

LOCATION DETERMINANTS OF BUSINESS SERVICES WITHIN A REGION WITH LARGE URBAN ASYMMETRIES

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Abstract

We carry out an analysis of the determinants of location for business services within a region, as opposed to the more usual comparisons among nations or regions. The expected higher concentration patterns at this level can be further biased when one or more urban centers have a disproportionate weight in regional economic activity. We propose an econometric analysis of location determinants (*scale, urbanization and agglomeration economies*, human capital and infrastructures) taking into account the influence of this kind of asymmetry. To this end, we identify one region with this characteristic (a disproportionate weight of the capital city's share with respect to the total, as shown via several location coefficients), namely the Spanish region of Aragon. Using intra-regional data, our results show that including the capital city in the regressions or not alters the conclusions on the determinants of location.

Keywords: Business services, spatial economics and services location.

JEL: L84, R12 and R11.

1. Introduction

Business services are non-financial services that contribute as intermediate inputs to improving business competitiveness through interactive co-productions. They include not only traditional activities such as rentals, accounting, security or cleaning services, but also advanced activities such as computing, engineering, R&D or advanced consultancy services. These are branches that are defined as strategic for the rest of the economic activity sectors in a country or region. Their important contribution to the economic growth of a region may be summed up as follows. They favor the dissemination of technology and innovation, they play a key role in job creation and foster the development of SMEs as a result of facilitating the access of these types of enterprises to external services. In short, they are a key factor for the competitiveness of a territory.

However, one of their most important characteristics, especially in the more advanced business services, is their extraordinary concentration of firms and employment around certain polarized nuclei, even more so than in the case of manufacturing industries and consumer services. This may act as a factor for regional and urban disequilibrium by accentuating differences and establishing growth paths with very diverse rates.

The recent boom in these services, partially due to the phenomenon of outsourcing in industry, may lead to an acceleration of this regional concentration wherever strong prior asymmetries in the location of economic activity in general exist. This would be the case, for instance, of a large city in which the majority of a region's population and businesses is concentrated. These concentration trends still do not offer

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clear signs of diminishing. Despite the fact that the new technologies make it possible to provide certain services from a distance and some services use back-offices in lower cost areas, the personalized character of many services requires physical proximity to customers.

To the best of our knowledge, the majority of empirical analyses on the determinants of business services (henceforth, BS) location compares nations or regions, or, when they refer to cities, use a very limited number of explanatory variables. However, the literature provides several alternative explanations for the location trends of these services, which justifies the need for a more comprehensive analysis that allows their validity to be tested. What is more, given the high degree of geographical concentration of BS, a more detailed analysis with a level of aggregation below that of the region becomes of interest. In particular, the question arises as to whether some results obtained for regions may be biased by the presence of a large urban center.

This paper responds to a threefold need. Our first goal is to obtain a greater degree of disaggregation in the analysis of the geographical location of BS, contemplating the economic behavior of smaller territories within a region, but which include several municipalities. This will affect the data employed, since a greater concentration of the sector is expected with respect to that of higher-level territorial units. Secondly, our aim is to carry out a preliminary analysis of the determinants of BS location most often identified by theory. This is a step that can be useful for further analyses that try to evaluate the elements capable of attracting the necessary supply to a region in order to develop its markets. The third goal in this analysis is to consider the influence of the extreme data that derive from a strong concentration of the whole of regional activity in a few nuclei.

To this end, we consider the application of an explanatory model of BS location to the Spanish region of Aragon, which is divided into 33 smaller territorial areas called *comarcas* (roughly equivalent to counties). This is an interesting case for the proposed objectives, since the region is not particularly specialized in the BS sector, although the weight of these services in the economy is growing quickly, and shows important asymmetries in their location.

The following section provides a brief review of the literature on BS location. In the third section, the location patterns of these services in the *comarcas* of Aragon are described by means of indexes constructed from the number of firms and of jobs in the sector. These illustrate the extremely high concentration around the regional capital. In the fourth section, a regression is estimated to explain the decisions to locate these firms as a function of several of their theoretical determinants. These include *economies of scale*, of *agglomeration* and degree of *urbanization*, together with allocations of human capital and infrastructures. After presenting the results of the application, our conclusions are outlined in the final section.

2. Determinants of business services location in the literature

The reasons explaining the location of services in general and BS in particular are usually wide-ranging and varied: factors related to supply, demand or the economic context, factors related to the market, business features and the nature of the services offered. It is generally accepted that several of these factors interact with one another and have more or less relevance depending on the geographical level under study (Rubalcaba

and Gago, 2003), thus complicating their analysis. In our approach we will use central place theory plus some elements identified as explanatory of industrial location decisions.

An initial aspect related to the location of BS firms is the search for locations from which their market potential may be maximized. The explanation of this behavior lies in the fact that the firms that tend to consume certain services externally do so in order to exploit the *economies of scale* that are generated in these activities (Stigler, 1951), which would be impossible in an integrated production model. In order to exploit these *economies of scale*, an intense productive specialization must be achieved, and such specialization is only possible when very large markets may be accessed. This will address BS firms towards the search for centralized locations from which they may maximize consumer potentials.

In particular, Christaller's *central place theory* (1935) has been of great utility in understanding the dynamics of the location of tertiary sector activities. Within this approach, economic activities are classified in a hierarchy according to the need for proximity to the customer or the possibility of concentrating production at one point from which the market may be supplied at a large scale at the cost of less proximity to consumers. Infrequent consumer activities, with low transport costs in which the customer is willing to cover large distances in order to consume, are thus designated as *superior*. These activities will tend to be concentrated at central points from which the potential market may be maximized. In contrast, Christaller's hierarchy classifies those convenience goods or services that the customer is not willing to cover large distances to consume as *inferior*.

Figure 1, taken from Daniels (1985) presents a schematic view of this idea. Starting out from a homogeneous distribution of the population –people or businesses– along a uniform plane, the service provider will seek to locate at that point from which he maximizes his potential customers while assuming the least possible distribution costs. The upper part of the figure represents the demand flows, intended to present the frequency with which a particular service is accessed. The height of the cones represents the intensity of consumption; the width represents the frequency with which they must be carried out. There will normally be a positive correlation between the height and width of the cones, since when a lower frequency in consumption is required, a greater demand will be made in each consumption. The shape that the cones corresponding to activities that are commonly consumed would have, is represented on the left of the figure. The activities that need to be consumed less frequently are superimposed on the right. The base of the cones is represented at the bottom of the figure: i.e. the sphere of spatial influence of a firm *versus* the frequency at which consumption is carried out. When this consumption is sufficiently spread out over time, a necessary requisite to avoid any trend to locate closer to customers, a process of centralization of manufacturing firms is usually produced in order to exploit *economies of scale*. In short, maximization of *economies of scale* and proximity to the customer enter into conflict, with one of these factors being sacrificed in benefit of the other. The choice of the location to the firm will depend on the importance that each factor has in each case. In BS, the object of our study, the strong trends of spatial concentration identified at both an international (Senn, 1993, or Gago and Rubalcaba, 2003, among others) and a national scale (see Gago, 2000, or Rubiera, 2005, for the Spanish case) lead to the conclusion that these are activities in which *economies of scale* play an essential role and dominate the also important proximity to customers.

In any case, the existing heterogeneity among BS should be reflected in location trends, with different degrees of concentration. Certain highly specialized services will tend to locate at central points of the superior hierarchy. At the same time, however, we must observe that other activities have to be more dispersed in the search for a location that is inferior in the hierarchy but closer to the customer. On the basis of this reasoning, we should observe very strong patterns of concentration of activities of a more advanced nature around the main urban nuclei (superior central points) along with processes of partial concentration around secondary cities (inferior central points).

INSERT FIGURE 1 AROUND HERE

However, it is also evident that a uniform distribution of the population does not exist in the real world and thus nuclei with very high population densities have the greatest possibilities of being the accumulation nodes described in the theory. This reality is likewise linked to the remaining potential determinants in the location of BS firms.

In fact, there exists a clear pattern of concentration in higher-income regions or geographical spaces and most especially in large urban nuclei. This is a concentration process that feeds itself. Higher-income regions and cities offer the best conditions for these services to arise. At the same time, the development of a broad, flexible offer in BS reinforces the power of attraction of these spaces, thus making them more productive (Ciccone and Hall, 1996).

That is to say, *economies of scale* are not the only relevant factors for this concentration of BS and above all of those that are the most knowledge intensive. Moulaert and Gallouj (1993) point out that in addition to transport costs, accessibility to human capital and *economies of agglomeration* must also be taken into account. As regards human capital, Baró and Soy (1993) and Hansen (1990), among others, consider this to be an essential factor in the location and growth processes of this type of firms. With respect to *economies of agglomeration*, it is evident that BS are very sensitive to both *external economies of location* and *external economies of urbanization* (Noyelle and Stanback, 1984; Polèse and Shearmur, 2003)). In an analysis similar to the one carried out in this paper, Parr and Budd (2000) find a systematic and well-defined locational pattern in the case of financial services within the UK. They point out that agglomeration may conveniently be approached in terms of the agglomeration used for the analysis of industrial location (*economies of scale*, *location economies* and *urbanization economies*).

In this respect, the extensive evidence accumulated recently regarding the influence of cities and their size on the generation of *economies of agglomeration* or the attraction of qualified human capital (Hall, 2000; Simmie, 2001; Jacobs, 1984) points out the relevance that large cities have in the creation of the social and cultural dynamics that foster *external economies of urbanization*. The interaction of economic actors belonging to similar activities concentrated in urban spaces brings about processes of creation of *knowledge spill-overs* that lead to increased growth and the attraction of more firms belonging to the activity sector (*external economies of location*), as reported by Jacobs (1984), Piore and Sabe (1984), Porter (1990) and Malecki and Oimas (1999), among others. At the same time, authors such as Shearmur (1998) find clear evidence that large cities are capable of attracting a greater concentration of qualified human capital.

Consequently, as Marshall and Wood (1995) point out, BS will tend to concentrate in highly urbanized areas. Firstly, because they are able of exploiting a

central position from these areas, which allows them to take advantage of *economies of scale*. Secondly, because they will be able to draw on high concentrations of human capital and strong *economies of agglomeration* in such areas. Thus, the processes of concentration become reinforced.

The consideration of all these aspects indicates that BS and, above all, the most advanced BS, behave ambiguously in their location. Estimating the degree of concentration or dispersion of BS in specific regions is thus a relevant empirical issue.

Hence the interest of testing this in different territories and at different levels of aggregation, and in particular, of attempting to analyze the influence of a large city on its territory of influence. However, we shall not focus on the role of large global cities, but rather on those that may be considered second or third rank, where the influence is more local and regional in nature. To the aforementioned importance of the degree of urbanization is to be added the fact that prior studies at a European regional level indicate that some of the relations that explain the location of BS may be biased by the presence of those regions that include the national capital (Rubalcaba and Gago, 2003). The second-ranking cities have different roles in each country and have been analyzed to a lesser extent, with exceptions such as Daniels and Bryson (2005)¹.

Furthermore, different approaches, such as the above and Rubalcaba and Merino (2005), indicate the need to combine regional and urban analysis. Our study aims to incorporate this notion, even if it is done in preliminary way. The study thus seeks to measure the determinants of the location of these services within a specific region (Aragon) where the characteristic concentration of the sector is heightened in a large city. The suitability of the chosen region to represent this spatial trend is presented in the following section.

3. The case of the *comarcas* in Aragon: a context of high concentration of business services.

In order to understand the characteristics of the location of BS within the region under study, a reference to the Spanish context may be useful². Two recent studies, Gago (2000) and Rubiera (2005), show that the polarization of BS in Spain is evident. As regards employment, the majority of the regions present significantly lower proportions in national employment levels in real estate and business services than those they possess with respect to total national employment. Madrid and Catalonia show much higher percentages than the remaining regions. In 2006, 43% of jobs in business services belonged to these two regions, Madrid with 23% and Catalonia with 20% (while they concentrate just 33.3% of total firms). When the analysis refers to the most advanced

¹ In their study of the performance of business services in Birmingham and its surrounding region, they report that, although there is a strong concentration of these services in the capital, the location and growth patterns of the different branches in other areas need to be taken into consideration in order to understand the potential of business services to change the character of the city.

² In Spain, there are few studies on the location of business services, which is understandable given the lack of disaggregated statistics until very recently. We may cite the work of Baró and Soy (1993) or Martínez *et al.* (2002). The results are necessarily more modest than in the more developed literature on the location of industries.

services, the polarization is even more pronounced in these two regions, with percentages of 30 and 24%, respectively, in earlier years (Rubiera 2005).

Our study will focus on Aragon, a region situated in the north-east of Spain and made up of 3 provinces. It occupies an extension of 47,719 km² (9.4% of Spain), and had 1,277,471 inhabitants in 2006 (2.9% of the Spanish total). Its weight in the Spanish gross domestic product in the above year was 3.1%. The GDP purchasing power parity *per capita* of the region in 2006 with respect to the EU-15 was 104.4. Its capital is Zaragoza, with 649,181 inhabitants in 2006 (more than a half of the total), and it is equidistant from Madrid and Barcelona. In 2006, this region was home to 2.8% of the total number of national firms, 3.2% of the industrial firms and 2.7% of the tertiary firms, but only 2.4% of the real estate and BS firms and 2.3% of firms exclusively devoted to the provision of BS.

The territorial reference unit for our analysis are the 33 *comarcas* in which the region is divided. A *comarca* is an intermediate entity between a municipality and a province. It is a unit made up of bordering municipalities linked by common characteristics and interests (the use of data for more than 700 municipalities, some of which have few inhabitants and scant economic activity, would not be very manageable)³. To test the strong spatial concentration of BS within these territories, we calculate a series of measures of concentration and inequality, verified both in theory as well as in practice.

These indexes are built from the number of firms and jobs located in each *comarca*. As an approximation of the number of firms, we employ the number of activity licenses provided by the Economic Activity Tax of the Statistical Institute of Aragon (IAEST). The analysis is repeated from the perspective of employment using the number of Social Security registered contributors published by the Central Treasury for Social Security. Both variables refer to the year 2000 and the original data on the municipalities were aggregated for the 33 *comarcas*.

Our interest focuses mainly on the most advanced business services, that is, the aggregation of three activities, which are *Computing Services* (NACE 72), *Research and Development Services* (NACE 73) and the rest, grouped together in *Other Business Services* (NACE 74). The data also allow us to observe the wider set of *real state and BS activities* (NACE Section K), which also includes *real estate and renting services* (NACE 70 and NACE 71). In the descriptive part of our analysis, we will comment on the results for all these different aggregation levels, which will let us appreciate if the level of knowledge intensity matters for spatial concentration in the region. In the estimation of our model we will focus on sectors 72, 73 and 74.

A first glance at the data shows that, in the case of services, employment is distributed among the *comarcas* in a very similar way to total employment, but important differences appear when we refer to BS. These are fundamentally concentrated in the *comarca* that includes the regional capital, Zaragoza, together with two others in which the other provincial capitals are located. The sum of these three *comarcas* supposes 72% of employment in the total number of activities, 81% in services, and 90.5% in BS – 96% in computing services (91% alone in the *comarca* of Zaragoza). No other *comarca*

³ On average, a *comarca* has more than twenty municipalities, a surface area of 1,446 km², a population of almost 38,000 inhabitants and an available gross income of 551.3 million euro. The surface area is disproportionate with respect to the resident population, especially when taking into account the high level of dispersion that both variables present.

reaches even 1% of the total. The concentration is also very high, though lower, with respect to the number of firms. Zaragoza alone represented 71% of the BS licenses in 2000 (together with the other two capitals, this figure reached 80%), as well as being the largest agglomeration in advanced services such as R&D and computing services⁴.

With such high figures, the indexes of concentration can do no more than confirm the first impression of a strong imbalance centered around the capital. With the data regarding the variable number of firms presented in Table 1, Theil's coefficient, Lorenz's index and the location coefficient indicate a higher concentration than the regional average in real estate and business services (0.55, 0.85 and 0.19 respectively). The three coefficients are especially high in R&D and in computing services and somewhat lower in other BS (Appendix A contains the formulas chosen for their calculation).

It is perfectly foreseeable that inequality in the spatial distribution of the activity increases as the reference territories decrease in size, especially when relating parts of the economy that are highly integrated with one another, such as *comarcas* within a region. The same occurs when taking into account sectors that are increasingly more disaggregated and hence have a lower number of firms. This is confirmed if we compare our indexes with those estimated for Spain in 1996/98 by Rubiera (2005) from regional data (Theil's index for the number of firms, 0.17; Lorenz, 0.70; location, 0.19): the indexes in Aragon are clearly higher. However, the differences found also show a greater objective concentration. If we may talk of a strong polarization in Spain due to the fact that Madrid and Barcelona represent almost 50% of the firms and employment in BS, this polarization must be higher in Aragon, since one single *comarca* concentrates up to 70%. On the other hand, the classification of sectors follows the same trend in Aragon as in Spain: services somewhat more concentrated than the average, but BS much more so than the rest. Computing and R&D services are also especially prominent in Spain.

Table 1. Concentration indexes. Aragon (2000)

	FIRMS			EMPLOYMENT		
	Theil	Lorenz	Location	Theil	Lorenz	Location
TOTAL	0.34	0.76	-	0.48	0.83	-
MANUFACTURES	0.12	0.75	0.06	0.40	0.80	0.15
SERVICES	0.38	0.78	0.06	0.57	0.86	0.09
Real Estate and BS (<i>NACE Section K</i>)	0.55	0.85	0.19	0.72	0.90	0.19
Computing services (<i>NACE 72</i>)	0.64	0.88	0.25	0.86	0.92	0.30
R&D (<i>NACE 73</i>)	0.64	0.88	0.25	0.79	0.92	0.29
Other BS (<i>NACE 74</i>)	0.57	0.86	0.21	0.72	0.90	0.19
BUSINESS SERVICES (<i>NACE 72+73+74</i>)	0.58	0.86	0.21	0.73	0.90	0.19

Source: Own, based on the Census of Economic Activities Tax (Statistics Institute of Aragon) and registered contributors to the Social Security system (Central Treasury for Social Security).

⁴ We do not include detailed results for the 33 *comarcas* in order to save space, but they are available from the authors upon request.

As can be seen, the pattern as regards the concentration of activities obtained from employment data shows results that are practically the same as those discussed above. Business services appear more concentrated than before in all cases. The only exception is a value of the location coefficient for the set of BS in Aragon of 0.19 instead of 0.21. These results indicate that the firms situated in the large centers of development of the sector are not only greater in number, but also larger.

Once we have seen the strong spatial concentration of business services (especially for the most advanced ones) in the Aragonese *comarcas*, it makes sense to investigate the variables influencing location decisions of these activities. To this end we carry out an econometric analysis in the next section.

4. Empirical analysis and results

4.1 Selection of variables

Our interest lies in ascertaining the reasons for the strong processes of concentration that have been identified. Following the proposals made by several authors, already reflected in Section 2, we intend to determine a list of variables to be analyzed by means of a simple econometric study, somewhat limited due to the reduced amount of statistical information available.

To apply our proposal to the economy of Aragon, the 33 *comarcas* in which this region is divided up were taken as the spatial reference. The dependent variable *LOC*, the location of BS firms, was firstly constructed from the number of licenses of registered BS firms in each *comarca* in the Economic Activities Tax as an approximation of the number of firms in the sector. In a second estimation, *LOC* was constructed as the number of registered contributors to the Social Security system in BS firms in each *comarca*, representing employment in the sector. Both variables include data for groups 72 to 74 in the NACE classification and refer to the year 2000. Appendix B summarizes the definition of the dependent variables, which are detailed below, as well as the sources of the data employed.

Firstly, a simple coefficient is proposed in order to estimate the effects of *economies of scale* on location patterns of BS firms. The maximization of the market size that may be accessed from each potential location is relevant, therefore we compute the index called *ESCALE* in the following way:

$$ESCALE_i = \frac{P_i + \sum_{j_i=1}^n \frac{P_{j_i}}{D_j}}{P_i + \sum_{j_i=1}^n P_{j_i}},$$

with P_i being the size of the potential market in the i -th territory for BS firms situated in this territory and $\sum_{j_i=1}^n \frac{P_{j_i}}{D_j}$ the size of potential market for such firms (in each one of the j -th territories (P_{j_i}) closest to the i -th region), adjusted by the distance between each territory and the i -th (D_j). The above part of the ratio is divided by the total market size in order to obtain the relative value of the potential market size. The larger the size of the accessible market is -and, thus, the higher the possibility of exploiting *economies of*

scale-, the greater the value of the proposed coefficient; and vice versa. The value of this coefficient will range from 0 to 1, reaching values higher than 0.5 only when a very pronounced concentration of the potential *economies of scale* in a particular territory exists.

Due to the scarceness of data, the *ESCALE* variable was obtained using the gross added value of each *comarca* (excluding its agricultural and energy components) as a proxy of the potential market to the BS firms.

Secondly, to introduce an index of the degree of agglomeration of the sector in a territory (*AGGLOM*), we choose to calculate the number of BS firms per km² in each territory.

Thirdly, we introduce a variable to reflect the degree of urbanization of the territories, since several studies have found this to be relevant in the location decisions of BS. In our application, we calculate the proportion of the resident population in municipalities of over 10,000 inhabitants with respect to the total in each *comarca* (*URBAN*). To build the variable, we employed the information provided by the Statistics Institute of Aragon (Iaest) relative to the year 2002⁵.

These are not the only relevant factors. Every firm values proximity to the resources it uses and in the BS sector the essential resource is human capital. It may thus be assumed that the abundance of qualified workers will also be an element to bear in mind in location decisions. The influence of human capital, *KHUM*, was introduced using the proportion of the population with a university degree with respect to the total employment in each *comarca*, and was obtained from the IAEST for the year 2001⁶.

The available *infrastructures* in the territories is another factor that has to be taken into account (Daniels, 1985); although the question as to what type of infrastructures attract BS firms the most is open to debate. On the one hand, the effect of infrastructures considered as being traditional in nature (*INFRATRAD*), i.e. roads and other public works, cannot be disregarded. However, it is also necessary to evaluate the volume of more advanced infrastructures (*INFRATEC*), i.e. the existing telecommunications networks in each territory.

In the latter case, we are dealing with insufficient statistical information. It has not been possible to obtain a synthetic indicator of traditional and advanced infrastructures disaggregated by *comarcas*. It was thus decided to make use of two proxy variables. *INFRATRAD* was defined as the number of kilometer of roads per *comarca* and *INFRATEC* as the number of telephone lines per *comarca*. Data is available for the first variable relative to the year 2002, while for the second we were forced to make use of data corresponding to the year 1995 (Oliveros, 2003). In both cases, the lack of more sophisticated variables questions the suitability of the employed variables for the goals of the analysis, and hence the results must be interpreted with special caution.

⁵ With figures of 100,000 inhabitants, the criterion commonly used at an international scale, only one city would be considered, Zaragoza. In Spanish analyses, a threshold of 10,000 inhabitants is considered normal.

⁶ It seems likely that the level of qualification of workers that influences the decision to locate is that of a period prior to such a decision. Consequently, it was also decided to substitute this variable by its lagged value. However, as the only available lag is ten years, the poor results obtained with this variant are not surprising, given the excessive distance of the data.

To sum up, six factors were chosen that may be considered relevant in the location decisions of BS firms (*LOC*) from a theoretical perspective, synthesized in the following expression of the location decisions model:

$$LOC_i = \beta_0 + \beta_1 ESCALE_i + \beta_2 AGGLOM_i + \beta_3 URBAN_i + \beta_4 KHUM_i + \beta_5 INFRATRAD_i + \beta_6 INFRATEC_i + u_i$$

In the empirical estimation, positive and statistically significant values may be expected for the majority of the β . The specific analysis of the value that each β takes will serve to evaluate which elements are the ones with the most influence on the decision of a firm to locate in a particular territory.

4.2 Results

Table 2 presents the results obtained when explaining the behavior of *LOC* as a function of the independent variables considered, calculated by means of a simple minimum quadratic regression (OLSQ). Owing to the peculiarities of the region (with a large disproportion of one single city, the regional capital, over the rest) two estimations are carried out with each dependent variable. One in which all the *comarcas* are included and another excluding the *comarca* of Zaragoza, which concentrates the major part of the economic activity of the region, as was shown in Section 3. The aim is to check whether this *comarca* attracts BS in a different way.

Table 2. Location determinants for business services among *comarcas* in Aragon

VARIABLE	LOC (Location of Business Services)			
	Number of business services licenses in each <i>comarca</i>		Volume of business services employment in each <i>comarca</i>	
	With Zaragoza	Without Zaragoza	With Zaragoza	Without Zaragoza
<i>ESCALE</i>	0.14 (2.07)**	0.39 (5.22)*	0.15 (1.30)	0.57 (4.00)*
<i>AGGLOM</i>	0.04 (0.48)	-0.08 (-1.13)	0.04 (0.31)	-0.18 (-1.43)
<i>URBAN</i>	0.82 (12.34)*	0.61 (9.37)*	0.81 (7.41)*	0.50 (4.01)*
<i>KHUM</i>	0.01 (1.74)***	0.13 (2.58)**	-0.00 (-0.37)	-0.08 (-0.87)
<i>INFRATRAD</i>	-0.01 (-1.85)***	-0.08 (-1.82)***	-0.01 (-1.16)	-0.06 (-0.67)
<i>INFRATEC</i>	0.01 (1.74)***	0.11 (2.64)**	0.01 (0.80)	0.10 (1.28)
R^2	0.99	0.97	0.99	0.90
Adjusted R^2	0.99	0.97	0.99	0.87
F-Statistic	7,945.32*	143.57*	192.16*	36.38*
Durbin-Watson	2.13	2.44	2.24	2.62

Note: Standardized coefficients. */**/** indicate a significance of 1, 5 and 10 %, respectively. In brackets, the value of the coefficient of the *t* statistic. Source: Own, on the basis of the sources cited in the text.

Analyzing the results obtained and comparing the estimations in which Zaragoza is excluded with those that include all the *comarcas*, the following conclusions may be drawn⁷.

Firstly, the fundamental variable for explaining the location of BS in this region is *URBAN*, in all the estimations, due to both its level of significance as well as the value of its coefficient. Both are somewhat lower in the estimations excluding Zaragoza. As demonstrated in other contexts, the degree of urbanization of territories is clearly significant and exerts a positive influence over the decision to locate a BS firm, thus reinforcing the concentration of these activities around the city of Zaragoza. Gago (2000) shows that, among the regions in Spain, employment in BS per inhabitant is explained by the *per capita* income of each region and by its index of urbanization (the proportion of population residing in urban nuclei of more than 50,000 inhabitants). The author expects the effect to be greater at lower levels of aggregation, as confirmed by our data.

Some studies on the Spanish regions of Madrid (Rubalcaba, 1998) and Catalonia (Soy, 1997) report growing patterns of departure from the large city centers towards well-linked locations on their peripheries. This may be explained by the excessive size of cities, which generates strong *diseconomies of agglomeration*. Observing the obtained data, we may conclude that this behavior is still not appreciated to a significant extent in the case of Zaragoza.

Secondly, the estimated coefficients for the variable *ESCALE* are both positive and significant, in keeping with what is to be expected for a variable that represents the access to the market from each *comarca*. However, both the value of the coefficient and its significance are higher when the *comarca* of Zaragoza is excluded from the estimation. In fact, it does not even reach a satisfactory level of significance for employment when Zaragoza is included. The explanation may lie in the strong concentration of economic activity produced around the capital, such that its high degree of urbanization seems to undermine the influence of the economic size of the market in this *comarca*. By excluding it, its effect as a driving force disappears and the result offers a better fit to the forecast. That is to say, the greater the size of the potential market, the greater the likelihood of the development of BS (positive sign, significant and with a higher value of the coefficient β_1).

Contrary to what was expected, the variable *AGGLOM* is not significant in any case. It may be supposed that the relevance of the *economies of agglomeration* around the capital is not observed in our estimation because these are incorporated via the variable *URBAN*, which is much more significant⁸. In alternative estimations *AGGLOM* is significant when the capital is included in its *comarca*⁹.

⁷ The explanatory capacity of the variables included is wide reaching in all cases. No problems of heteroscedasticity (*White's* test) or normality (*Jarque-Bera* test) that globally invalidate the results in any of these were found. Neither did the multicollinearity tests point out any serious deficiencies in the model.

⁸ Parr (2002) proposes a classification of internal and external economies to explain the different types of agglomeration economies that coexist. A critical aspect pointed out for their identification is the fact that agglomeration economies of different types may coexist: internal and external to the firm, of scale, scope.

⁹ The estimations were repeated substituting the variable *ESCALE* based on the gross added value of the *comarca* by another that is based on the number of total firms in each *comarca*. The results

The results of these three variables jointly suggest that the key to the decision of locating within the region is the urban concentration, and in this aspect, given the high asymmetry versus the rest, the *comarca* that includes the capital is without doubt the most attractive. The concentration of firms belonging to the sector, which follows a similar pattern to *URBAN*, with an accumulation in the capital city, does not separately influence the decision, while the size of the accessible market from each location does intervene, but above all when the firms established in the capital are excluded. In this last case, the access to the market becomes more relevant, and urbanization less so, such that in the distribution of jobs, both are found to have equal importance.

The remaining variables are only determinant for the location of firms, not of employment. The greater spatial concentration of employment verified in a previous section may explain why location decisions respond only to the two key variables. On the one hand, to *URBAN*, in which the rest of the *comarcas* cannot compete with Zaragoza, the place where the BS firms with the largest number of jobs are located. On the other hand, when Zaragoza is discarded, employment also responds to the size of the accessible market (*ESCALE*). There is no space left for the influence of other variables.

Human capital, measured by means of the proportion of the population with a degree with respect to the total number of jobs, is significant and positive when the estimation is made for all the *comarcas*, but increases its weight when Zaragoza is excluded from the analysis. This result points in the same direction as the coefficients of the variables analyzed up to now. The general trend is that of concentrating in Zaragoza. Although human capital is more abundant in this *comarca* than in the rest, it occupies a second rank, since the other two variables are much more determinant. However, when we exclude Zaragoza and analyze the appropriate location for a BS firm among the other *comarcas* in the region, *KHUM* is found to be more significant and has a higher coefficient, although far behind *URBAN* and *ESCALE*.

In alternative estimations in which human capital also included the population with intermediate levels of education, the variable is no longer significant. This reflects both the fact that the differences between *comarcas* are defined by higher education, since secondary education is distributed in a much more homogeneous way, and that the relevant qualification for the location of BS is the university degree.

As mentioned above, the variables referring to infrastructures must be interpreted with caution since these are *proxy* variables. Both the variables aimed at analyzing the effect of traditional infrastructures as well as those of a more technological nature are statistically significant in the complete regression for the number of firms (at a level of barely 10%), but their coefficients show very moderate effects and take different signs. The existence of technological infrastructures, *INFRATEC*, seems to have a positive

may seem surprising, but they support this interpretation. For the estimations with all the *comarcas*, *ESCALE* takes a negative sign. Without Zaragoza, the sign becomes positive and remains significant for licenses. *AGGLOM*, on the other hand, is significant and positive only with Zaragoza. Our interpretation is that BS firms in Aragon normally seek to locate in the city of Zaragoza, causing the result of the estimation to be inversely related to the sizes of the accessible market. Thus, they concentrate in this *comarca* not only in order to maximize their potential market from there, which they could achieve from neighboring *comarcas* with lower set-up costs, but also to take advantage of the relations that are forged between firms, be it in the same business sector (*AGGLOM*) or in others (*URBAN*).

influence on the concentration –as expected- and, if Zaragoza is removed from the analysis, its influence increases (5% level of significance and a higher coefficient). However, traditional infrastructures, *INFRATRAD*, have a negative influence, although they present low coefficients and a level of significance of only 10%. Thus, the explanation that the better the links, the lower the presence of BS firms, since they may access the *comarca* from other locations, cannot be upheld categorically. Nevertheless, the appropriateness of analyzing both types of infrastructures separately is confirmed, though this must be done with caution.

It is difficult to directly compare these results with studies that use different variables and contexts, but we shall refer to one of the most recent, which at the same time uses a multivariate analysis, namely that of Rubalcaba and Gago (2003). Although it refers to advanced European countries, there are some similarities with the finding of these authors in order to explain BS location: the importance of access to customers and of what they call *economies of agglomeration*, the main determinant in their results. However, these *economies of agglomeration* are captured by a variable of population density that makes it more similar to our variable of urbanization. Although their treatment is different, they also recognize peculiarities in the regions that include the national capital (in their application these are especially observed in relation to income), which lends new support to their separate consideration.

5. Final remarks

This paper presents an empirical analysis of the determinants of the strong geographical concentration of BS within one region, representing an intermediate level between the urban and regional level. Our specific aim has been to understand whether these determinants explain the location of these firms in a different way when there is a center with an unbalanced weight with respect to the region as a whole, for which it is crucial to consider the degree of urbanization.

In the regression analysis used to study the determinants of the location of BS firms among the *comarcas* of Aragon, six possible explanatory factors that are relevant from a theoretical perspective were taken into consideration. In order to take into account the effect of the high concentration of all types of activity in the *comarca* of Zaragoza, where the major urban center of the region is situated, we carried out the estimation twice, with and without this *comarca*, since the relations with the explanatory variables experience significant changes if it is excluded from the sample.

This treatment confirms the influence of extreme patterns of urbanization. Business services, even more so than economic activities as a whole, are concentrated in the capital city, which has a disproportionate weight in the region's economic activity in general. This fact is supported by the relevance of the variable of urbanization, essential in the location decision of BS.

From the analysis carried out, it may be concluded that the strong concentration of BS appreciated in the region of Aragon around the city of Zaragoza mainly responds to the search for *economies of urbanization* and *economies of scale*. The former lead firms to locate in or around Zaragoza, where the major part of the economic activity is concentrated, and from where they have at their disposal a central location with access to the entire regional space and the main national centers of production, explained by the latter variable. This result is coherent with theoretical and empirical evidence in this respect. Other related studies, such as Martínez *et al.* (2002) for the Asturian economy or

Rubiera (2005) for the Spanish economy, find that advanced BS firms seek central locations in order to maximize their market size. Gago (2000) points out the importance of the degree of urbanization for the presence of employment in BS among Spanish regions, and states that a greater influence would be expected if the territorial aggregation were lower, which is confirmed by our results.

Moreover, this concentration in the capital could still have not generated so great a volume of *diseconomies of urbanization* as to produce significant forces of crowding-out of BS firms, in contrast to larger cities like Madrid or Barcelona. If the *economies of scale* seem to explain the fact that the majority of BS firms in the region are situated close to the *comarca* of Zaragoza, the existence of positive *economies of urbanization* would explain the fact that the majority of these choose to locate specifically in the city of Zaragoza.

The remaining effects studied, infrastructures and human capital, seem to exert much less of an influence than the *economies of urbanization* and of *scale*. As regards human capital, this is a relevant variable, but is likewise concentrated in the *comarca* of Zaragoza and its surroundings, thus reinforcing the effect of the rest of the factors studied. This is more significant when Zaragoza is excluded from the analysis. Improvements in the available data would be needed to better explain the effect of infrastructures, favorable to location in the case of technological infrastructures and negative in the case of traditional infrastructures.

The system proposed in this paper for identifying the determinant variables of business location at levels below that of the region may be of interest in order to repeat its application in other contexts, thus allowing comparison between experiences in different regions and in order to confirm or not the different influence of the variables depending on the considered level of aggregation. In our case, the variables that determine the location of BS are practically the same with or without including the capital city, but their influence changes notably between the two cases. It is important to go into these changes in explanatory power in more detail in order to understand the effects of this concentration of BS in the development of regions where this occurs, given the potential of these activities to influence their economic development.

References

- Baró, E. and A. SOY (1993): Business service location strategies in the Barcelona metropolitan region, in: P.W. Daniels *et al.* (Eds.) *The Geography of Services*, pp. 23-35. London: Frank Cass.
- Ciccone, A. and R.E. HALL (1996): "Productivity and the Density of Economic Activity", *American Economic Review*, 86 (1), pp. 54-70.
- Cuadrado, J. R. and L. Rubalcaba (1993): Regional Trends in Business Services Supply, in: P.W. Daniels *et al.* (Eds.) *The Geography of Services*, pp. 51-65. London: Frank Cass.
- Daniels, P. W. (1985): *Services industries: A geographical appraisal*. Methuen.
- Daniels, P.W. (1993): *Service industries in the world economy*. Oxford: Blackwell.
- Daniels P.W. and BRYSON, J. R. (2005): "Sustaining Business and Professional Services in a Second City Region: The Case of Birmingham, UK", *The Service Industries Journal*, 25, 4, pp. 505-524.
- Gago, D. (2000): Las relaciones entre los servicios a las empresas y la industria en el contexto regional, *Working Paper 2/2000*. Madrid: SERVILAB.
- Hall P. (2000): "Creative Cities and Economic Development", *Urban Studies*, 37, pp. 639-49.

- Hansen, N. (1990): "Do producer services induce regional economic development?", *Journal of Regional Science*, 30 (4), pp. 465-476.
- Illeris, S. and J. Phillippe (1993): Introduction: the role of services in regional economic growth, in: P.W. Daniels *et al.* (Eds.) *The Geography of Services*, pp. 3-10. London: Frank Cass.
- Jacobs, J. (1984): *Cities and the wealth of nations*, Vintage, New York.
- Malecki, E. and Oinas, P. (1999): *Making connections. Technological learning and regional economic change*. Aldershot, Ashgate.
- Marshall, N. and P. Wood (1995): *Services & Space. Key aspects of Urban and Regional Development*. Singapore: Longman Singapore Publishers.
- Martínez, S. R.; Rubiera, F.; Cueto, B.; Dávila, M and Quindos, M. P. (2002): *Estudio del sector de los servicios avanzados a empresas en Asturias*. Llanera: Estudios Sectoriales del Instituto de Desarrollo Regional del Principado de Asturias (IDEPA).
- Moulaert, F. and C. Gallouj (1993): The locational geography of advanced producer firms: the limits of economies of agglomeration, in: P.W. Daniels *et al.* (Eds.) *The Geography of Services*, pp. 91-106. London: Frank Cass.
- Noyelle, T. J. and T. M. Stanback (1984): *The economic transformations of American cities*. Rowman & Allanheld.
- Oliveros, D. (2003): Infraestructuras y renta comarcal en Aragón, Trabajo de investigación para la obtención del DEA. University of Zaragoza. Mimeo.
- Parr, J. B. (2002): "Missing elements in the analysis of agglomeration economies", *International Regional Science Review*, 25, pp. 151-168.
- Parr, J. B. and L. BUDD (2000): "Financial services and the urban system: an exploration", *Urban Studies*, 37 (3), pp. 593-610.
- Polèse, M. and Shearmur, R. (2003): "Is Distance Really Dead? Comparing Industrial Location Patterns over Time in Canada", *International Regional Science Review*, 27 (4), pp. 1-27.
- Porter, M. E. (1990): *The competitive advantage of nations*. McMillan, London.
- Piore, M. and Sabel, C. (1984): *The second industrial divide*, Basic Books, New York.
- Rubalcaba, L. and D. Gago (2003): "Regional concentration of innovative business services: testing some explanatory factors at European regional level", *The Services Industries Journal*, 23 (1), pp. 77-94.
- Rubalcaba, L. and Merino, F. (2005): "Urban supply-demand interrelation in business services", *The Services Industries Journal*, 24 (2), pp. 163-180.
- Rubiera, F. (2005): *Los servicios avanzados a las empresas. Dinámicas de localización y efectos sobre el desarrollo regional*. Madrid: IDEPA/Thomson-Civitas.
- Senn, L. (1993): Service activities, urban hierarchy and cumulative growth", in: P.W. Daniels *et al.* (Eds.) *The Geography of Services*, pp. 11-22. London: Frank Cass.
- Shearmur, R. (1998): "A geographical perspective on education and jobs: employment growth and education in the Canadian urban system, 1981-1994", *Canadian Journal of Regional Science*, 21 (1), pp. 15-48.
- Simmie, J. (2001): "Innovation and agglomeration theory", in Simmie, J. (eds.): *Innovative cities*. London, Spon Press.
- Stigler, G. J. (1951): "The division of labour is limited by the extent of the market", *Journal of Political Economics*, 59, pp. 185-193.
- Soy, A. (1997): "Servicios a empresas y desarrollo regional y urbano: el caso de Cataluña", *Economía Industrial*, 313, pp. 105-113.

APPENDIX A

Concentration and inequality indexes employed.

1. Relative redundancy index or Theil's index

Together with Lorenz's index, this is one of the measures with the greatest capacity to synthesize the level of concentration of BS. It belongs to the family of additively decomposable measures and is calculated by applying the following equation:

$$CT = 1 - \frac{\sum_{j=1}^k z_{sj} * \log \frac{1}{z_{sj}}}{\log k},$$

where z_{sj} are the proportions of the variable under study in each of the s sectors considered for each one of the j -th territories (*comarcas* in our case) and k is the number of territories. The index takes the value 0 when the concentration is minimum and 1 when it is maximum. It is usually very close to zero, and tends towards 1 when a strong spatial concentration exists.

2. Lorenz's index of concentration

As is well known, this is mainly used to analyze the distribution of income. With slight adaptations, it may be used in different situations, such as that proposed in this paper. Specifically, we use the expression:

$$I_L = \frac{\sum_{j=1}^k (p_{sj} - q_{sj})}{\sum_{j=1}^k p_j},$$

where $p_{sj} = N_i/N$ gives the proportion that the N_i *comarcas* with fewer businesses/jobs in sector s represent with respect to the total. On the other hand, $q_{sj} = A_{sj}/A_{sk}$, being $A_{sj} = \sum_{j=1}^j z_{sj} n_{sj}$ and $A_{sk} = \sum_{j=1}^k z_{sj} n_{sj}$, where n_{sj} is the position that the j -th *comarca* occupies once they have all been arranged in ascending order according to the value of z_{sj} (the proportion of the j -th *comarca* with respect to the total regional number of businesses/jobs in sector s). This way of calculating assumes that higher values than those of Theil's coefficient will be taken. Its values will also range between zero and one, and will approach unity when a high concentration exists.

3. Location coefficient

Finally, the location coefficient is calculated; values higher than 0.25 will indicate a very high zonal concentration. It is obtained by applying the formula:

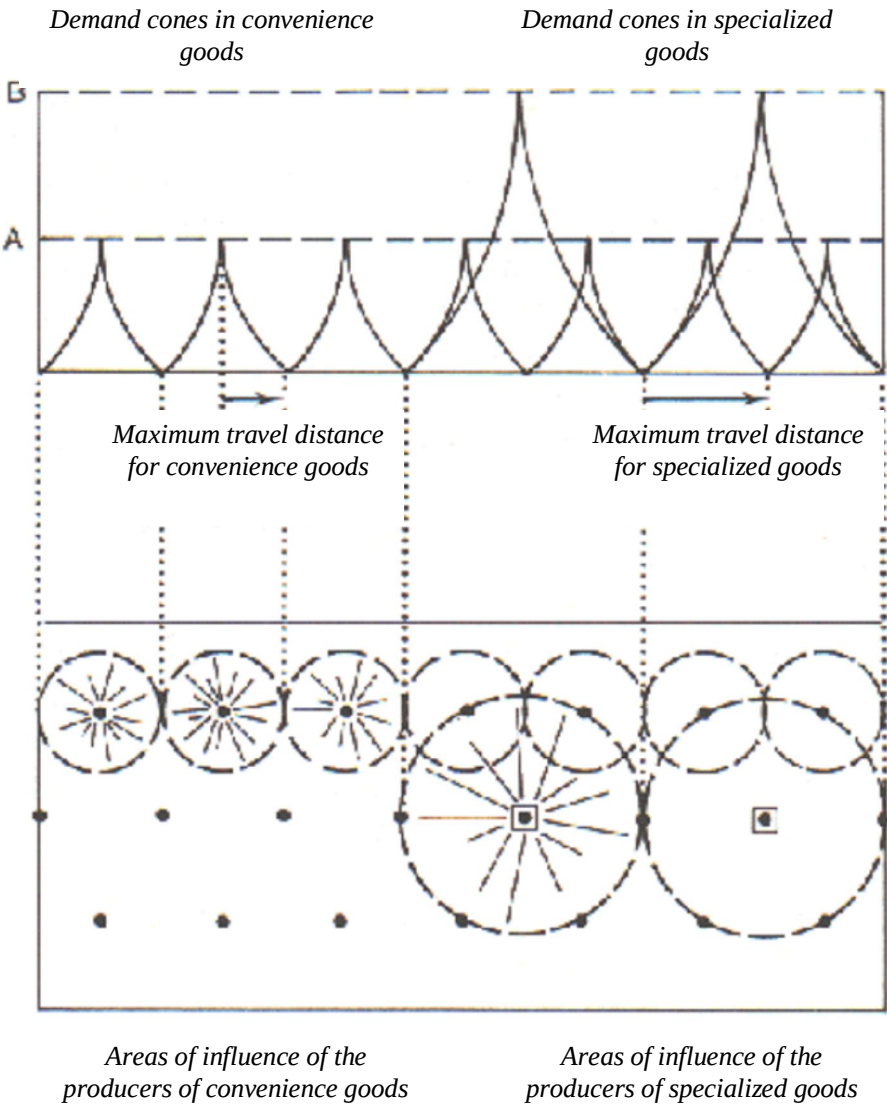
$$L_s = \frac{1}{2} \sum_{j=1}^k |(x_{sj} / x_s) - (x_j / x)|,$$

where x_{sj} is the variable to which the index is applied in sector s and in the j -th *comarca* (firms/jobs); hence x_s is this same variable for the regional total of sector s . According to this logic, x_j is the total of all the sectors of the variable under study in the j -th *comarca* and x is the regional total of this same variable. This way of calculating the index has two implications: first, by taking the regional total as the reference, the value of the coefficient for said total may not be calculated, in contrast with the two previous cases; and second, lower values will be obtained than with other indexes.

APPENDIX B**Variables and data sources**

Variables	Description	Source and year of reference
<i>LOC</i> Location of business	Proportion of licenses in the Economic Activities Tax/employees registered with the Social Security system for business services firms located in each <i>comarca</i> with respect to the regional total	<i>Statistics Institute of Aragon (IAEST)</i> <i>Central Treasury for Social Security</i> 2000
<i>ESCALE</i> <i>Economies of scale</i>	Size of the market which may be accessed from each <i>comarca</i> , approximated by the industrial and services added value and weighted for distance.	Own, with data from IAEST 2000
<i>AGGLOM</i> <i>Economies of agglomeration</i>	Number of Business Services firms (licenses in the Economic Activities Tax) in the <i>comarca</i> per km ²	IAEST 2000
<i>URBAN</i> Degree of urbanization	Resident population in municipalities of over 10,000 inhabitants with respect to the total	IAEST 2002
<i>KHUM</i> Human capital	Population with degrees in each territory over the total number of employed	IAEST 2001
<i>INFRATRAD</i> Traditional infrastructures	Kilometers of roads per km ² in the <i>comarca</i>	Oliveros (2003) 2002
<i>INFRATEC</i> Technological infrastructures	Number of basic telephony networks per <i>comarca</i>	Oliveros (2003) 1995

Figure 1. Schematic representation of Christaller’s theory of central places.



Source:
Davies
(1976)
cited in
Daniels
(1985),
p. 76.