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Evidence on the Determinants of Foreign Direct Investment. The Case of Three European Regions

L. Artige and R. Nicolini

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Abstract

This study aims at analyzing the determinants of foreign direct investment inflows for a group of European regions. The originality of this approach lies in the use of disaggregated regional data. First, we develop a qualitative description of our database and discuss the importance of the macroeconomic determinants in attracting FDI. Then, we provide an econometric exercise to identify the potential determinants of FDI inflows. In spite of choosing regions presenting economic similarities, we show that regional FDI inflows rely on a combination of factors that differs from one region to another.

Keywords: Foreign Direct Investment, Productivity, Regions.
JEL: F20, O18, R10.

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Corresponding author: Rosella Nicolini, Instituto de Análisis Económico, Campus de la UAB, 08193 Bellaterra (Barcelona), Spain. Ph. +345806612, Fax: +345801452. E-mail: rosella.nicolini@uab.es .

1. Introduction

Foreign direct investment[1] (FDI) flows in the world have rapidly grown since the 1990s and more rapidly than trade flows between countries. They accounted for approximately 1 per cent of world GDP before 1995 and between 2 to 4 per cent thereafter.[2] The large part of world FDI inflows goes to developed countries although the share of developing countries has been increasing since 2000 whereas most of outflows continue to originate from developed countries. Among the latter, the European Union has become by far the largest host economy and provider of FDI since 1980 reflecting the process of economic integration among its members.

FDI inflows have been considered favorably by an increasing number of countries that have multiplied financial and fiscal schemes to attract multinational enterprises on their soil (Hanson 2001). They are generally seen as a source of job creation and technological transfers bringing higher productivity in the host economy. At the same time, they are also widely perceived as an indicator of productivity performance of an economy. In other words, FDI inflows appear to be both a source and a consequence of productive efficiency. Hence this apparent virtuous circle fuels competition among countries to attract FDI. However, if the benefits of FDI continue to be debated, the conclusions about the fundamental determinants of FDI are not less controversial. The vast empirical literature that has developed so far has not provided conclusive evidence (Markusen, 2002).

The theoretical analysis of FDI determinants starts with the question why a firm should become multinational to sell in foreign countries. The firm could service foreign markets by only exporting its products. However, there are obstacles to exports such as tariffs, transport costs and exchange rate volatility. On the other hand, tax burden and the quality of institutions may deter a firm to set up a foreign plant (Barba Navaretti and Venables, 2004). These are the external determinants of

[1] Foreign direct investment is the capital transaction that a "direct investor" carries out in a foreign "direct investment enterprise" (affiliate) to obtain a lasting interest in this foreign firm and a significant degree of influence on its management. The threshold of 10%-or more-ownership of a firm's capital is in general required to be accounted for as a direct investment. Cross-border mergers and acquisitions have been a growing component of FDI flows in the recent past.
[2] See UNCTAD database: www.unctad.org

the firm's FDI decision-making. The firm could also sign a contract with a licensee to produce and sell its products. This alternative may not be satisfactory either because of the presence of firm-specific assets (technologies, managerial skills…) in the production line and agency costs with the licensee. These are the internal determinants of the firm's FDI decision-making.[3] In all these situations, FDI is a way to internalize trade costs and externalities from firm-specific assets. This analysis rests on partial equilibrium and hence leaves aside the relationship between the firm's decision making and other variables. Some effort has been realized to model FDI behavior in a general equilibrium framework but the enterprise has turned out to be challenging. These general equilibrium models typically distinguish two main motivations why a firm would like to make direct investments in foreign countries (Markusen 1984, Helpman 1984 and Shatz and Venables 2000). The first one is to avoid trade frictions (tariffs, transport costs…) to better serve the local market. This type of FDI is called "horizontal" or "market seeking" since it implies a duplication of production plants. The second motivation is to have access to lower-cost inputs. This type of FDI is called "vertical" or "production cost-minimizing" since there is fragmentation. The objective is to economize on production factors to maximize profits on each part of the production line. Based on a general equilibrium framework, Brainard (1997) finds that the ratio of US exports to the sum of affiliate sales and exports is inversely related to trade frictions and plant-level fixed costs giving credit to the "horizontal" motivation of FDI. During the same period, Markusen *et al.* (1996) and Markusen (1997) proposed a general equilibrium "knowledge-capital model" unifying the horizontal and vertical motivations of FDI decisions. Based on this model, Carr, Markusen and Maskus (2001) find empirical evidence for both types of motivations using a panel of bilateral country-level US outbound and inbound affiliate sales. Their results have been nevertheless questioned by Blonigen, Davies and Head (2003). Brainard (1993) finds little support for vertical motivation of FDI. Yet the vertical motivation seems to matter but only for a

[3] Internal determinants are more difficult to test since they are unobservable. Generally, R&D intensity and advertising intensity are used as proxies to identify firm-specific assets (see for instance Morck and Yeung 1992).

few manufacturing sectors, such as machinery and electronics, and for certain host countries (Hanson, Mataloni and Slaughter 2003, Feinberg and Keane 2001).

Due to the difficulty of building tractable general equilibrium models, the large body of empirical literature on FDI determinants is based on a partial equilibrium framework at the firm level and tests the macroeconomic determinants on FDI decisions. The data used are generally at industry level or at country level and, when it is available, at firm and plant level. We propose a brief review of this literature.[4] There is a lack of consensus on the effect of macroeconomic determinants on FDI except for market size. Measured by GDP or GDP per capita, market size seems to be the most robust FDI determinant supporting the horizontal model (e.g. among many others, Kravis and Lipsey 1982, Wheeler and Mody 1992, Billington 1999). The effect of trade barriers is found to be positive by Lunn (1980), negative by Culem (1988) and insignificant by Blonigen and Feenstra (1996). Trade openness is inversely related with FDI by Kravis and Lipsey (1982) and Culem (1988) while Wheeler and Mody (1992) found this determinant insignificant. Short-run movements in exchange rates are generally found to be associated with an increase in inward FDI (Froot and Stein 1991, Swenson 1994, Blonigen 1997). However, Lipsey (2001) shows that FDI flows are much more stable than other capital flows during severe exchange rate crises.

The effects of FDI determinants of the vertical model are even more debated. Labor cost is found to be positively related to FDI by Wheeler and Mody (1992) and Feenstra and Hanson (1997). The effect is negative for Culem (1988) and insignificant for Lucas (1993). The effect of taxes on FDI has been the subject of many papers with contradictory results. Hartman (1984) found a negative relationship between retained earnings FDI and the host country tax rate. Billington (1999) confirms the negative effect while Swenson (1994) found a positive effect and Wheeler and Mody (1992) concluded this determinant insignificant. Agglomeration (cluster of firms) effects signal high quality of infrastructure, human capital, specialization and also higher competition. These affect both

[4] For an extensive review of this literature see Caves (1996) and Blonigen (2005).

horizontal- and vertical-type FDI. They are found to be positive and highly significant for US FDI by Wheeler and Mody (1992).

Apart from methodological flaws, the lack of consensus in the literature may suggest that the relevance of FDI determinants may depend on location. Geographic specificity will not be identified at national or firm level. A regional standpoint may thus be more appropriate to signal location patterns. A few papers have appeared very recently with a regional focus. Crozet, Mayer and Mucchielli (2004) study the determinants of FDI location in the 92 French departments using plant-level data. Their results show that Paris and the regions near the frontiers are major recipients of FDI. The effects of market size and agglomeration are positive while it is negative for wages at plant level. Interestingly relative to the present paper, they aggregated their data by industry and found that the sign and the magnitude of the effects of these determinants typically depend on the sectors. Boudier-Bensebaa (2005) shows that FDI in a small country like Hungary are highly concentrated, in particular in the region around Budapest. Using aggregate FDI data at county level, she finds that unemployment rate (labor availability), local market size and agglomeration effects have a positive and significant effect on FDI location. However, the absence of data at industry level does not allow for a finer analysis.

The present paper follows this line of empirical investigation by testing macroeconomic determinants of FDI inflows. The originality of this work comes from its regional focus. We build a panel using data on FDI and potential determinants disaggregated at both regional and industry levels over the period 1995-2002. We selected three European regions (Baden-Württemberg, Catalunya and Lombardia) and six sectors. The choice of these three regions is motivated by the availability of comparable data and the existence of common characteristics among them. They do not have a capital city, belong to an association (Four Motors for Europe [5]) to develop all kinds of relations, and have close corporate tax rates (~35%),[6] which rules out tax competition as a FDI determinant across them.

[5] The fourth region is Rhône-Alpes (France). It has been excluded because there are no data available on regional FDI inflows for the period 1995-2003.
[6] Source: //www.taxpolicycenter.org

In addition, these regions are in the Euro-zone where many trade frictions have been eliminated. Thus, the number of potential discriminating FDI determinants among them is reduced.

The question we want to address is the following: do the determinants for the six sectors play a similar role across the three regions? If the answer is positive, then geographical idiosyncrasies, which exist across regions, do not matter for the location of FDI. Our results show that the answer is negative for all the determinants but market size. Therefore, there are local characteristics associated with the determinants at work. These may be limited in time and reflect a different stage of development of the regional economies. Yet they can be viewed as an evidence of a variety of patterns to attract FDI.

The remaining of the paper is organized as follows. In Section 2, we provide a brief overview of the FDI trends of the three regions. In Section 3, we propose some descriptive statistics on potential FDI determinants. Then, in Section 4, we run a few econometric estimations to quantify statistically the determinants of FDI by regions. Section 5 concludes.

2. Foreign direct investment in three European regions: Baden-Württemberg, Catalunya and Lombardia

In our sample of regions, the performance of FDI inflows per capita is the highest in Baden-Württemberg and the lowest in Catalunya. In particular, Catalunya underperformed in relative terms between 1999 and 2003. It seems that it did not fully take advantage of the euro context and the world FDI boom of this period. Before 1999 Lombardia did not attract more FDI inflows than Catalunya. After 1999 Lombardia experienced a net increase in FDI inflows following the world upward trend. Lombardia may have benefited from the euro-effect more than Catalunya. The euro meant for Italy currency and interest rate stability, an important criterion for foreign investors (Figure 1).

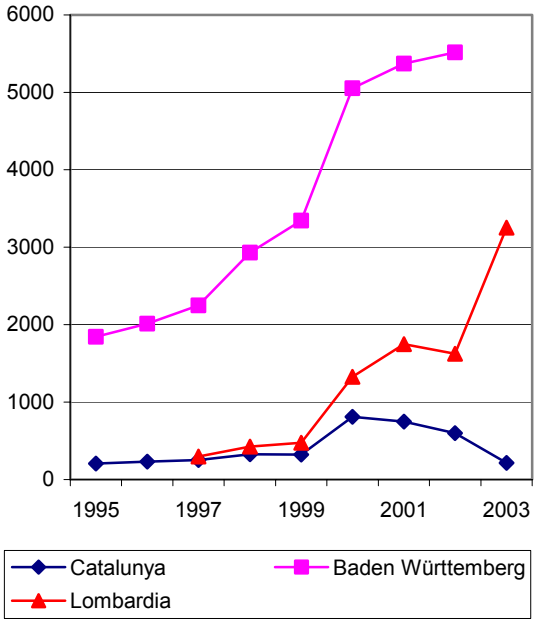

Figure 1: FDI inflows per capita
(Source: Regional Statistical Offices - Calculus: Authors)

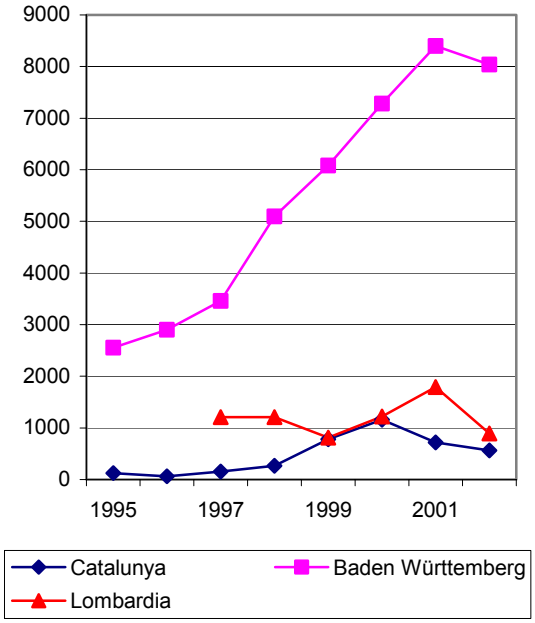

Figure 2: FDI outflows per capita
(Source: Regional Statistical Offices - Calculus: Authors)

We do not observe the same trend regarding FDI outflows (Figure 2). The performance of Catalunya and Lombardia remained roughly close over the period. The high rate of FDI outflows per capita in Baden-Württemberg confirms that Germany is one of the world's biggest investor in foreign countries with the United States and France.

The analysis of cumulative flows by sector reveals a few common trends and peculiarities, which bring information on the economic landscape of each region (Table 1 and 2). However, this analysis must be made with some care because sector data records the sector of the direct investor and not the sector of the investment destination. This is not a problem for most economic activities where the investor's sector and the sector of the investment destination are the same. There is one important exception: the *finance and credit* sector. This sector includes all banking activities. Banks often invest in foreign enterprises via resident non-banking holding companies. Hence, when the direct investor is a bank we are not able to track precisely in which sectors the bank finally invests. In fact, under the industrial breakdown recommended by the OECD and Eurostat, FDI realized by banks via financial holdings are recorded in the *Finance and credit* sector. This sector accounts for a large share of FDI

inflows in all regions, though to a lesser extent in Lombardia (17%). In Baden-Württemberg most of FDI inflows (70%) are realized by banks and other financial institutions while this share reaches 41% in Catalunya. Another sector that accounts for a large share of FDI inflows in all regions is the sector of *Other services* (real estate, transport, trade, hotel). The foreign firms belonging to this sector represent the second most important FDI provider in all regions (35% in Catalunya, 17% in Lombardia and 11% in Baden-Württemberg). The ranking of this sector reflects the predominance of services in the economy of rich entities. The last common trend that may be highlighted is the high share of *Traditional Manufacturing* in FDI outflows of all regions (35% in Catalunya, 12% in Baden-Württemberg and 35% in Lombardia). This is the first sector in Catalunya and Lombardia. In Baden-Württemberg, if we add this sector and *Machinery and Automotive*, the share climbs up to 30%. This shows the tendency of rich countries to offshore activities in these sectors.

On the other hand there are differences among the three regions. The cumulative FDI flows in Catalunya are dominated by two sectors, *Finance and credit* and *Other services,* which accounted for three quarter of FDI inflows and about 60% of FDI outflows over the period 1993-2003. The electrical, electronic and high tech industries have attracted 10% of FDI inflows. In Baden-Württemberg, 70% of cumulative FDI inflows are realized by financial institutions. This means that firms entering this market are, to a wide extent, banks and the investment operations are mostly acquisitions of domestic firms' shares. The distribution of cumulative FDI outflows is more balanced. The firms from this German region investing abroad belong to the sector of *Finance and Credit*, *Other services* and *Traditional Manufacturing* and *Machinery and Automotive*. In Lombardia, the distribution of cumulative FDI inflows reveals more diversified foreign investment and a predominance of manufacturing investments: 31% in *Traditional Manufacturing*, 16% in *Machinery and Automotive*, 10% in the electrical, electronic and high tech industries and 9% in *Chemical*. The sector of *Other services* do not represent a high share of cumulative FDI inflows and outflows. This

shows the high specialization of this region in industry. The Lombardian banks are nonetheless active abroad. The sector *of Finance and credit* accounts for 34% of cumulative FDI outflows.

[TABLE 1 ABOUT HERE]

[TABLE 2 ABOUT HERE]

[TABLE 3 ABOUT HERE]

3 Potential FDI determinants: some theory and descriptive statistics

The descriptive statistics on our three European regions show that most of the FDI inflows originate from countries belonging to the European Union (Table 3). Therefore, it is reasonable to consider that these FDI inflows are horizontal FDI.

3.1 A theoretical framework of analysis

According to Feenstra (2004) among others, *horizontal FDI* occurs if a firm chooses to produce in different countries with each plant selling locally to a market. In general, such a type of FDI requires that the revenues of producing and selling locally should offset the plant fixed costs. Horizontal FDI allows economies on transport costs and benefits from local production costs. Looking at the fundamental determinants, Markusen (2002) argues that there are two factors that turn out to be crucial for the existence of horizontal FDI: the size of the local markets and the marginal production cost in the case of producing directly in the host market. The first factor is evident: firms invest abroad to serve the local host market. Therefore, the size of the local demand (known also as market size or market potential) will be determinant for the firm's investment decision. The second factor, the level of local production costs, will determine whether the firm produces locally to sell locally or whether it supplies the host market by exporting its home-based production.

Following Feenstra (2004) and Markusen (2002), we develop a simple standard theoretical framework describing the determinants affecting the choice between exporting and investing (horizontal FDI) in a host economy. We consider such a decision process for a firm under monopolistic competition, i.e. the firm can fix its selling price by applying a mark-up over the production costs. Let us concentrate on the choice of exporting or investing in region *j* faced by a firm initially located in region *i*. The size of the mark-up relies on the elasticity of the demand ($\sigma>1$) the consumers address to the firm's supply. We model the utility function of consumers in region *j* with a CES (constant elasticity of substitution) function. If it exports from region *i* to region *j*, the firm incurs an iceberg transport cost equal to T_{ij}. We assume that the firm produces the output just by using labor input.

First, let us focus on the export option. When producing in region *i* and then exporting in region *j*, the firm faces the demand of the local consumers for a variety of the good it produces (c_{ij}) at prices p_{ij} ($p_{ij}= T_{ij}\, p$), namely the local price in region *j* is the level of prices in region *i* corrected by the transport cost, as:

$$c_{ij} = \left(\frac{p_{ij}}{P_j}\right)^{-\sigma}\left(\frac{Y_j}{P_j}\right), \qquad (1)$$

where Y_j is region *j*'s GDP and P_j refers to the overall price index defined as:

$$P_J = \left(\sum_{i=1}^{C} N_i \left(p_{ij}\right)^{1-\sigma}\right)^{1/1-\sigma}, \qquad (2)$$

and where N_j is the number of goods imported by region *j* and exported by each region $I = 1,..C$.

The unique input is labor and the correspondent production function is $L_i=\beta y_i$ with β, the marginal cost. Producing in region *i* and exporting in region *j* yields a revenue $p_{ij}\, c_{ij} = p_i\, y_i$ by which we derive $y_i = c_{ij}\, T_{ij}$ as the whole output for export. Each unit of labor is paid at wage w_i. In the export option, the total profits of exported quantities (for a firm) are equal to

$p_i\, y_i - w_i\, L_i$. By replacing the proper expressions, we get the total profits for export:

$$\pi_e = (p_i - w_i\beta)c_{ij}T_{ij.} \tag{3}$$

According to Dixit-Stiglitz (1977), by maximizing the profit function, the firm can fix the selling price as:

$$p_i\left[1 - \frac{1}{\sigma}\right] = \beta w_i, \tag{4}$$

and by replacing (4) into (3) we get the final expression for the profit when the firm decides to export from region *i* to region *j*:

$$\pi_e = \frac{1}{\sigma}\left(\frac{p_i T_{ij}}{P_j}\right)^{1-\sigma} Y_{j.} \tag{5}$$

When the firm settles in the final market rather then exporting, the production function changes, since building a plant in region *j* implies plant specific fixed costs (α). Therefore, when the firm makes a direct investment region *j*, the production function becomes $L_j = \alpha_j + \beta y_j$. For the sake of simplicity, we assume that the marginal cost of labor is equal in both regions, but fixed costs and wages can differ. In fact, when producing directly in the host region, the firm pays the workers the wage w_j. In the case of direct investment in region *j*, the demand for the variety of the good produced by the firm we are considering turns out to be:[7]

$$c_j = \left(\frac{p_j}{P_j}\right)^{-\sigma}\left(\frac{Y_j}{P_j}\right). \tag{6}$$

As before, the firm fixes the selling price by maximizing its profit function ($p_j y_j - w_j L_j$) as in Dixit-Stiglitz (1977), and it is equal to:

[7] There is no transport cost when producing and selling locally.

$$p_j\left[1-\frac{1}{\sigma}\right]=\beta w_j. \qquad (7)$$

Hence, the final profit that a firm obtains by investing directly in region *j* is the following:

$$p_j y_j - w_j\left(\beta y_j+\alpha_j\right)=\frac{1}{\sigma}\left(\frac{p_j}{P_j}\right)^{1-\sigma} Y_j - w_j\alpha_j. \qquad (8)$$

A firm will establish a plant in region *j* rather than exporting when the profit is higher in the first option, namely when:

$$\frac{1}{\sigma}\left(\frac{p_j}{P_j}\right)^{1-\sigma} Y_j - w_j\alpha_j > \frac{1}{\sigma}\left(\frac{p_i T_{ij}}{P_j}\right)^{1-\sigma} Y_j.$$

According to the previous inequality, horizontal FDI will be more likely when transport costs are high, plant fixed costs low and wages low. By manipulating algebraically this inequality and following Markusen (2002), Feenstra (2004) proves that such inequality holds also for high level of GDP, especially when they are similar across region *I* and region *j*. Moreover, such an inequality is likely to hold when the relative endowment in human capital (high and medium skilled workers) is high and similar across regions.[8] This briefly shows the theoretical motivation that makes firms prefer direct investment to export. After having established these theoretical arguments, we carry on with an empirical analysis in order to assess the weight of those factors in determining FDI inflows.

3.2 A selection of FDI determinants: descriptive statistics

The literature distinguishes various determinants driving FDI flows according to their horizontal or vertical nature. We provide some statistics about a few determinants of horizontal FDI inflows for our sample of regions.

[8] Intuitively, we can justify this effect by looking at the increase in productivity of the unique input, labor.

i) Market size and economic potential

All our regions are strong economic powers within their respective countries without possessing the traditional attributes that come with central political power. Nevertheless, there are some differences among them. Baden-Württemberg and Lombardia are significantly more populated than Catalunya (see Table 4). They are also wealthier. Baden-Württemberg is the richest of the three regions as measured by an indicator of GDP per capita over the period 1995-2002 (Figure 3).[9] Then comes Lombardia and then Catalunya close, but below, the EU average. A convergence among these three regions towards the EU average standard of living can be observed (Figure 3). This means that the growth rate of GDP per capita in Catalunya has been higher than the two other regions'.

[TABLE 4 ABOUT HERE]

[9] Source: Eurostat database.

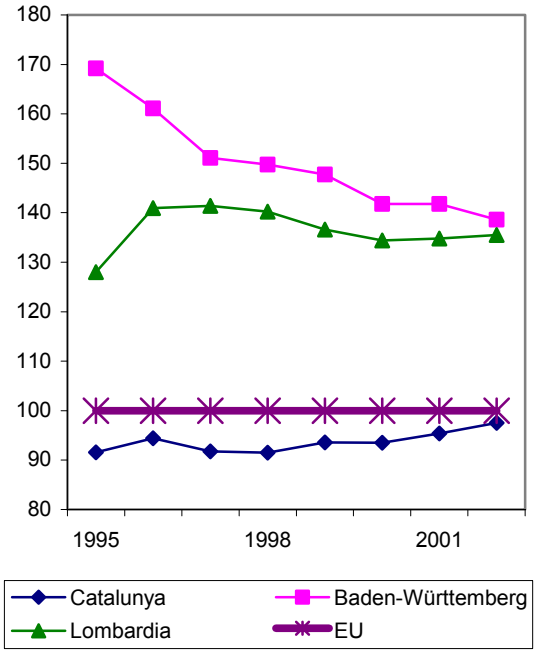

Figure 3: GDP per-capita index in the three regions (EU average=100) (1995-2002)
(Source EUROSTAT - Calculus: Authors)

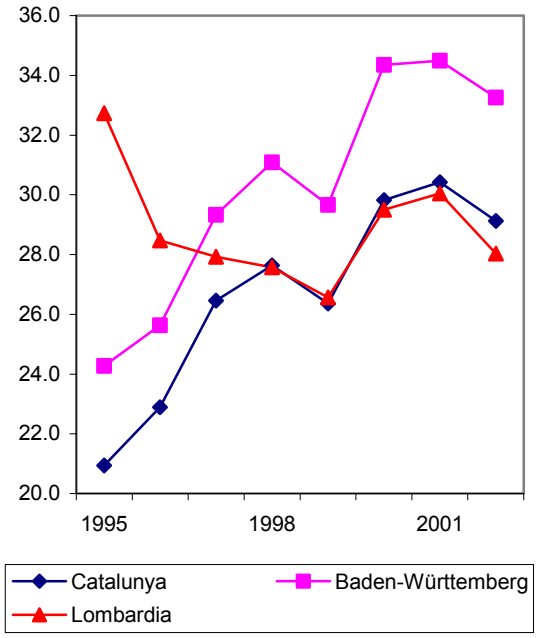

Figure 4: Exports as a percentage of GDP in the three regions (1995-2002)
(Source: Regional Statistical Offices - Calculus: Authors)

ii) Regional Openness

All the regions have very open economies with a high level of exports as a percentage of GDP (Figure 4). According to this statistics, Baden-Württemberg was the largest exporter before Catalunya and Lombardia. There is a striking parallelism between Baden-Württemberg and Catalunya. Both have experienced an upward trend over the period. The performance of Lombardia declined and then bounced back.

iii) R&D and innovation expenditure

Another relevant variable for foreign direct investment is the R&D (research and development) expenditure at regional level. Research and development effort captures the dynamism of a region by looking at the resources it allocates to innovation activities. R&D is widely considered as a way to foster economic growth. A general overview on the R&D spending at regional level (as % of GDP) draws a first picture of the relative intensity of R&D effort at regional level. The data included in the

following table refers to the intramural R&D spending by the main three actors involved in R&D investments: firms, government and universities (higher education).

[TABLE 5 ABOUT HERE]

The table compares the distribution of the R&D investments for two years of reference (1995 and 2002). In all the categories of investments, Baden-Württemberg outperforms the other regions although the level of R&D investment is relatively stable between 1995 and 2002. For Catalunya, we can observe that the level of investment in 1995 is lower than in the other regions except in the higher education sector. The figures for 2002 show a significant increase in that level in the business sector and a more modest one in the higher education sector.

iv) Unit labor cost

Unit labor cost is one of the indicators to assess labor productivity.[10] It is calculated by dividing average compensation of employees (wages plus benefits) by nominal added value. Therefore, this indicator ranges from 0 to 1. The lower the indicator, the higher the productivity. We computed the unit labor cost for two sectors that are the most relevant for FDI flows, over a period (1995-2001) for which data is available. In the first graph, we present the unit labor cost in manufacturing in the three regions (Figure 5). Two regions (Catalunya and Lombardia) have relatively similar performance. The Catalan manufacturing industry is the least performer and its labor productivity is slightly declining. The best performer is Baden-Württemberg, which even managed to improve its labor productivity level in the ultimate years. In the sector of services, the variance of performance is lower and the labor productivity level is much higher than in manufacturing (Figure 6). This is not surprising since there is much less international competition in services than in manufacturing, leaving opportunities for higher markups. The interregional comparison distinguishes

[10] The choice of the unit labor cost indicator to assess labor productivity was dictated by the absence of data on total annual hours worked to compute labor productivity per hour, and on capital stock to compute total factor productivity.

two frontrunners (Baden-Württemberg and Lombardia) from Catalunya, which is lagging behind. In all the three regions, the labor productivity level is declining over that period, indicating perhaps that markups are being trimmed by higher competition.

To compare the growth rate of labor productivity across regions over the study period, we constructed a unit labor cost index for each region. The purpose of this exercise is to identify any possible convergent or divergent process in terms of labor productivity by sector across our sample of regions. Either process is likely to reduce or increase the heterogeneity of the regional attractiveness. This index is set at 100 in 1995 for all regions. Then we calculate this index in the subsequent years and compare them to the first one. In the manufacturing sector (Figure 7), Baden-Württemberg experienced a strong degradation of its manufacturing productivity before reversing the trend in the ultimate years as already seen in the previous graph. Nevertheless its productivity in 2001 is lower than in 1995. For Lombardia, the labor productivity has little evolved. The labor productivity of the Catalan manufacturing sector is declining over the period. In the sector of services, we observe a general degradation of productivity in all regions as previously (Figure 8). The levels of Catalunya and Lombardia in 2001 are very close while the decline in Baden-Württemberg has gone out of control.

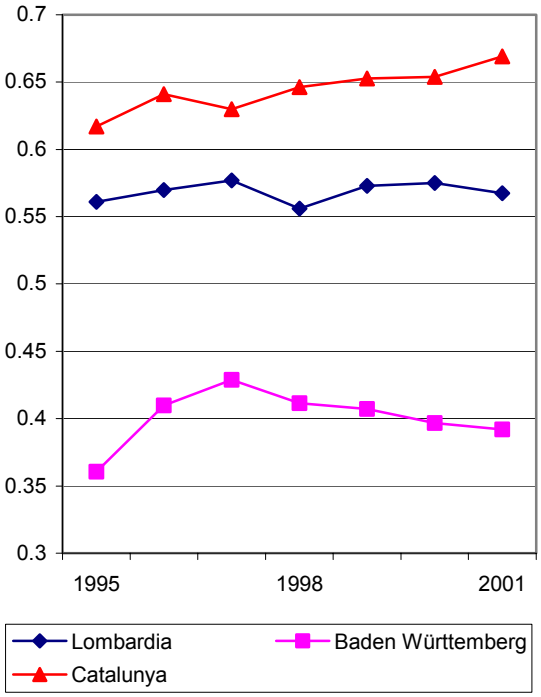

Figure 5: Unit labor cost in manufacturing by region (1995-2001)
(Source EUROSTAT - Calculus: Authors)

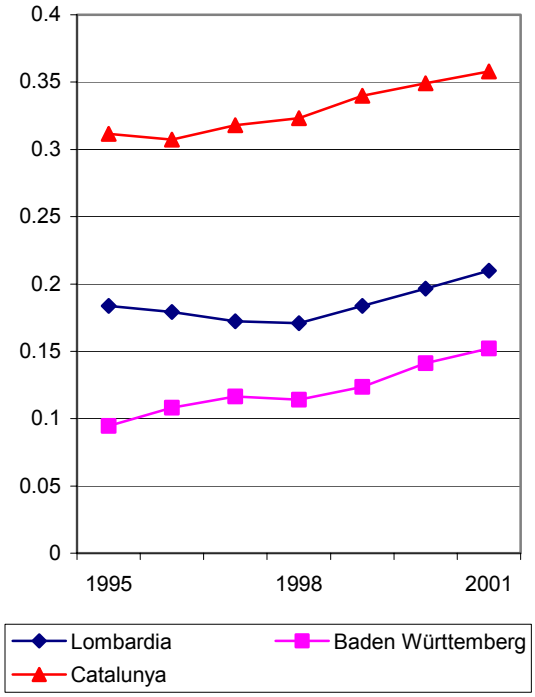

Figure 6: Unit labor cost in services by region (1995-2001)
(Source EUROSTAT - Calculus: Authors)

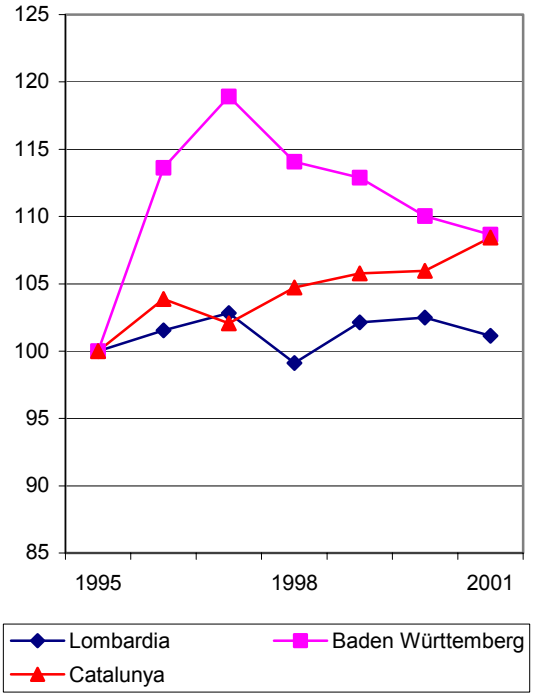

Figure 7: Unit labor cost evolution in manufacturing (1995-2001)
(Source EUROSTAT - Calculus: Authors)

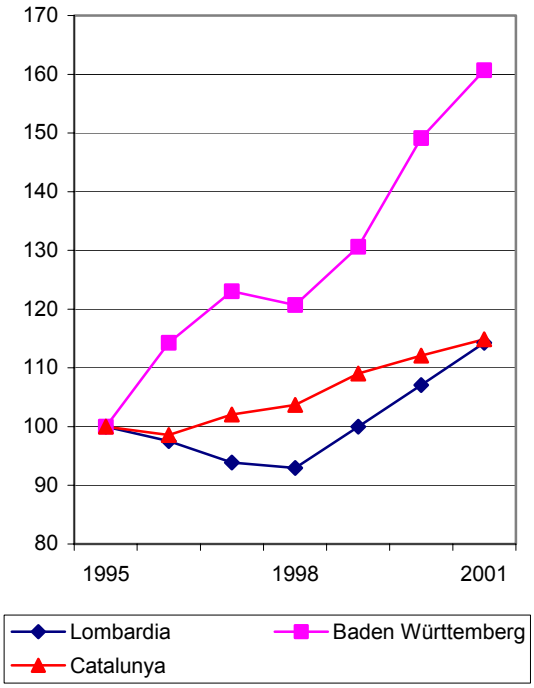

Figure 8: Unit labor cost evolution in services (1995-2001)
(Source EUROSTAT - Calculus: Authors)

4. Regional attractiveness: an empirical analysis

The purpose of this section is to propose an empirical analysis to identify the determinants affecting the FDI inflows. The question we address is the following: do the determinants for the six sectors we selected play a similar role across the three regions to attract FDI ? We built a database focusing on FDI inflows and its determinants at the regional and sector levels. We collected data from various regional statistical offices and from Eurostat for the period 1995-2002. At the moment, there are no complete and reliable information at regional level before 1995, the year when Eurostat initiated the collection of data at regional level. Once the data by year and region was collected, we worked out the database to order it in six comparable sectors at the regional level. We label the sectors as follows: Traditional manufacturing (including food & beverage, textile, paper, metal products, wood furniture), Mechanical, machinery and automotive, Electrical, Electronic and high-tech, Chemical, Financial and business services (including holding), Other services.

For every year we have data corresponding to the six selected sectors and we organize them in such a way to merge sectors and years. For each variable we build a vector as a list of the 8 years and for each year we list the six sectors. For Catalunya we have a final cross-section matrix of 48 observations. The cross section matrix for Baden-Württemberg reduces to 35 because data on the finance and credit sector were removed and data on 2002 real value added are missing. Our decision to exclude data on the finance and credit sector is motivated by the following consideration. This sector attracts a large amount of FDI and we do not know in which sectors the direct investments from the banks are realized. Then, we preferred to remove the finance sector from the sample in the case of Baden-Württemberg to avoid additional difficulties of interpretation. As for Lombardia, we reduced the sample to 35 observations since data were not available for all the periods. The sample period starts from 1997 and ends in 2002. Finally, for all the regions, data on gross fix capital formation stops in 2001.

For each region, the general equation for our estimation is the following:

$$FDIp_{ij} = \alpha_j + \underline{\beta x_{ij}} + \varepsilon_{ij}, \qquad j(\text{sectors}) = 1 \ldots 6 \text{ and } i \text{ (years)} = 1995 \ldots 2002,$$

where $FDIp_{ij}$ represents the annual per-capita inflows of FDI in each region and $\underline{\beta x_{ij}}$ is a vector of variables selected as proxies for FDI determinants. We followed the literature to select the potential FDI determinants. We isolate variables related to the local business climate (such as openness to trade, R&D investments, human capital), as well as some macro-indices (local GDP as proxy for local wealth as well as gross capital formation). Moreover, among those determinants, we tested two indicators of productivity, *real labor productivity* (measured as real value added per employee) and *unit labor cost* (compensation of employees per unit of value added).

One should reasonably expect that all these factors display a positive correlation with the amount of FDI inflows. They proxy the local factors that investors are likely to look for when they decide to invest. The only one that is expected to show a negative coefficient is the unit labor cost since an increase in this indicator means a decrease in productivity and hence a less attractive determinant for investors. We applied the cross section technique for each regional matrix at two dimensions (by year and by sector). We run the regressions by estimating the matrix with the OLS technique including fixed effects by sector and applying the White correction for controlling for heteroskedasticity problems.[11] In all the regressions we control for fixed effects by sector, in order to capture the possible heterogeneity among sector principally due to their own productive structure (LSDV[12] estimators).[13] The variables selected for each region *i* and sector *j* annually are summarized in Boxes 1, 2 and 3. In addition, to control for size effects we normalize to population all variables we

[11] This is the most suitable way to proceed for this kind of exercise as discussed in Greene (2000) and Wooldridge (2002)
[12] LSDV stands for *Least Square Dummy Variable.*
[13] We also perform the F-stat test for each specification in order to evaluate to what extent the LSDV estimator should be preferred to the OLS one (given that the F-stat equals 2 at a 10% level of significant). In the case of Baden-Württemberg the F-test always confirms that the LSDV is the most appropriate estimator. For Lombardia and Catalunya it is not the case (at least for the chosen level of significance), but we still prefer the LSDV estimator to the OLS because it guarantees the robustness of the results and helps to control for multicollinearity. Moreover it improves the level of the Adj R-square (as shown by the positive value of the F-statistics). In fact, including fixed effects means that there exist latent regional variables that deserve to be considered but the data at hand prevent from identifying them.

are using. This means that we analyze the determinants of FDI per-capita inflows in each of our three regions.

[BOX 1 ABOUT HERE]

[BOX 2 ABOUT HERE]

[BOX 3 ABOUT HERE]

We begin with considering a common specification regression for all our regions including all the variables listed in the Tables 6-8 (with the appropriate exclusions of variables with high collinearity). Since the results from this regression are not significant, we tried alternative specifications presented from column 1 to 8 in Tables 6-8. In these alternative specifications we control for heteroskedasticity and multicollinearity effects. The following three tables summarize the most significant and statistically robust results:

[TABLE 6 ABOUT HERE]

[TABLE 7 ABOUT HERE]

[TABLE 8 ABOUT HERE]

[TABLE 9 ABOUT HERE]

Tables 6 to 8 summarize the empirical results obtained for each region: Catalunya (Table 6), Baden-Württemberg (Table 7) and Lombardia (Table 8). We selected eight specifications. In the first four, we regress FDIP (Foreign Direct Investment per capita by region and by sector) on a few macroeconomic variables including GDP per capita and regional productivity measures at sector level. The next three specifications focus on determinants regarded as representative of the level of

technology and innovation. The eighth specification includes macroeconomic determinants and human capital.[14]

Looking at the results across regions, two comments can be made. First, GDP per capita by region and by sector is statistically significant for the sample of regions. This confirms the findings of the literature on FDI at national level. This result provides further evidence of the horizontal nature of FDI in these three regions, where market size predominates as a determinant. Second, the dummies by sector are also always significant. In each specification, we introduce a dummy associated with the distribution by sector of the FDI inflows. Raw data points out that the distribution of FDI across sectors is not the same across our regions. A region may display either a distribution strongly orientated toward a specific sector or a changing distribution over time. The dummy DUM reflects the high share of manufacturing in the FDI distribution in Lombardia, while the dummy DAVERAGE gives higher weight to the sectors that receive a high proportion of FDI (namely more than the annual average) in Catalunya and Baden-Württemberg. In these last two regions, the FDI inflows do not target a unique sector all time long, but they alternatively flow to different sectors. The different dummies by sector we introduced in the regressions mean that either the region (e.g. Lombardia) displays a strong and permanent FDI attractiveness in a sector (statistical significance of DUM) or the region possesses a changing FDI attractiveness over time (e.g. Catalunya and Baden-Württemberg, as shown by the statistical significance of DAVARAGE). Such an effect can be related to the regional economic environment and the corresponding changes occurring during the time period of our study.

[14] We ran also regressions (available upon request) including one-period lag of the explanatory variables and the results we obtain are similar. For Baden-Württemberg, Catalunya and Lombardia, POLS estimations (available upon request) replicate the same results as LSDV estimations but with a lower R-square. We tested the robustness of these results by estimating these models by GMM technique (Table 9). The results got by GMM confirm those by LSDV, but they are statistically less reliable because of the lack of observations. For instance, the J-test suffers from problems associated with the small dimension of the sample.

Regarding the other determinants, the results are different across regions and these observed differences constitute the most interesting insight of this paper. Recall that we selected 6 sectors common to the three regions and that we regress FDIP, all sectors together,[15] on a few determinants for each region. Our results show that some determinants appear to be statistically significant for some regions and not for the others. We propose three arguments to explain those differences. First, it is possible that foreign investment is attracted by a variety of determinants, a few being predominant (such as GDP per capita) and others less relevant. Therefore, different sets of determinants are sufficient to attract FDI as long as market size exists in the region. This would confirm GDP per capita as a sufficient determinant. Second, the FDI performance may be driven by particular determinants over that period reflecting strengths and weaknesses of each region relative to the endowment in those determinants. Third, for a given sector, the production of this sector may be of different range or quality across regions (for instance, luxury and low-range products in the textile sector) and, hence, investment in that sector may be responsive to different FDI determinants relative to the range.

Let us now look at the results for a few determinants in particular:

i) As already mentioned, the dummies and fixed effects are always very significant (DAVARGE in Tables 6 and 7, DUM in Table 8). It implies that heterogeneity by sector is an important component in our analysis. By heterogeneity, we mean the characteristics related to each sector: for instance, risk, entrepreneurial ability [16] and also asymmetric supply or demand shocks that can affect regional economic activity. By doing this, we control the effects of the regional economic environment.

ii) Regarding the indicators of labor productivity, the results are robust. The unit labor cost indicator (ULBV) is significant for Lombardia (Table 8) and Baden-Württemberg (Table 7) and so is the real labor productivity measure (RPRODUC). Both indicators are not significant for Catalunya (Table 6). No obvious explanation comes to mind. One comment deserves to be mentioned. The economy of Catalunya, like that of the rest of Spain, has been growing significantly in that period catching up with

[15] The lack of data does not allow for regressions by sector separately.

[16] As argued in Henderson (2003) when using fixed effect at plant level.

the EU living standard. This has happened despite a low labor productivity growth. Possibly, the market potential in Catalunya, as part of the EU, was attractive enough for foreign investors regardless of its performance.

iii) The regional export performance (EXPORTP) is significant and positive only in Lombardia (Columns 3, 4, 6 in Table 8) and Catalunya (Column 4 in Table 6). This relationship between foreign investments and export performance may indicate that those foreign investments have contributed to the export performance, or the increasing export performance has been a good signal in terms of competitiveness for foreign investors to favor those destinations. This result is interesting because this relationship does not appear for Baden-Württemberg, though a world-class exporter. The location choice across regions may obey to different objectives of the investors.

iv) The level of regional human capital (HCP and HRSTV) and the regional expenditure in R&D (RDP) seem to be important determinants only for Catalunya (Columns 5 and 7 in Table 6). Foreign investors seem to have accompanied the increasing trends observed for the investment in human capital and in R&D in that region. Again, the catching-up process toward the EU average may explain this positive relationship.

5. Conclusion

In this study we examined the main potential determinants likely to attract FDI in three European regions. In the first part we provided an overview of the FDI trends by sector and by region possibly associated with a selection of potential determinants. In particular, we looked at GDP, labor productivity and a few other indicators. We ran regressions to identify a relationship between FDI inflows by region and by sector and those determinants.

Our results show that, in line with the empirical literature on the subject, there is always a positive and statistically significant relationship between GDP and FDI per capita for all regions.

Apart from that, there is no unique pattern across regions regarding FDI determinants. This diversity recalls the lack of consensus existing in the literature on the effect of these determinants at more aggregate or disaggregated levels of analysis. There are several possible interpretations. One of these can be associated with the diversity of regions. Despite relatively similar economic performance and economic environment, the three regions of our sample have their specializations and may rely on different determinants to attract FDI. Two observations can be made. First, the difference in FDI performance across regions cannot be attributed to clear-cut determinants. As a result, regional wealth is not a sufficient condition to attract large amounts of FDI. Second, the FDI distribution by sector, different across regions, may be important to analyze FDI regional performance.

All the sectors are not associated with the same determinants. The difference in FDI distribution (by sector) across regions may be explained by the differences we observed in the statistical significance of the determinants across those regions. In Catalunya, FDI inflows are not concentrated in a single sector. The declining labor productivity does not seem to affect (or has not yet) statistically foreign investment inflows, while market size, openness to trade, R&D effort and human capital are determinants associated with FDI inflows. Regarding Baden-Württemberg, FDI inflows, with little concentration by sector, seem to be mostly related to the size of its market and its labor productivity performance. Finally, our econometric results show that Lombardia, attracting much less FDI (per capita) than Baden-Württemberg, remains an attractive FDI destination for specific sectors due to its market size and its productivity performance. It has a strong specialization in traditional manufacturing and has attracted many foreign investments in that sector despite strong international competition. We also observed that R&D and human capital determinants are significant only for Catalunya. This could be due to the fact that Catalunya stands at a different stage of economic development compared with mature economies of Baden-Württemberg and Lombardia.

The lack of data prevented us from carrying out a more exhaustive econometric analysis. The first next step would be to extend this study to a larger number of regions and realize a finer analysis

by sector (ideally using NACE classification at two digits) to identify the FDI determinants. This exercise would help to identify other possible potential FDI determinants (by sector and by region) that remain hidden when performing an analysis at aggregate level.

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Evidence on the Determinants of Foreign Direct Investment: The Case of Three European Regions

Lionel Artige
(Université de Liège and Universitat Autònoma de Barcelona)

Rosella Nicolini
(Instituto de Análisis Económico, CSIC)

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Table 1: Cumulative FDI inflows by sector (1995-2003) (%)
(Sources: Regional Statistical Offices - Calculus: Authors)

	Baden Württemberg	**Catalunya**	**Lombardia**[1]
Traditional Manufacturing	9	9	31
Machinery and Automotive	5	1	16
Finance and credit	70	41	17
Electrical and high-tech	2	10	10
Chemical	3	4	9
Other services[2]	11	35	17
TOTAL (millions €)	296,232	26,583	83,455

Table 2: Cumulative FDI outflows by sector (1995-2003) (%)
(Sources: Regional Statistical Offices - Calculus: Authors)

	Baden Württemberg	**Catalunya**	**Lombardia**
Traditional Manufacturing	12	35	35
Machinery and Automotive	18	2	3
Finance and credit	40	31	34
Electrical and high-tech	2	3	7
Chemical	…	2	5
Other services[5]	28	27	16
TOTAL (millions €)	458,264	27,725	122,379

[1] For the period 1997-2003 for Lombardia.
[2] Including Real Estates, Transport, Trade and Hotels.

Table 3: Cumulative FDI flows by country of destination or origin (1995-2003) (%)
(Sources: Regional Statistical Offices - Calculus: Authors)

	INFLOWS				OUTFLOWS		
	Baden Württemberg	**Catalunya**	**Lombardia**		**Baden Württemberg**	**Catalunya**	**Lombardia**
European Union + Switzerland	76.4	67.0	87.3		33.3	72	51.2
US	13.3	14.6	9.6		37.7	6.8	8.4
Japan	0.7	0.4	0.9		…	1.4	0.6
Others	9.6	18	2.2		29	19.8	39.8
TOTAL (millions €)	296,232	26,583	83,455		458,264	27,725	122,379

Table 4: Fact sheet of three European regions
(Source EUROSTAT and regional institutes of statistics - Calculus: Authors)

	Population (2002)	Area (sq km)	GDP in 2002 (€ millions)	GDP per capita in 2002 (€)
Catalunya	6 240 368	31 930	127 993	20 652
Baden-Württemberg	10 600 906	35 751	311 980	29 347
Lombardia	9 108 645	23 863	260 223	28 687

Table 5: Total intramural R&D spending (as % GDP)
(Source EUROSTAT - Calculus: Authors)

	1995	***2002***
Business enterprise sector		
Catalunya	0.55	0.86
Baden-Württemberg	2.77	3.08* (2001)
Lombardia	0.90	0.87
Gouvernment sector		
Catalunya	0.09	0.11
Baden-Württemberg	0.46	0.41
Lombardia	0.13	0.09
Higher education sector		
Catalunya	0.24	0.30
Baden-Württemberg	0.42	0.42
Lombardia	0.15	…

* 2001

Box 1 : Macroeconomic variables

FDIP*ij* = Amount of annual per-capita FDI inflows in region *i* and sector *j* (millions EURO)
EXPORTP*i*= Amount of annual per-capita export flows in region *i* (millions EURO)
ULBV*ij*= Unit labor cost as average compensation of employees over added value for region *i* and sector *j*, by year
RPRODUC*ij*=Productivity by region *i* and sector *j* as real value added (discounted by the correspondent price index) over employment , by year
GDPP*i*= Annual gross domestic product per capita in region *i* (euro),
FBCFP*i*=Annual gross fixed capital formation per capita in region *i* (euro)

Sources:
EUROSTAT
Lombardia: Ufficio Italiano Cambi and Annuario Statistico Lombardia
Catalunya: IDESCAT and Secretaría General del Comercio Exterior
Baden Württemberg: Statistiches Landesamt Baden- Württemberg

Box 2 : Research and technological variables

RDP*i*= Annual expenditure in research and development per capita in region *i* (euro)
HCPi= Annual quota of students coursing in universities (as % of total population) in region *i*
HRSTV*i*= Number of people (as % of total population) who fulfill the conditions of human resources in science and technology in region *I*, by year

Source:
EUROSTAT

Box 3 : Dummies

DAVERAGE: (Catalunya and Baden Württemberg) Dummy for investments (by year) whose amount is greater than the average,
DUM: (Lombardia) Dummy for investments in traditional manufacturing

Table 6: CATALUNYA
Dependent variable**: FDIP**
Method of estimation**: LSDV (with White correction)**
Fixed effect by sector
Values in brackets: **Standard Error**

	1	2	3	4	5	6	7	8
C	-71.24 (42.83)	-27.85*** (8.19)	-27.32 (16.39)	-16.76*** (6.17)	-31.74*** (9.55)	-19.54** (5.60)	-14.74** (5.74)	-6.44 (10.72)
DAVERAGE	10.02** (4.73)	10.24** (3.95)	9.51** (4.15)	11.25*** (4.09)	10.31*** (4.01)	10..06** (1.55)	10.15** (3.75)	11.90*** (4.35)
RPRODUC	2.00* (1.12)	0.23 (0.42)		0.12 (0.42)	0.21 (0.43)	0.24 (0.41)	0.23 (0.41)	0.065 (0.44)
ULBV	62.54 (39.42)		-7.88 (11.88)					
GDPP		1.49*** (0.50)	1.95*** (0.74)					
EXPORTP				3.40*** (1.14)				5.00 (3.62)
FBCFP								-5.67 (5.59)
HCP							472.92*** (148.43)	303.30 (298.90)
HRSTV					1.17*** (0.355)			
RDP						69896*** (24441)		
F-stat	0.93	1.20	0.5	1.22	0.93	1.14	0.95	1.66
Adj R-squared	0.45	0.57	0.44	0.59	0.57	0.56	0.58	0.60
N. Obs.	42	48	42	48	48	48	48	48

***Level of significance 1 %, ** 5%. *10%

Table 7: BADEN-WÜRTTEMBERG
Dependent variable**: FDIP**
Method of estimation**: LSDV (with White correction)**
Fixed effect by sector
Values in brackets: **Standard Error**

	1	2	3	4	5	6	7	8
C	0.412*** (0.05)	-0.51*** (0.17)	-0.55*** (0.19)	-0.61*** (0.20)	-0.54* (0.27)	-0.49 (0.44)	-0.52* (0.18)	-0.35 (0.37)
DAVERAGE		0.13*** (0.02)	0.13*** (0.02)	0.13*** (0.02)	0.13*** (0.02)	0.13*** (0.02)	0.13*** (0.03)	0.13*** (0.02)
RPRODUC	0.0003 (0.0006)							
ULBV	-0.49*** (0.14)	- 0.26** (0.10)	-0.27** (0.10)	-0.27** (0.10)	-0.27** (0.10)	-0.27*** (0.10)	-0.25** (0.12)	-0.27*** (0.09)
GDPP		0.02*** (0.005)	0.03*** (0.007)	0.05** (0.02)	0.037 (0.033)	0.04 (0.03)	0.02** (0.01)	0.02** (0.009)
EXPORTP			9.81 E-06 (2.18 E-06)					
FBCFP				-0.07 (0.08)	-0.07 (0.09)	-0.07 (0.09)		
HCP						-2.21 (7.25)		-3.14 (6.75)
HRSTV							0.003 (0.008)	
RDP					118.8 (330.6)			
F-stat	8.15	30.7	30	31.5	34	30.7	22.6	24
Adj R-squared	0.67	0.89	0.89	0.89	0.89	0.89	0.87	0.89
N. Obs	35	35	35	35	35	35	35	35

***Level of significance 1 %, ** 5%. *10%

Table 8: LOMBARDIA
Dependent variable**: FDIP**
Method of estimation**: LSDV (with White correction)**
Fixed effect by sector
Values in brackets: **Standard Error**

	1	2	3	4	5	6	7	8
C	-1.57*** (0.39)	-1.49*** (0.41)	-0.94** (0.38)	-1.24*** (0.39)	-1.21 (2.75)	-1.15*** (0.28)	-1.44*** (0.29)	-1.04*** (0.23)
DUM	0.17*** (0.06)	0.174** (0.06)	0.15** (0.07)	0.17*** (0.06)	0.17** (0.06)	0.10** (0.03)	0.10** (0.02)	0.15** (0.07)
RPRODUC	0.002* (0.001)			0.002* (0.0012)	0.002* (0.001)	0.001** (0.0006)		0.002* (0.001)
ULBV		-0.28* (0.16)	-0.28* (0.15)				-0.18** (0.07)	
GDPP	0.06*** (0.015)	0.06*** (0.015)	0.012 (0.023)	0.015 (0.02)	-0.007 (0.15)			
EXPORTP			0.001** (0.0005)	0.001* (0.0005)		0.0008** (0.0004)		0.0009 (0.0008)
FBCFP					2.5 E-08 (3.6 E-08)			0.05 (0.10)
HCP					11.81 (21.8)			
HRSTV								
RDP						1683.13 (1631.75)	5371.4*** (1001.8)	
F-stat	0.3	0.9	1.2	0.6	0.4	1.0	1.5	0.4
Adj R-squared	0.58	0.58	0.61	0.61	0.58	0.73	0.65	0.60
N. Obs	30	30	30	30	30	24	24	30

Level of significance: ***1 %, ** 5%. *10%

Table 9: Estimations
Dependent variable**: FDIP**
Method of estimation**: GMM (White covariance)**
Values in brackets: **Standard Error**

	Catalunya	Catalunya	Catalunya[a]	Baden-Württemberg	Baden-Württemberg	Lombardia	Lombardia
C	-25.76** (9.56)	-10.02* (5.168)	-6.85* (3.56	4.46*** (0.077)	-4.77** (1.96)	-1.04*** (0.28)	-0.59** (0.212)
DAVARAGE	11.97*** (2.39)	12.52*** (2.59)	10.46** (1.67)	-0.285 (0.519)	2.04*** (0.43)		
RPRODUC						0.002* (0.0008)	
ULBV				-0.75*** (0.218)			-0.314** (0.123)
GDPP	1.45** (0.68)				0.18** (0.07)	0.041** (0.01)	
EXPORTP			2.96 (4.5)				0.001*** (0.0002)
HCP	155.18 (252.18)	474.25** (226.26)					
RDP			-33676.01 (130889.8)				
Adj R-squared	0.42	0.42	0.59	0.04	0.66	0.33	0.38
J – stat	0.09	0.144	2.50 E-27	0.087	0.022	0.07	0.013
List of Instruments	ULBV, EXPORTP, FBCFP, RDP	ULBV, EXPORTP, FBCFP, RDP	HCP, ULBV, FBCF,	RPRODUC, GDPP, EXPORTP,FBCFP	ULBV, EXPORTP, FBCFP	ULBV, EXPORTP, FBCFP	RPRODUC, GDPP, FBCFP, HCP
N. Obs	42	42	35	35	42	30	30

Level of significance: ***1 %, ** 5%. *10% , [a] J-TEST confirms the right specification of the model