URBAN SYSTEMS IN THE BARCELONA PROVINCE: A FIRST STEP FOR ESTIMATING LOCAL ECONOMIC ACTIVITY*

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ABSTRACT: Local economic activity, social services or infrastructures are important issues for local authorities: although there is plenty of information on economic activity at national or regional levels, the same is not true for smaller territorial divisions (NUTS-3 or smaller). As local authorities can promote local economic growth, they are interested in up-to-date information on local economic performance: if a local economy is growing slower than its neighbours, the local government might be able to take appropriate action provided it can receive an "early warning". Most local economic activity indicators are based in the evolution of the labour market, as it is considered a good *proxy* for economic activity and actualised information on the labour market can be retrieved without much cost. The problem is that local authorities (like municipalities) are often too small for such an indicator to be efficient: economic activity in a certain municipality does not depend only on the municipality's labour market but also on the neighbouring municipalities' labour markets. Many countries have created higher level local authorities (for example, *metropolitan areas*) to solve this problem, but in most cases, administrative boundaries are somewhat arbitrary and do not coincide with local economic activity: municipality *a* has a strong economic and labour market dependence on municipality *b*, but they might form part of different administrative areas. Other repetitive trips, like those related to education (taking children to school), health (going to the doctor or to the hospital) or shopping also contribute to define *urban systems*. These trips have often a strong relation with commuting trips, as workers and families try to optimise their journeys.

These small groups of municipalities, with strong economic, social and commuting ties could be used as administrative territorial units for local policy making, overcoming the defficiencies of municipalities (too small) and NUTS-III level units (too large).

An interesting alternative is to use *local labour markets* (like *Travel-to-Work areas* or *Daily Urban Systems*) as an alternative to administrative boundaries. A local labour market is formed by a group of municipalities with highly interconnected labour markets; their economies will also be strongly interdependent. The problem is that algorithms used for designing local labour markets do not restrict their size or population: in a polarised region like Catalonia we can expect to find small, isolated municipalities that form their own local labour market, while large cities (like Barcelona) will form a very large and populated local labour market. In the first case, the local activity indicator is not likely to be efficient, as it needs a minimum size. In the second case, it "masks" economic differences of municipalities integrated in a metropolitan area, thus becoming ineffective as a local policy instrument. Another problem is that this methodology is unidimensional, relying only on commuting flows.

A secondary problem arises when local labour markets' boundaries do not coincide with local authorities: if a local authority contains more than one local labour market, it might be forced to implement several differenced policies, one for each local labour market; if a local labour market is divided among two local authorities, they will have to co-ordinate their policies. If both situations coincide for the same local authority, it might be forced into a "schizophrenia" of incompatible economic measures.

In this paper we will try to overcome these differences, by obtaining a trade-off between all these compromises: we will show that the *local labour market* concept is still valid for the implementation of a local economic activity indicator, but our local *urban systems* will be constructed using a methodology alternative to the usual algorythms, which constrains them to have a maximum and minimum population size, to take into account the existing educative, health and shopping infrastructure and to coincide with administrative boundaries whenever possible. As an example, we have defined *urban systems* for the province (NUTS-3 level) of Barcelona, which is the most populated in the region (NUTS-2) of Catalonia (Spain).

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1.- Introduction

Local economic activity, social services or infrastructures are important issues for local authorities: although there is plenty of information on economic activity at national or regional levels, the same is not true for smaller territorial divisions (NUTS-III or smaller). As local authorities can promote local economic growth, they are interested in up-to-date information on local economic performance: if a local economy is growing slower than its neighbours, the local government might be able to take appropriate action provided it can receive an "early warning". Most local economic activity indicators are based in the evolution of the labour market, as it is considered a good proxy for economic activity and actualised information on the labour market can be retrieved without much cost.

The problem is that local authorities (like municipalities) are often too small for such an indicator to be efficient: economic activity in a certain municipality does not depend only on the municipality's labour market but also on the neighbouring municipalities' labour markets. Many countries have created higher level local authorities (for example, *metropolitan areas*) to solve this problem, but in most cases, administrative boundaries are somewhat arbitrary and do not coincide with local economic activity: municipality *a* has a strong economic and labour market dependence on municipality *b*, but they might form part of different administrative areas.

On the other side, NUTS-III or similarly sized territorial divisions (like Spanish *provincias* (provinces) or French *departaments*) are usually too large to be considered a single local unit: specially in the case of densely populated, urban zones, a NUTS-III territorial unit might host several differenced territorial aspects, each one of them needing different policies.

It is clear, thus, that we need an “intermediate” territorial unit between NUTS-III level and municipalities. This unit should ideally be composed of a group of neighbouring municipalities with strong economic, social and quality-of-life relationships between them and a common economic evolution. It could also be used in local policy-making

purposes. Our aim in this paper is to find a suitable methodology for the estimation of such territorial units and its application to the NUTS-III level province of Barcelona.

An interesting alternative is the use of *local labour markets* (also known as *travel-to-work areas* or *daily urban systems*). A *local labour market* is formed by a group of municipalities with strong commuting relationships between them. Usually, strong commuting flows are associated with strong, non-labour, regular mobility flows (related to leisure, buying or services). All these flows will provoke a strong synchronisation of the economies in the municipalities belonging to the *local labour market*, so they can be analysed jointly. The similar behaviour of their economies means that a common policy can be designed for all municipalities in the *local labour market*.

Infrastructures construction policy can be improved also by the introduction of *local labour markets*. There are two extremes that should be avoided:

- On the one hand, excessive concentration of infrastructures in the province capitals and large cities, as it would cause a decrease in the welfare, both for non-capital residents (who would be forced to long displacements in order to fulfil their needs) and for capital residents (due to the congestion of capitals and their infrastructures).
- On the other hand, a excessive dispersion of infrastructures would lead to redundant services, underemployed facilities and inefficient building and maintenance costs.

Standing in between both extremes, the use of a territorial unit similar to *local labour markets* would avoid the negative effects of excessive dispersion and excessive concentration of infrastructures, while keeping most of their advantages.

There have been several experiences in the use of *local labour markets* (see epigraph 2). Most of them have been successful, but we think this concept could be improved, as it relies only in commuting data, while other important ties between municipalities (mostly, non-labour trips, like shopping, taking children to school or going to the hospital) are ignored.

In this paper we will face the territorialisation of the Barcelona province (in Catalonia, Spain) into *urban systems*. We improve the concept of *local labour markets* by considering commuting, but also other dimensions of inter-urban relations.

Barcelona province is a NUTS-III level territorial unit that holds 24% of Catalan territory, 75.9% of its population and 76% of the employed workers in 1996 (7719 km^2, 4628277 inhabitants and 1659972 workers, respectively). It is (together with Madrid) Spain's most populated and urbanised province, and it has the largest inter-municipal commuting levels (in 1991, 36.9% of the employed workers out-commute from their residence municipality, against 29.6% in Madrid and 25% in Valencia). Instead of the usual algorythms, we have developed a methodology that takes into account the issues commented above. We think territorialisations for NUTS-III levels of large urban zones in Europe (for example, Madrid NUTS-III province, the Dutch Randstadt or London Metropolitan Area) or even the United States (see Giuliano and Small's (1991) study for the Los Angeles region) would yield similar results.

2.- Previous experiences and methodologies used

The first modern division of Catalonia into areas smaller than NUTS-III level was proposed in 1933 (see Vila, 1975): Catalonia was divided in 38 *comarcas*, although another 3 were created later (in 1988). Although this territorialisation was done by a commission of geographers, who relied mostly on physical and communications network data, they also included some important economic information. For example, they asked each municipality the following question: "Which major town is chosen by residents in the municipality for shopping?". They also included the restriction that all residents in the *comarca* should be able to travel to the *comarca*'s capital and back to their residence municipality in the same day. Due to Catalonia's particular geography and communications network, these *comarcas* (given official rank by Catalan regional government in the early 80's) are still a good approximation to Catalonia's *local labour markets*.

The first analytical approximation to the concept of *local labour markets* was enunciated by Fox and Kumar (1965). It was based on the daily home-to-work displacements (*commuting*) so towns that had a strong commuting relationship with a large city would be grouped with it, to form a *Functional Economic Area*. This approach was systematised by authors like Coombes (1986), Smart (1974) or Ward (see Pacinelli, 1998), who turned Fox and Kumar's concept into algorithms that automated the construction of *local labour markets*. These algorithms have been applied to several countries and regions, like the United Kingdom (*travel-to-work areas*), Holland (*daily urban systems*), Italy (*sistemi locali di lavoro*; see Pacinelli, 1998), or, in Spain, to Catalonia (*àrees funcionals*; see Palacio, 1998) or Valencia (*mercados de trabajo locales*; see Casado, 1997).

All these algorithms have a common methodology: first, they select some municipalities (usually, 20% of the total) to act as *potential attraction poles* or would-be heads of *local labour markets*. Then, they deduce a rule to attach the rest of municipalities to these heads (normally, a municipality is tied to the head to whom it has the largest out-commuting flow). The algorithm includes a stopping condition, when a pre-determined level of self-contention is achieved (this is, when the proportion of workers who reside and work in the same *local labour market* has reached the desired figure). Usually a minimum acceptable size is selected, too, so *local labour markets* that do not achieve the minimum selected size are merged with larger *local labour markets*.

This methodology has been successfully applied to several countries and regions. It has helped to analyse commuting patterns and it is used as a policy instrument by local authorities.

Anyway, although this approach has proved to be an useful tool, it also has some disadvantages:

- The heads of the *local labour markets* are exogeneously chosen. This choice can seriously affect the final results. We could say that this algorithms are "top-down" methods.

- By choosing a head for each *local labour market*, the algorithm implicitly accepts monocentrism, which, in many cases, is an oversimplification of the actual urban structure.

- In polarised regions (like Catalonia or Valencia), the algorithm leads to the definition of very large urban areas, which can be as large as the NUTS-III entity we were trying to divide: for example, Palacio's (1998) territorialisation of Catalonia (which has been extensively used by the regional government) leads to the creation of a very large urban area for Barcelona, which extends across most of Catalonia's coastal and pre-coastal plain, which includes about 100 municipalities and more than 3.500.000 inhabitants. Casado's (1997) territorialisation of the NUTS-II level region of Valencia obtains an urban area for the city of Valencia (the region's capital) which is exactly the same as the NUTS-III province of Valencia. This result is likely to happen in any other polarised region (see, for example, Van der Laan (1998) for the Dutch Randstadt).

  These findings are not "wrong", as they reveal the extension of the metropolitan fact, and they contribute to identify the influence of a large city in the surrounding region. Sadly, these large urban regions are impractical both as a small, territorial unit and as a means of measurement of local economic activity. For example, Palacio's *local labour market* of Barcelona includes zones with very different economic, urbanistic or sociological profiles, which require differenced local policies. Even though all these zones' economies are strongly correlated with Barcelona's, and their quality of life relies heavily on infrastructures located in Barcelona (such as hospitals or universities), the relationship between many peripheral zones in the area might be weak[1].

- Usually, *local labour markets* do not coincide with pre-existent territorial units (small units, like *comarcas* or Metropolitan Areas, but also larger units, like

[1] "A very large conurbation like London may not be by any means a single local labour market in any sense, particularly for the less-skilled and lower-paid occupational groups" (Hall, 1981 (quoted in Simpson, 1992)). See also Mills, 1990.

NUTS-III or even NUTS-II levels). This could lead to arguments if different territorial authorities are involved in the same *local labour market*. These discrepancies can render "divided" *local labour markets* useless for policy-making (see Pacinelli, 1998).

3.- Proposed methodology for the territorialisation of the (NUTS-III) province of Barcelona into *urban systems*

As a means to solve the commented deficiencies of the most-used territorialisation algorithms, we have designed a different approach. The main difference with previous methodologies is that ours is a multidimensional approach: we have used commuting data, but also other non-commuting trips between municipalities.

3.1.- Commuting: Our fist phase was (like previous studies) the use of commuting data. We opted for a "bottom-up" approach: there are no pre-selected "potential heads", but all municipalities start at the same level and are joined with the municipality they have the strongest commuting relationship with. Thus, the steps that constitute the first phase of our methodology can be synthesised as follows:

1) In the first step, only commuting flows larger than 10% of the total employed workers residing in the *origin* municipality are considered: the municipality with the largest out-commuting flow (measured in % of the total resident employed workers) was grouped with the municipality that received the flow. After that, both municipalities were considered a single unit. The process went on until all commuting flows larger than 10% of the resident workers were exhausted. This proceeding is analogous to some jerarquical cluster algorithms.

2) Some small municipalities had no flows larger than 10% of their resident workers. If they belonged to the Barcelona province, they were attached to the group (*urban system*) to whom they had the largest out-commuting flow.

3) When all municipalities had joined a group, all adscriptions were revised: in a few cases, a municipality had the largest aggregate commuting flow to a *urban system* other than it had been adscribed to. These municipalities were reassigned.

An important issue is how commuting flows to the municipality of Barcelona should be treated: Barcelona alone accounts for 25% of the population and 30% of the jobs in Catalonia in 1996 (32% and 39%, respectively in the province), and commuting flows to Barcelona are the largest of all. If Barcelona were included in our calculations, results would have been similar to Palacio's (1998; see epigraph 2). To avoid the formation of a macro-*urban system* of Barcelona (which would account for half the province in extension and two-thirds of its population), we have opted for removing all commuting flows directed to Barcelona from our calculations. Thus, the municipality of Barcelona will be considered a *urban system* in itself. This approach could also be used in other polarised regions.

This might look like a radical solution, and it probably is. In defence of our solution, we can say that, by grouping Barcelona municipality and the five *urban systems* that surround it, we obtain Barcelona Metropolitan Area. Thus, the elimination of commuting flows to Barcelona allows us to obtain a disaggregation of this area without significant negative effects.

In any case, Barcelona and the *urban systems* that surround it have strong commuting, economical and social relationships, and this should be always kept in mind when designing and implementing local policies.

3.2.- Non-commuting trips (quality of life criteria): As happens with economic activity, when the researcher wants to measure the quality of life of a territory, one of the first points consists on defining the unit of measure. Quality of life depends on individual data, but also on aggregate data, because of the existence of some services that are supplied to the collectivity only in some points of the territory, such as educational institutions or health centers. In order to solve this problem, a solution is to divide Barcelona province into urban systems, using a multivariant methodology that reflects the different variables that affect quality of life.

We have focused in educational and health services in order to define the new aggregation. The chosen criteria can be summarised in the following points:

1. Number of educational units in the secondary school
2. Number of educational units in the primary school
3. Number of educational units in the professional education
4. Number of branches (specialities) in the professional education centers
5. Existence of primary health units
6. Existence of primary assistence centers
7. Existence of hospitals

Following these criteria we choosed the municipalities that could be designated as centers of a subsystem or a system. Once this was done, we had to decide the adscriptions of every municipality to any subsystem or system. The criteria we followed are listed below:

1. Resolution of the Education Department, of the Catalan Government, february 17th 1998, relative to the adscription of basic and primary school centers to the secondary school centers.
2. Health map of Catalonia, developed by the Health Catalan Institute, of the Catalan Government.
3. 1991 students commuting data.

Additionaly, we had in mind the need of having some homogeneity between quality of life systems and economic systems, and the wish of securing some afinities with the administrative *comarques* local aggrupations.

3.3.-Fine-tuning: All *urban systems* obtained were required to fulfil the following conditions:

- *Self-contention*: The resulting *urban systems* should maximise intra-system commuting and minimise inter-system commuting. This condition is basical in any *local labour markets*-forming algorithm.

- *Size*: whenever possible, the resulting *urban systems* should be larger than 30.000 inhabitants. We also tried to avoid too large systems (larger than 200.000 inhabitants), although it was not always possible to fulfil these conditions.
- *Coincidence between urban systems and comarcas*: the resulting groups fitted fairly well with comarcal boundaries: *urban systems* closer to Barcelona tended to have smaller extension than *comarcas*, but they were mostly sub-divisions of existing *comarcas*. On the other side, *urban systems* located further away from Barcelona were very similar to existing *comarcas*. As the coincidence between *urban systems* and *comarcas* was very strong, some small municipalities were re-assigned to the *comarca* they belonged, to assure a perfect fit[2].
- *Sub-division of larger systems*: Some large systems (either in extension or in population) accepted a further division in *sub-systems*.
- *Geographical continuity of systems and sub-systems*: Although this condition was not explicitly used in our methodology (it is explicitly formulated in other algorithms), the resulting *systems* and *sub-systems* turned out to be geographically continuous, with only one exception (the Molins *sub-system*. Anyway, the two parts of the *sub-system* are joined by a major road, which acts as a "bridge" between them).
- *Home-workplace maximum distance*: Other algorithms eliminate flows longer than 50 kilometres, as they consider them unrealistical (Palacio, 1998). Previous studies (Artís *et al*, 2000; Romaní, 1999) lead us to think that this procedure is arbitrary. Thus, we have included flows longer than 50 km. in our calculations.
- *Conciliation between commuting aggregations and quality of life aggregations*: The main differences that can be found between economic systems and quality of life systems are summed up in the fact that we have defined more units (systems and subsystems) in the quality of life aggregation than in the other. Hence, in the quality of life agglomeration there are 23 systems, while in the economic one there are 22[3]. Looking at the subsystems, in the former we found 48 while in the

[2] Some municipalities in Osona *comarca* belong to Girona province. They have been included in our territorialisation. We have included also a small number of municipalities from Girona province (north of Barcelona) and Tarragona province (south) which are close to Barcelona province and have their strongest commuting relations with municipalities in Barcelona province.

[3] The municipality of Cornellà de Llobregat (with a population of 82490 in 1996) provides a large range of services, so it has been considered as a one-municipality system, instead of a part of Llobregat system.

latter there are only 37. It means that we can study the province more precisely in the quality of life scale than in the economic one. The main reason lies in the multidimensionality of quality of life, which enables a better determination of the basic unit of study.

As there were no substantial differences between both aggregations and the commuting-based aggregation yielded more homogeneous *urban subsystems* (both in surface and population) than the quality of life aggregation, we decided to use the commuting *urban systems* and *subsystems* as the base of our final aggregation. Anyway, according to the quality of life results, some municipalities were relocated (Casado (1997) found a similar result for the Valencia case, when he compared his territorialisation with the regional government's infrastructures-based division).

4.- Territorialisation of the Barcelona province: a brief comment on the results

As we have commuting data from the 1986, 1991 and 1996 Population Censuses, we have applied our methodology to all three sets of data: the results show (with the exception of the Molins *subsystem*) stability for the *urban systems* obtained.

A superficial comparison of our results and Palacio's, who uses a methodology based on Smart's algorythm shows important differences. From these, we will point out the most important: first of all, it is clearly seen that in Palacio's territorialisation, the *urban systems* surrounding Barcelona disappear under one new large *urban system* which contains more than 3500000 inhabitants. The second important difference is the one related to the fact that in Palacio's there does not exist any limit concerning to poblational size, so we can find *urbans systems* which have a great number of inhabitants, and some others whose number of inhabitants is very small. Finally, it is worth mentioning the case of these *urban systems* formed by just one or two municipalities and a very low population.

The rest of the quality of life-based territorialisation is identical to the commuting-based territorialisation.

Nevertheless, a closer look reveals that both territorialisations are quite compatible: in fact, the aggregation of Barcelona and the 9 surrounding *urban systems* gives us Palacio's *local labour market* of Barcelona. On the other side, most comarcal *urban systems* obtained by us can be divided using Palacio's *local labour markets*. This is an additional proof that the elimination of the commuting flows to Barcelona has not flawed our results.

Since we have built these *urban systems* we may analize them through their mobility features. At first sight it is easy to distinguish between two different kinds of *urban systems* in Barcelona's province, depending on the fact that they are near to Barcelona city or far from there. Those ones closer to Barcelona show a great labour mobility between *urban systems*[4], while those which far from Barcelona do not present a great number of daily labour trips out of their systems. However, all the systems have a great labour mobility inside them.

There exist other important differences between the *urban systems* depending on their closeness to Barcelona. For instance, those closer to Barcelona have a higher population density than the rest (the six *comarcas* of Barcelonès, Baix Llobregat, Vallès Occidental, Vallès Oriental, Maresme and Garraf, sometimes grouped under the name of *Metropolitan Comarcas* hold 89.72% -4154852 inhabitants- of the provincial population in just 33.52% of the province's extension -2636.7 km^2-, with a population density of 1575.7 inh./km^2). In fact, most of the *urban systems* on the boundaries of the province have a great land extension which includes the whole comarca where the municipalities are in, but their inhabitants number is quite low (just 10.28% of the population –475645 inhabitants- in 66.48% of the territory –5227.6 km^2-, with a density of 90.98 inh./km^2).

Another important feature that may be discovered is the one related with differences in sectoral labour especialization of the workers who live in the *urban systems*. Using 1996 census data we obtain the especialization index that there exists in a *urban system* on an

[4] The *urban systems* considered closer to Barcelona which share this feature are those ones which belong to the so-called metropolitan area, first ring and second ring around the city.

activity sector[5] depending on the number of working people that live there. When we analyse these results we may see that most of the *urban systems* are specialized in industry. However, there are spatial differences in other activity sectors such as agriculture or services. On the one hand, *urban systems* specialized in agriculture are only found at the boundaries of the province. On the other hand, specialization in the part of sector services oriented basically to banking and services for other companies is found in the *urban systems* of Barcelona and its close neighbours.

The working population in a *urban system* can be classified into two groups: the ones who live in the *urban system*, and the ones who effectively work there. Some of these may effectively work and live in the same *urban system*, and some others may live and work in different places, and that is what causes mobility between different *urban systems*.

When we analyse these *urban systems* we may discover that in most of them the number of working population who live in the place is higher than the number of working population who effectively work there. The *urban systems* whith greater number of resident workers than jobs are found just next to Barcelona city. On the contrary, there are few *urban systems* that have a higher rate of working population who work there. These are the one of Barcelona city and some others which are very near to it but, except one, not beside.

There exist some large *urban systems* which have a great number of inhabitants or a big extension, so they can be divided into what we call *urban sub-systems*. These *urban sub-systems* are usually areas which have a strong labour and non-labour relationship between their municipalities, but they are not big enough to create a *urban system*.

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[5] This especialization index is obtained using the following formula: $IE_{ij} = \frac{\frac{O_{ij}}{O_j}}{\frac{O_i}{O}}$, where IE_{ij} is the especialization index that exist in the *urban system j* at the activity sector *i*, O_{ij} is the number of working people that lives in the *urban system j* and works at the activity sector *i*, O_j is the number of working people living in the *urban system j*, O_i is the number of working people that works at the activity sector *i* and lives at the Barcelona province, and *O* is the number of working people that lives at the Barcelona province.

Therefore, they must be added to another area to obtain a *urban system* where it is easier to study its economical behaviour. Some examples of *urban sub-systems* are those included in the *urban systems* of Llobregat or Bages.

To conclude with this comment on the results, we may emphasize that daily labour mobility is very important in Barcelona province. This mobility is greatly influenced by Barcelona city and the municipalities around it.

An intersting fact is that *urban systems* closer to Barcelona are smaller in surface but have larger population than the rest: as we get closer to the province boundares, *urban systems* become larger, but less populated. Thus, we can outline a *density gradient* in Barcelona province, with a peak in the municpality of Barcelona.

Barcelona is clearly the province's main centrer, although it is not the only center: there are other large cities, like Sabadell, Terrassa, el Prat de Llobregat or Manresa that attract workers from their *urban systems* and also from other *urban systems*. We can consider them as sub-centers or secondary centers (Boix and Trullén, 2000). This phenomenon of policentrism coexiting with a dominant center has been also detected in other large urban areas (for example, Giuliano and Small (1991) for the Los Angeles region).

5.- Conclussions

In this paper we have analysed territorial division of NUTS-II or NUTS-III level regions into small, homogeneous areas that can be used for local policy-making and for estimating local economic activity, thus improving the information that local authorities receive.

Commuting is the variable most commonly used for such territorialisations. We have commented and discussed the usual algorythms, but we have decide finally to implement our own methodology, because being a "bottom-up" and multidimensional system, it allows us to obtain smaller territorial units, which we think are better suited to the purposes commented above.

The results show a homogeneous territorialisation of the Barcelona province (NUTS-III level) and a strong compatibility with pre-existing territorial units and with the influence areas of educational and health infrastructures.

Anyway, the coincidence between commuting-based and quality of life-based aggregations is a finding that should be confirmed for other similar areas.

The next step in this research is the inclussion in our study of other variables that contribute to inter-municipal ties, like shopping trips or leisure trips.

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FIGURE 1: LOCATION OF CATALONIA

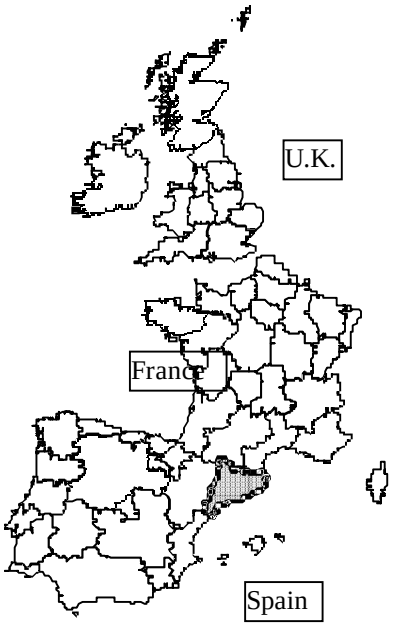

FIGURE 2: CATALONIA AND THE BARCELONA PROVINCE

FIGURE 3: URBAN SYSTEMS

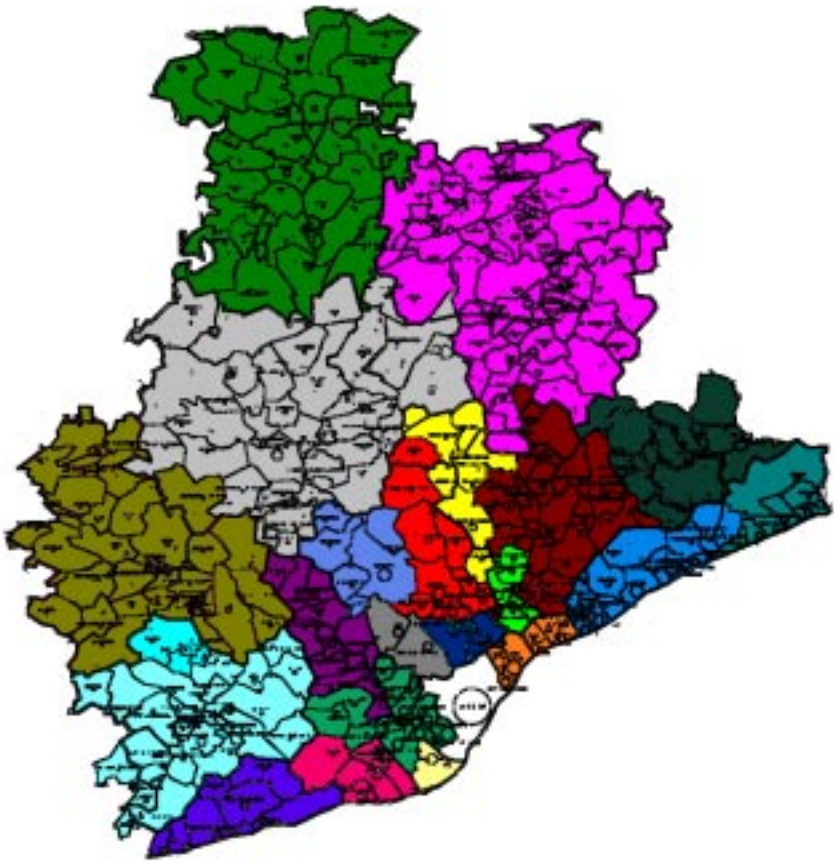

FIGURE 4: URBAN SUB-SYSTEMS

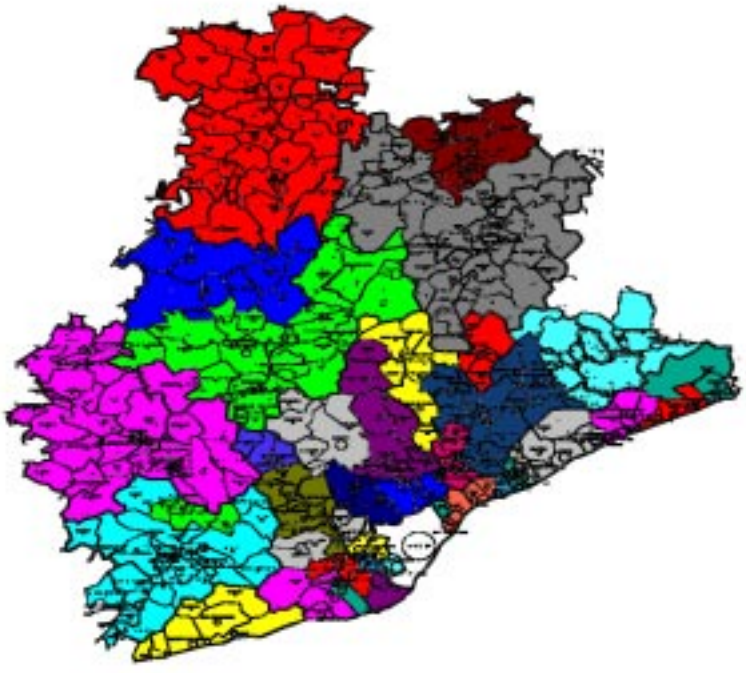

TABLE 1: URBAN SYSTEMS AND URBAN SUBSYSTEMS

Urban System	1	2	3	4	5	6	7	8	9	10	11
Besòs	8	413.106	84.447	138.462	5,02%	8,28%	57,70%	30,65%	4,50%	4,31%	2,01%
Urban Sub-systems:											
Besòs-Mar	5	264.875	62.618	88.245	3,72%	5,28%	57,45%	40,05%	2,68%	4,13%	0,45%
Masnou	2	25.056	5.238	9.761	0,31%	0,58%	66,14%	36,96%	1,91%	0,84%	0,00%
Santa Coloma de Gramenet	1	123.175	16.951	40.456	1,01%	2,42%	76,75%	42,40%	0,00%	0,00%	0,00%
Barcelona	1	1.508.805	659.786	529.751	39,20%	31,68%	21,21%	36,74%	0,00%	0,00%	0,00%
Berguedà	31	38.606	11.646	12.860	0,69%	0,77%	16,79%	7,88%	7,24%	6,40%	9,12%
Riera de Caldes	7	29.193	13.071	11.506	0,78%	0,69%	42,92%	49,78%	2,50%	3,73%	1,59%
Maresme Nord	7	59.537	20.707	22.122	1,23%	1,32%	22,20%	16,89%	5,99%	4,12%	10,88%
Urban Sub-systems:											
Riera de Calella	4	33.843	12.268	12.676	0,73%	0,76%	25,69%	23,26%	8,55%	6,26%	3,55%
Tordera	3	25.694	8.439	9.446	0,50%	0,56%	33,62%	25,93%	3,61%	2,87%	1,94%
Cerdanyola-Montcada-Ripollet	3	106.474	37.770	38.778	2,24%	2,32%	54,90%	53,71%	3,39%	4,01%	2,26%
Delta del Llobregat	5	135.310	32.311	49.956	1,92%	2,99%	52,76%	26,96%	6,54%	3,53%	2,92%
Urban Sub-systems:											
Gavà-Castelldefels	3	76.599	20.195	29.552	1,20%	1,77%	56,87%	36,89%	3,84%	2,06%	0,19%
Viladecans	2	55.711	12.116	20.404	0,72%	1,22%	68,28%	46,58%	0,50%	1,00%	0,00%
Granollers	23	173.168	67.914	67.207	4,03%	4,02%	29,34%	30,07%	10,65%	6,90%	10,86%
Urban Sub-systems:											
Pla de Granollers	4	13.509	5.293	5.287	0,31%	0,32%	42,84%	42,91%	1,31%	1,08%	1,23%
Congost	19	159.659	61.621	61.920	3,66%	3,70%	31,76%	33,08%	10,89%	6,77%	9,29%
Llobregat	13	581.515	164.516	206.184	9,77%	12,33%	52,30%	39,92%	3,61%	4,10%	9,88%
Urban Sub-systems:											
Cornellà-Sant Joan Despí	2	109.295	34.863	38.234	2,07%	2,29%	66,63%	63,41%	2,41%	3,37%	0,00%
Esplugues-Sant Feliu-Sant Just	3	95.913	34.319	35.223	2,04%	2,11%	65,34%	64,44%	1,89%	2,72%	2,66%
Hospitalet	1	255.050	60.340	87.667	3,58%	5,24%	70,55%	57,23%	0,00%	0,00%	0,00%
Molins	4	37.662	13.359	14.694	0,79%	0,88%	57,07%	52,78%	2,71%	1,74%	1,56%
Sant Boi	3	84.447	20.728	29.459	1,23%	1,76%	62,41%	46,57%	0,78%	1,46%	0,07%
Anoia	34	87.100	30.257	32.303	1,80%	1,93%	14,69%	8,92%	17,46%	6,01%	9,06%
Bages	35	152.586	52.009	54.310	3,09%	3,25%	11,30%	7,38%	11,75%	8,20%	9,25%
Urban Sub-systems:											
Manresa	27	122.895	43.938	44.875	2,61%	2,68%	13,26%	11,42%	11,92%	8,83%	6,49%
Bages Nord	8	29.691	8.071	9.435	0,48%	0,56%	31,25%	19,64%	19,64%	1,34%	4,50%
Baix Llobregat Nord	12	123.778	58.327	46.345	3,47%	2,77%	34,32%	47,81%	6,90%	3,57%	11,83%
Urban Sub-systems:											
Esparreguera-Olesa	3	31.864	8.182	11.381	0,49%	0,68%	46,89%	26,12%	3,55%	1,95%	0,14%
Martorell	9	91.914	50.145	34.964	2,98%	2,09%	39,18%	57,60%	5,80%	4,21%	8,76%
Maresme Sud	18	213.771	62.664	76.585	3,72%	4,58%	28,32%	12,40%	5,91%	6,06%	7,21%
Urban Sub-systems:											
Riera d'Arenys	5	28.799	7.872	10.278	0,47%	0,61%	37,58%	18,53%	3,92%	4,21%	2,33%
Mataró	10	145.570	46.326	51.932	2,75%	3,11%	25,60%	16,62%	5,96%	7,53%	2,09%
Riera de Premià	3	39.402	8.466	14.375	0,50%	0,86%	60,07%	32,20%	3,76%	4,73%	1,34%
Parets-Mollet	6	68.666	31.545	27.597	1,87%	1,65%	46,00%	52,76%	4,90%	4,33%	11,91%
Prat de Llobregat	1	63.255	24.397	22.056	1,45%	1,32%	52,47%	57,03%	0,00%	0,00%	0,00%
Rubí-Sant Cugat	2	101.295	38.457	38.988	2,28%	2,33%	47,36%	46,63%	2,47%	4,31%	4,15%
Sabadell	10	283.954	108.126	103.049	6,42%	6,16%	26,90%	30,34%	6,61%	11,14%	10,10%
Baix Montseny	16	40.926	19.303	16.467	1,15%	0,98%	20,43%	14,27%	6,87%	5,45%	0,12%
Terrassa	6	177.824	59.121	62.316	3,51%	3,73%	25,10%	21,06%	4,23%	2,84%	17,00%
Osona	51	122.923	48.705	50.248	2,89%	3,00%	8,66%	5,77%	12,71%	4,67%	11,46%
Urban Sub-systems:											
Osona Nord	9	19.422	6.832	8.014	0,41%	0,48%	28,86%	16,57%	4,89%	6,29%	3,62%
Vic	42	103.501	41.873	42.234	2,49%	2,53%	10,79%	10,14%	13,49%	5,17%	13,48%
Alt Penedès	31	80.610	30.926	30.730	1,84%	1,84%	17,16%	17,68%	8,63%	9,18%	4,13%
Urban Sub-systems:											

Sant Sadurní	4	14.093	5.042	5.320	0,30%	0,32%	27,50%	23,50%	3,20%	2,95%	3,98%
Vilafranca	27	66.517	25.884	25.410	1,54%	1,52%	20,52%	21,97%	9,13%	9,99%	8,64%
Garraf	7	94.681	27.206	34.451	1,62%	2,06%	29,80%	11,10%	7,74%	6,07%	4,13%

Description:
1.Number of municipalities
2. Population
3. Number of jobs in the system
4. Number of resident employed workers in the system
5. % resident employed workers in the province
6. % jobs in the province
7. % resident workers in the system who out-commute
8. % workers who commute into the system
9. % of central commuting in the sustem
10. % reverse commuting in the system
11. % cross-commuting in the system

TABLE 2: SECTORAL SPECIALISATION INDEX OF THE URBAN SYSTEMS

Urban System	Agriculture	Fishing	Minning	Industry	Energy	Construction	Banking and other services to firms	Other services
Besòs	0,4285	1,7245	0,2311	1,0320	1,0012	1,2361	0,9047	0,9872
Barcelona	0,2527	0,9296	0,1549	0,7143	1,0288	0,5441	1,4087	1,1753
Berguedà	5,8907	0,1354	11,6838	0,9490	2,0046	1,9690	0,4611	0,8847
Riera de Caldes	2,2458	0,3041	0,6418	1,1953	0,7466	1,3388	0,7208	0,8653
Maresme Nord	3,7646	3,0840	0,3338	0,8725	0,6034	1,3933	0,5910	1,0828
Cerdanyola-Montcada-Ripollet	0,3141	0,1579	0,4232	1,1495	0,9338	1,1533	0,8125	0,9466
Delta del Llobregat	1,2536	0,4202	0,8870	0,9448	0,8942	1,5221	0,8545	1,0073
Granollers	1,6053	0,1562	0,9157	1,2797	1,0147	1,2246	0,7082	0,8353
Llobregat	0,4803	0,4133	0,4277	1,0505	1,0127	1,1038	0,9258	0,9869
Anoia	2,3590	0,2437	0,4572	1,4617	0,8796	1,1526	0,5371	0,7443
Bages	2,1637	0,0322	15,9091	1,1551	1,1851	1,2134	0,6637	0,8819
Baix Llobregat Nord	0,9393	0,2831	0,7613	1,2687	0,9810	1,3030	0,7447	0,8410
Maresme Sud	2,6917	3,9745	0,2357	1,0701	0,8111	1,0921	0,8821	0,9227
Parets-Mollet	0,4175	0,2219	0,6244	1,4591	0,8093	0,9386	0,6831	0,7865
Prat de Llobregat	0,8805	0,7535	0,1860	1,0323	0,9707	1,0580	0,9064	1,0013
Rubí-Sant Cugat	0,5298	0,1570	0,5261	1,1113	1,0576	1,0158	1,0229	0,9261
Sabadell	0,3977	0,1528	0,3424	1,2305	0,8375	1,1051	0,8682	0,8788
Baix Montseny	3,0179	0,5029	1,8873	1,4362	1,2750	1,4553	0,4892	0,7073
Terrassa	0,4358	0,2807	0,2633	1,2010	1,0816	1,2393	0,8171	0,8912
Osona	4,4382	0,2611	1,1104	1,3187	1,1494	1,2581	0,5654	0,7643
Alt Penedès	4,6944	0,1423	1,5220	1,2268	0,7268	1,3351	0,6316	0,8013
Garraf	0,9650	9,5461	0,6669	0,7379	1,2506	1,6185	0,8680	1,1195