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On the Difficulty of Comparing the Spatial Distribution of Service Industries Across Nations: Contrasting Spain and Canada.

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Abstract

The spatial distribution of employment in service industries is compared for Spain and Canada for nine (9) industry classes. The empirical and theoretical literature on modern services stresses the importance of agglomeration economies for high-order services. The relationship between city-size and location is examined with emphasis on cases that deviate from predicted patterns. The results for Spain and Canada reconfirm the weight of city-size as a determinant of location for high-order services. However, once one goes beyond this fairly predictable result, national differences in geography, institutions, and development come to the fore, making generalizations more difficult. Unlike most manufacturing industries, the definition and the spatial behavior of many service sectors is highly sensitive to institutional factors, creating unique patterns largely fashioned by national context.

Key words: Services, Location, Cities, Urban Size, Spain, Canada.

Introduction: why might services locate differently in different nations?

This paper compares the spatial distribution of employment in service industries in Spain and in Canada. There is no particular reason for the choice of these two nations beyond the fact that the authors are familiar with them, a necessary pre-condition if the authors are to usefully analyze empirical results. An abundant literature has developed over the last few decades on the location of service industries (Coffey and Shearmur 1997, Daniels 1985, Illeris 1996). Much of this literature has focused on so-called high-order services, sometimes also applying other labels such as producer services, business services, knowledge-intensive services, and so on (Hanell and Neubauer 2006, Rubiera 2005, Shearmur and Doloreux 2008, Wernerheim and Sharpe 2003). This is understandable for this is where most of the growth in service employment has occurred since the 1960s, although in more recent times employment growth in the health sector has accelerated in industrialized nations, a reflection of aging populations.

As the label "high order" implies, such services tend to concentrate at the top of the urban hierarchy Indeed, high-order, knowledge-rich, services almost define the modern metropolis. Studies for Spain, Canada, and other industrialized have confirmed, time and again, the positive relationship between city-size and employment in high-order, knowledge-rich, services (see studies cited above). Typical examples are banking, securities traders, consulting in various fields (management, engineering, etc..), advertising, and software development, as well as an almost infinite (and growing) range of scientific and technical services. The reason they are also alternatively referred to as producer or businesses services is that they act as intermediary inputs into production, a reflection of the growing complexity and knowledge-content of modern production processes.

The reasons for the concentration of such services in large metropolitan areas are not difficult to explain. On the input side, the diversity and rapidly changing nature of talents and know-how mean that only the largest cities will provide the necessary labor pool. A large management consulting firm, for example, is constantly combining and recombining talent, depending on the nature of the contract. The same holds for a large advertising firm which, depending on the ad campaign, may need an opera singer one day, a cartoonist the next, and an animal trainer the day thereafter, and so on. Such industries are, in other words, dependant on a constant stream of face-to-face meetings with a wide (and changing) range of individuals. No wonder that the largest management consultancies and ad agencies are headquartered in a few "world" cities (Taylor 2004). On the output side, the low cost of service delivery (at least in many cases) further facilities concentration, reinforced in recent times by the introduction of IT (information technology) which allows the almost costless delivery of reports, blueprints, video clips, and other information-rich products to distant places. A securities broker in New York or London can take an order over the phone or via the Internet, with little consideration the client's location. The effect of IT has, on balance, been to consolidate the concentration of high-order services in large metropolitan areas (Gaspar and Glaeser 1998, Hall 1999)

On the other hand, for services for which the consumer must be present at the place of production (or sale), city-size matters less. Classical central place theory (Christaller 1935) remains entirely adequate to explain the spatial distribution of most such consumer services, with retailing the prime example. Most services, health and education included, remain constrained by distance and market access, although IT has opened new doors (i.e. distance learning). Other services again are subject to specific size and distance constraints, with accommodation and other tourist-related services an obvious example. Here, the consumer is willing to travel over often considerable distances to partake the service. The amenity attributes of place (climate, natural beauty, architecture, etc...) are the principal considerations rather than city-size, although the latter can be an attractive force in some cases. Summarizing, we can identify four types of services in terms of spatial distribution:

o   Services sensitive to agglomeration economies, exhibiting hierarchal distributions. As noted earlier, the prime examples are business, financial services, and other information-rich services. Certain transport (i.e. air travel) and communication services (i.e. TV and radio broadcasting) equally fall in this class, due to the weight of scale economies in the case of former (air transport hubs) and the weight of diversified information inputs for the latter. Wholesaling and distribution services are also subject to important scale economies, with a growing trend to concentration. Agglomeration economies (size) are also a factor for higher order education and health services. However, for these two cases location may also be influenced by public sector choices, a first indication that national institutional frameworks can affect distributions.

o   Services that need to be close to the consumer, and thus exhibit fairly even spatial distributions. Retailing, household, and other personal services are typical examples, as well as primary health and education services.

o   Services sensitive to geography and natural attributes, with accommodation and tourist-related services the prime examples. Geography also matters for transport services, with country-size and population density important considerations.

o   Services sensitive to public sector choices and institutional (and historical) context. The distribution of public service (public administration) employment is the prime example. One would not expect such employment to be distributed in the same manner in a highly centralized state such as France as in a highly decentralized nation such as the United States. Indeed, the very definition of what constitutes public administration employment may vary from one nation to another, a point to which we shall return.

For the two latter classes, the effects of national differences are fairly easy to conceptualize. Thus, in nations such as France and the United States with significant climatic differences (cold North, warm South), climate will have a visible impact on location decisions of firms and households. The attraction of "sunny" locations is today well documented, both in Europe and in America (Cheshire and Magrini 2006, Rappaport 2007, Rappaport and Sachs 2003). On other hand, in a nation such as Canada with few "sunny" locations, climate will matter less, and city-size more. By the same token, the effects of country-size on the distribution of transport services are fairly easy to predict. In a vast nation such as Canada with numerous isolated communities (each

with its own airport), city-size should matter less than in the more densely settled nations of Europe.

For high-order information-rich services, reasons why the basic rules of location (notably, city-size) might apply differently are more difficult to conceptualize. A priori, there is no reason why agglomeration economies should apply differently to, say, management consulting activities in nation x and nation y. It is difficult to imagine why the positive relationship with city-size should not hold. However, the relationship might be stronger or weaker across nations, depending on development levels and institutional context. Let us consider each factor in turn, starting with information-rich producer services (consulting, advertising, computer services, etc…). We may reasonably assume that the (intermediate) consumption of such services is a positive function of GDP levels, more developed economies consuming proportionality more producer services than less developed economies. Thus, in nations characterized by major internal development disparities (Italy is a prime example in Europe), we would expect the effects of such disparities to weaken the hierarchical relationship between city-size and location for producer services.

Let us now considered the impact of institutions, a notion that encompasses not only political and administrative structures, but also the legal and legislative framework that governs the functioning of the economy and of society as a whole. Different nations have different institutions. This, more than anything else, makes comparisons across nations difficult. Here, we encounter a major difference between the study of location of manufacturing activity and of services. What constitutes a particular manufacturing activity and *mutatis mutandis* where it locates are little affected by institutions. A textile mill is a textile mill everywhere; an automobile assembly plant is an automobile assembly plant. Not so for many service industries, where definitions are more often fuzzy and porous, subject to nation quirks. Consider the financial sector. A priori, "banks" seems like a clearly defined activity with the same meaning across nations. However, a closer look at the banking sector reveals a broad variety of legislative frameworks across states with differing definitions of what banks can and cannot do. For example, Canadian banks are not allowed, at least in principal, to engage in investment banking, an activity left to portfolio mangers and similar institutions; while investment banking is a major factor in German banks. US banks are State or locally chartered, constraining their market areas, unlike Spanish or Canadian banks which function nationally. Locally chartered credit unions (*Cajas* in Spain), quasi-banks, are a major presence in some nations, but not in others. The financial sector is highly regulated in all nations, affecting both the organization and the spatial distribution of establishments. In short, rigorous comparisons are impossible.

Finance is not the only regulated sector. Other examples are health, education, telecommunications, and air travel. Should one expect the same location patterns for health-related employment in nations in which the health sector is largely public as in nations where it is largely private? Probably not. In other cases, dividing lines between sectors are highly porous, allowing firms to move between industry classes depending on local context and self-interest. A prime example is the distinction between retail and wholesale trade. If, for example, in country *x* it is more advantageous to declare oneself a retailer (for fiscal or other reasons) than a wholesaler, the latter sector will be proportionally smaller in nation *y*, which makes no such fiscal distinction.

Data and Methodology

As for any cross-country study, the primary challenge is the comparability of data and of observations. Comparing industry classes in the service sector creates particular challenges, as noted in the foregoing discussion. The comparability of observations is no less problematic. No international rule exists for defining urban areas, cities, or metropolitan areas. No two nations apply exactly the same rules. No rigorously comparable dataset exists, even among the nations of the EU, although Eurostat has made considerable progress. Ideally, from an economic analytic point of view, urban areas should conform to integrated labor markets (commuting sheds). Statistics Canada is one of the few national statistical agencies to systematically apply a labor market rule to the definition of urban areas, where all municipalities and spatial units falling within a common commuting shed are classified as belonging to the same urban area. According the 2001 Canadian census, Canada had 147 urban areas, classified as either CMAs (Census Metropolitan Areas: population over 100,000) or CAs (Census Agglomerations: population above 10,000, but below 100,000).

<<Table 1 about here>>

Spain has no equivalent system of urban (agglomeration) classified areas. Data is available by municipalities only, which may or may not fall within a common labor shed. The challenge, thus, is building a comparable system for Spain, grouping municipalities which are part of the same urban area. The initial dataset comprised 453 urban observations for Spain. Taking into account geographical proximity and information on labor market connections, a new database was built comprising 226 aggregated metropolitan areas with populations of 10,000 or above. Although not rigorously comparable with the Canadian system, the number of urban observations in Spain is comparable, given the population size of the two countries, with similar city-size distributions (Table 1). The five largest urban areas have comparable populations; we may thus reasonably assume that associated agglomeration economies are not dramatically different and that the city size variable measures comparable realities. In addition to population data, urban areas in both nations with less than 500,000 inhabitants are classified according to distance from a larger metropolis, using a scheme employed in previous studies (Polèse and Shearmur 2004, 2006, Polèse, Rubiera, and Shearmur 2007). For Spain, observations are also classified as coastal/ interior and as administrative capitals (or not) of provinces or autonomous communities.

The construction of a comparable employment dataset by service industry class was largely guided by the nature of available data for Spain. In both Spain and Canada, data was drawn from the 2001 census. The nation with the more aggregated industry classes essentially sets the rules for the others. In Canada, highly disaggregated data by industry is available at the urban level (several hundred classes), but for only sixteen (16) broad industry classes in Span. Thus, the Spanish classes become the benchmark. Canadian industry employment data was reclassified to fit into nine (9) broad (Spanish) service industry classes listed below:

(1) Retail Trade, Wholesaling, and Distribution

(2) Accommodation and Tourist-related Services

(3) Transportation, Storage, and Communication

(4) Finance and Insurance

(5) Business and Scientific Services and Real Estate

(6) Public Administration.

(7) Education

(8) Health Services

(9) Household and other Personal Services

A more detailed listing of industries contained in each class is given in appendix 1. We are fairly confident that the nine (9) classes capture the same industries in each nation. This, however, does not do away with the issues raised in introduction on the inherent difficulty of comparing service industries. The highly aggregated nature of the classes above does serve to diminish some problems (i.e. all financial institutions are grouped together), but in turn creates others. The grouping of "real estate" with business and scientific services is particularly unfortunate. Real estate-related services tend to exhibit a very different spatial logic from that of business services. In North American classifications, real estate management is generally classified with the financial sector, unlike the Spanish system. In short, the perfect classification system does not exist.

The data are analyzed in using various tools, descriptive statistics as well as correlation and regression analysis. The point of departure is the relationship between service employment location (relative employment concentrations) and city-size. The relationship is visually illustrated using location quotients[1] showing relative service employment concentrations by city-size class for Spain and for Canada. For both the Canadian (n=147) and the Spanish urban systems (n= 226), location quotient results are regressed against city population size for each industry group. This completed by a correlation analysis of location quotients by paired industry groups.

The relationship between city-size and location quotients is plotted for selected industry groups in both nations. The latter part of the analysis focuses on Spain and on high-order services. Regression analysis residuals are mapped and analyzed. Finally, a more complete regression model for higher-order service groups is attempted for Spain.

Results I: The relationship with city-size

Table 2 shows regression results for the relationship between city-size (log) and location quotients (log) for employment by industry group[2] for Spain (n = 226) and Canada (n= 147). Correlation coefficients (between paired industry groups) are given on table 3 for both nations. Figures 1 to 5 show location quotients by city-size class in Spain and Canada for five industry groups, focusing on those of most interest. Finally, scatter gram

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[1] The location quotient (LQ) is defined as: $LQij=(Eij/Ej)/(Ei/E)$. Where E is employment, i the industry and j the urban region.

[2] Household and Domestic Services are excluded because of low numbers in Canada

results for the relationship between city-size and location quotients are shown on figure 6 for three industry groups.

<<*Table 2 about here*>>

The regression results (table 2) illustrate both the similarities and the differences between the two nations. As expected, the two highest-order industry groups (4 and 5), both exhibit a positive and significant relationship between relative employment concentration and city, but slightly stronger in both cases in Canada than in Spain. In each country, the relationship is stronger for business and scientific services, the most knowledge-intensive group, which again is consistent with expectations. The relationship is visually illustrated on figure 1, which reveals an almost perfectly hierarchical relationship in both nations. By the same token, the plotted scatter grams (figure 6) for group 5 show largely similar patterns for both nations. In short, whether in Canada or in Spain, knowledge-intensive services are, as a rule, sensitive to agglomeration economies as measured by city-size.

<<*Figures from 1 to 5 and 5a about here*>>

For financial services (group 4), the relationship, although positive, is less symmetrical, especially for Spain. Figure 2 reveals a relative concentration of financial service employment in mid-sized urban areas (populations between 100,000 and 250,000) as well in several smaller places (populations above 25,000), with location quotients well-above those for Canada. However, it is interesting to note that no city below one million exhibits a quotient above unity (the national average) suggesting a partially bi-modal distribution in Spain (unlike Canada) with both a strong concentration in the very largest cities and then in a group of mid-sized cities. A possible explanation (to which we shall return) is the presence of *Cajas* (local credit unions), which are traditionally located in provincial capitals of which there are fifty-two (52) in Spain. Credit unions are less prevalent in Canada. Also, Canada's administrative geography is different with only ten provinces.

<<*Table 3 and 3a about here*>>

Staying with these two high-order groups, the correlation matrix (table 3) reveals that their respective location quotients are positively related in both nations, but more strongly in Spain than in Canada (with coefficients, respectively, of 0.70 and 0.50). Thus, in both nations, high-order services, whether business or financial services will often cluster in the same large cities. This, again, is as expected. But, this is where the similarities end. Taking group 5, the most knowledge-intensive group, as our benchmark, the next highest correlation for Canada is with group 3 (transportation and communications), which is not unexpected since this group includes knowledge-intensive activities such as broadcasting and also because favored cities will often be local transport hubs. However, in Spain although group 5 also shows a positive relationship with group 3, as expected, correlations are even stronger (unlike Canada) with group 6 (public administration) and especially with groups 7 and 8, respectively education and health services. This would seem to suggest that the geography of services (retailing and tourist-related activities aside) is much more "deliberate" in Spain, so to speak, with health, education, and knowledge-intensive services often co-

located in the same urban areas[3]. It is difficult not to interpret this as the reflection of a different institutional context.

Geography also plays a role. Its impact is, in part, illustrated by figure 3, which shows a largely hierarchical distribution for transportation and communications services in Spain, in turn confirmed by a positive and significant regression coefficient (table 2), but not for Canada. The fairly high quotients for smaller Canadian cities (thus, the absence of a significant relationship with city-size) reflects the relative concentrations of transport services, but also some communications services, in small outlying cities far from a major urban center. Many such cities house not only a local airport, but also local radio and televisions stations. The influence of geography is also apparent for group 2 (accommodation), showing a significant but negative regression coefficient for Canada, where we would again expect accommodation services to be proportionately more present in small outlining cities (note the positive correlation with transportation, group 3). In Spain, by comparison, the accommodation sector appears to locate within its own universe, almost in opposition to others, with no significant relationship to city-size and with negative correlations with the education and health sectors. This result is not difficult to interpret. The accommodation sector in Spain is in large part oriented toward tourism, concentrated in coastal areas. However, as in Canada, it is positively correlated with industry group 3 (transportation and communications) which, again, is not surprising.

The indirect impact of tourism also helps to explain the difference between Canada and Spain for industry group 1, largely dominated by employment in retailing. The retailing demand engendered by tourists (and other semi-permanent residents) largely wipes out any city-size effect; thus, the absence of a significant relationship (table 2). For Canada, the relationship is significant and negative, a reflection of the often disadvantaged status of small cities. In numerous small towns, retailing and personal services account for a disproportionate share of local employment, simply because there is little else in terms of employment opportunities, with transfer payments (pensions, unemployment insurance...) an important source of local income. This impression is strengthened by the positive correlation with the health sector. Smaller communities will, as a rule, have higher shares of older persons.

The most intriguing result is for health, but also the most difficult to explain. The spatial distribution of employment in health services seems to evolve in opposing directions in Spain and in Canada. The relationship with city-size is significant in both cases, but in opposite directions, positive in Spain and (mildly) negative in Canada (table 2). The impression of spatial "opposites" is reinforced by the positive correlation with business and scientific services in Spain, but negative in Canada. In Spain, the health sector exhibits significant positive correlations with public administration (group 6) and education (group 7), while in Canada the relationship only holds up (but less strongly)

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[3] It is possible that Spain's generally lower level of tertiarization introduces a bias. The nine service accounted for 57% of Spain's total employment in 2001, compared to 73% in Canada. However, it is difficult to see what the bias might be since the denominator in the location quotient equation is a constant in both nations.

for education. On the whole, public service sector employment (groups 6, 7, and 8) appears fairly evenly distributed over space in Canada, with little relation to city-size, and with even a slight negative relation, as noted, for health services. The negative relation with size is clearly visible on figure 5 for health services, with the smallest class showing the highest location quotient, the opposite of the result for Spain.

How might this difference be explained? The most obvious explanation is geography. In Canada, because of distance, many small outlying communities will have hospitals or clinics since large urban centers are too far to service the local population. To test for this hypothesis only "central" cities were considered; that is, the largest cities (500,000+) and those within one hour's travel time (figure 5a). Clearly, the geography explanation must be rejected. The difference between smaller cities (populations under 50,000) in Spain and in Canada is now even greater. In other words, small towns in Canada, including those near large urban centers, have proportionately much higher shares of local employment in health services than in Spain. Location quotients, it is useful to recall, are calculated in relation to the national average, eliminating any bias attributable to national differences in health employment. In Canada, employment in health services in small cities is, as a rule, above the national average (a quotient above unity), but well blow the national average in Spain.

No simple explanation comes to mind. Visibly, Spain has a different philosophy than Canada with respect to the location of services provided (mainly) by the public sector, with health services the most notable example. The difference might, for example, reflect a difference in the nature of the service or in the coverage provided. A totally universal health care system, as in Canada, should in principle not be affected by spatial differences in income, while a service where the service is billed and/or provide by the market (at least in part) would be. The difference might equally be due to differences in the organization and management of the service, perhaps due to resource constraints; with a more centralized structure in country *x* compared to country *y*. Whatever the explanation might be in the Canadian-Spanish case, the spatial distribution of health care services provides an example of the probable impact of institutional factors and of national context.

Results II: Factors other than city-size.

In this section, we focus on Spain and the three industry groups representative of high-order services (groups 3, 4, and 5). All three, we saw, show a positive relation with city-size (table 2), exhibiting generally hierarchical distributions (figures 1, 2, and 3), consistent with theory and with the literature. The absence of a significant relationship in Canada for group 3 (transportation and communications) was fairly easy to explain, a reflection of its vast geography. For the other two groups, the relationship was systematically hierarchical in both nations, but somewhat less so in Spain. Why might such high-order services deviate from the norm? The answer may lie in the residuals. The residuals for the three relevant regressions (formulation on table 2) were mapped for Spain (figures 7, 8, and 9). Following an examination of the geography of residuals[4],

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[4] Note that the residuals exhibited normal distributions in all three cases, as would be expected.

three new regression were carried, introducing variables suggested by the maps (table 4).

<<Table 4 about here>>

<<Figure 6 about here>>

Before looking at Spanish results, a word is in order on the spatial distribution of residuals in Canada for industry groups 4 and 5 (the reader may which to consult the scatter grams again: figure 6). For business and scientific services, the most knowledge-intensive and also the most hierarchical, an examination of Canadian observations with the highest positive residuals revealed an above-average presence of Western Canadian urban areas, often small and often specialized in mining or petrol exploration. Such extractive activities are large employers of engineers, geologists, and other related scientific and technical personnel, driving up the location quotients for industry group 5. This is not a variable which would make much sense on Spain. Capital cities were also overrepresented, which is not surprising, a variable which should equally play in Spain. For financial services (group 4), no particular logic was discernable in Canada for observations that exhibited predicted results above (or below) the regression line. Residuals were a mixed bag, both in terms of region or type of city, an indication that the residuals are essentially "random", that there is little more to say about the location of most financial services beyond the attraction of size and the weight of agglomeration economies. As we shall see, the Spanish case is rather different.

Starting with transportation and communications services (figure 7), the mapped residuals reveal quite clear regional trends. These services are manifestly underdeveloped (given city-size) in the south, which is somewhat surprising given the weight of tourism in much of this part of Spain. On the other hand, it is useful to recall the aggregate nature of industry group 3. What this result suggests is that tourism has a limited impact (i.e. on only some sub-sectors such as air travel). It is also a reminder of the generally less-developed nature of the Spanish south. The highest values (residuals) seem to follow the arteries linking Madrid with Mediterranean ports in the southeast, with Asturias and Cantabria in the North (national highway IV), and with Barcelona to the northeast. In short, as in Canada, deviations form the norm (as predicted by city-size) can generally be traced to geography. Given, the nature of the service, this is not surprising.

There is less reason to believe why geography should intervene for knowledge-intensive services represented by groups 4 and 5 (putting aside exceptions such as oil exploration). There is no a priori reason to think why geography should matter for financial services. Yet figure 8 reveals definite regional patterns. Again, southern Spanish cities are underperformers (given their size). Another cluster of negative residuals is observable in the extreme northwest (Galicia, notably), traditionally one of Spain's poorest regions. Here, what we are seeing is not so much the impact of geography as of development differences. On the basis of figure 8, it would appear that financial services are sensitive to income levels, an entirely reasonable assumption. Investment banking and portfolio management are not generally services in high demand among poor populations. In Spain regional income disparities act, it appears, as

a counterweight to agglomeration economies based on pure population size, reducing the predictive power of the latter for financial services.

The interference of regional development disparities shows up even more clearly for business and scientific services (figure 9). With only minor exceptions, all the high positive residuals lie within an approximate rectangle bounded by Madrid, Valencia, Barcelona, and Bilbao: the Spanish economic heartland, in other words. Whether the term "center-periphery" is appropriate is not the issue. Rather, as for financial services, it is the role of the spatial distribution of demand in the location of high-order services. In nations such as Spain, characterized by significant internal development differences with often deep historical roots, we should no expect to observe neatly hierarchical distributions for high-order services.

On table 4, the residuals for the three industry groups are regressed against four new variables, one institutional and three geographic. Unsurprisingly, the two geographic variables that refer to coordinates (west-east and south-north) are significant for the transport and communications sector, although with a low r^2. For financial services, both the role of provincial capitals (undoubtedly via the presence of local *Cajas*) and of geography comes out, the latter via the repulsive effect of coastal locations and the attraction of the north. For business and scientific services, the development effect comes out via the simultaneous pull of the east and the north, although with, again, a small R^2, undoubtedly the reflection of a rather crude specification on our part. An income or GDP variable would perhaps have shown better results.

<<Figures from 7 to 9 about here>>

Conclusions

Taking the Spanish and Canadian urban systems, we examined the spatial distribution of service employment for eight major industry groups, using location quotients, correlation and regression analysis, as well as mapping techniques. On the whole, our findings are consistent with the literature and with exceptions. In both nations, high order-services, specifically financial and knowledge-intensive business services, exhibit hierarchical distributions, concentrated at the upper end of the urban hierarchy. By the same token, city-size matters less for consumer-oriented services such as retailing and accommodation services, with even an observed negative relation for Canada.

Once we go beyond these fairly predicable results, a number of differences emerge between Spain and Canada. In most cases, differences can be traced to differences in geography and in institutional context. Regulatory differences, as well as differences in administrative or political models, can influence location choices for services sectors such as finance, transportation, communications, education, and health.

The impact of geography is evident for accommodation and other tourist-related services. In Spain, with a well-developed tourist sector concentrated mostly in coastal areas (generally along the Mediterranean), the observed distribution is largely independent of other considerations, with only weak links to other service sectors. Geography also matters for transportation and communications services, with higher concentrations in smaller cities in Canada, a reflection of greater distances.

The role of institutional and development differences is more difficult to interpret. Services provided (at least) in part by the public sector (education, health…) appear to exhibit different spatial patterns in the two countries. On the whole, such services seem to be more spatially clustered in Spain, positively associated with city-size. No such pattern is discernable in Canada, where publically-funded services are often proportionally more present in smaller cities. The most visible difference is for health services, which are positively related with city-size in Spain, but negatively in Canada. Geography is not the explanation for the difference equally holds for cities falling within a short distance from larger cities. Visibly, health services in Spain are not organized along the same lines as in Canada.

The spatial distribution of financial, businesses, and scientific services in Spain in part mirrors internal development differences, with higher relative concentrations (given city-size) in cities located in the (richer) northern and eastern parts of the nation. No equivalent pattern is discernable in Canada. The location of financial services in Spain is also sensitive to the administrative status of cities (provincial capital or not), most probably a reflection of the presence of *Cajas (*credit unions) in capitals. Again, no similar pattern is discernable in Canada. However, the capital-city factor is positively associated with businesses and scientific services in both nations.

The general impression for Spain (as compared to Canada), although difficult to demonstrate rigorously, is: (1) of a more "structured" (or deliberate) pattern of urban service location, focused on a limited number of large and mid-sized cities and (2) of a more "dualistic" pattern, with marked regional differences, which in turn impact local demand levels for different services. The former is in part, we suggest, a reflection of institutional choices and differences, while the second mirrors internal differences in development.

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Appendix 1 - Description of Industry Classes

1 - Retailing, Wholesaling & Distribution

Food, beverage, and other wholesalers

Grocery and general merchandise stores

Gasoline stations, automobile dealers, automotive parts, repair and maintenance

Shoe and clothing stores

Furniture and home appliances stores

Pharmacies, other stores and retailers

2- Accommodation

Hotels and other traveler accommodation

Rooming and boarding houses

RV and camper parks and recreational camps

Restaurants, other food services, and drinking places

3- Transport, Storage, and Communication

Air, rail, truck, and water transportation

Urban transport

Warehousing and storage

Radio and television broadcasting

Telecommunications

Postal service & courriers

4- Finance & Insurance

Banks & other credit institutions

Securities trading & Portfolio Management

Insurance carriers and related activities

5- Business & Scientific Services and Real Estate

Software, IT services & data processing

Accounting & Management consulting

Advertising and related services

Architects & engineering, scientific and technical services

Legal services

Managers and lessors of real estate

6- Public Administration

National / Federal government administration

Provincial & regional public administration

Municipal & local public administration

7- Education

Elementary and secondary schools

Community colleges and other post -secondary

Universities

8-Health

Hospitals & Out -patient care centers and homes

Offices of physicians and other health practitioners

Clinics, medical and diagnostic laboratories

9-Personal

Personal, domestic, and laundry services

Figures and tables

Table 1 - Basic information, Canada and Spain (2001)

	Canada		Spain	
Total population (2001)	30,007,894		40,847,371	
Area (Km^2)	9,984,670		504,782	
Density (inhabitants per km^2)	0.33		80.92	
Service sector in total employment [%]	72,59%		57.44%	
Five largest metropolitan areas	Toronto	4,675,481	Madrid	4,802,868
	Montreal	3,327,089	Barcelona	4,334,202
	Vancouver	1,986,913	Valencia	1,405,220
	Ottawa	1,051,242	Seville	1,124,859
	Calgary	951,395	Bilbao	984,144
Population in urban areas over 500,000	14,935,856 (49,77%)		18,459,762 (45.19%)	
Number of cases [n]	9		13	
Population in urban areas between 100,000 and 500,000 inhabitants	5,013,036 (16.70%)		7,350,027 (18.01%)	
Number of cases [n]	25		35	
Total urban population: urban areas, 10,000 inhabitants and over	23,658,741 (78,84%)		30,807,451 (75.42%)	
Number of cases [n]	147		226	

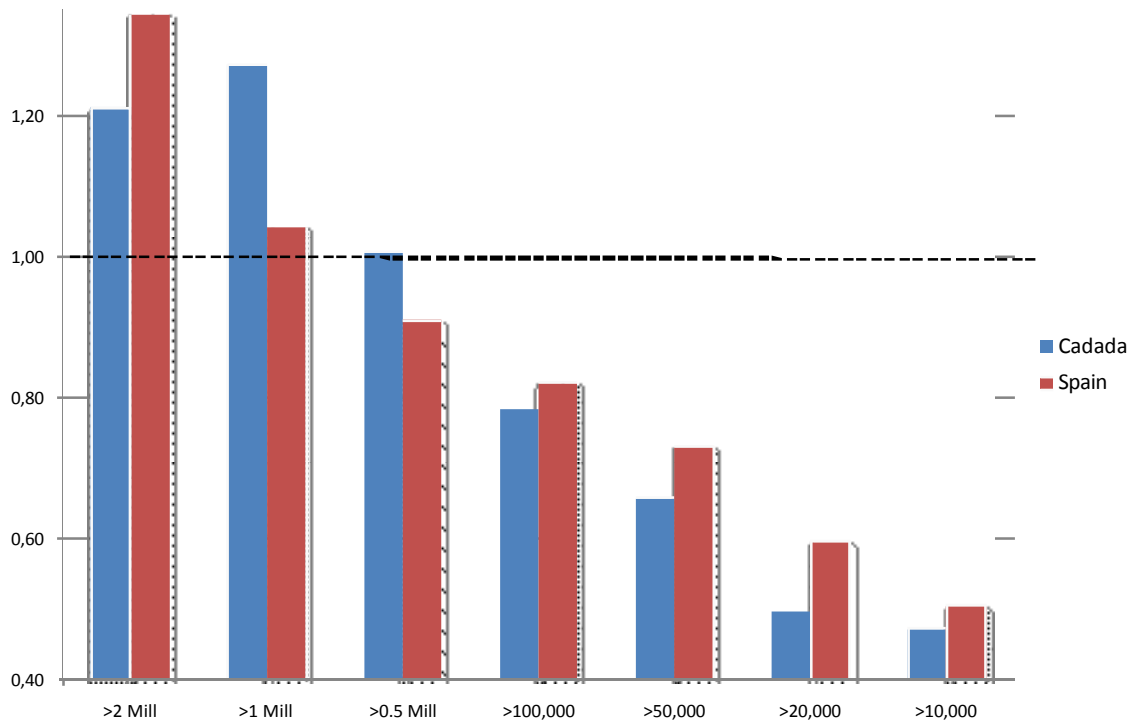### Table 2. Relationship between population size and location quotients: Spain and Canada, for eight industry groups

$$LQ_{xa}=\alpha+\beta LOG(POPSIZE)_a+u_x$$

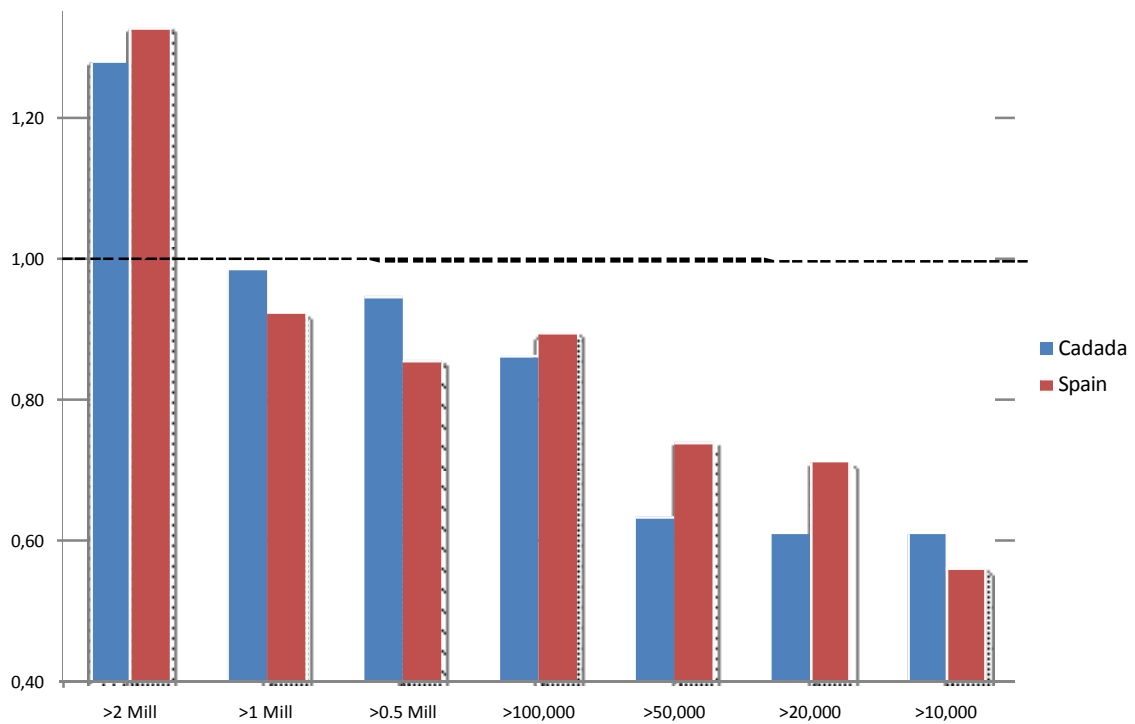| Industry Group	B (coefficient)		R^2	
	Canada	Spain	Canada	Spain
(1) Retail Trade, Wholesaling, and Distribution	-0.019 (*)	0.008	0.290 (●)	0,003
(2) Accommodation and Tourist-related Services	-0.045 (**)	0,013	0.070 (●●)	0.001
(3) Transportation, Storage and Communication	0.030	0.061 (**)	0.018	0.107 (●●)
(4) Financial and Insurance	0.092 (**)	0.104 (**)	0.303 (●●)	0.252 (●●)
(5) Business & Scientific Services and Real Estate	0.137 (**)	0.121 (**)	0.578 (●●)	0.469 (●●)
(6) Public Administration,	0.047	0.078 (**)	0.009	0.039 (●●)
(7) Education	0.017	0.073 (**)	0.009	0.107 (●●)
(8) Health Services	-0.043 (*)	0.113 (**)	0.022 (●)	0.137 (●●)

(**) Significant at 0,01 ; (●) at 0,05

Figure 1. Business & Scientific Services and Real Estate, Canada and Spain (2001). Location Quotients
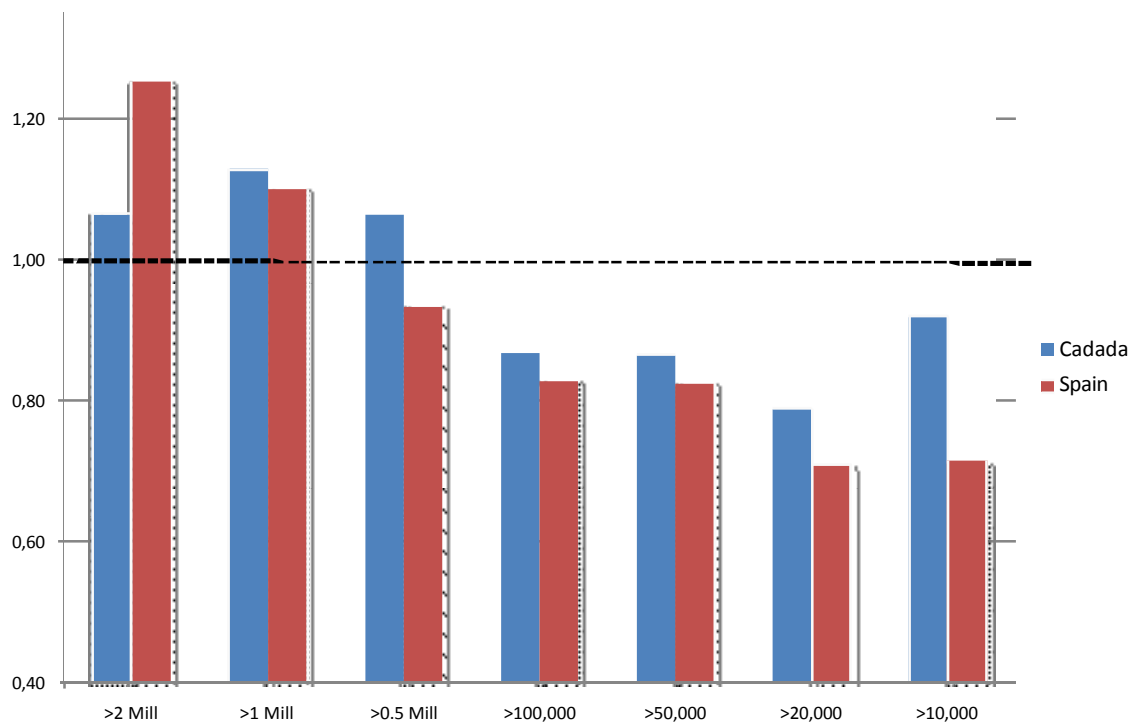

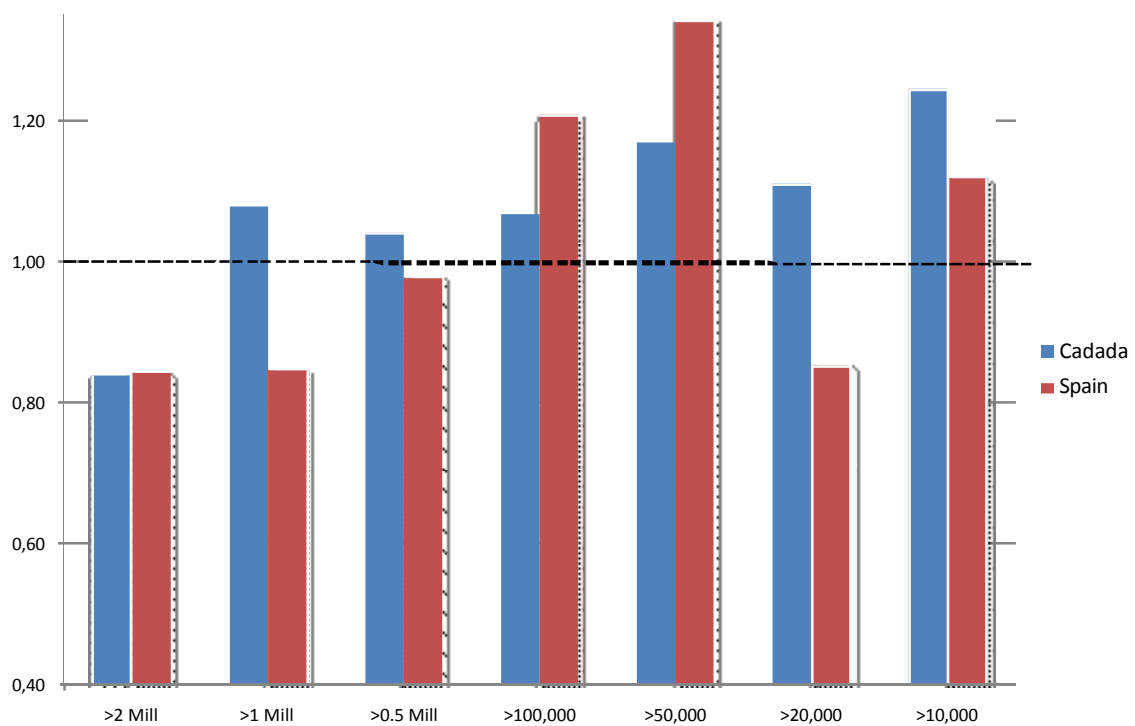**Figure 2. Finance and Insurance, Canada and Spain (2001) Location Quotients**
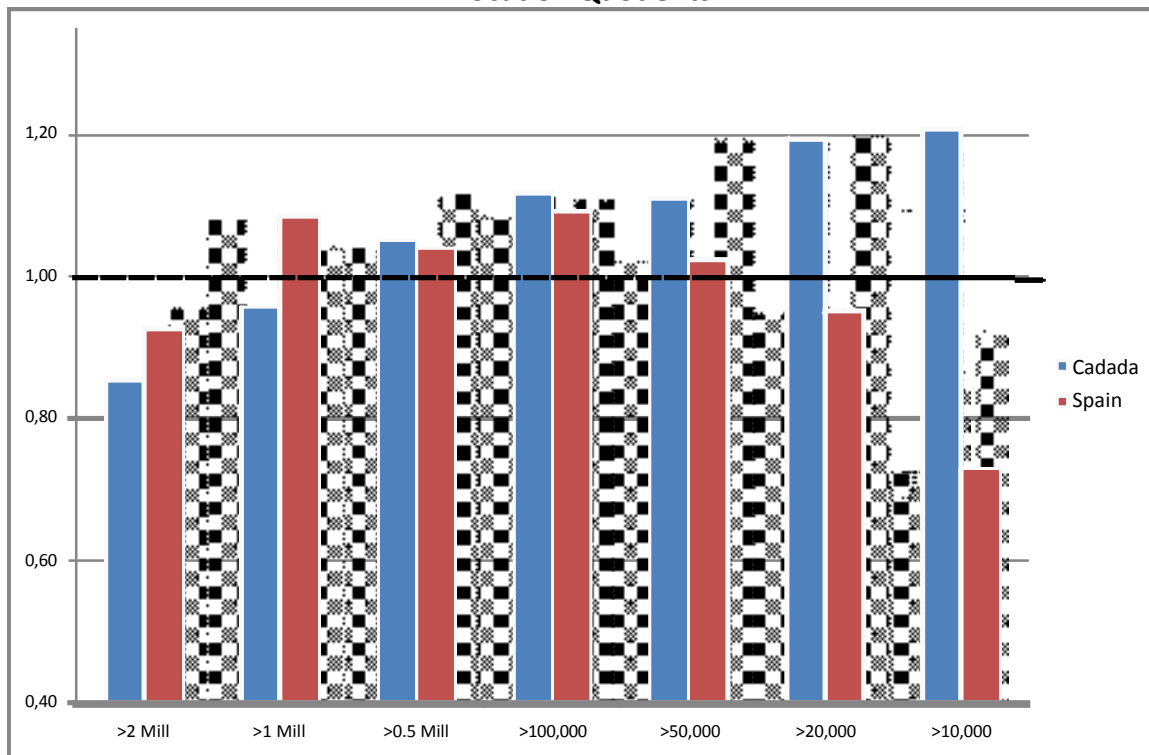
**Figure 3. Transport, Storage and Communication, Canada and Spain (2001)
Location Quotients**

**Figure 4. Accommodation and tourism services, Canada and Spain (2001)
Location Quotients**

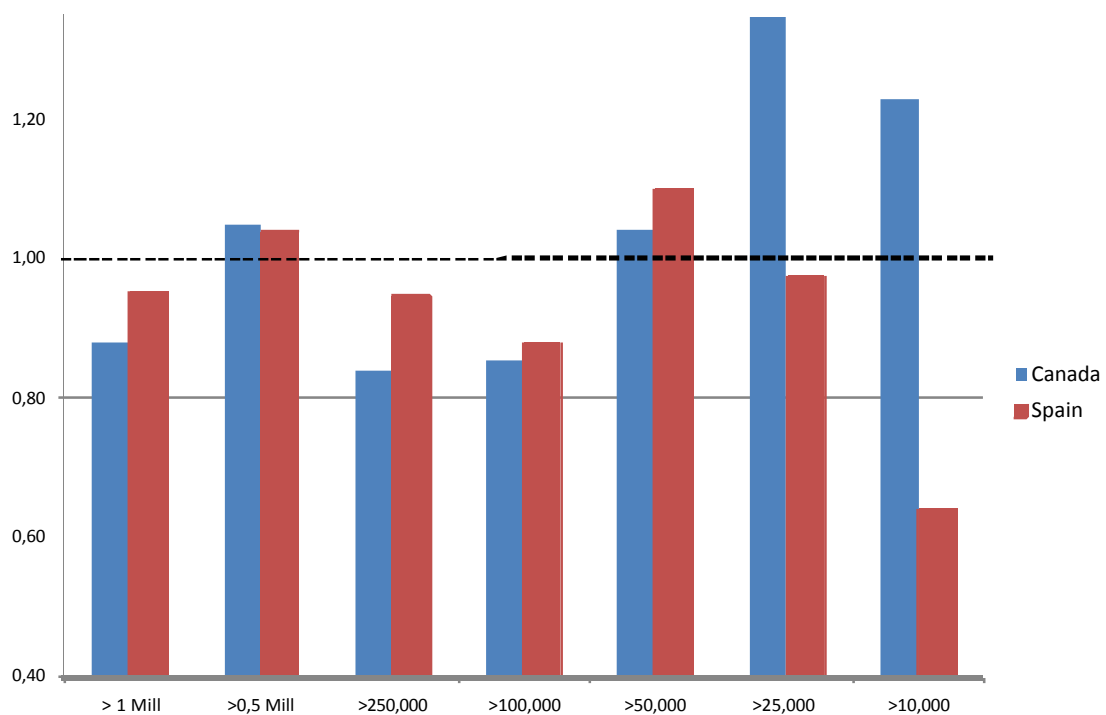**Figure 5 - Health Services, Canada and Spain (2001).**
Location Quotients

Figure 5a - Health Services, Canada and Spain (2001).
Location Quotients
Central places (less than 1 hour driving from a metropolis over 500,000 inhabitants)

Table 3. Pearson correlation matrix: location quotients by industry group. Spain (2001) (226 observations)

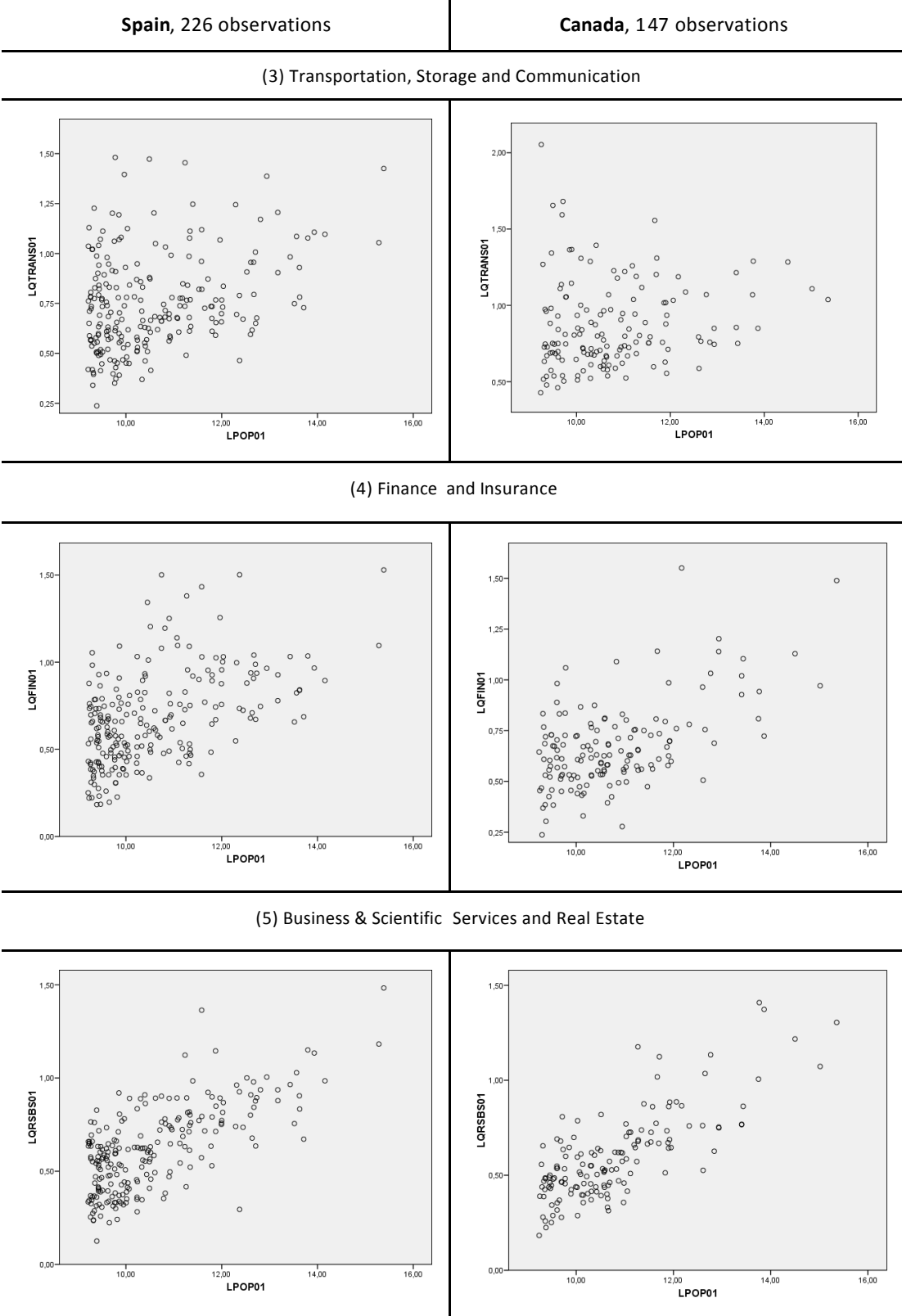|	Retail & Wholesale	Accommo-dation	Transport. and com.	Financial & insurance	Business & Scientific	Public Admin.	Education	Health
Retail & Wholesale	1	0.042	**0.260 (**)**	**0.227(**)**	0.106	0.002	**0.186 (**)**	**0.133 (*)**
Accommo-dation	0.042	1	**0.167 (*)**	0.068	-0.105	-0.029	**-0.257 (**)**	**-0.151 (*)**
Transport. and Com.	**0.260 (**)**	**0.167 (*)**	1	**0.511 (**)**	**0.241 (**)**	**0.137 (*)**	0.077	**0.205 (**)**
Financial & insurance	**0.227 (**)**	0.068	**0.511 (**)**	1	**0.703 (**)**	**0.318 (**)**	**0.444 (**)**	**0.543 (**)**
Business & Scientific Services	0.106	-0.105	**0.241 (**)**	**0.703 (**)**	1	**0.334 (**)**	**0.573 (**)**	**0.636 (**)**
Public Admin.	0.002	-0.029	**0.137 (*)**	**0.318 (**)**	**0.334 (**)**	1	**0.577 (**)**	**0.581 (**)**
Education	**0.186 (**)**	**-0.257 (**)**	0.077	**0.444 (**)**	**0.573 (**)**	**0.577 (**)**	1	**0.762 (**)**
Health services	**0.133 (*)**	**-0.151 (*)**	**0.205 (**)**	**0.543 (**)**	**0.636 (**)**	**0.581 (**)**	**0.762 (**)**	1

** Significant at 0.01 (bilateral). * Significant at 0.05 (bilateral).

Table 3a. Pearson correlation matrix: location quotients by industry group. Canada (2001) (147 observations)

	Retail & Wholesale	Accommo-dation	Transport. and com.	Financial & insurance	Business & Scientific	Public Admin.	Education	Health
Retail & Wholesale	1	0.111	0.062	0.101	-0.064	**-0.200 (*)**	0.157	**0.318 (*)**
Accommo-dation	0.111	1	**0.171 (*)**	-0.099	-0.086	0.073	0.067	0.055
Transport. and Com.	0.062	**0.171(*)**	1	0.143	**0.280 (**)**	**0.299 (**)**	0.077	-0.051
Financial & insurance	0.101	-0.099	0.143	1	**0.496 (**)**	-0.034	0.101	-0.021
Business & Scientific Services	-0.064	-0.086	**0.280 (**)**	**0.496 (**)**	1	**0.237 (**)**	0.138	**-0.212 (**)**
Public Admin.	-0.200	0.073	**0.299 (**)**	-0.034	**0.237 (**)**	1	**0.269 (**)**	0.161
Education	0.157	0.067	0.077	0.101	0.138	**0.269 (**)**	1	**0.350 (**)**
Health services	**0.318 (**)**	0.055	-0.051	-0.021	**-0.212 (**)**	0.161	**0.350 (**)**	1

** Significant at 0.01 (bilateral). * Significant at 0.05 (bilateral).

Figure 6. Relationships between location quotient and population size. Plotted results (LOG transformations) for three industry groups. Canada and Spain.
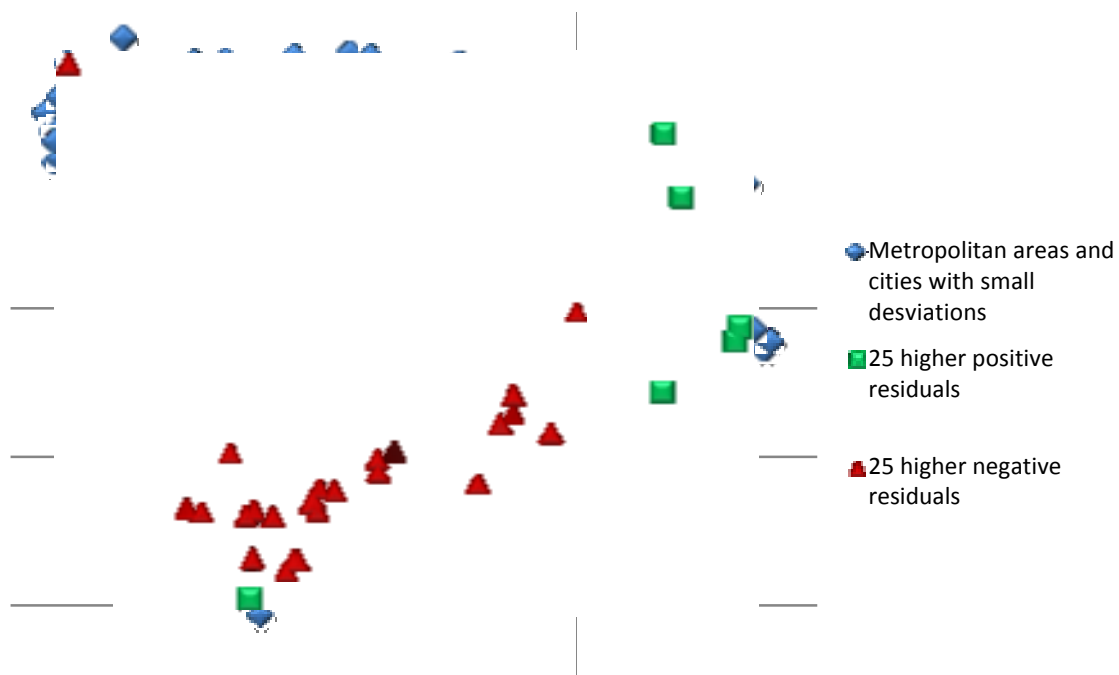
Spain, 226 observations	**Canada**, 147 observations

(3) Transportation, Storage and Communication

(4) Finance and Insurance

(5) Business & Scientific Services and Real Estate

Table 4. Relationship between residuals and four variables. Three industry groups. Spain (226 observations) (2001)

$$RESIDUALS_i = \alpha + \beta_1 CAPITAL + \beta_2 COASTAL + \beta_3 CENTRAL + \beta_4 EASTWEST + \beta_5 NORTHSOUTH + u$$
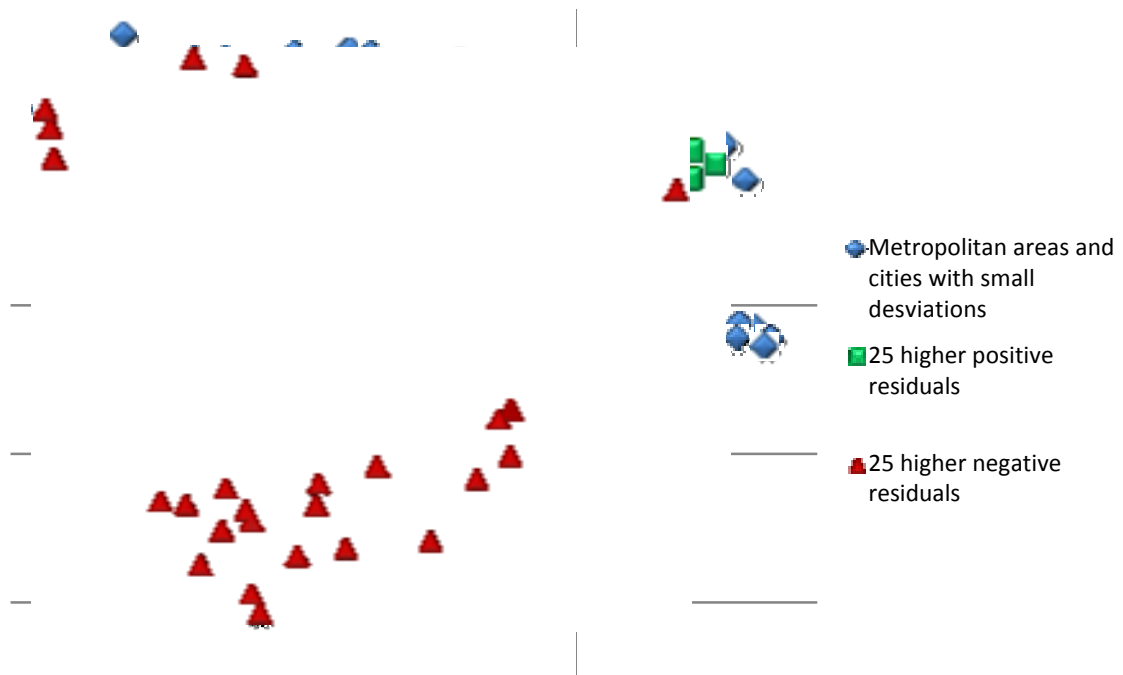
	(3) Transport and Communications	(4) Finance and insurance	(5) Business & Scientific Services and Real Estate
CAPITAL: Capital of province (1 if so, 0 otherwise). 52 capitals	-0.024	**0.092 (**)**	0.016
COASTAL: Coastal location (1 if coast, 0 otherwise)	0.030	**-0.115 (**)**	-0.031
Central: (1 if 1hr drive from a metropolis of 0.5 million +, 0 otherwise)	-0.038	-0.036	0.019
EASTWEST: East (values from 0 to 1, west-east coordinates)	**0.230 (*)**	0.141	**0.064 (*)**
NORTHSOUTH: North (values from 0 to 1, south-north coordinates)	**0.151 (*)**	**0.260 (**)**	**0.108 (*)**
R^2	**0.044 (♦)**	**0.229 (♦♦)**	**0.061 (♦)**

(**) Significant at 0,01; (*) at 0,05.

Figure 7. Transportation and Communications Services. Mapped Regression Residuals Spain (2001)

Metropolitan areas and cities with small desviations

25 higher positive residuals

25 higher negative residuals

Figure 8. Finance and Insurance. Mapped Regression Residuals. Spain (2001)

Metropolitan areas and cities with small desviations

25 higher positive residuals

25 higher negative residuals

Figure 9. Business & Scientific Services. Mapped Regression Residuals. Spain (2001)

Metropolitan areas and cities with small desviations

25 higher positive residuals

25 higher negative residuals