP_{it} + \partial D_t + f_i + v_{it} \qquad (6)$$

where D_t represents the dummies that capture macroeconomic shock and f_i is the specific fixed effect of the company.

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[7] A bootstrap with 1000 distinct samples has been used.

[8] The estimation of the LR statistic demands an asymptotic behaviour of the LM estimates

The control variables used (X_{it}) are:

- Age of the company expressed in years of age
- Exportation intensity defined as the volume of exports divided by the level of sales of company *i*
- Penetration of imports defined as the volume of imports of sector *j*, divided by production plus the difference between imports and exports of sector *j*
- Concentration of the market share of sector *j* measured by the Herfindhal index, calculated by the following expression:

$$Herf = \sum_{i=1}^{N} S_i^2 \qquad (7)$$

where S_i^2 is the market share of company *i* and *N* is the total number of companies in sector *j*.

Absorption capacity defines the TFP of company i in *t-1* to *i*, divided by the maximum level of TFP* of sector *j* in *t-1*. That is to say:

$$ABC_{it} = \frac{TFP_{it-1}}{TFP_{jt-1}^{*}} \qquad (8)$$

The articles that have analysed the effects of inward FDI on the Spanish manufacturing industry through the survey of Business Strategy, define the presence of the MNC in sector j as the ratio between the number of people employed by the MNC in sector j and the total number of workers in this sector[9] (Barrios and Strobl 2002, Barrios et al. 2004, Castellani and Zanfei 2002). This measurement would be adequate if the sample were made up of production centres; however, the survey collects information at company level, many of which have a presence in several regions, this may introduce two biases into the proposed measure:

- If a company has subsidiaries in different regions, we incorporate a bias by allocating all employment to the region where the central headquarters are located.
- If a domestic company has subsidiaries in various regions, we incorporate a bias if we consider that its relationship with the MNC is limited to the region where the central headquarters are located.

[9] Gubler and Hamida (2009) show that this indicator is adequate to estimate the demonstration effect at intra-industrial level, but does not recognise either vertical effects or the transference of knowledge through the labour market.

Information is available concerning the regional location of subsidiaries, which allows, for each company, the estimation of its level of exposure to inward FDI $(\mathrm{IFDI}_{\mathrm{ijt}})$, for this we will follow the ensuing steps:

a. Estimate the level of employment for sector *j* and region *k*.

$$L_{jk} = \sum_{i=1}^{N_j} w_{jk} f_{ik} l_i \,, \forall i \in j$$

where l_i represents the number of employees of company *i*; f_{ik} is the percentage of subsidiaries that company *i* has in region *k*; w_{jk} represents the percentage of employment created at national level in sector *j* and in region *k*, estimated with the information supplied by the Industrial Survey of Companies performed by the National Institute of Statistics (INE) in Spain; N_j is the total number of companies in sector *j*. As such $w_{jk} f_{ik} l_i$ is a proxy for the number of employees that company *i* has in region *k*.

b. Estimate the inward FDI in sector *j* and in region *k*, using as a proxy the percentage of employment generated by MNCs in sector *j* and in region *k*:

$$IFDI_{jk} = \frac{\sum_{i=1}^{N_j} MNC_i \times w_{jk} f_{ik} l_i}{L_{jk}}, \forall i \in j$$

where MNC is a dummy variable that takes a value of 1 if the company is an MNC. We consider that a company is an MNC if 50% of its ownership is in the hands of a foreign company.

c. Calculate the level of exposure to inward FDI using the following expression

$$\mathrm{IFDI}_{\mathrm{ijt}} = Max\left(P \times IFDI_j\right)$$

where P is a vector that takes a value of 1 if the company has a presence in region *k*; $IFDI_j$ is a vector that collects for sector j the in region FDI for each of the regions.

In order to incorporate the effect of geographical distance, we estimate for each company *i* pertaining to sector *j*, the foreign presence in the regions in which it doesn't have establishments at time *t* $(\mathrm{OUTFDI}_{\mathrm{ijt}})$, for this we follow the ensuing steps:

a. Estimate the outside FDI that retrieves the presence of the MNC in sector *j* outside of region *s*, using the weighted sum of the inward FDI of the remaining regions other than *s*, the square of the distances between the capital of region *s* and region *k* being the weighting factor.

$$\mathrm{OUTFDI}_{js} = \sum_{k=1}^{K} \frac{FDI_{jk}}{d_{ks}^2} \ \forall\, k \neq S \qquad (9)$$

where $\mathrm{d}_{\mathrm{ks}}^2$ is the square distance between the capitals of the regions..

b. If a company *i* has establishments in various regions, the presence of the outside FDI will be distinct in each of the regions, as such the effect will be determined by that region in which the stated presence is the greatest, that is to say:

$$\mathrm{OUTFDI}_{\mathrm{ijt}} = Max\left(P \times OUTFDI_{js}\right)$$

where $\mathrm{OUTFDI}_{\mathrm{j}}$ is a vector that collects for sector j the outside FDI of each of the regions.

Finally, note that although some studies show that to estimate accumulated time averages as a temporary variable provide better results in the estimated parameters (Pesaran y Smith 1995); we decided to estimate with annual variability for two reasons: Firstly, in our sample of companies we do not have sufficient temporal data for all the entities, approximately more than 70% do not have information for 9 years, meaning that our limitation of using averages between our temporal horizon is large. On the other hand, Baltagi and Griffin (1997) show that to increase the data pool to incorporate temporal variability, mitigates the possible biases caused by individual heterogeneity over time[10].

5. Estimation Results

We decided to divide the sample between MNC and domestic companies, as it can be expected that both the control variables and absorption capacity could have different effects on both types of companies. In any case, we will discuss the results obtained with each of the methodological approaches (linear model, quadratic model, endogenous threshold model), with all the samples and both groups.

[10] For an application on the effects of FDI, see Baltagi, Egger and Pfaffermayr (2007).

The linear model

The coefficients of TFP and absorption capacity are significant and negative, for all of the samples used, which confirms the idea of convergence. The companies with less absorption capacity are those that have experienced greater productivity growth, these results coincide with those obtained by Girma (2005) and Griffith et al. (2002). Neither age nor export propensity affect TFP growth. The concentration of competition is in all cases significant and has a negative sign, which is consistent with the evidence offered for the United Kingdom (Girma 2005, Nickell 1996). However, it does not coincide with the results of Barrios and Strobl (2002), who obtain a positive sign for a sample of Spanish companies for the period between 1990 and 1998. Possibly structural transformation experienced by the Spanish market justifies the change of sign (See Table 1).

The increase in competition arising from intensification of imports has a positive effect on TFP for domestic companies but not for MNCs, because for these companies the market is wider than the domestic market (Barrios and Strobl 2002). However, export activity has no significant impact on any of the groups analysed (See Table 1).

The coefficient that we obtain for in region FDI is negative and its interaction with absorption capacity is positive. The value of the coefficients allows us to propose that the presence of the MNC would create a crowding out effect for all companies that have an absorption capacity of less than 0.78, at which point we would get a positive spillover. However, when we divide the sample between domestic and MNC, the effects are no longer significant. These results confirm that the high heterogeneity between domestic and MNC companies justifies the need to work with two separate samples.

The Quadratic model

The results obtained in the quadratic model for in region FDI, show us that for the full sample the relationship between learning capacity and spillover is positive and intensifies with increasing learning capacity. When we divide the sample between domestic and MNC companies, this relationship is not maintained. In the case of domestic companies we did not find statistically significant relationships. However, for MNCs a U shaped relationship between absorption capacity and spillover was obtained, in which all effects are negative. Again, the need to divide the sample between MNC and domestic companies is confirmed.

Table 1 FDI spillovers and absorptive capacity: linear interaction model

VARIABLES	***All sample***		***Domestic Firms***		***Multinational Firms***	
	Without industry dummies	***With industry dummies***	***Without industry dummies***	***With industry dummies***	***Without industry dummies***	***With industry dummies***
Constant	0.708***	0.704***	0.702***	0.694***	0.717***	0.728***
	(0.017)	(0.017)	(0.018)	(0.019)	(0.050)	(0.052)
TFP	-0.598***	-0.600***	-0.604***	-0.605***	-0.569***	-0.571***
	(0.021)	(0.021)	(0.024)	(0.024)	(0.047)	(0.047)
Age	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Herfindahl Index	-0.083*	-0.072	-0.094*	-0.080	-0.081	-0.091
	(0.045)	(0.047)	(0.052)	(0.055)	(0.085)	(0.094)
Export Intensity	-0.015	-0.018	-0.021	-0.023	-0.006	-0.014
	(0.012)	(0.012)	(0.015)	(0.016)	(0.020)	(0.020)
Imports Penetration	0.030***	0.030***	0.041***	0.042***	0.003	0.006
	(0.011)	(0.011)	(0.013)	(0.013)	(0.021)	(0.021)
Abosortive Capacity (ABC)	-0.162***	-0.160***	-0.148***	-0.144***	-0.178**	-0.188**
	(0.033)	(0.024)	(0.037)	(0.037)	(0.086)	(0.086)
IFDI	-0.076**	-0.074*	0.004	0.007	-0.108	-0.107
	(0.006)	(0.006)	(0.048)	(0.048)	(0.087)	(0.087)
IFDI * ABC	0.096**	0.093**	0.007	0.004	0.109	0.106
	(0.047)	(0.047)	(0.058)	(0.058)	(0.106)	(0.107)
OUTFDI	0.022	0.023	0.058**	0.061**	-0.053	-0.056
	(0.023)	(0.023)	(0.028)	(0.028)	(0.041)	(0.041)
OUTFDI * ABC	-0.026	-0.026	-0.074**	-0.075**	0.066	0.074
	(0.028)	(0.028)	(0.028)	(0.034)	(0.049)	(0.050)
Mean ABC (%)	80.6		80.6		80.7	
Adj R2	0.42	0.43	0.43	0.43	0.37	0.37
Obsv	9950	9950	7825	7825	2125	2125
Sample	1993-2006	1993-2006	1993-2006	1993-2006	1993-2006	1993-2006
DW	2.107	2.106	2.121	2.124	2.231	2.214

*Significant at 10%; *significant at 5%; **significant at 1%***

Table 2 FDI spillovers and absorptive capacity: quadratic interaction model

VARIABLES	*All sample*		*Domestic Firms*		*Multinational Firms*	
	Without industry dummies	*With industry dummies*	*Without industry dummies*	*With industry dummies*	*Without industry dummies*	*With industry dummies*
Constant	0.793***	0.788***	0.705***	0.696***	1.798***	1.872***
	(0.101)	(0.102)	(0.115)	(0.115)	(0.355)	(0.357)
TFP	-0.602***	-0.604***	-0.607***	-0.608***	-0.552***	-0.555***
	(0.021)	(0.021)	(0.024)	(0.024)	(0.047)	(0.048)
Age	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Herfindahl Index	-0.089**	-0.077*	-0.100*	-0.084	-0.074	-0.079
	(0.045)	(0.047)	(0.052)	(0.055)	(0.085)	(0.093)
Export Intensity	-0.014	-0.017	-0.020	-0.022	-0.004	-0.012
	(0.012)	(0.012)	(0.015)	(0.016)	(0.020)	(0.020)
Imports Penetration	0.031***	0.031***	0.042***	0.043***	0.004	0.008
	(0.011)	(0.011)	(0.013)	(0.013)	(0.021)	(0.021)
Abosortive Capacity (ABC)	-0.371	-0.367	-0.154	-0.145	-2.886***	-3.052***
	(0.253)	(0.254)	(0.285)	(0.286)	(0.887)	(0.893)
ABC Square	0.134	0.133	0.007	0.003	1.657***	1.754***
	(0.159)	(0.160)	(0.180)	(0.180)	(0.546)	(0.550)
IFDI	-0.055	-0.045	0.262	0.256	-1.728***	-1.750***
	(0.229)	(0.229)	(0.295)	(0.295)	(0.575)	(0.576)
IFDI * ABC	0.046*	0.025**	-0.638	-0.621	4.115***	4.166***
	(0.573)	(0.574)	(0.739)	(0.740)	(1.421)	(1.422)
IFDI * ABC Square	0.031**	0.041	0.402	0.389	-2.456***	-2.490***
	(0.359)	(0.359)	(0.463)	(0.740)	(0.877)	(0.878)
OUTFDI	0.363**	0.350**	0.435**	0.417**	0.399*	0.393*
	(0.153)	(0.153)	(0.201)	(0.201)	(0.233)	(0.233)
OUTFDI * ABC	-0.889**	-0.852**	-1.024**	-0.972*	-1.054*	-1.041*
	(0.382)	(0.383)	(0.502)	(0.503)	(0.584)	(0.585)
OUTFDI * ABC Square	0.541**	0.519**	0.595*	0.562*	0.690*	0.688*
	(0.239)	(0.239)	(0.313)	(0.314)	(0.366)	(0.367)
Adj R2	0.42	0.42	0.43	0.43	0.37	0.38
Obsv	9950	9950	7825	7825	2125	2125
Sample	1993-2006	1993-2006	1993-2006	1993-2006	1993-2006	1993-2006
DW	2.111	2.110	2.121	2.128	2.232	2.216

*Significant at 10%; *significant at 5%; **significant at 1%***

The Threshold Model

The threshold model estimation for the total sample identifies three threshold values (43.8%, 52.3% y 80.5%), in the same way, we appreciate that the quantity is reduced to a threshold when working with domestic companies, expanding to two in the case of the sample for MNCs (See Table 3).

Table 3

Test for Threshold Effects: P-value from LM Tests

VARIABLES	***All Sample***		***Domestic Firms***		***Multinational Firms***	
	P-value	***Thresholds***	***P-value***	***Thresholds***	***P-value***	***Thresholds***
Single Threshold	0.071*	43.8% (36.4-51.2%)	0.002***	81.0% (73.6-87.9%)	0.001***	79.2% (71.8-86.1%)
Double Threshold	0.002***	52.3% (40.2-59.3%)	0.289		0.001***	90.1% (82.7-97.5%)
Triple Threshold	0.005***	80.5% (71.4-89.6%)			0.221	

Note: Confidence intervals (based on the model with industry dummies) in threshold models need not be symmetric.

The model of three thresholds used for the entire sample, shows that smaller companies with smaller asset endowments are those that benefit most from in region FDI. The companies with average productivity would suffer a crowding out effect, and the most advanced firms would generate positive spillover, although of a lesser intensity. This may be the consequence of integrating, in the same sample, domestic and MNC companies, which have a high degree of heterogeneity, In fact the separation of both types of companies into two samples, allows us to obtain more coherent results.

The threshold model estimated for domestic companies shows that in region FDI has a positive effect on the productivity of domestic companies with a high absorptive capacity ($\hat{\alpha}_1$ >81.0%). The regional FDI generates negative spillover between domestic enterprises of medium and low absorption capacity ($\hat{\alpha}_1$ <81.0%). It is the first time that negative spillovers have been verified for the Spanish case. It is possible that increasing competitive pressure from the attractiveness of the Spanish market is causing a crowding out effect between less productive domestic companies. That is to say, we confirm that the technological gap causes the more productive companies to be the generators of spillover, and the rest to be adversely affected.

Similar effects are identified for MNCs. The intensification of competition associated with the presence of the MNC generates positive spillover between MNCs with high technological asset endowment. Specifically, those that are almost on the technological frontier ($\hat{\alpha}_2 > 90.1\%$), are those that generate greater spillover. In the same way, those MNCs that have low absorption capacity are adversely affected by in region FDI. These results do not coincide with those presented by Barrios and Strobl (2002), in which significant spillovers for MNCs with presence in Spain are not identified. This evidence may be a consequence of a more mature domestic market, and the ensuing increase in competition. The obtained results are consistent with Wang and Blomström's model (1992), where they conclude that spillovers do not only depend on the level of presence of the MNC, but are also subject to the conditions of company investment decisions. In this sense, the greater the investment in technology by the MNC, the more valuable the knowledge that it can potentially contribute to the Spanish economy will be, since the magnitude of the spillover depends in turn on the technological effort made by the Spanish company, which is necessary to absorb knowledge. We also have a second order effect related to competition, spillovers mean improved business competitiveness, both in local companies, and in the MNCs with which they compete; the competitive advantage of the MNC is eroded and it is forced to import new technology to maintain its market share. From this, the generation of a virtuous circle that can contribute to the technological convergence of the Spanish economy could be inferred.

Outside region FDI generates spillovers with signs identical to those described for in region FDI, and of lesser intensity[11]. From this we can infer that geographical proximity is a determining factor for the transfer of knowledge, as evidenced by the work of Girma (2005), Resmini and Nicolini (2007) and Barrios et al. (2006).

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[11] If the coefficients obtained for the sample of domestic companies are compared, it is revealed that the negative spillovers caused by MNCs from outside region is 2.79 times lower than those generated by MNCs located in the same region, and in the case of positive spillover the ratio is 4.82 times. The comparison of the coefficients obtained for the sample of MNCs show similar results.

Table 4 FDI spillovers and absorptive capacity: threshold regression estimates

VARIABLES	*All sample*		*Domestic Firms*		*Multinational Firms*	
	Without industry dummies	*With industry dummies*	*Without industry dummies*	*With industry dummies*	*Without industry dummies*	*With industry dummies*
Constant	0.773***	0.762***	0.781***	0.771***	0.793***	0.780***
	(0.010)	(0.011)	(0.012)	(0.013)	(0.021)	(0.024)
TFP	-0.650***	-0.650***	-0.673***	-0.674***	-0.644***	-0.642***
	(0.018)	(0.018)	(0.021)	(0.021)	(0.036)	(0.036)
Age	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Herfindahl Index	0.001	0.022	-0.049	-0.023	-0.018	-0.051
	(0.039)	(0.041)	(0.046)	(0.048)	(0.067)	(0.074)
Export Intensity	-0.017	-0.015	-0.015	-0.016	-0.014	-0.011
	(0.010)	(0.011)	(0.013)	(0.014)	(0.016)	(0.016)
Imports Penetration	0.025***	0.026***	0.024**	0.025**	0.032*	00.032*
	(0.009)	(0.009)	(0.011)	(0.011)	(0.016)	(0.016)
Abosortive Capacity (ABC)	-0.185***	-0.182***	-0.166***	-0.163***	-0.207***	-0.206***
	(0.023)	(0.023)	(0.028)	(0.028)	(0.041)	(0.042)
IFDI						
$I\,(ABC < \hat{\alpha}_1)$	3.958**	3.998**	-0.074***	-0.074***	-0.096***	-0.096***
	(1.688)	(1.687)	(0.008)	(0.008)	(0.012)	(0.012)
$I\,(\hat{\alpha}_1 \leq ABC < \hat{\alpha}_2)$	0.939**	0.935**			0.036***	0.036***
	(0.439)	(0.439)			(0.012)	(0.012)
$I\,(\hat{\alpha}_2 \leq ABC < \hat{\alpha}_3)$	-0.076***	-0.076***				
	(0.007)	(0.007)				
$I\,(ABC > \hat{\alpha}_3)$	0.074***	0.074***	0.094***	0.092***	0.117***	0.116***
	(0.007)	(0.007)	(0.008)	(0.008)	(0.017)	(0.017)
OUTFDI						
$I\,(ABC < \hat{\alpha}_1)$	-2.142***	-2.172***	-0.026***	-0.024***	-0.003	-0.002
	(0.708)	(0.708)	(0.006)	(0.006)	(0.007)	(0.007)
$I\,(\hat{\alpha}_1 \leq ABC < \hat{\alpha}_2)$	-1.231***	-1.238***			0.003	0.005
	(0.404)	(0.404)			(0.007)	(0.007)
$I\,(\hat{\alpha}_2 \leq ABC < \hat{\alpha}_3)$	-0.021***	-0.019***				
	(0.005)	(0.005)				
$I\,(ABC > \hat{\alpha}_3)$	0.016***	0.018***	0.019***	0.022***	0.036***	0.038***
	(0.004)	(0.005)	(0.006)	(0.006)	(0.012)	(0.012)
$\hat{\alpha}_1$	43.8%	43.8%	81.0%	81.0%	79.2%	79.2%
$\hat{\alpha}_2$	52.3%	52.3%			90.1%	90.1%
$\hat{\alpha}_3$	80.5%	80.5%				
Adj R2	0.57	0.57	0.57	0.57	0.61	0.61
Obsv	9950	9950	7825	7825	2125	2125
Sample	1993-2006	1993-2006	1993-2006	1993-2006	1993-2006	1993-2006
DW	2.063	2.068	2.076	2.079	2.167	2.169

*Significant at 10%; *significant at 5%; **significant at 1%***

6. Conclusions

The demonstration effect allows the transfer of knowledge from MNCs to domestic companies with a corresponding effect on productivity. This flow is determined by both absorption capacity and geographical proximity. In this sense, Girma (2005) suggests a U shaped relationship between the learning capacity of the domestic company, and the intensity of spillover associated with inward FDI. Taking into account that economic and institutional development influence the generation of spillover (Meyer and Sinani 2009), the issue was raised as to what extent the technological gap in an economy determines this relationship.

Companies that are close to the domestic technological frontier in economies that have a technological gap, would be classified as medium technology companies at international level. Therefore, MNC companies are liable to provide knowledge generating productivity gains. Also, smaller companies with a lesser learning capacity will see their productivity reduced by the intensification of competition.

The Spanish economy is characterised as a developed economy that has a technological gap with respect to more advanced economies. It has also been a major recipient of FDI at world level, in fact we have estimated that 43% of employment in the manufacturing industry is generated by MNCs, and in some sectors such as the chemical industry, the ratio reached 85%. Therefore, we consider that the conditions are meet to contrast the hypotheses raised in this paper

A sample of 2,274 firms, of which 1,790 are domestic and 484 MNC, has been used for a time period between 1993 and 2006. With the objective of avoiding bias that is incorporated by the use of data from companies instead of production units in the estimation of inward FDI, a proxy is proposed that considers the geographic location of subsidiaries.

We contrast the existence of differential effects of inward FDI on total factor productivity (TFP), in terms of absorption capacity and geographical distance. Specifically, the threshold model in the manufacturing sectors estimated for domestic companies, provides evidence that in region FDI has a positive effect on the productivity of domestic companies with a high absorptive capacity ($\hat{\alpha}_1$ >81.0%). By contrast, the effect becomes negative for domestic companies of medium and low absorption capacity ($\hat{\alpha}_1$ <81.0%). These results confirm the hypothesis proposed on the effects derived from the technological gap in the relationship established between absorption capacity and spillover.

MNCs that have high absorptive capacity benefit from in region FDI, in contrast, those with low capacity lose competitiveness. This demonstrates a high degree of competition in the domestic market. In accordance with the model of Wang and Blömstrom (1992), spillovers depend not only on the level of presence of MNCs, but are also conditional upon the investment decisions of companies. In this sense, the greater the investment in technology by the MNC, the more valuable the knowledge that can potentially contribute to the Spanish economy will be, provided that it is invested in knowledge generation. In addition, we have a second order effect related to competition; spillovers signify an improved competitiveness, in both local companies and the MNCs with which they compete, eroding the competitive advantage of the MNC and forcing it to import new technology in order to maintain its market share. From this we could infer the generation of a virtuous circle, which can contribute to the technological convergence of the Spanish economy.

Outside region FDI generates spillovers with signs identical to those described for in region FDI, and with lower intensity, for both domestic companies and for MNCs. From this we can infer that geographic proximity is a determining factor for the transfer of knowledge, as evidenced by the work of Girma (2005), Resmini and Nicolini (2007) and Barrios et al. (2006).

References

Adsera, A. (2000). “Sectoral spillovers and the price of land: a cost analysis”, Regional Studies and Urban Economics, Vol. 30, pp. 565–585.

Aitken, B. J. and Harrison, A. E. (1999). “Do domestic firms benefit from direct foreign investment? Evidence from Venezuela”, American Economic Review, Vol. 89, pp. 605–618.

Arellano, M. and Bover, O. (1990). “The econometric of Panel Data” Investigaciones Económicas, Vol. XIV, Nº1, pp. 3-45.

Baltagi, B. H. and Griffin, J. M. (1997). “Pooled estimators versus their heterogeneous counterparts in the context of the dynamic demand for gasoline” Journal of Econometrics, Vol. 77, pp. 303–327.

Baltagi, B. H., Egger, P. and Pfaffermanyr, M. (2007). “Estimating models of complex FDI: Are ther third-countrý effects?” Journal of Econometrics, Vol. 140, pp. 260–281.

Barrios, S. and E. Strobl (2002), “Foreign direct investment and productivity spillovers: evidence from the Spanish experience”, Review of World Economics /Weltwirtschaftliches Archiv, Vol. 138, pp. 459-481.

Barrios, S., Dimelis, S., Louri, H. and Strobl, E. (2004), “Efficiency Spillover from Foreign Direct Investment in the EU Periphery: A Comparative Study of Greece, Ireland and Spain”, Review of World Economics, 140(4): 689-705.

Ben Hamida, L. (2007). “Inward Foreign Direct Investment and Intra-Industry Spillovers: The Swiss Case. Ph.D. dissertation. Switzerland”, University of Fribourg.

Ben Hamida, L and Gugler, P. (2009). “Are There Demonstration-Related Spillovers From FDI? Evidence From Switzerland”, Social Science Research Network.

Blomström, M. and Kokko, A. (1998). “Multinational corporations and spillovers”, Journal of Economic Surveys, Vol. 2, pp. 247–277.

Blomstrom M., Sjoholm F. (1999) “Technology Transfer and Spillovers: Does Local Participation with Multinationals Matter?”, European Economic Review, 43, 915-23.

Campa, J.M. and Guillen, M.F. (1996). “Spain: A boom from economic integration. John H. Dunning, Rajneesh Narula, eds. Foreign Direct Investment, and Governments”. Routledge, New York. 207-239.

Castellani, D. and Zanfei, A. (2002) “Multinational companies and productivity spillovers: is there a specification error?” Working paper, Version # 1.2, February 2002.

Cohen, W. M. and Levinthal, D.A. (1989). “Innovation and learning: the two faces of R&D”, Economic Journal, Vol. 99, pp. 569–596.

Cohen, W.M. and Levinthal, D.A. (1990). “Absorptive capacity: A new perspective on learning and innovation” Administrative Science Quarterly 35(1): 128-52.

Chernozhukov, V., Fernandez-Val, I. and Newey, W. (2009). “Quantile and Average Effects in Nonseparable Panel Models” MIT, Boston University, MIT.

Criscuolo, P. and Narula, R (2008) “A novel approach to national technological accumulation and absorptive capacity: aggregating Cohen and Levinthal”, The European Journal of Development Research, 20 (1): 56-73.

Damijan, J.P., Knell, M., Majcen, B., and Rojec, M. (2003). “The role of FDI, R&D accumulation and trade in transferring technology to transition countries: Evidence from firm panel data for eight transition countries” Economic Systems 27(2): 189-204.

De Mello, L.R: (1997). “Foreign direct investment in developing countries and growth: A selective survey”, The Journal of Development Studies, 1997, 34, 1, 1-34.

Driffield, N. and Love, J. (2002). “Does the Motivation for Foreign Direct Investment Affect Productivity Spillovers to the Domestic Sector?” Working Paper RP2002. Aston Business School.

Dunning, J.H. (1988). “The eclectic paradigm of international production: A restatement and some possible extensions” Journal of International Business Studies 19(1): 1-31.

Findlay, R. (1978). “Relative backwardness, direct foreign investment, and the transfer of technology: a simple dynamic model” Quarterly Journal of Economics, Vol. 92, pp. 1–16.

Fosfuri, A., Motta, M. and Thomas, R. (2001). “Foreign direct investment and spilloversthrough workers’ mobility” Journal of International Economics, Vol. 53, pp. 205–222.

Girma, S. (2005). “Absorptive Capacity and Productivity Spillovers from FDI: A Threshold Regression Analysis” Oxford Bulletin of Economics and Statistics, 67, 3 (2005) 0305-9049.

Girma, S. and Görg, H. (2005). “Foreign Direct Investment, Spillovers and Absorptive Capacity: Evidence from Quantile Regressions” Deutsche BundesBank, Discussion Paper Series 1: Economic Studies No 13 Oxford Bulletin of Economics and Statistics, 67, 3 (2005) 0305-9049.

Girma, S. and Görg, H. (2007). “Evaluating the foreign ownership wage premium using a difference-in-differences matching approach”, Journal of International Economics, Vol.72 (1), pp. 97-112.

Girma, S.; Wakelin, K. (2007). “Local Productivity Spillovers from Foreign Direct Investment in the U.K. Electronics Industry”, Regional Science and Urban Economics, forthcoming 2007.

Görg, H. and Strobl, E. (2005). “Spillovers from foreign firms through worker mobility: An empirical investigation”, Scandinavian Journal of Economics, 107, pp. 693-709.

Granger, C. and Teräsvirta, T (1993). “Modeling Nonlinear Economic Relationships”. Oxford: Oxford University Press.”

Greene, W.H. (1999). “Econometric Analysis” Prentice Hall, Cap. 4, 5 y 11.

Griffith, R., Redding, S. and Simpson, H. (2002). “Productivity Convergence and Foreign Ownership at the Establishment Level” IFS Working Paper WP02/22.

Haggan,V. and Ozaki,T (1981). “Modeling nonlinear vibrations using an amplitude-dependent autoregressive time series model”. Biometrika 68, 189-96.

Hansen, B.E. (1996). “Inference When a Nuisance Parameter is Not Identified Under the Null Hypothesis” Econometrica, Vol.64, No.2 (Mar 2000). pp. 413-430.

Hansen, B.E. (2000). “Sample Splitting and Threshold Estimation” Econometrica, Vol.68, No.3 (May 2000). pp. 575-603.

Hanson, G.H. (2001). “Should Countries Promote Foreign Direct Investment?” Discussion Paper Series, United Nations Conference on Trade and Development.

Hymer, S. H. (1976). “The International Operations of National Firms: A Study of Direct Foreign Investment” MIT Press, Boston, MA.

Jaffe, A.B. and Trajtenberg, M. (2002) “Patents, Citations and Innovations: A Window on the Knowledge Economy”, Cambridge, MA: MIT.

Kinoshita, Y. (2000). “R&D and Technology Spillovers via FDI: Innovation and Absorptive Capacity”, WDI Working Paper, 349.

Koenker R. and Basset, G. (1978). “Regression Quantiles” Econometrica, Econometric Society, vol. 46(1), pages 33-50.

Kokko, A. (1994), “Technology, market characteristics, and spillovers” Journal of Development Economics, Vol. 43, p. 279-293.

Kokko, A. (1996). “Productivity spillovers from competition between local firms and foreign affiliates” Journal of International Development 8(4): 517-530.

Kokko, A., R. Tansini and M.C. Zejan (1996). “Local technological capability and productivity spillovers from FDI in the Uruguayan manufacturing sector” Journal of Development Studies, Vol. 32, pp. 602-611.

Kugles, M. (2006). “Spillovers from foreign direct investment: Within or between industries?”, Journal of Development Economics 80 (2006) 444-477.

Kumar, N. (1996). “India: industrialization, liberalization and inward and outward foreign direct investment”, in J. Dunning and R. Narula (eds.) Foreign Direct Investment and Governments, London: Routledge.

Lipsey, R. (2002). "Home and Host Country Effects of FDI" NBER Working Papers 9293, National Bureau of Economic Research, Inc.

Meyer, Klaus E. and Sinani, Evis (2009). “Where and When Does Foreign Direct Investment Generate Positive Spillovers? A Meta Analysis” Journal of International Business Studies, 40(7): 1075-1094.

Nakamura, T. (2002). “Foreign investment, technology transfer, and the technology gap: A note”, Review of Development Economics, Vol. 6 pp.39 - 47.

Narula, R., and Marin, A. (2003). “FDI spillovers, absorptive capacities and human capital development: Evidence from Argentina”. Working Paper, No. 2003-016, Maastricht Economic Research Institute on Innovation and Technology, The Netherlands

Nickell, S. (1996). “Competition and corporate performance” Journal of Political Economy,Vol. 104, pp. 724–746.

Pesaran, M. H. and Smith, R. (1995). “Estimating long-run relationship from dynamic heterogeneous panels” Journal of Econometrics, Vol. 68, pp. 79–112.

Resmini, L. and Nicolini, M. (2007). “Productivity Spillovers and Multinational Enterprises: in Search of a Spatial Dimension”, Papers DYNREG10, Economic and Social Research Institute (ESRI).

Rodriguez-Clare, A., (1996). “Multinationals, linkages, and economic development”. American Economic Review 86, 852–873.

Saggi, K. (2006). “Preferential Trade Agreements and Multilateral Tariff Cooperation” International Economic Review, Vol. 47, No. 1, pp. 29-57, February 2006.

Smeets, R. (2008) “Collecting the Pieces of the FDI Knowledge Spillovers Puzzle” The World Bank Research Obs. 2008; 23: 107-138.

Tong, H. (1983). “Threshold Models in Nonlinear Time Series Analysis: Lecture Notes in Statistics”. 21, Berlin: Springer.

Tong, H. (1990). “Non-Linear Time Series: A Dynamical System Approach”. Oxford: Oxford University Press.

Wang, J.Y. and Blomström, M. (1992). “Foreign investment and technological transfer: a simple model” European Economic Review, Vol. 36, pp. 137–155.

Appendix

Table 1 FDI and OUTFDI Sectorial

(Percentage)

Comunidad Autónoma (Region)	FDI in region		FDI outside region	
	1993	2006	1993	2006
Andalucía	32.45	42.17	44.69	43.93
Aragón	47.39	64.17	53.49	50.98
Asturias	6.72	67.20	37.15	40.22
Balears Illes	9.19	20.29	47.74	43.32
Canarias	27.09	37.94	47.21	47.33
Cantabria	34.19	44.91	23.88	44.67
Castilla y León	48.55	22.15	50.36	40.01
Castilla - La Mancha	56.34	65.36	33.33	45.88
Cataluña	63.65	59.23	42.29	47.50
Comunitat Valenciana	45.40	31.66	47.48	50.24
Extremadura	37.23	36.07	44.04	47.08
Galicia	13.70	41.30	35.53	47.10
Madrid	54.23	38.40	50.48	56.26
Murcia	7.99	18.47	45.43	41.24
Navarra	56.20	68.77	31.49	46.47
País Vasco	16.35	43.36	46.10	49.30
Rioja	46.44	29.44	37.73	48.36

Table 2 Summary statistics of control variables

(Average)

Sector	Age		Abosortive Capacity		Exports Intensivity	
	1993	2006	1993	2006	1993	2006
Manufacture of meat	17,8	28,0	0,799	0,814	0,026	0,088
Food products, tobacco and drinks	29,5	36,0	0,805	0,813	0,074	0,115
Textiles and dressed	19,1	30,0	0,776	0,795	0,088	0,146
Leather and footwear	12,9	22,8	0,802	0,802	0,172	0,188
Manufacture of wood	13,4	21,4	0,780	0,811	0,045	0,057
Manufacture of paper	25,6	30,3	0,806	0,784	0,140	0,167
Publishing and printing	20,2	32,3	0,800	0,807	0,028	0,041
Manufacture of chemicals	33,5	39,2	0,795	0,806	0,154	0,264
Manufacture of rubber and plastic products	22,0	29,9	0,781	0,769	0,112	0,222
Manufacture of fabricated metal products	22,5	25,6	0,785	0,806	0,136	0,163
Manufacture of machinery	21,9	30,5	0,799	0,808	0,188	0,277
Motor vehicles and other transport equipment	26,8	31,2	0,789	0,784	0,290	0,387
Manufacture of furniture	13,8	20,8	0,752	0,826	0,082	0,090
Manufacturing n.e.c.	21,5	28,2	0,819	0,776	0,231	0,287
Total	**22,6**	**29,4**	**0,792**	**0,800**	**0,130**	**0,183**