

# Chapter 2

## From Local Units to Economic Regions in Spain

### Where Agglomeration Economies are Meaningful

Fernando Rubiera-Morollón and Ana Viñuela

#### 2.1 What is a *Region*?

Over the last 100 years, Urban and Regional Economics has grown spectacularly as an applied field of Economic Science, using the terminology proposed by Schumpeter in 1954. This discipline has been capable of providing theories and analysis that go far beyond its strict goals. Some of the most interesting economic theories of the past 20 years have been proposed from the perspective of Regional and Urban Economics and we have seen extraordinary growth in the development of statistical tools for empirical study. However, all this theoretical and technical development has not been accompanied by a clear definition of the fundamental concept of *region* in Regional Science (Behrens and Thisse 2007).

In this first section we review how the evolution of Regional Science itself has been accompanied by a continuing reassessment of the concept of *region*. Each of the new ways of understanding what a *region* is and how it may be defined provides important nuances and is underpinned by a different view of the aspects that are to be highlighted. At the same time as carrying out a synthetic review of the evolution that has taken place, we shall also attempt to deduce the fundamental elements of each approach to the concept of *region*.

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F. Rubiera-Morollón (✉)  
REGIOlab – University of Oviedo, Oviedo, Spain  
e-mail: [frubiera@uniovi.es](mailto:frubiera@uniovi.es)

A. Viñuela  
Facultad de Economía y Empresa, Dpto. de Economía Aplicada, Universidad de Oviedo,  
Avda. de El Cristo, S/N, Oviedo 33006, Spain

### ***2.1.1 The Weakness of the Concept of Region Since the Origins of Regional Science***

The existence of a multidisciplinary field known as Regional Science can lead us to assume that the concept of *region* should be clearly defined. However, this is not so; the definition of *region* has been an ever-present weakness for all the disciplines that may be grouped together under the name of Regional Science.

Geography was defined by Kant, Humboldt and Hetter as *the Science of dividing the landscape into regions* (see Lancaster 1939). The development of Geography in the eighteenth and nineteenth centuries already raised the need to delimit the total surface area into spatial areas –i.e. regions– so as to facilitate their study. The *region* thus becomes a tool of the geographer to encompass and study the totality of space. Starting from known geographic references, new spatial areas that are homogeneous with respect to one another according to diverse criteria are progressively explored and described (see Claval 2007). These early geographers soon became aware of the difficulty of defining the concept of region insofar as the variables that could be used to define regional areas may be highly diverse. This might in turn give rise to highly diverse ideas and could even place the analysis outside the field of Geography itself when employing mainly geological, cultural or social criteria, among others (Claval 2003).

Whatever the case may be, the complexity of the definition grew with increased knowledge of physical space, as the emphasis of Geography and regional delimitation began to fall more on social or cultural aspects than on geological, topographical or physical criteria. This actually made it even more difficult to reach consensus regarding a single concept of region. Authors such as Jean-Louis Giraud-Soulavie in France, Alexander von Humboldt in Germany and William Marshall in Britain were aware that the concept of region must necessarily incorporate cultural, economic and social variables. The key element, from these first regional delimitations that fully incorporate multi-dimensionality in the discipline, is to maintain the essence of delimiting homogeneous spatial areas. These pioneering studies already revealed the limitation of the administrative division of territories, as they gave rise to heterogeneous spaces in terms of scientific criteria (Claval 2007).

### ***2.1.2 The Incorporation of Economics in the Definition of the Concept of Region***

At the beginning of the twentieth century and subsequent to the decisive contributions of Humboldt, Weber and Von Thünen, Economics was the discipline that began to show the most interest in approaching the definition of homogeneous regions using specific criteria from Economic Science.

The work of the three aforementioned authors clearly established the key concept of *centrality*, i.e. there exists a central place to which businesses and

individuals come to perform their necessary market exchanges. By clearly accepting the existence of this central place to which all such businesses and individuals gravitate, we can build a view of economic space in connection with that place. For example, Von Thünen, in his work *The Isolated State* of 1826, links the value of land with its situation relative to the *centre*, where the market is located (Von Thünen 1966). The distance of each place with respect to the closest market implies a different value or rent to the land, *ceteris paribus* other features of the place, where the differences derive precisely from the savings made in transportation and opportunity costs. The land closer to the centre will be more highly valued. All activities will be willing to pay more for these locations, but those activities that can generate more value per square metre of surface area and which value proximity to the centre most will manage to become established there, because either their transportation costs or their opportunity costs are higher. In other words, activities that are more extensive but of lesser added value will be located farther from the centre, while intensive activities in terms of the use of space and high added value will be able to acquire the land closest to the centre. This behaviour is repeated throughout different territorial units around different centres that present similar dynamics in their surroundings.

Within this context, August Lösch made a major contribution in 1938 with his work *The Nature of Economic Regions*. The starting point of Lösch's line of reasoning is the acceptance that regions conceived exclusively in terms of geographical or cultural criteria are –from a purely economic point of view– artificial units with no interest for Economics, unless they possess the capacity to effect significantly different economic policies by constituting themselves as administrative regions with far-reaching or total (country-level) independence in their political actions. The concept of *region* proposed by Lösch rests on the distribution of land in terms of transport and opportunity costs. Different centres or markets are progressively generated over a homogeneous space. The inhabitants or economic activities of the region will come to the market, the *centre*, which, thanks to lower transport costs, will enable them to cover their needs and distribute their products. Obviously, the world is not a homogeneous plane that may be distributed in perfect hexagons but it can actually be very well explained by means of the regions suggested by Lösch.

Lösch's approach gains in value when combined with the proposal formulated almost concurrently by the German geographer Walter Christaller in 1935. Although Christaller's idea is less precise in defining how space is structured for economic reasons, it provides a complement that Lösch did not fully take into account. In addition to the existence of the allocation of space explained by Lösch, Christaller notes that there is a *hierarchy of central places*; i.e. not all central points or cities are equal, as there are *higher-order* centres, with a greater concentration of activities, and other *lower-order* places. Some basic needs that require very frequent journeys are spread over space in *lower-order central places*, while other, less frequent consumer or exchange activities may become concentrated in *higher-order central places*.

In 1949, Zipf identified an empirical regularity that relates size with position in the *hierarchy of central places*, providing this approach with more power to define the concept of *region* in terms of economic criteria.

### **2.1.3 Geographical Communities, Functional Regions, Local Labour Markets and Metropolitan Areas**

While the view that emerges from combining the ideas of Humboldt, Weber, von Thünen, Lösch, Christaller and Zipf was to remain in force throughout the twentieth century and even today, Regional Science has continued its search for the definition of a *region* and its physical limits.

The combination of Geography and Sociology, among other disciplines, gave rise to the concept of *Geographical Communities*, spaces in which strong social and economic interactions are produced that eventually generate identities and commonalities (Poplin 1979). Based on the idea of the existence of *Geographical Communities*, different authors have sought ways to define sets of elements that delimit space which has led to the idea of *functional regions*; i.e. regions defined regardless of administrative borders which are constructed according to diverse economic, social, cultural or geographical factors.

Some studies have followed this line in Economic Science, especially within the field of Labour Economics, in addition to that of Urban and Regional Economics itself. Authors in these disciplines began to be concerned with defining geographical areas that share a *single local labour market*. As cities grow and expand, their geographical boundaries also move further afield. Consequently, *metropolitan areas* often cover several administrative divisions. This expansion of the *metropolitan area* leads to the ever-increasing phenomenon of *commuting*, i.e. daily displacements between the place of residence and the workplace, which are sometimes located in different administrative regions. Thus, the coordination of local policies and actions in terms of transportation or urban planning becomes a must and some procedures have to be designed to define and identify a space in which most of the population residing there also works there: what is known as the *local labour market* (in what follows, *LLM*).

The drawback of this approach lies in establishing the criteria and ways of defining to what extent a place belongs to a particular *LLM* or not. Numerous methodologies have been developed to define the geographical area that can be considered a *LLM*. Worth highlighting in this regard are the methodologies designed by Sforzi (1987, 1990), Serra et al. (2002), Rozenblat and Cicille (2003) and ISTAT (1997, 2006). The previous chapter of this book, by Sforzi, summarizes the different applications of all these methodologies in diverse countries.

### 2.1.4 *External Economies and Industrial Districts*

A somewhat related, though differentiable line of research on *functional regions* is the definition of *industrial districts* mentioned in the previous section. In 1820, Alfred Marshall published his seminal work *Principles of Economics* in which he presented the nowadays-essential concept of *external economies* (Marshall 1890). The concentration of highly specialized activities in a reduced geographical area leads to the unleashing of a set of cumulative processes and increasing returns. Such effects are not caused by the firm's scale of production, but by its interactions with other similar firms within its setting and the scale of the industry (sector) in the location as a whole. Thus, the relations of the companies that coexist in a place generate increasing returns that cannot be explained from within the firms themselves, but rather from the industry (sector) and the place where a variety of similar firms are located.

The concept of *external economies* is obviously fundamental within the field of Industrial Economics, but also in that of Regional and Urban Economics, which finds a different way to that of the classical approach of addressing the connections between space and economic activity. In 1979, Giacomo Becattini published an article in the *Rivista di Economia e Politica Industriale* which marked the beginning of a new branch of the literature that contains a new approach to the relationship between economy and space. This author put forward the concept of the *industrial district*, which is not a concentration of businesses or a network of firms, but rather the productive manifestation of local society. The concept of industrial district is defined as a “[...] socio-territorial entity which is characterised by the active presence of both a community of people and a population of firms in one naturally and historically bounded area” (Becattini 1991).

When identifying the existence and extent of *industrial districts* in practice, it becomes impossible to use administrative boundaries in view of the fact that an industrial district may go beyond such limits or be contained within them. Furthermore, industrial districts are a dynamic concept, while administrative limits do not usually change over time. An *economic region*, as defined by classical authors, structured around a single centre, can also contain diverse *industrial districts*. Unlike other approaches, it may be stated that the identification of industrial districts does not necessarily cover the entire territory. Once their presence and limits have been established, there are “empty” areas in which no industrial districts have been found to be present. In short, this is not an approach that seeks to cover the whole country, but only to detect those places where the spatial concentration of certain sector generates *Marshallian external economies*.

It is clear that the key to applying the concept of *industrial district* to an observable empirical reality subject to analysis lies in delimiting its outline. The need to start out from a territorial unit whose extension is not constrained by administrative boundaries and which may change over time is consistent with the concept of *local labour markets* (Sforzi and Lorenzini 2002). This is precisely the way in which Sforzi (1987, 1990) and ISTAT (1997, 2006) put forward the methodology for defining industrial districts. First, *LLMs* are used as a territorial unit for identifying such districts. Second, each *industrial district* is identified from its socioeconomic features that distinguish them from other *LLMs*.

### 2.1.5 *A Novel Approach Provided by the New Economic Geography: Economies and Diseconomies of Agglomeration*

In the last third of the twentieth century, a vast body of diverse research began to take shape starting in 1991 with the pioneering publication *Increasing Returns and Economic Geography* presented by Krugman (1991) in the *Journal of Political Economy* (further extended by Krugman 1995) and which was fully developed with the work of Fujita et al. (1999), Baldwin et al. (2003) and Ottaviano and Thisse (2004), among others. We refer here to the New Economic Geography (NEG), whose development is fundamental in the field of Regional and Urban Economics as well as in that of International Economics.

The NEG contributes a number of novel aspects to the discussion of the concept of *region*, excellently summarized by Behrens and Thisse (2007). As these authors point out, this theoretical framework is the first to provide an explanation as to why strong economic disparities across space exist between regions and are maintained or even grow despite the fact there may be free movement of the factors of production, which, according to neoclassical economic theory, would result in their progressive disappearance.

In their simplest formulation, the NEG models propose the existence of two regions: *centre* and *periphery*. The idea of *centre* and *periphery* is defined here in a different way to the classical approach, although there are links between the two views. The NEG focuses on understanding *centripetal forces*, which tend to concentrate activities in the *central* region, and *centrifugal forces*, which tend to disperse them towards the *peripheral* region.

The gains derived from large-scale production and from the *positive externalities* associated with *size* lead to the concentration of economic activity in *central* locations from which the largest possible market is accessible. Transportation costs constrain this concentration behaviour, but the strength of this limitation depends on the consumption characteristics of the activity. Consistent with the classical approach, those activities that require intense personal interaction between consumers and producers (which includes many services) and/or are consumed daily or very frequently will display quasi-equal distributions over space. In contrast, activities that are tradable over broader distances, not requiring proximity to the point of consumption, and/or are demanded less frequently will concentrate their production in a limited number of *central* locations. As distance costs fall and trade increases, larger concentrations should normally grow in *size*. A shift in the national economy towards agglomeration-sensitive goods and services (and away from, say, agriculture) also favours the growth of larger concentrations (Parr 2002).

As large concentrations grow, diseconomies naturally appear, producing an expulsion effect for some activities. Wages and land prices are in part a function of city size. Wage-sensitive and space-extensive activities will be pushed out by what is sometimes called the *crowding-out effect* of rising wages and land prices in large metropolitan areas. This *crowding-out effect* will most notably be felt by medium-technology manufacturing –which has less need for the highly skilled

labour in large cities (Henderson and Thisse 1997)— and also by wholesaling and distribution, which are extensive consumers of space, giving rise in turn to the growth of smaller cities.

On the other hand, the *agglomeration economies* associated with urban concentration lead to firms within the same industry benefitting through lower recruitment and training costs (shared labour-force), knowledge spillovers, lower industry-specific information costs and increased competition (Rosenthal and Strange 2001; Beardsell and Henderson 1999; Porter 1990). The increasing size of the metropolis makes certain infrastructures possible, such as international airports, post-graduate universities, research hospitals, etc. The recent literature stresses the positive link between productivity and the presence of a diversified, highly qualified and versatile labour pool (Duranton and Puga 2002); Glaeser 1998; Glaeser et al. 1995). As highlighted by Hall (1998), Eaton and Eckstein (1997) and Castells (1976), large metropolises stimulate the exchange of knowledge, while the link between urban agglomeration and economic growth has been explored by Polèse (2005). Activities that are characterized by the need for high creativity and innovation will in general choose to locate in or near to major metropolitan areas (Desmet and Fafchamps 2005).

It is reasonable to infer that the trade-off between the *centrifugal* and *centripetal* forces that push economic activities towards large cities or drive them out should give rise to an economic landscape characterized by regularities in industrial and employment location patterns based on the size of and distance from some other (larger) cities (Redding and Venables 2004).

The transition from a simple formulation of NEG models with two regions to a more complete formulation with  $n$  regions is by no means simple. The presence of more than two regions complicates the simple perception of the reality described by the basic models due to opening up the possibility of the existence of intermediate regions as well as more complex interactions. In fact, as pointed out by Behrens and Thisse (2007), one of the empirical and theoretical challenges of the broadening of the NEG framework requires the definition of models that encompass the complexity resulting from addressing the presence of multiple regional realities.

The perspective of the NEG brings several new dimensions to the discussion regarding the definition of the concept of *region*: (1) the connection between the concept of *region* and the explanation of existing regional differences; (2) the possibility of proposing regional classifications that do not present spatial contiguity, but rather common features that induce similar *centripetal* or *centrifugal* dynamics; and (3) the notion of the *region* as an economic unit that interacts economically with others and whose main feature is economic opening (no borders to the movement of goods and services or factors of production).

## 2.2 From the Theoretical to a Practical Concept of a Region

Clearly, the fundamental challenge is to find a regional classification that synthesizes the different conceptual approaches to the theoretical concept of *region* and which has a relatively easy empirical interpretation and construction. Ideally,

we should have an empirically analysable *region* containing units consistent with the classical view of Lösch, Christaller and those who followed them which is at the same time the aggregation of functional units, though without creating scientifically irrelevant divisions. In short, a region that empowers the study of key issues in Regional Economics such as the effects of location- or urbanization-type *external economies of agglomeration*.

Thus, in this section we suggest an integrating proposal based on three major lines of empirical research developed over the past 25 years: (1) the literature on how to define *local labour markets (LLMs)* so as to define the base unit, the methodology designed and applied mainly by Sforzi in Italy and by Boix in the Spanish case; (2) the work by Coffey and Polèse in the late 1980s and early 1990s in which they propose a classification based on (population) size and the *distance to size* in order to capture the effects of *agglomeration economies*; and (3) the recent development of the concept of *incremental distances* proposed by Partridge, Rickman and others, which has links to the classical regional literature.

### **2.2.1 The Basic Unit of Analysis: Local Labour Markets**

Insofar as we are attempting to define a concept of *region* based on economic criteria, it would be inconsistent to use administrative divisions, no matter how disaggregated they are. The starting-out point must be that of defining the basic spatial unit, delimited by boundaries that guarantee its consistency, comparability and meaning.

The regionalization method developed by Sforzi and Lorenzini (2002) and ISTAT (2006), applied to Spain by Boix and Galleto (2006), identifies *local labour markets (LLMs)* through a multi-stage process to then use them as the basic spatial unit to define industrial districts. Defining *local labour market areas* requires information on residence-work mobility so that they contain a geographic area within which most of the population lives and works. *LLMs* are created from the information on municipalities, a very small administrative unit, combining data on the resident employed population, total employed population and displacements from the place of residence to the workplace.

### **2.2.2 Re-aggregating the Basic Units According to Size and Distance to Size**

Having defined the basic spatial unit, *LLM areas*, in order to include the importance of *agglomeration/urbanization* and *distance* to the major population concentrations, the next step is to classify these basic units in order to incorporate these concepts.

There are many ways to re-aggregate the areas, but we propose a regional classification wholly based on the key aspects of modern Urban and Regional Economics. Following Polèse (2009), we consider a number of key aspects:



(1) *location* matters, because industries (and therefore economic activity and employment) are always drawn to places best suited for commerce and interaction with markets; and (2) *size* matters, because dynamic industries, or the most advanced in each epoch, are naturally drawn to large cities and places within easy reach. A corollary can be deduced from (1) and (2), namely: (3) *proximity to size* also matters. Another basic idea of Regional Economics is: (4) *cost* matters, because without adequate size or a propitious location, places will grow if they have a clear labour cost advantage or, alternatively, an exceptional resource endowment.

Thus, Coffey and Polèse (1988), Polèse and Champagne (1999) and Polèse and Shearmur (2004) for Canada and the subsequent application of their ideas to the Spanish case by Rubiera (2006), Polèse et al. (2007) and Viñuela et al. (2010) propose a classification of space that takes into consideration the existence of agglomeration economies (*size*) and *distance* as key factors. However, the classifications of these authors always adopt administrative regions as the basic unit of analysis. Here we propose the classification or re-aggregation of more cohesive and meaningful basic units, *LLMs*, based on the criteria of population *size* and *distance*. To illustrate this approach, Fig. 2.1 shows a schematic representation for an idealized national space economy. Each cell is a municipality (administrative local unit), with various municipalities being aggregated into *LLMs* (blue line). The reader will undoubtedly note the resemblance to the classic idealized economic landscapes of Christaller, Lösch, and Von Thünen, all of which posit one metropolis or marketplace at the centre. Thus, Fig. 2.1 represents a large *LLM*, in terms of population, at the *centre* (the main metropolis, which includes different municipalities), but also four smaller *urban LLMs* of different population *sizes* around it, the rest being considered *rural* in terms of population size. Regardless of their size, *LLMs* can also be *central* (close to the main metropolis), or *peripheral* (located at some distance from the metropolis).

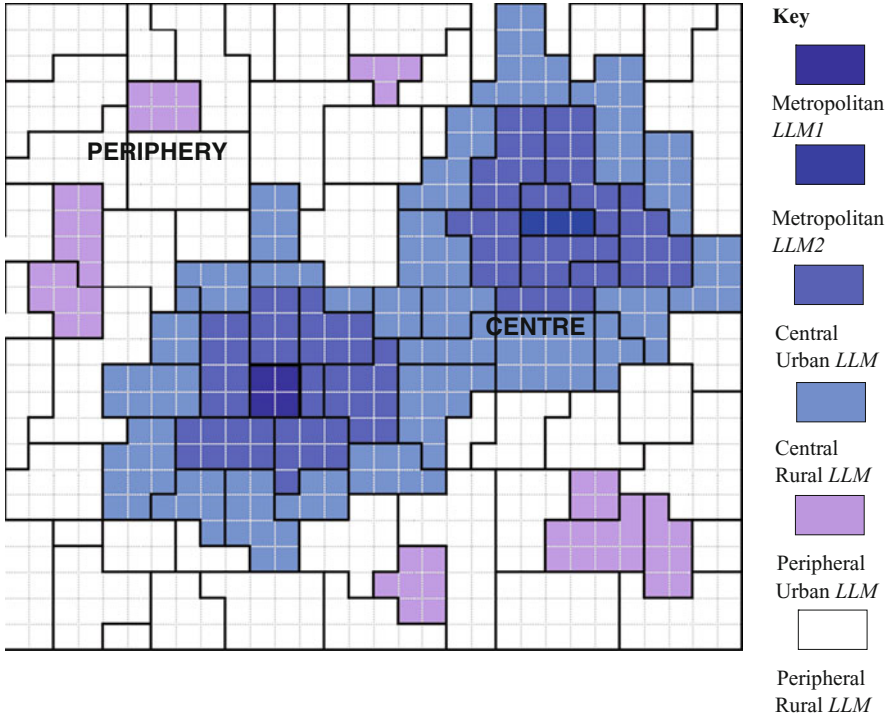
To summarize, this idealized space may be classified first by *size* into:

1. *Metropolitan areas: local labour markets* with more than a certain population size.
2. *Urban areas: LLMs* that are urban, though not large enough to be considered a metropolitan area.
3. *Rural areas: LLMs* that are clearly not urban.

A parallel distinction, based on proximity to the major metropolis, is applied to all non-metropolitan *LLMs*:

1. *Central areas: LLMs* “close” to the large metropolitan area.
2. *Peripheral areas: LLMs* located “far” from the metropolitan area.

The 1-h drive criterion takes into account several factors such as road conditions (e.g. motorway or not), the spatial limits of metropolitan areas and the distinctive characteristics of the area being classified. Thus, as can be seen in Fig. 2.4, *central* areas do not necessarily form perfect rings around metropolitan areas. The 1-h threshold, also used in other applications, has been found to be very robust and a



**Fig. 2.1** Schematic representation of the classification of spatial units (Source: Own elaboration based on Viñuela (2011))

good indicator of the range within which spatial interaction with the metropolis remains fairly easy, especially for face-to-face relationships related to the consumption of higher-order services (see Porter (1990) and McCann (2007), among others).

### 2.2.3 *The Measurement of Distance: The Incremental Distance*

One of the major problems when classifying an area as *central* or *peripheral* is the subjectivity of the criteria used when choosing the distance metrics (linear distance, Euclidean distance, distance by road, time, etc.) and also the distance threshold.

However, taking into account Christaller's ideas (1935) on the hierarchies of places and the connection between urban size and the position in the hierarchy of places of each city from Zipf (1949), we know that only large cities are able to offer a full range of goods and services. If we only consider the distance to the central place (the metropolitan area), the higher place in Christaller's hierarchy, we somehow make a mistake by forgetting that certain goods and services *are* offered in smaller urban places. One way of solving this problem is to define a set of

incremental distances to each tier (size) of urban area so that we first quantify the distance to the next tier, where *some* additional and higher-order goods and services are produced, and then quantify the incremental distance to the next higher urban tier, maybe a metropolitan area, where higher-order services and urban amenities are located. This idea of *incremental* distances, suggested by Partridge et al. (2008, 2009), brings together the effect of the *distance* to large agglomerations: individuals and businesses need access to the higher-order services, urban amenities, higher qualified jobs and lower cost products that are only present in large urban agglomerations due to the presence of strong agglomeration economies. Thus, we can measure the distance from a large agglomeration as a “penalty” to access the goods and services present in such an agglomeration.

The proposal set out in the previous section allows us to have a set of regions that do not necessarily have any spatial contiguity, but whose conceptual definition is strongly consistent. Although these regions can be incorporated into the analysis as dichotomous variables, they may be incorporated in empirical models in a different way via the use of *incremental distances*.

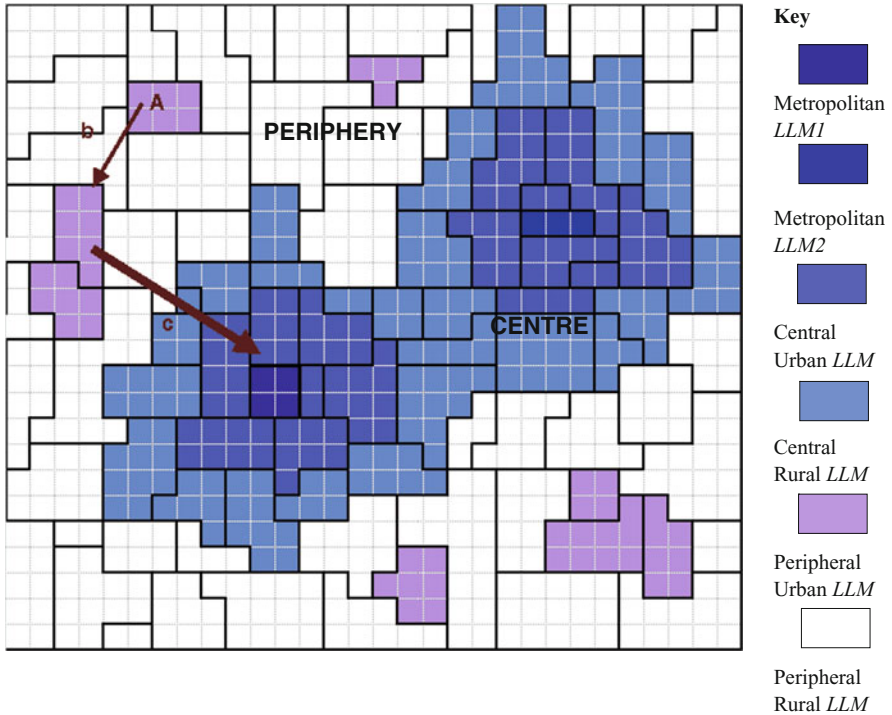
Note that the distance criteria proposed by Partridge et al. (2008, 2009) essentially consists in establishing a hierarchy of *LLMs* such that each *LLM* is associated not only with a *size* value (population both residing and working within the *LLM*), but also with a *distance* value that reflects the total cumulative disadvantage due to distance measured across all urban *LLM* tiers (Fig. 2.2).

## 2.3 *Economic Regions Based on LLMs: A Proposal for the Spanish Territory*

Spain is divided administratively into 8,105 municipalities which are aggregated into 50 provinces (NUTS III level), excluding Ceuta and Melilla, and 17 Autonomous Communities or NUTS II regions (Fig. 2.3 – Maps 1 and 2). The number of municipalities within each province ranges from 34 (Las Palmas) to 371 municipalities (Burgos). Besides, there are Autonomous Communities with several provinces, such as Andalusia with eight provinces, and others with only one, like Asturias. Furthermore, simply for the sake of comparison with certain other European member-states, the 17 Autonomous Communities can be aggregated into seven administrative regions or NUTS I regions (Fig. 2.3, Map 3), which have no real internal political or administrative meaning.

### 2.3.1 *First Step: Defining Local Labour Market Areas for Spain*

Applying an algorithm that consists of four main stages and a fifth stage of fine-tuning, Boix and Galleto (2006) aggregate the 8,106 Spanish municipalities into 806 *LLMs*. The algorithm starts out from the municipal administrative unit and



**Fig. 2.2** Schematic representation of incremental distances. (From point A, the distance to the closest Urban *LLM* is  $b$  and only  $c$  to the Metropolitan *LLM* (the distance to the Metropolitan *LLM* is  $b + c$  but  $-b$ , which is the distance already computed from A to the nearest urban area) (Source: Own elaboration based on Partridge et al. (2008, 2009))



**Fig. 2.3** Spanish administrative division of the territory into Provinces (NUTS III), Autonomous Communities (NUTS II) and NUTS I

generates the *LLMs* using data from the 2001 Spanish Census on the resident employed population, total employed population and displacements from the place of residence to the workplace. A detailed explanation of the methodology is



**Fig. 2.4** Spanish division of the territory into *Local Labour Markets* (Source: Own elaboration based on Boix and Galleto (2006))

available in Boix and Galleto's report, from 2006. Map 4 shows the 806 *LLMs* defined by these authors (Fig. 2.4).

### **2.3.2 *Second Step: From Local Labour Markets to Economic Regions (Size and Distance to Size Criteria)***

After defining the local employment systems, we can now classify these basic spatial units first according to *size* and then according to *distance to size*. Table 2.1 shows the distribution of local labour markets by population size in Spain, where five tiers or levels are defined.

The two first tiers, *LLM1* and *LLM2*, correspond to metropolitan areas or *centres* in Christaller's nomenclature. Given the major difference in size between the metropolitan areas of Madrid and Barcelona and the rest (with more than 500,000 but less than 2,500,000 inhabitants), we consider it appropriate to distinguish these two levels. The next lower urban tiers, *LLM3* and *LLM4*, basically include cities of more than 100,000 but less than 50,000 inhabitants and between 50,000 and 100,000 inhabitants, respectively. Finally, those *LLMs* with less than 50,000 inhabitants are considered *rural areas (LLM5)*.

After classifying the *LLMs* in terms of population *size*, we propose to improve the classification by discriminating by *distance to size*, taking the metropolitan areas *LLM1* and *LLM2* as the highest tiers of the hierarchy.

**Table 2.1** Distribution of *LLMs* by population size (2001)

	Number of <i>LLMs</i>	Number of municipalities	% of total population
<i>LLM1</i> > 2,500,000 inhabitants	<i>Madrid</i>	153	20.51 %
	<i>Barcelona</i>	51	
2,500,000 inhabitants > <i>LLM2</i> > 500,000 inhabitants	<i>Valencia</i>	52	16.49 %
	<i>Sevilla</i>	39	
	<i>Bilbao</i>	59	
	<i>Malaga</i>	20	
	<i>Zaragoza</i>	96	
	<i>Palmas de Gran Canaria</i>	15	
	<i>Sabadell</i>	17	
	<i>Santa Cruz de Tenerife</i>	17	
500,000 inhabitants > <i>LLM3</i> > 100,000	60 <i>LLMs</i>	2,102 municipalities	31.20 %
100,000 inhabitants > <i>LLM4</i> > 50,000 inhabitants	50 <i>LLMs</i>	666 municipalities	8.56 %
<i>LLM5</i> < 50,000 inhabitants	686 <i>LLMs</i>	4,822 municipalities	23.23 %
<b>Total</b>	<b>806 <i>LLMs</i></b>	<b>8,106 municipalities</b>	<b>40,533,475 inhabitants</b>

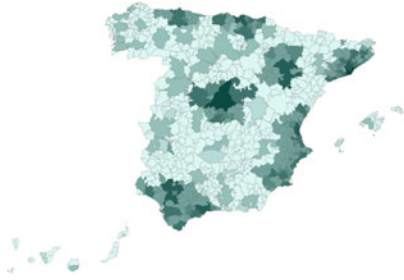
Source: 2001 Spanish Census, INE

Two distance criteria are tested here when defining a *LLM* as *central* or *peripheral*: the one hour's drive criterion (Fig. 2.5 – Map 5) and the linear distance criterion (Fig. 2.5 – Map 6). A summary of the resulting classification can be seen in Table 2.2 Depending on the size of the population, an urban *LLM* can be classified as *LLM3* or *LLM4* and then, according to its location or distance (A or B criterion) from the metropolitan areas, it may be further classified as *central* (*LLM3C* or *LLM4C*) or *peripheral* (*LLM3P* or *LLM4P*).

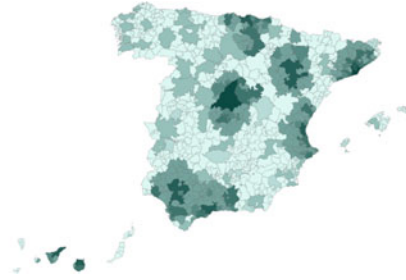
The *Economic Regions* resulting from the classification of the *LLMs* according to size and distance can be seen for the Spanish case in Fig. 2.5 – Map 1 (1 h drive criterion) and Fig. 2.5 – Map 5 (linear distance criterion). The criterion chosen does not seem to significantly change the *central* or *peripheral* character of the *LLMs*.

## 2.4 Evaluation: Administrative Regions Versus Economic Regions

After defining the *Economic regions* based on *LLM* size –in terms of population– and location and adapting them to the Spanish case, it is necessary to evaluate the performance of such regions compared to administrative regions. According to Fischer, (1980), an optimal *region* should fulfil at least one of two principles: *internal homogeneity*, whereby individual regions should be as homogeneous in the attribute space as possible; and *external separation*, whereby different regions



Map 5: Economic Regions based on *LLMs*, size and distance to size: one hour's drive criterion.



Map 6: Economic Regions based on *LLMs*, size and distance to size: linear distance criterion.

**Fig. 2.5** Spanish division of the territory into *Local Labour Markets* (2001) (Source: Own elaboration with data from 2001 *Spanish Census*, published by INE (2007), and the Boix and Galleto (2006) methodology)

**Table 2.2** *LLM* classification by size and distance to size adapted to the Spanish case

<i>LLM1</i>		
Local labour markets that constitute a metropolis of more than 2,500,000 inhabitants (Metropolitan Areas of Madrid and Barcelona)		
<i>LLM2</i>		
Local labour markets that constitute a metropolis of between 500,001 and 2,500,000 inhabitants		
	Central <i>LLMs</i>	Peripheral <i>LLMs</i>
	(A) No more than one hour's drive from a <i>LLM1</i> or 2	(A) More than one hour's drive from a <i>LLM1</i> or 2
	(B) No more than 100 km, linear distance	(B) More than 100 km, linear distance
<b>Urban <i>LLMs</i></b> Between 100,001 and 500,000 inhabitants	<b><i>LLM3C</i></b>	<b><i>LLM3P</i></b>
<b>Urban <i>LLMs</i></b> Between 50,001 and 100,000 inhabitants	<b><i>LLM4C</i></b>	<b><i>LLM4P</i></b>
<b>Rural <i>LLMs</i></b> Less than 50,000 inhabitants	<b><i>LLM5C</i></b>	<b><i>LLM5P</i></b>

Source: 2001 Spanish Census, INE (2007)

should be as far apart in the attribute space as possible. Pursuing these principles, in the next two sections we shall evaluate the robustness of the proposed *Economic Regions* versus the administrative regions commonly used (NUTs regions at different levels).

To evaluate the homogeneity of the regions, we shall use the well-known Theil inequality index (Theil 1967), frequently applied to the distribution of income and

**Table 2.3** *Economic regions versus administrative regions: the Theil index and the within component, both total and by gender, in Spain (2001)*

	Theil WITHIN component					
	<i>LLMs</i> (806 units)	Economic regions (8 units)	NUTS III provinces (50 units)	NUTS II Aut. Comm. (17 units)	NUTS I (7 units)	
<i>Total</i>	2.4340	1.4279	1.8553	1.8435	1.9474	1.9995
<i>Male</i>	2.3148	1.3494	1.7819	1.7513	1.8522	1.9042
<i>Female</i>	2.6401	1.5601	1.9836	2.0008	2.1101	2.1628

Source: 2001 Spanish Census, INE (2007)

wealth. The index can be decomposed as the sum of the *between* and *within* components. The *within* component will be useful to quantify the intraregional homogeneity of the regions in relation to the spatial distribution of employment or economic activity. Given the characteristics of the Theil index, if the internal homogeneity of the regions increases (a decrease in the *within* component), this necessarily implies that the heterogeneity between regions increases (a rise in the *between* component).

Table 2.3 shows the *within* component of the Theil index for the administrative/political regions –NUTS I (7 regions), NUTS II (17 *Autonomous Communities*) or NUTS III (50 *Provinces*)– and also for the 806 Spanish *LLMs* and the proposed *Economic Regions* (8 regions) based on these *LLMs*. The table tests the homogeneity of the employment distribution, both total and by gender.

Despite the scale effect, i.e. *ceteris paribus*, intraregional inequality decreases with the number of regions, the *within* component for the eight *Economic Regions* is clearly lower than for any of the NUTS regions. In other words, the proposed classification shows a higher degree of internal homogeneity in the distribution of employment, i.e. the local labour markets grouped under size and distance criteria are more coherent (even by gender) than any other political-administrative division of the territory.

Understandably, the *Economic Regions* formed by grouping the 806 *LLMs* are less homogeneous in terms of employment distribution than the *LLMs* considered independently, such heterogeneity being mainly due to the lower tiers of *LLMs*, i.e. *LLM4* and *LLM5*, where industry-specific factors play a greater role in the distribution of employment. We have to bear in mind that *LLMs* are originally built to specify homogeneous local labour markets and therefore any other technical clustering, even those based on these *LLMs* as is the case here, will result in less homogeneous regions.

However, it must be stressed that the eight *Economic Regions* resulting from aggregating the *LLMs*, in contrast with any type of administrative division of the territory, have economic meaning and incorporate relevant approaches from Regional and Urban Economics. This regionalization scheme offers the researcher a concept of the Economic Region that has a better interpretation and analysis in terms of the Urban and Regional Economics literature.



**Table 2.4** *Economic regions versus administrative regions: the Theil index and the within component by industry, in Spain, 2001*

Theil index	Theil WITHIN component				
	Economic regions (8 units)	<i>LLMs</i> (806 units)	NUTS III provinces (50 units)	NUTS II Aut. Comm. (17 units)	NUTS I (7 units)
<i>Total</i>	1.0176	0.9777	0.1826	0.4905	0.6338
Agriculture, hunting and forestry activities	3.7286	3.5730	0.8932	1.7720	2.4371
Fishing	3.0814	2.8681	0.9450	1.7421	2.4068
Extractive industries	2.3362	1.8050	1.2637	1.6909	1.9688
Manufacturing	2.6969	2.0901	1.5886	2.0602	2.2682
Production and distribution of energy	2.0300	1.6178	1.1236	1.4548	1.6292
Construction	2.5604	1.9500	1.4719	1.9139	2.1082
Minor sellers; repairs	2.5406	2.0265	1.3782	1.7941	1.9189
Hotels and restaurants	2.9777	2.0502	1.6686	2.1410	2.3183
Transportation, storage and communications	3.4599	2.4150	2.0852	2.6019	2.8005
Financial intermediation	3.4331	2.3208	1.9631	2.5118	2.7438
Education	2.7992	2.1429	1.7305	2.1803	2.3337
Health and veterinary activities	2.9176	2.2251	1.8073	2.3000	2.4927
Other social activities and services for households	3.0352	2.2775	1.8804	2.4261	2.6192
Household activities	2.9100	2.0937	1.6680	2.1373	2.3427

Source: 2001 Spanish Census, INE (2007)

An additional analysis is carried out in Table 2.4 to evaluate the spatial patterns of distribution of employment for the same regions, though this time by industry. The 2001 Spanish Census offers employment figures for sixteen (16) types of industries.

The results for the Theil index once again show that *LLMs* are the best possible aggregation in terms of homogeneity, while *Economic Regions* are generally the second best. The *primary sector* and *extractive industries* tend to be highly concentrated in specific territories, and therefore neither the size nor location of the *LLM* determines its industrial specialization, but rather the location of natural resources. In other studies, the NEG fails to explain the distribution of economic activity in these cases. That is why *provinces* are found to be more homogeneous areas than the proposed *Economic Regions* for these industries. However, for the remaining sectors, i.e. those for which the location does not depend on the primary location of natural resources and where scale and agglomeration economics are

especially relevant, *Economic Regions* are more homogeneous than *provinces* despite there being only 8 classes versus the 50 *provinces*.

It is widely known that *provinces* and *autonomous communities* are an administrative division of the territory that respond to political, sociological or historical will, but have no economic meaning, as they could be interpreted as the sum of different local or provincial governments. In other words, they are not homogeneous.

In the light of the analysis of homogeneity in terms of the distribution of employment, we conclude that *Economic Regions* are as good as *provinces* and clearly better than other administrative regions in pure terms of internal homogeneity and *between* class heterogeneity. However, it should also be recalled that *Economic Regions* have an added advantage: they have economic meaning and allow regional researchers to interpret the results obtained in line with the New Economic Geography and previous contributions of the regional and urban literature.

To conclude this evaluation, we would like to show some examples of spatial location of industries in Spain using the proposed *Economic Regions*. A Location Quotient (*LQ*) is calculated by *LLM* to identify the degree of specialization in the different types of industries. The *LQ* is the simplest way of measuring the specialization of a territory and can be calculated as:

$$LQ_{xa} = \frac{\frac{\sum_{i=1}^n e_{xi}^a}{n}}{\frac{E_x}{E}}$$

where:

$LQ_{xa}$  = location quotient of sector x in synthetic region a,

$n$  = number of spatial units in synthetic region a,

$e_{xi}^a$  = employment in sector x in spatial unit i of synthetic region a,

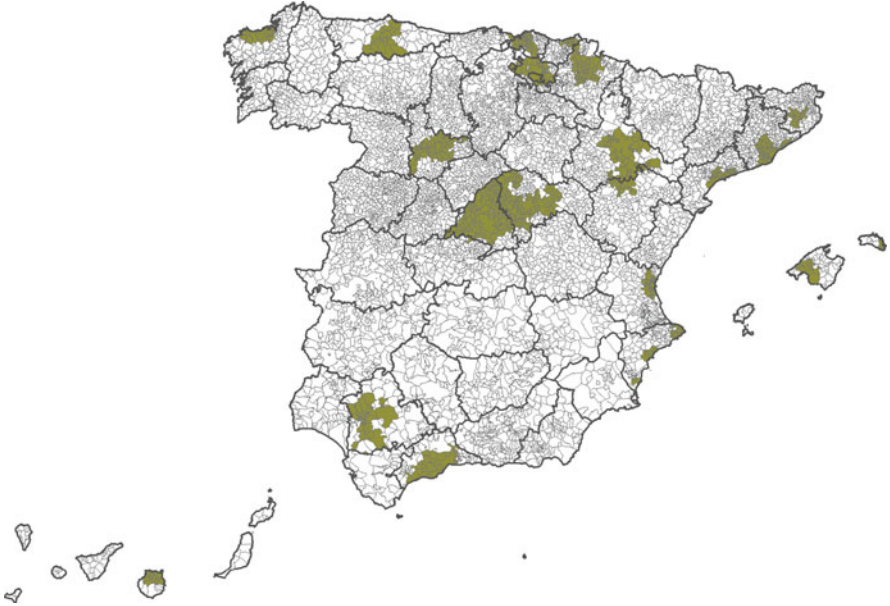
$e_i^a$  = total employment in spatial unit i of synthetic region a,

$E_x$  = total employment in sector x in Spain, and

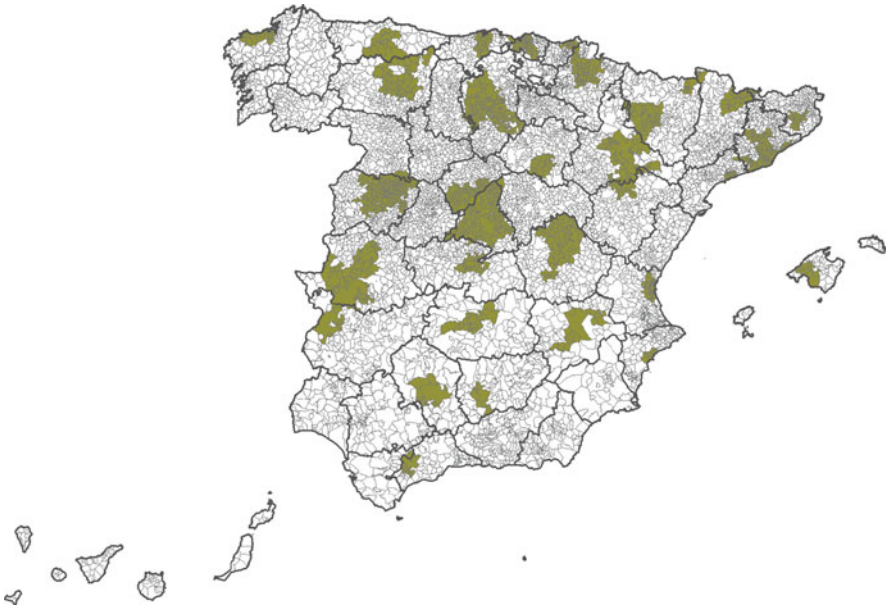
$E$  = total employment in Spain.

The following maps show the *LLMs* specialized in Business Services and Real Estate Activities (Fig. 2.6), Financial Services (Fig. 2.7) and Manufacturing (Fig. 2.8), i.e. those areas where the *LQ* index is higher than one.

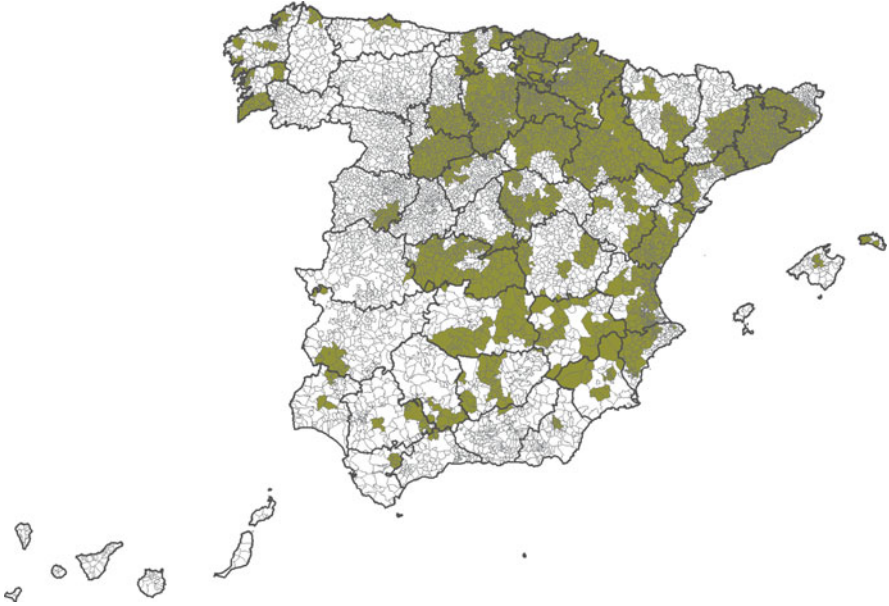
First of all, it should be stressed that in many cases the industries are highly concentrated in local areas that do not coincide with any of the administrative divisions commonly used, even at the highest level of disaggregation, i.e. municipalities. This calls for a higher level of internal coordination between municipal and even provincial and autonomous community institutions in the



**Fig. 2.6** *Local labour markets* specialized in Business Services and Real Estate Activities, Spain, 2001 (Source: Own elaboration with data from the 2001 Spanish Census, INE (2007))



**Fig. 2.7** *Local labour markets* specialized in Financial Services, Spain, 2001 (Source: Own elaboration with data from the 2001 Spanish Census, INE (2007))



**Fig. 2.8** *Local labour markets specialized in Manufacturing, Spain 2001* (Source: Own elaboration with data from the 2001 Spanish Census, INE (2007))

design and implementation of, industrial, employment, infrastructure or transportation policies, among others.

*Distance* and *size* affect location patterns, and this can be easily proved by comparing the patterns of specialization maps with the map of the proposed Economic Regions, i.e. *LLMs* classified by *size* and *distance*. We can observe a strong concentration of higher-order services, such as Business Services and Real Estate Activities, in the larger metropolitan areas and a similar pattern of distribution for Financial and Insurance Activities, with a major preference for metropolitan areas and the next lower-tiered cities. On the other hand, as theory predicts, the higher wages and land rent in the bigger cities push manufacturing activities out of the major agglomerations, but these activities still tend to locate close to them. That is, distance to the market matters.

In summary, this is an example of how patterns of concentration can be analysed using the proposed *Economic Regions* and how the same type of analysis could be very limited if based on any other administrative division of the territory, whether *provinces*, *autonomous communities*, NUTS I or even municipalities.

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