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

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Abstract

This study aims at analyzing the determinants of FDI (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. 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, O47, R10.

1. Introduction

Foreign direct investment (FDI) has widely become a byword for efficient investment, job creation, high wages and technological transfers. Most governments in the world have promoted generous policies to attract FDI on their soil.

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

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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.

FDI implies a long-term relationship between a host economy and a foreign resident who wants to invest in this host economy. Two important issues may be raised when FDI is to be studied. One question is to know whether the host economy benefits from the capital import. The other question is about the motivations and the expectations that led the foreign resident to invest in that host economy. This paper addresses the latter by carrying out an econometric analysis on the FDI determinants in three European regions: Baden-Württemberg in Germany, Catalunya in Spain and Lombardia in Italy (see map in Annex).

1.2 The determinants of FDI

What attracts FDI? What are the benefits that foreign firms search by investing in host countries? Shatz and Venables (2000) distinguish two main reasons why a firm would like to make direct investments in foreign countries. The first one is 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 main motivation is to economize on tariffs and transport costs. The second reason is to have access to lower-cost inputs. This type of FDI is called "vertical" or "production cost-minimizing" since there is fragmentation. The motivation is to economize on production factors to maximize the profits on each part of the good production. Most of the world's FDI is horizontal in nature and, hence, are driven by market size.

The great variety of FDI determinants observed in investor surveys (e.g. A.T. Kearney, 2003) emerges in the form of a lack of consensus in the econometric studies. This can be explained by the lack of data, the different variables as FDI determinants used by the empirical literature and, possibly, by the use of aggregate data.

In the literature a few FDI determinants are regularly cited:

- **Market Size** as measured by GDP or GDP per capita seems to be the most robust FDI determinant in econometric studies. This is the main determinant for horizontal FDI. It is irrelevant for vertical FDI. (Shatz and Venables 2000, Billington 1999, Branard 1997, Wheeler and Mody 1992, Kravis and Lipsey 1982).

- **Transport costs** will be determinant for horizontal FDI. However it can also be decisive for vertical FDI since this is often an investment with the objective to export the goods produced. Branard (1997) finds a positive correlation between FDI and transport costs.

- **Production factor cost**: This is the main criterion motivating vertical FDI. Lower cost is also favorable to horizontal FDI. Feenstra and Hanson (1997) find that labor cost is positive and significant for US FDI in Mexico. A similar result is obtained by Wheeler and Mody (1992) for US FDI in electronics.

- **Agglomeration effects** signal high quality of infrastructure, human capital, high productivity and specialization. These affect both horizontal and vertical FDI are found to be highly significant for US FDI by Wheeler and Mody (1992).

- **Fiscal incentives** tend to affect more vertical FDI since it is cost-sensitive. Many countries have tax incentives to attract FDI.

- **Business/investment climate** relates to the institutional framework. Regulatory, bureaucratic and judicial environments are now considered as very important criteria for investment and development.

- **Trade barriers/openness** is somewhat an uncertain determinant. A weak openness tends to favor horizontal FDI and deter vertical FDI.

1.3 Methodological motivations and objectives

This paper focuses on the question related to the benefits expected by the foreign firms from investing in a host economy. In other words, our aim is to find out the determinants offered by the host economy that turned out to attract the types of FDI flows recorded over a historical period (1995-2003). The originality of this work comes from two forms of desegregation: we build and exploit econometrically a database including data on FDI and potential determinants disaggregated at both the regional and sector levels. The objectives of this paper are then threefold:

1. We want to analyze the FDI performance by sectors in three European regions: Baden-Württemberg, Catalunya, and Lombardia over the period 1995 to 2003.
2. Then we attempt to identify the determinants of each region's FDI performance over the sample period.
3. We finally try to find out insights on FDI determinants at the sector level.

The motivation for studying FDI from a regional standpoint is the same as for most regional works: a lot of interesting characteristics or changes are simply hidden at more aggregate levels. More importantly, FDI determinants and effects may be localized and, hence, a regional analysis may be more appropriate to obtain better-grounded results.

The absence of regional analysis of FDI in the literature has a simple explanation: the lack of data. Some effort has been made to collect and streamline data for European regions by regional statistical offices. Most of this data starts from 1995. For most of the other regional variables, Eurostat collects data from 1995. This means that the development of time-series makes now possible to start this kind of regional study even though the time period still remains a bit short to obtain results with confidence.

We have chosen only three European regions (Baden-Württemberg, Catalunya, Lombardia) for three reasons:

- These three regions belong to a club called Four Motors for Europe and share common characteristics among them (see Appendix).

- These three regions belong to countries that have close corporate tax rates (~35%), which rules out tax competition as a determinant of FDI location across these three regions and enables us to focus on other determinants (OECD statistics[1]).

[1] Available at ://www.taxpolicycenter.org

- More practically, since the collection of data for regions requires a lot of effort, we wanted to start such an analysis with a small number of regions to examine the results and enrich the work in the future with other European regions.

The core of our analysis is basically disentangling the importance of the general business climate and environment in attracting investment. Our idea is unifying the usual separated view between macro and micro factors affecting FDI for a sample of European regions. Our results prove that a measure of regional productivity as well as local wealth may be important variables at the time to choose a destination, but not in al situations.

The remaining of this study is organized as follows. In Section 2, we provide a brief overview of the FDI trends for a group of 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. Our results confirm the findings of other studies realized at national level concerning the importance of productivity, local wealth and business climate. 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).

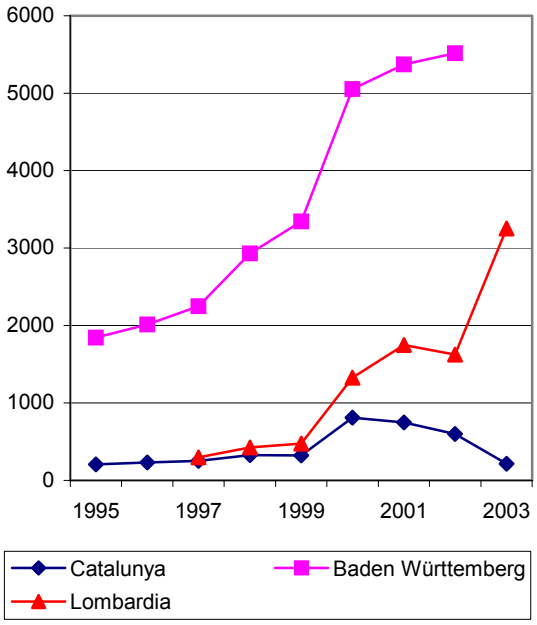

Figure 1: FDI inflows per capita
(Source: Regional Statistical Offices - Calculus: Authors)

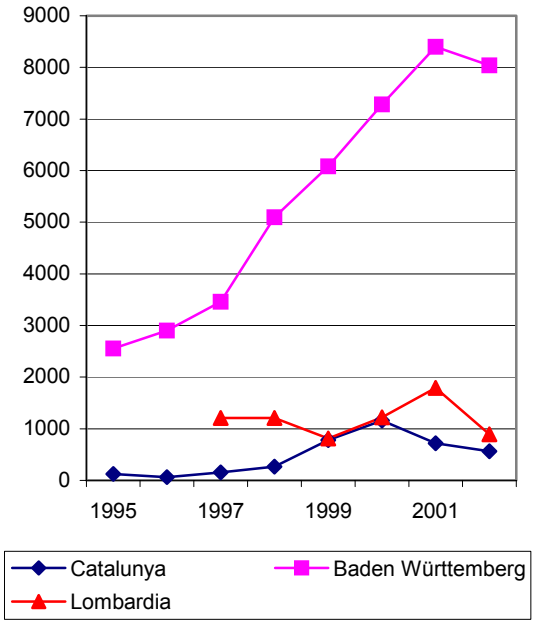

Figure 2: FDI outflows per capita
(Source: Regional Statistical Offices - Calculus: Authors)

Again we do not observe the same trend regarding FDI outflows (Figure 2). The performances 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: banks. When the direct investor is a bank, we do not know the sectors in which the bank invests. Since banks are in general large investors, data by sector requires to be interpreted focusing primarily on direct investors. Among the common trends, we observe that the *Finance and credit* sector accounts for a large share of FDI inflows in all regions, though to a lesser extent in Lombardia (17%). The *Finance and credit* sector represents investment banking activities. Banks often invest in foreign enterprises via resident non-banking holding companies. Under the industrial breakdown recommended by the OECD and Eurostat, FDI realized by banks via those holdings are recorded in the *Finance and credit* sector. 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 countries.

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 those 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.

The case of Baden-Württemberg is even simpler: 70% of 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 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 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 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 FDI outflows.

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

	Baden Württemberg	Catalunya	Lombardia[2]
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[3]	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[4]
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

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[4]**		**Baden Württemberg**	**Catalunya**	**Lombardia[4]**
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

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

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 a transport cost equal to T_{ij}. We assume that the firm produces the output just by using labor input.

First, let us concentrate 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} ($p_{ij}= T_{ij}\, p_i$, 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 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 the region j.

The unique input is labor and the correspondent production function is $L_i=\beta y_i$ with β, the marginal cost and y_i ($=c_{ij}\, T_{ij}$) 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) can be computed and 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:[4]

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

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:

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

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

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

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

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

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

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.[5]

This shows briefly 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 Descriptive statistics

3.2.1 Market size and economic potential: some evidence

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 5). They are also wealthier. Baden-Württemberg is the richest of the three regions as measured by GDP per capita over the period 1995-2002 (Figure 3). Then comes Lombardia followed by Catalunya close to 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: 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

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

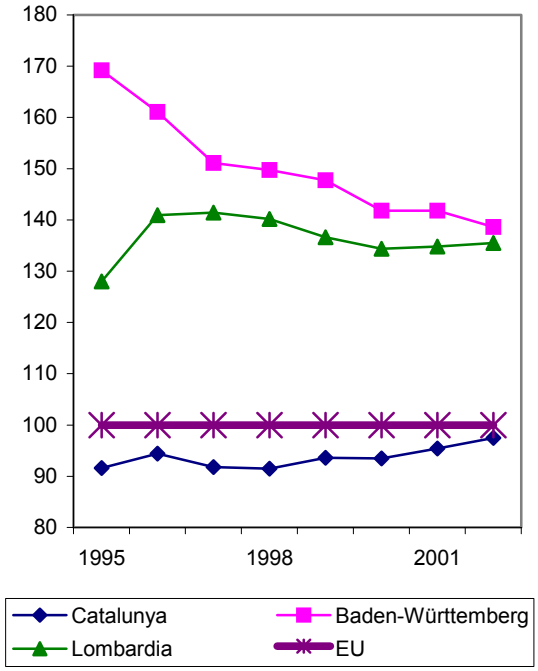

Figure 3: GDP per-capita index in the three regions (EU average=100) (1995-2002)
(Source EUROSTAT - Calculus: Authors)

3.2.2 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.

Looking at the exports per capita, the picture is somewhat different (Figure 5). All regions display a smooth and increasing curve. According to this statistics, Baden-Württemberg remains the largest exporter before Lombardia and Catalunya is the least but slightly catching up Lombardia.

The export performance of the regions is good and is keeping up. This conclusion is less clear in Figure 4 because exports and GDP do not always fluctuate jointly.

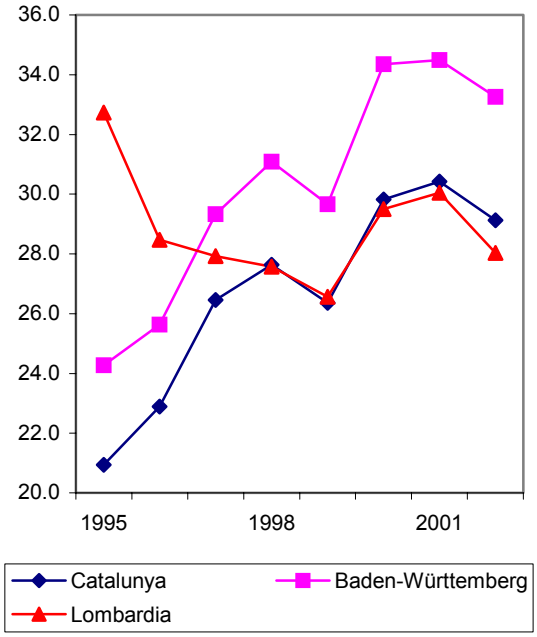

Figure 4: Exports as a percentage of GDP in the three regions (1995-2002)
(Source: Regional Statistical Offices - Calculus: Authors)

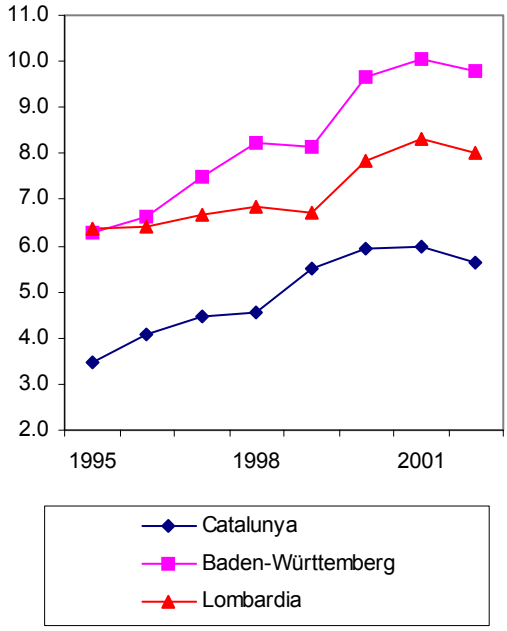

Figure 5: Exports per-capita in the three regions (1995-2002) (€ thousands)
(Source: Regional Statistical Offices - Calculus: Authors)

3.2.3 Unit labor costs

Unit labor costs are one of the indicators to assess productivity. 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 costs 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 costs in manufacturing in the three regions (Figure 6). Two regions (Catalunya and Lombardia) have relatively similar productivity performance. The Catalan manufacturing industry is the least performer and its productivity is slightly declining. The "outperformed" is Baden-Württemberg, which even managed to improve its productivity level in the ultimate years.

In the sector of services, the variance of performance is lower and the productivity level is much higher than in manufacturing. 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 two frontrunners (Baden-Württemberg and Lombardia) from Catalunya, which is lagging behind. In all the three regions, the productivity level is declining over that period, indicating perhaps that markups are being trimmed by higher competition.

To learn more about the productivity performance of each region over this period we constructed a unit labor cost index for each region. 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, 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 productivity has little evolved. The 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 9). The productivity levels of Catalunya and Lombardia in 2001 are very close while the decline in productivity in Baden-Württemberg has gone out of control.

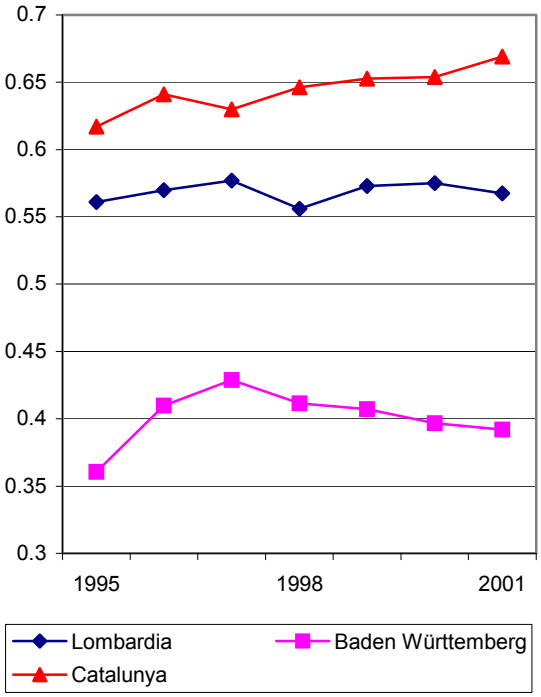

Figure 6: Unit labor cost in manufacturing by region (1995-2001)
(Source EUROSTAT - Calculus: Authors)

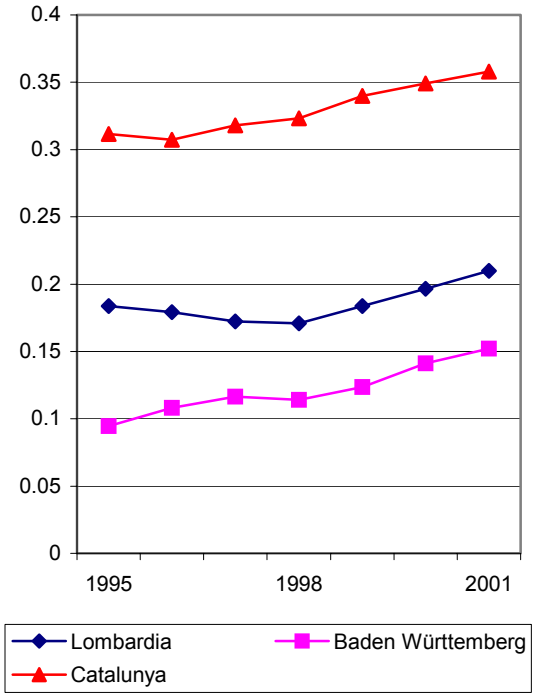

Figure 7: Unit labor cost in services by region (1995-2001)
(Source EUROSTAT - Calculus: Authors)

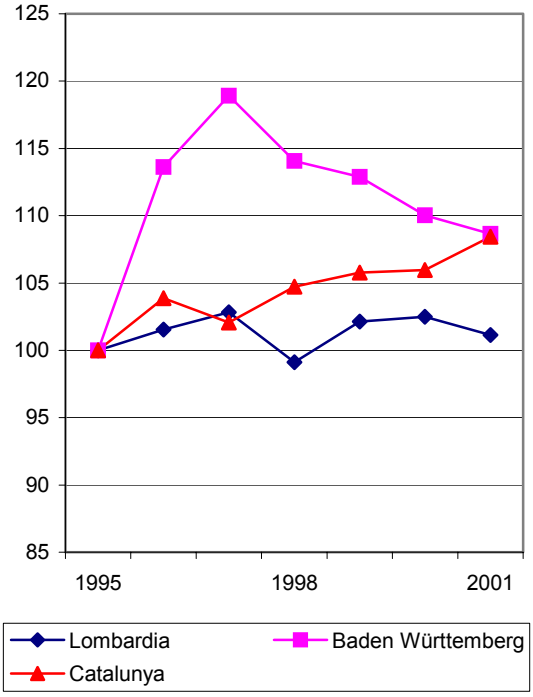

Figure 8: Unit labor cost evolution in manufacturing (1995-2001)
(Source EUROSTAT - Calculus: Authors)

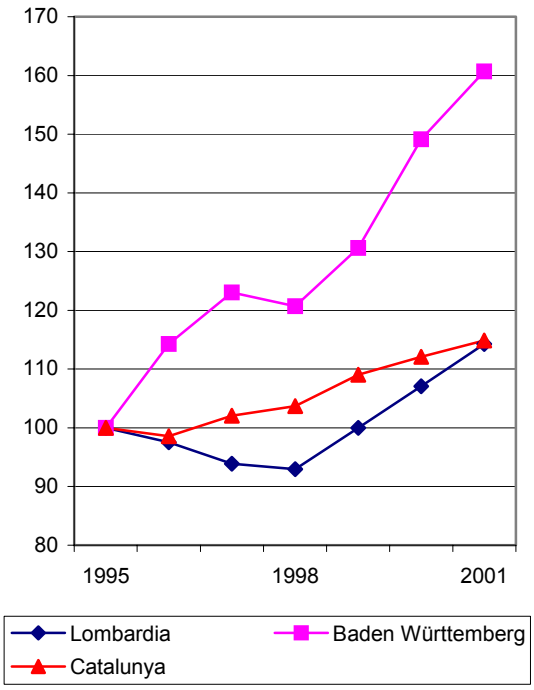

Figure 9: Unit labor cost evolution in services (1995-2001)
(Source EUROSTAT - Calculus: Authors)

3.2.4 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: 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	…

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.

The involvement of the Catalan economy in sectors with medium-high technological (MHT) contents is quite important. In that respect, Catalunya's performance is as good as the others'. In 2000, according to the data published by Eurostat on the number of employees in MHT sectors, Lombardia recorded 458,158 employees, Baden Württemberg 391,151 and Catalunya 223,791.

For our sample of regions, the following graph shows to what extent the size of human resources in science and technology (as % of total population) is significant and constantly growing over time.

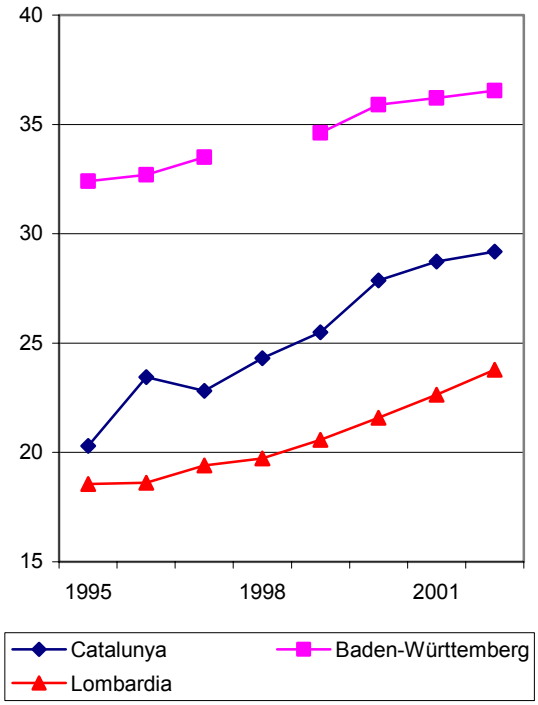

Figure 10: Human resources in R&D (as a percentage of the population)
(Source EUROSTAT - Calculus: Authors)

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 want to address is the following: do the determinants for the six sectors we selected play a similar role across the three regions to attract FDI? If the answer is positive, then geographical idiosyncrasies, which exist across regions, do not matter for the location of FDI. The results of this work show that the answer is negative. 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. Nevertheless, our work emphasises the role of market size as a robust FDI determinant. As for the five others, our results may be interpreted as an evidence of their weak influence or as an evidence of a variety of patterns to attract FDI.

This econometric exercise focuses on the determinants at the regional and sector level likely to affect foreign investors' decisions. To our knowledge, this is the first study carried out at the regional and sector levels. Our expectations are to obtain more insights at this level of disaggregation.

We built a database focusing on the FDI inflows and its determinants at the regional and sector levels. We collected data from various regional statistics offices and from Eurostat for the period 1995-2003. 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 the data corresponding to the six selected sectors and we organize them in such a way to merge sectors and years. For Catalunya we get a final cross-section matrix of 48 observations. In case of Baden Württemberg we get a cross section matrix of 35 observations because we dropped out the finance sector. Our choice 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.

The general equation for our estimation is the following:

$$FDIp = \alpha + \underline{\beta x} + \varepsilon,$$

where *FDIp* represents the annual per-capita inflows of FDI in each region and $\underline{\beta x}$ 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 productivity* (measured as real value added per employee) and *unit labor costs* (compensation of employees per unit of value added).

One should reasonably expect that all these factors should 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 and applying the White correction for controlling for heteroskedasticity problems. In the regressions for Catalunya and Baden-Württemberg we control for fixed effects by sector, in order to capture the possible heterogeneity among sector principally due to their own productive structure (LSDV estimators). Because of the reduced number of available years in the cross section, we just perform POLS estimations for Lombardia. 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 are using. This means that we analyze the determinants of FDI per-capita inflows in each of our three regions.

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

We run several regressions by applying alternative specifications with the purpose to select the model which fits the most the real data.

Then, we isolate a group of specifications and we replicate the same regression for the three different regions. The following three tables present our results:

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)		-7.84 (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)		
Adj R-squared	0.45	0.57	0.55	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)			
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**: POLS (with White correction)**
Values in brackets: **Standard Error**

	1	2	3	4	5	6	7	8
C	-1.59*** (0.40)	-1.35*** (0.43)	-0.85** (0.36)	-1.12*** (0.36)	-1.23** (0.44)	-1.07*** (0.28)	-1.39*** (0.35)	-0.91*** (0.23)
DUM	0.15** (0.07)	0.138** (0.07)	0.15** (0.07)	0.15** (0.07)	0.15** (0.07)	0.060** (0.024)	0.05** (0.02)	0.15** (0.07)
RPRODUC	0.002*** (0.0004)			0.002*** (0.0005)	0.018*** (0.0004)	0.001*** (0.0004)		0.02*** (0.0004)
ULBV		-0.26** (0.11)	-0.27** (0.10)				-0.12* (0.08)	
GDPP	0.06*** (0.016)	0.06*** (0.016)	0.013 (0.022)	0.017 (0.019)				
EXPORTP			0.001** (0.0004)	0.001** (0.0004)		0.001** (0.0003)		0.0009 (0.0006)
FBCFP					0.210*** (0.06)			0.05 (0.083)
HCP					11.93 (8.84)			
HRSTV								
RDP						1666.28 (1418.46)	5270.4 (1167)	
Adj R-squared	0.57	0.52	0.53	0.58	0.57	0.67	0.58	0.58
N. Obs	30	30	30	30	30	24	24	30

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

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. [6]

Looking at the results across regions, two comments can be made. First, there is a determinant that is statistically significant in all specifications and in all the three regions. This determinant is GDP per capita by region and by sector. This confirms the findings of the literature on FDI at national level. Our regressions show that the positive relationship seems to be robust even at the regional and sector level. This result can also be interpreted as an 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

[6] 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 and Catalunya, POLS estimations (available upon request) replicate the same results as LSDV estimations but with a lower R-square.

more than the annual average) in Catalunya and Baden Württemberg.[7] 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 results obtained mean that either the region (such as Lombardia) displays a strong and permanent FDI attractiveness in a sector or the region possesses a changing FDI attractiveness over time (such as Catalunya and Baden-Württemberg). Such an effect can be related to the regional economic environment and the corresponding changes occurring during the time period of our study.

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 run FDIP, all sectors together,[8] 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 make some comments on the results for a few determinants:

a) As we mentioned, the dummies and fixed effects are always very significant. It implies that heterogeneity is an important component in our analysis. By heterogeneity, we mean the characteristics related to each sector: for instance, risk, entrepreneurial ability [9] 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.

b) Regarding the indicators of productivity, the results are consistent. The unit labor cost indicator (ULBV) is significant for Lombardia and Baden-Württemberg and so is the real productivity measure (RPRODUC). Both indicators are not significant for Catalunya. 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 the EU living standard. This has happened despite a low productivity growth. Possibly, the market potential in Catalunya, as part of the EU, was attractive enough for foreign investors regardless of its productivity performance. This does not rule out the possibility that, in the future, productivity becomes a statistically significant determinant in Catalunya.

c) The regional export performance (EXPORTP) is significant and positive only in Lombardia and Catalunya. 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

[7] The Finance and credit sector has been removed from the FDI distribution in Baden-Württemberg.
[8] The lack of data does not allow for regressions by sector separately.
[9] As argued in Henderson (2003) when using fixed effect at plant level.

appear for Baden-Württemberg, though a world-class exporter. The location choice across regions may obey to different objectives of the investors.

d) The level of regional human capital and the regional expenditure in R&D seem to be important determinants only for Catalunya. 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, productivity and a few innovation indicators. We ran regressions to identify a relationship between FDI inflows by region an by sector and those determinants.

Our results show that there is not a unique way of interpreting the determinants of FDI inflows in our regions. We always identify a positive and statistical significant relationship between GDP and FDI per capita, as it is not the case for the other determinants.

The three regions of our sample, despite relatively similar economic performance and economic environment, 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 performances.

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 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 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 disentangle other possible potential FDI determinants (by sector and by region) that could remain hidden when performing an analysis at aggregate level. At the same time, this type of exercise could also leave room for the emergence of new features in the regional patterns of FDI attractiveness.

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Appendix

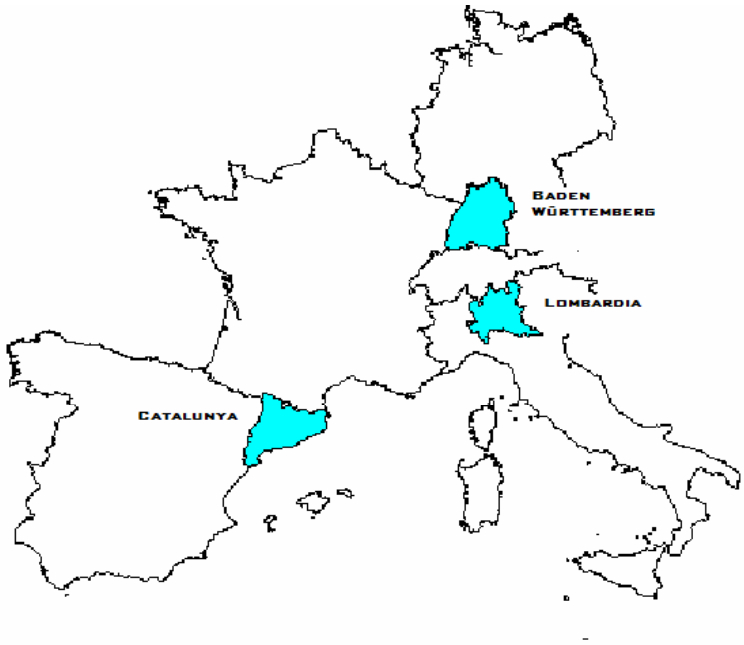

Figure 11: The three European regions: Baden-Württemberg in Germany, Catalunya in Spain and Lombardia in Italy.

Baden-Württemberg

Baden-Wurttemberg is the third largest *Land* in Germany. In the industrial sector, Baden-Württemberg possess 18,2 % of manufacturing plants in Germany. Manufacturing activities contribute the most to the added value of the country (33%) followed by financial intermediation, renting and business activity (28,4%). The principal industrial activity of the region is the production of machinery and vehicle construction (located in particular around Stuttgart) hiring respectively 22,1 % and 19,5% of workers. Machineries and motor vehicles are the sectors for which the region shows a high comparative advantage in trade flows, representing the main export flows with 27.224 and 23.616 millions of euro (in 2003), followed by chemical products. (Source: Baden-Württemberg wirtschaftsministerium).

Catalunya

Catalunya is in the North-East of Spain. The regional imports approximately accounted for 30% of the Spanish imports while exports represented 27, 7% of the total in Spain in 2002. Services provide the most important contribution to the regional economy (62%) followed by industry (28,1%) and construction (8,2%). In the same year, the employment rate in Catalunya achieved 9,2 % of the active population and it was lower than the Spanish rate (11,1%).

In the last few years, Catalunya reinforced its position as a business and financial pole in Spain. In 2002, the gross revenue of the industrial sector was approximately 112.500 millions euros, equivalent to 25 % of the overall national value. In the same year, Catalunya accounted for 17,5% of the national bank accounts and nearly 19% of all Spanish bank agencies. (Source: IDESCAT and www.gencat.net)

Lombardia

It is the most populated Italian region with the highest concentration of business and wealth. The economy represents one-fifth of the Italian economy. Lombardia concentrates 18,4% of the Italian workforce with a low unemployment rate (3,8%).

The number of enterprises (740.000) in Lombardia accounts for 15% of the national amount. The crafts industry represents the largest share of the industrial activity, representing one sixth of the regional economy (18-20% of the national total).

The industry's contribution to the regional economy is approximately 36%, while services represent nearly 62% of the total. In addition, Lombardia is the major Italian financial centre with 25.8% of national commitments and 23,.4% of the overall national deposits.

Lombardia is also a very open region. In 2004, it received 37% of the overall national imports and 30% of the national exports. (Source: Annuario Statistico della Lombardia).