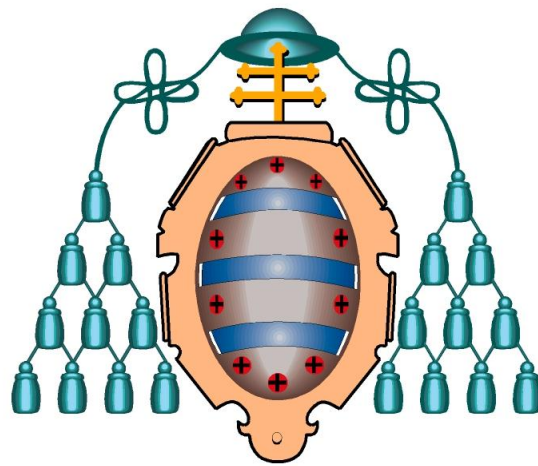# Universidad de Oviedo

Facultad de Economía y Empresa

Trabajo Fin de Máster en Economía: Instrumentos del Análisis Económico

What Places Grow Faster? An Empirical Analysis of Employment Growth Factors at a Local Level for the Spanish Economy

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What Places Grow Faster?

An Empirical Analysis of Employment Growth Factors at a Local Level for the Spanish Economy

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Abstract

The objective of this work is to study employment growth in Spain at a local scale. We are interested in understanding the dynamics with a high degree of spatial disaggregation. Seeing as it is impossible to obtain data on GDP or similar variables when descending to a local scale, the analysis of employment growth may serve as a proxy of local growth and provide some hints about local economic development. Using the 2001 census database, we organize the information using the methodology to define Local Labour Markets. To introduce the influence of the position of each territory regarding the main metropolitan areas we use an Incremental Distances approach, calculating the distances from each territory to different sizes of cities. Other geographical characteristics are also taken into account. The rest of the variables that will be introduced are the usual ones in macroeconomic studies, but applied at a very local level: education, diversification and sectorial structure, among others. Finally, to consider the relevance of the economic features and behaviour of the closer territories, spatial auto-regressive methods are applied. Results show that geographical variables, especially size and distances, explain many of the differences among spatial units in employment and population growth. Urban and rural areas employment is explained by different variables. The behaviour of the closer territories has a great importance too. The variables that could be affected by policies are less capable to affect employment growth tendencies.

Keywords: local labour markets, incremental distances, local employment growth, local and regional policies, Spain.

1. Introduction.

What places grow faster? How relevant are the geographical factors to local employment growth and how effective the political action could be? How important is the city size and how important is the distance to largest cities? Do the same factors have the same influence on the growth of urban and rural areas? How relevant is the regional economic environment to the local growth?

We have all these questions and many others in mind for this research. Our main objective is to make a contribution to the understanding of the Spanish local growth from an empirical approach.

It is true that there is a considerable amount of theoretical literature about economic growth and even more empirical papers that study this issue, some also referred to the Spanish case, but most of the empirical analyses are proposed for national or regional scales (Autonomous Communities or Provinces, NUTS II or III in the case of Spain). The studies that go to a very local scale are much less profuse, and specifically for the Spanish case there is a little number of papers. That absence of more studies about local growth is due to several reasons.

First, local growth analysis clash with data limitation in most of the countries, and this limitation is particularly relevant in the Spanish statistical official system (Viñuela *et al.*, 2012). The information about GDP or another similar ways to measure general economic growth is not available at a local level in Spain. The maximum level of spatial disaggregation of GDP in this country is the provincial level (NUTS III). If we are really interested in studying local growth we must assume the need for some type of approximation of GDP local behaviour. In the literature the use of employment growth is quite accepted as an approximation of the general economic growth, normally available with a higher degree of spatial disaggregation. Nonetheless, we must be aware about the important differences among these two variables (GDP and employment) and the limitations that are imposed by this lack of more suitable local data.

A second problem which explains the small number of published empirical research about local growth is the inconsistences that are usually found in this type of studies. Previous attempts for other economies suggest confusion about how the economic growth theories could be supported when we use very local data and consider the entire geographical environment. First, it has been suggested that identical factors may exert their influence in a different way depending on the period analysed (Massey, 1995; Shearmur and Polèse, 2007; Strambach, 2001). In their study of Canada, Shearmur and Polèse show that although local employment growth can be quite well modelled over three decades, the influence of specific factors differs across time. For instance, education levels, strongly associated with employment growth in the 1980s, are not associated with employment growth in the 1970s and 1990s. Blien, Suedekum, and Wolf (2005), who analyse the effect of diversity and industrial concentration on growth in

Germany, show that industrial structure only tends to have a short-term effect, while Strambach, writing about Stuttgart in the early 1990s, states that "during global changes, a given top position in technological fields is no guarantee of the future competitiveness of a region." One may thus conclude that industrial structure does or does not have an impact on growth depending on the period analysed. Although these three studies include time in different ways, they demonstrate that the effect of any particular factor on local employment growth may depend on when, where and how the study is carried out.

Concerning these issues, in this research we would like to explore growth in the Spanish case from an empirical approach and try to provide a better understanding of which factors and which type of localities have more influence. As results seem to be very sensible to procedures, we put all our attention in providing a proper definition of the concept of *local area* and *distance*. We meditated on what is a local area and adopted the most standard way of delimitate it: the *Local Labour Markets* (Sforzi and Lorenzini, 2002; Boix and Galleto, 2006; and Rubiera and Viñuela, 2012). Reflecting on different *distance* measures, we opted for using the concept of *incremental distances* (Patridge et al., 2008 and 2009). Regarding the data, we are restricted to use Spanish census (INE, 2001), the only database in Spanish official statistics that offers information at a very local level (municipalities). Information about geographical conditions is provided by CNIG, the national geographical information institute. Finally we use a set of different econometrical approaches, from the simplest linear regressions to spatial auto-regressive methods (Anselin, 1988; Anselin, Florax, and Rey, 2004). Each one of the econometric models provides a different perspective of the same image and allows us to shape the main and more stable conclusions.

The paper is divided up as follows. In the following section a definition of the concept of *local labour market* and explanation of why we decide work at this level is made. In section two, our notions regarding the factors that generate employment growth at a local scale are used in order to propose a general empirical model. This general proposal is implemented and adapted to the characteristics and existing information for the Spanish economy in section three. The results obtained are presented and commented in the fourth section. The final section of conclusions summarizes the main contributions of this analysis and future research lines.

2. Understanding the factors of employment growth at a *local level* and proposing an empirical approach.

A starting point: a proper definition of local level.

The point from where we must start an analysis of growth at a local scale is just explaining what we understand by *local level*.

A number of researchers, initially in the United States from the 1960s (Fox and Kumar, 1965), and then in Europe from the 1970s (Smart, 1974), have devised quantitative techniques for the identification of local units consistent with the theoretical framework of *Regional Economics*. Different names were given to these areas, such as *Functional Economic Areas* and *Labour Market Areas*, but they all referred to a region that internalizes the home-to-work daily journeys of its residents. A few years later, the ISTAT-Sforzi defined functional regions for Italy that were called *Sistemi Locali del Lavoro* (in English, *Local Labour Markets: LLMs*). After that, *LLMs* were updated on the basis of the data collected by the Censuses of 1991 and 2001. A complete explanation of the procedure is presented in Sforzi and Lorenzini (2002) and Sforzi (2012). The regionalization method developed by ISTAT-Sforzi was applied to Spain by Boix and Galleto (2006).

We are going to use this concept of *local area* and thanks to that we can be sure that our spatial unit of analysis, (i) is identified on the basis of daily journeys from home to work, because labour has a basic role in people's life and guides their territorial behaviour with regard to the municipality where they live and work; (ii) describes a place that corresponds to the area where the local population develops most of its economic and social relationships; and (iii) is a place that allows for the common interest of the local population to be identified as a whole (Sforzi, 2012 and Rubiera and Viñuela, 2012).

Delimitating the factors of employment growth at a local level.

Local employment growth, and indeed local development, can be attributed to three types of factors.

First, the local institutional context (Cooke, Heidenreich, and Braczyk, 2004), specific actors (Galaway and Hudson, 1994), inter-firm dynamics and knowledge spillover (Malecki and Oinas, 1999; Porter, 1990) have been proposed. In particular, researchers in the field of innovation studies describe how certain regions have managed to develop local innovative systems by combining these factors in particular ways (Cooke *et al.*, 2004). However, such factors are difficult to measure and include substantial qualitative components, making their effects difficult to capture using a statistical approach (Doloreux, Shearmur, and Filion, 2001). Numerous case studies have described how such factors can induce employment growth at a local level, but despite these cases, it is difficult to draw general conclusions

(Markusen, 1999). Rather, a set of best practices can be determined and can serve as a basis for implementing policies in other regions.

The second type of factors that can affect local employment growth are also local in nature, but can more easily be measured. An area's endowment of human capital (Florida, 2002; Romer, 1989), its industrial structure (Porter, 1998), its local costs (Weber, 1929), and level of diversity (Jacobs, 1984; Porter, 1990) are all put forward as growth factors. The effect of such factors on employment growth is verified by way of statistical analysis of various sorts: a large group of regions or cities is usually taken into account, and the effect of each factor on growth is then determined using techniques such as regression analysis (Beckstead and Brown, 2003; Florida, 2002; Shearmur and Polèse, 2007). Similar techniques are also used to identify growth factors for nations (Barro and Sala-i-Martin, 1995). Some general conclusions can be drawn from this type of analysis. Florida (2002), for instance, suggests that a highly educated local workforce is conducive to local growth (of employment and income). Henderson (2003) shows that local specialisation in certain industries tends to lead to employment growth in the industry; while Quigley (1998) shows that for a region, a diverse economy tends to be associated with growth. These conclusions are not always generally accepted. For instance, as Blien, Suedekum, and Wolf (2005) point out, there is an ongoing debate between researchers who defend that a diverse economy leads to growth (Jacobs, 1984; Markusen, 1996; Quigley, 1998) and those who defend that specialisation is conducive to growth (Porter, 1996). Florida's (2002) contention that for regions an educated workforce is conducive to growth, while to some extent compatible with human capital theory, is not supported by evidence in the Canadian case after controlling for other growth factors (Shearmur and Polèse, 2007). Thus, despite the theoretical possibility of deriving general conclusions about the effect of certain measurable local factors on growth, a general model has so far proven elusive.

The third type of factors that can be considered when analyzing local employment growth are structural. By structural we do not mean industrial structure (which we consider to be a local factor of the second type), but geographical and historical structures. Geographical location and, particularly, proximity to markets (Krugman, 1995; Partridge et al., 2006), historical trends or accidents (Krugman, 1995; Davis and Weinstein, 2002), and the centre–periphery and urban–rural divides (Parr, 2001) have been put forward as having an effect on employment growth outcomes. To the extent that there has been greater emphasis on local development over the last twenty years (Martin and Sunley, 1998; Parr, 2001), policy makers have tended to show less interest in these wider structures (Eisinger, 1988; Keating, 1993). This can partly be attributed to the failure of top-down policies implemented in the 1960s and 1970s, which were aimed at balancing growth across wide geographical areas, and partly to the fact that statistical models, which are used to describe geo-structural effects, fell out of fashion over this period (Philo, Mitchell, and More, 1998). They were often seen as too simplistic —unable to deal with the qualitative factors that

are also important for understanding development— and as tending to make grandiose claims about development factors that did not bear out in practice.

Building an empirical proposal to analyse employment local growth.

The general ideas summarized previously may be synthesized and schematised in the relationships presented in Figure 1. On the basis of these relationships, a regression model can be proposed to estimate the causal mechanisms of employment growth.

Figure 1. A Schematic Representation of Local Employment (and Population) Growth Factors and Processes.
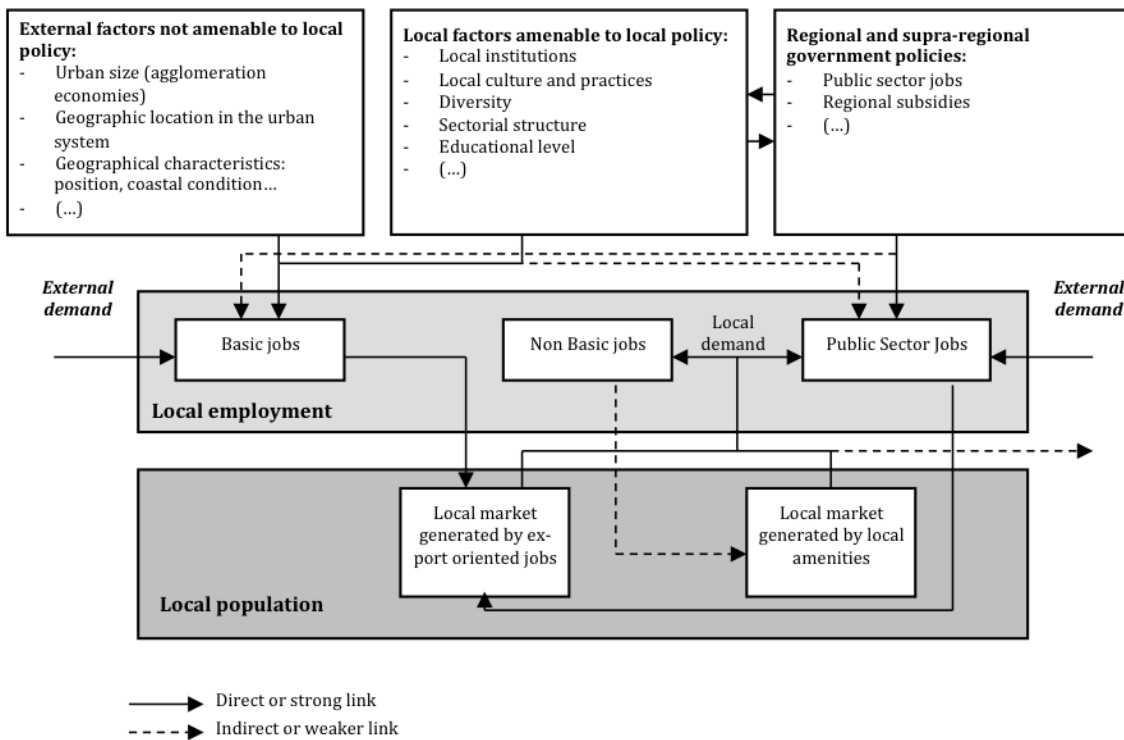
Source: Rubiera (2005).

Our objective is translating this idea of local process of employment creation into an empirical approach. We propose using a typical regression method in which we transform the forces interacting at the local level in measurable variables.

In line with the idea that population and employment in a local area have a bivariate causal relationship (Freeman, 2001); for this case, the dependent variable will be the total local employment growth in each region (G_{emp}), while the total local population will be used as an explanatory term. This

G_{emp} variable is measured as the logarithmic growth rate between 1991 and 2001. The first year of the period is used as base year.

The independent variables are divided into *geo-structural* and *political* factors affecting employment growth.

Beginning with the political factors and given the existing limitations of statistical information, we may consider four empirically observable variables. Many other variables could be considered depending on the availability of data, so our proposal is constrained by the knowledge on the Spanish case databases.

First, a variable to measure the effect of educational level (E) is introduced. This variable is defined as the percentage of people with university degree over the total population in the base year.

Then, to evaluate the relevance of the political implications in a local area, we decided to introduce a dummy variable that takes the value 1 if the *LLM* contains an administrative capital of province; otherwise the variable takes the value 0. This variable, C, shows the influence of being a central administrative area.

The degree of specialisation/diversity of the territory (S) in the base year is the next *political* variable considered. In accordance with Shearmur and Polèse (2005), we propose the following specialisation index:

$$S_r = \ln\left(\frac{1}{\sum_{i=1}^{n} e_i} \sqrt{\sum_{i=1}^{n} \left(e_i \left(lq_i - 100\right)\right)^2} \right) \qquad [1]$$

where S_r is the specialisation index for area r; lq_i is the location quotient of sector i for area r (these location quotients have been multiplied by $100 - A$ more detailed explanation of this variable is presented below–); e_i is the employment in sector i for area r. Accordingly, values tend to $-\infty$ when the profile is identical to the whole economy and all location quotients are equal to 100, but tends to $+\infty$ as the profile diverges from the base profile of Spain (the more the area is specialized in one or more of the n sectors analysed). To include possible non-linear effects, this variable is also considered as a quadratic term.

Apart from the *S* index, we introduced location quotients as separate terms that inform us about the specific sectors in which a local area is specialized. This could be relevant specially referring to some strategic sectors like knowledge intensive business or services. As location quotients (*LQ*) we use the most common formulation, comparing the employment rate for a certain sector in a spatial unit with the national employment rate for that sector:

$$LQi = \frac{e_i/e}{E_i/E} \qquad [2]$$

where LQ_i is the location quotient of sector *i* for area *r*, e_i is the employment in sector *i* for area r (our areas will be Local Labor Markets formed by municipalities, so this term and the following one represent a sum), *e* is the total employment in the area considered, E_x is the total employment in sector *i* in Spain, and *E* is the total employment in Spain.

On the other hand, *geo-structural* factors may be approximated by means of a series of variables that characterize the spatial units under consideration. According to Parr (2002), two basic dimensions must be taken into consideration in the *geo-structural* approach.

First we should distinguish between *size* dimensions in terms of population, some suggesting that flows of economic activity tend to favour more urbanized areas, and others stating that flows within urban areas tend to favour larger cities. Ross Mackay (2003) conducted a study of employment growth in Britain using this division. In Canada, Coffey and Polèse (1988), Coffey and Shearmur (1996) and Polèse and Shearmur (2004) described the distribution of employment growth across the urban system and between central and peripheral areas. Using a static perspective, Polèse, Shearmur and Rubiera (2006) applied a similar classification of territories based on their degree of urbanization and their belonging to central or peripheral areas to the analysis of the Spanish case. All these studies show a strong trend for employment growth, particularly in strategic economic sectors such as high order services, to concentrate in and around cities, and more specifically, in and around large metropolitan areas. Nevertheless, the possibility of existence of *agglomeration diseconomies* must be taken into account. To evaluate these ideas we incorporate the population size of each locality to this analysis by means of a variable *P,* introduced as the logarithm of the population of each spatial unit.

Second, as important as the *size* of each locality is their position in the context of the urban structure of the country. Following Polèse (2009), we consider a number of essential facts: (i) *location* matters, because industries (and therefore economic activity and employment) are always drawn to places best suited for commerce and interaction with markets; and (ii) *size* matters, because dynamic industries, or the most advanced in each epoch, are naturally drawn to large cities and places within easy reach regarding the relevant market. A corollary can be deduced from (i) and (ii), namely: (iii) proximity to size also matters. Another basic idea of Regional Economics is: (iv) *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. Having defined the basic spatial unit (*LLM* areas), in order to include the importance of *agglomeration/urbanization* and *distance* to the major population concentrations, next step is to introduce some way of measuring such ideas.

Following Coffey and Polèse (1988) and Polèse and Champagne (1999), among others papers, propose a classification of the space by *size* and *distance* levels. To illustrate this approach, Figure 2 shows a schematic representation for an idealized national space economy. Each cell is a municipality (administrative local unit) which are aggregated into *LLMs* (blue line). The reader will undoubtedly note the resemblance with the classic idealized economic landscapes of Christaller (1935), Lösch (1938), and Von Thünen (1826); all of which posit one metropolis or marketplace at the centre. Thus, Figure 2 represents a big, in terms of population, *LLM* at the centre (the main metropolis, containing different municipalities), but also some smaller urban *LLMs* of different population sizes around it. The rest of them are considered *rural* according to population *size*. First we just could classify this idealized space by *size* in, by instance,

> (i) *Metropolitan areas*: *local labour markets* with more than certain population size.

> (ii) *Urban areas: LLMs* not big enough to be considered a *metropolitan area itself*.

> (iii) *Rural areas: LLMs* of small size.

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

> (i) *Central: LLMs* "close" to the big *metropolitan area.*

> (ii) *Peripheral: LLMs* located "far" from *the metropolitan area.*

Figure 2. Schematic Representation of the Classification of Spatial Units.
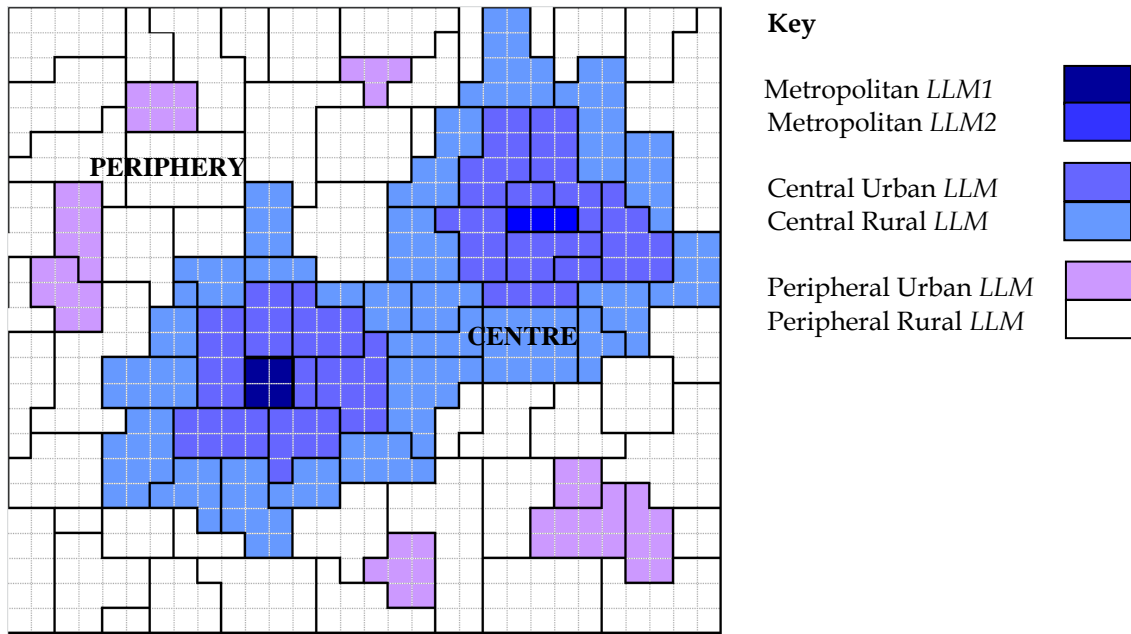
The problem, as the reader could imagine, is how we can define being located "close" or "far" from a big *Metropolitan area*. A very ingenious way of solving this was recently proposed by Patridge *et al.* (2008 and 2009) based on Christaller's ideas (1935) on the hierarchy of places and the connection between urban *size* and the *position* in the hierarchy 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 linear distance to the main central place, the one ranking highest in Christaller's hierarchy, we somehow make a mistake by forgetting that certain goods and services are also offered in smaller and nearer urban places. One way of solving this problem is to define a set of *incremental distances* to each tier (*size* level) of urban areas. We first quantify the distance to the next tier, where some additional higher-order goods and services are produced, and then the *incremental distance* to the next higher urban tier, maybe a metropolitan area, where more higher-order services and urban amenities are provided. This idea is illustrated on Figure 3.

Figure 3. Schematic Representation of *Incremental Distances*.
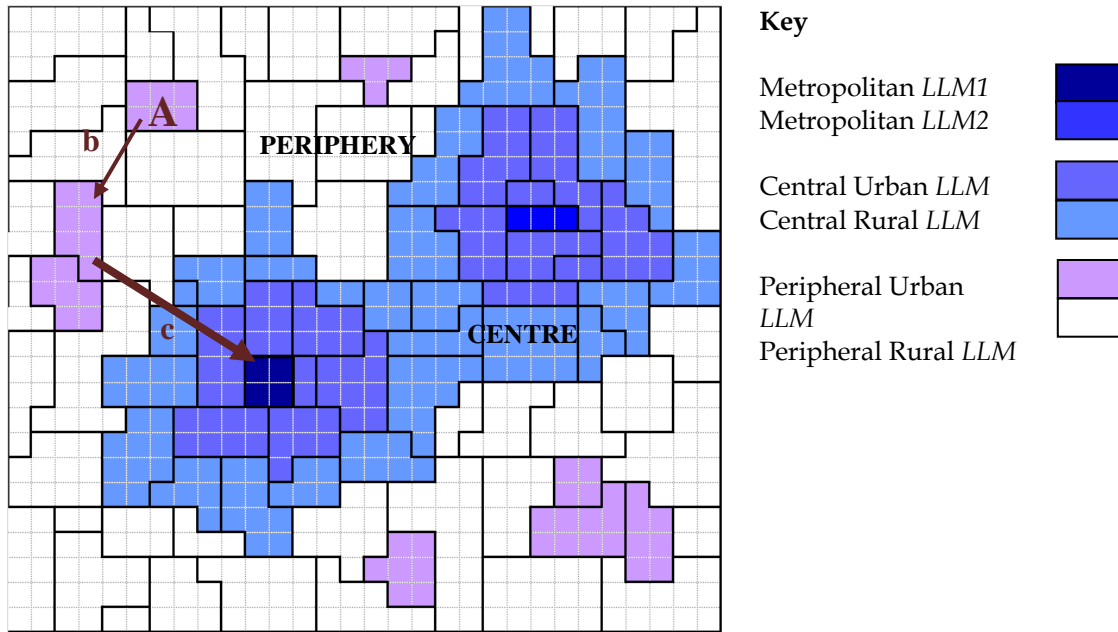
From point A, b is the distance to the closer Urban LLM, and c is the distance to the Metropolitan LLM (the distance to the Metropolitan *LLM* is b+c, but –b, which is the distance already computed from A to the nearest Urban Area).

Source: Rubiera and Viñuela (2012) based on Partridge et al. (2008 and 2009).

The concept of *incremental distances*, suggested by Partridge et al. (2008 and 2009), brings together the effects of *distance* and 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 highly populated places due to the presence of strong agglomeration economies. Thus, we can measure the *distance* to a large agglomeration as a "penalty" to access the goods and services offered there.

Consequently, the mathematical way of introducing the *incremental distances* from LLM_i in the model considered would be: $\delta_{i-1}ID_{LLMi-1} + \delta_{i-2}ID_{LLMi-2} + \cdots + \delta_2 ID_{LLM2} + \delta_1 ID_{LLM1}$; were *ID* is the incremental distance from an *LLM* in tire *i* to the nearer *LLM* in each one of the higher tires: LLM_1 for the biggest metropolitan areas; and LLM_2, LLM_3, … LLM_{i-1} for the rest or urban areas organized by *sizes*. These *incremental distances* discount the effect of being near an intermediate *LLM* that may offer some higher-order goods and services: inhabitants of the *LLM* considered don't have to travel necessarily to the further highest ranked *LLMs*, reducing the aforementioned penalty.

Although urbanization and centrality with regard to large metropolises may be the main *geo-structural* factor, other variables should be considered.

As Polèse (2009) said, *location* just by itself matters. This could be especially important if we take into consideration the influence of international markets. The position of a local area must be considered not only with regard to the national urban system, but also to the international

connections. Proximity to some borders with important trade flows could be relevant. In order to capture this effect we propose, apart from the system of incremental distances, including the spatial position of each *LLM* using its longitude (*X*) and latitude (*Y*) coordinates.

In relation to the previous idea, proximity to the coast (*C*) gives a better position in terms of international trade because, as Hummels (1999) pointed out, it allows *door-to-door* shipping transportation, thus reducing costs. This is reinforced by the fact that airports in coastal cities are normally the most important gateways to international air connexions. The coast also includes spaces with a greater propensity to develop a standard type of "sun and beach" tourism. Rappaport and Sachs (2003) studied the relevance of the coast in the US economy, finding clear correlations, not only with density, but also with productivity and growth.

A final equation proposed to estimate.

All these variables may be synthesized in an expression like the following:

$$G_{emp} = \alpha + [\beta_1 P] + \left[\gamma_1 Ed + \gamma_2 S + \gamma_3 S^2 + \gamma_3 I + \sum_{i=1}^{n} \gamma_4^i LQ_i\right] + +\delta_k C_k +$$

$$[\rho_1 X + \rho_2 Y] + \left[\sum_{j=1}^{n} \varphi_1^j ID_{ij}\right] + \varepsilon_i \qquad [3]$$

where *P* is the logarithm of the population, *E* is the percentage of population with university education in each *LLM*, *S* is the specialisation index obtained by applying expression (1) and *I is* a dummy variable that takes value 1 when the area is the capital city of a province or autonomous community. LQ_i are the location quotients calculated in all the areas for the selected sectors as presented in equation (2). *ID* is the *incremental distance* to the different tires of *LLMs considered* (alternatively, we will use the linear distance to the nearest LLM1, allowing for comparison). *C* is a dummy variable that takes the value 1 when the *LLM* includes a coastal municipality, distinguishing between two different coastlines: Atlantic and Mediterranean. *X* and *Y* are the longitude and latitude coordinates. *Incremental distances* and coordinates use the centroid of each area (most important municipality of a *LLM* in terms of population) as the reference point.

3. Translating the general approach to the specific case of the Spanish Economy.

Delimitation and classification of the LLMs in Spain.

Administratively, Spain is divided into 8,106 municipalities that are aggregated into 50 provinces (NUTS III level), excluding Ceuta and Melilla; and seventeen Autonomous Communities or NUTS II regions (Figure 4 - Maps 2 and 3). The number of municipalities within each province ranges from 34 (Las Palmas) to 371 municipalities (Burgos). Furthermore, only for comparative purposes with other European member-states, the seventeen Autonomous Communities can be aggregated into seven statistical regions or NUTS I level (Figure 4, map 1), which have no real internal, political or administrative meaning.

Figure 4. Spanish administrative division of the territory into NUTS I, Autonomous Communities (NUTS II) and Provinces (NUTS III).

| Map 1: NUTS I regions | Map 2: Autonomous Communities or NUTS II regions | Map 3: Provinces or NUTS III regions |

Source: Rubiera and Viñuela (2012)

Using the 8,108 Spanish municipalities as base blocks, Boix and Galleto (2006) apply an algorithm of five stages. This process allows pointing out candidates to be the centre of a *LLM*, and gradually adding other municipalities it generates the 806 spatial conglomerates used in this study. There are two principles underlying the algorithm which make possible to talk about functional regions with economic sense: labour self-containment (a minimum of 75%) and commuting (a maximum of 25%). Therefore, Local Labour Markets integrate in the same unit the vast majority of labour and income movements, being regions with high internal homogeneity and, at the same time, high external heterogeneity (Rubiera and Viñuela, 2012). Figure 5 shows the 806 *LLMs* defined by Boix and Galleto (2006) for the Spanish case.

Figure 5. Division of Spanish territory into *Local Labour Markets.*

Source: Boix et al.(2012).

After defining the local labour systems we can classify these basic spatial units, first according to *size* and then to *distance to size* as had been proposed in the previous section. Table 1 show the distribution of Spanish *LLMs* by population *size* in Spain, where six tiers or levels are defined. The two first tiers, *LLM₁* and *LLM₂*, correspond to the metropolitan areas or centre, to follow Christaller's nomenclature. Given the big gap in size between Madrid and Barcelona metropolitan areas, and those classified as *LLM₂* (with more than 500,000 but less than 2,500,000 inhabitants), we considered appropriate to distinguish those two levels. The next levels of lower urban areas; *LLM₃*, *LLM₄* and *LLM₅*; basically includes cities of more than 50,000 inhabitants but less than 500,000. Finally, those *LLMs* with less than 50.000 inhabitants are considered rural areas (*LLM₆*).

Incremental distances proposed by Partridge *et al.* could be applied to the *LLMs* of Table 1. Figure 6 shows central and peripheral *LLMs* according with a linear distance criterion. Nevertheless this is only an illustration of *distances*, for the empirical analysis a more precise matrix of *incremental distances* was built for each one the 806 *LLMs*.

Table 1. Distribution of *LLMs* by population *size* (1991).

	Number of LLM	Number of municipalities	% of total population
LLM1 > 2.500.000 inhabitants	Madrid Barcelona	152 51	20.58%
2.500.000 inhabitants > *LLM2* > 500.000 inhabitants	Valencia Sevilla Bilbao Zaragoza Malaga Palmas de Gran Canaria Sta. Cruz Tenerife	52 39 59 95 20 15 17	15.15%
500.000 inhabitants > *LLM3* >250.000	15 LLMs	377 municipalities	13.96%
250.000 inhabitants > *LLM4* >100.000	46 LLMs	1,741 municipalities	18.16%
100.000 inhabitants > *LLM5* > 50.000 inhabitants	43 LLMs	793 municipalities	7.23%
LLM6 < 50.000 inhabitants	693 LLMs	4,697 municipalities	24.92%
TOTAL	**806 LLM**	**8,108 municipalities**	**38.871.359 inhabitants**

Source: Own elaboration with data from 1991 Spanish Census, published by INE (2007), and Boix and Galleto (2006)

Figure 6. Spanish territory division based on *LLMs, size* and *distance to size* (2001).
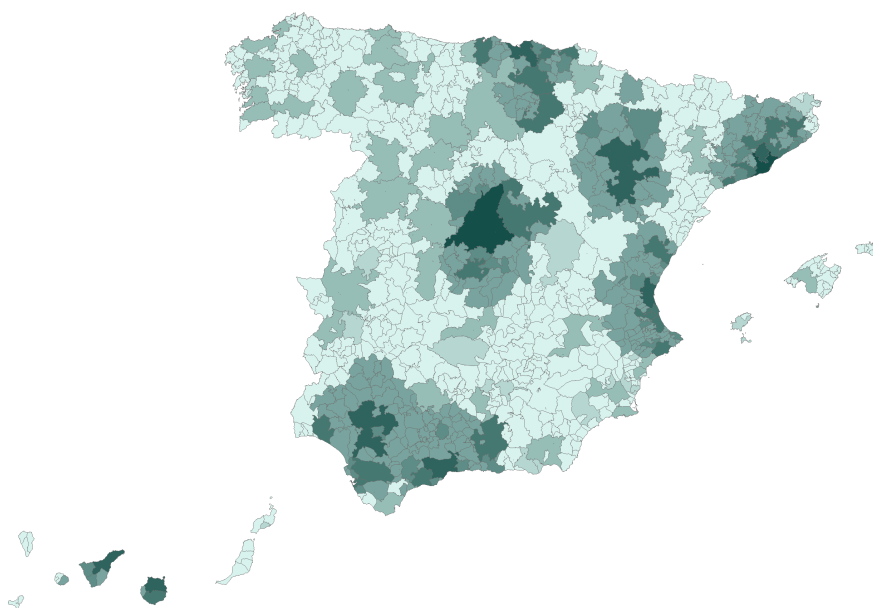
Source: Own elaboration with data from 2001 Spanish Census, published by INE (2007), and Boix and Galleto (2006) methodology.

Databases: the Spanish Census and geographical references.

One of the main problems in the application of this approach, represented by expression (3), was the major difficulty in obtaining suitable data for each variable. The data employed is summarised in Table 2.

Table 2. Variables and Data Used in the Empirical Approach.

	Variables	Database
G_{emp}	Employment growth	Logarithmic growth rate of employment and population between 1991 and 2001 calculated using Spanish Census (1991 and 2001; data supplied by the Spanish National Institute of Statistics, INE).
P	Population logarithm	Logarithm of the population, taken from the 1991 Census (Spanish National Institute of Statistics, INE).
Ed	Educational level	Percentage of population with a university degree. Taken from the 1991 Census (Spanish National Institute of Statistics, INE).
I	Capital of province or Autonomous Community	Dummy variable that takes value 1 if the LLM contains a municipality that is capital of province or capital of Autonomous Community, and 0 otherwise.
S S^2	Specialisation index	Calculated using Equation (1) with data from the 1991 Spanish Census (Spanish National Institute of Statistics, INE).
LQ	Location quotient	Calculated using Equation (2) with data from the 1991 Spanish Census (Spanish National Institute of Statistics, INE).
AC MC	Cantabrian and North-Atlantic Coast / Mediterranean and South-Atlantic Coast (including the islands)	Dummy variables that take value 1 if the LLM contains a coastal municipality, and 0 otherwise. This information was provided by the CNIG (Spanish National Centre for Geographical Research).
X	Longitude coordinate	Provided by the CNIG (Spanish National Centre for Geographical Research).
Y	Latitude coordinate	Provided by the CNIG (Spanish National Centre for Geographical Research).
LD_{LLM1} -------------- ID_{LLM1} ID_{LLM2} ID_{LLM3}	Linear distance, or alternatively, incremental distances	Linear distance to the highest-ranked LLM. Incremental Distances from a LLM to the nearer LLM in each higher tier according with classification of table 1. All the distances are calculated using the CNIG database (Spanish National Centre for Geographical Research). Digital maps of the Spanish territory.

Spatial unit of the analysis: Spanish Local Labour Markets

The main database for the application of the empirical formulation proposed above is the Spanish Census, administered by the INE (National Statistics Institute of Spain). Although there are partial updates every three years, comprehensive database are only available every ten years. The last two available Spanish censuses are for 1991 and 2001. We shall use the data from 1991 as the base year and compare it with the data from 2001.

The Census provides information about population, employment – divided into sixteen industrial classes (to calculate the dependent variable G_{emp} and the independents variables S and LQ) – and level of qualification of the workers in each area (to construct the variable E). To calculate the incremental distances (ID) we use data from the digital maps of the CNIG (Spanish National Centre for Geographical Research), which provide all the longitude (X) and latitude (Y) co-ordinates for Spanish municipalities, and information about the coastal condition of each municipality. All this information is aggregated using the LLM areas defined by Boix and Galleto (2006).

Estimation procedure: a proposal of a set of models.

As the spatial units, concepts, distance measures and a set of real variables (subject to data availability) are delimitated, the last point is to decide and estimate a procedure to apply the equation [3] to the Spanish case. Instead of using just one approach, we propose to estimate a set of different models that get more complex gradually, from the simplest linear regressions to different approaches considering spatial auto-regressive processes.

We propose nine different models. The first two (A and B) aim to evaluate separately the local and policy-susceptible factors, and the geographical factors, applying a simple linear estimation method. Comparing these two models, an evaluation of the extent of policies influence could be obtained. The third model (C) is a combination of the previous ones, still using simple lineal regression estimation. In the two following models (D and E) we incorporate the distance effect maintaining the same variables as before. *Model E* is the most complete in terms of variables included, so over this specification we may introduce some changes in order to answer some other questions. First, we are interested in knowing if growth in urban and rural areas could be explained by the same factors or not. To that end, we divided the sample into two subsamples according with the urban or rural condition of the LLMs. This is made in the two following models that are estimated by means of linear regression. The following list pursues to make this succession of specifications clearer:

(i) *Model A:* local and policy-susceptible factors of Table 2 are considered.

(ii) *Model B:* geographical factors referred in Table 2.

(iii) *Model C:* aggregation of both sets of variables, local and policy-susceptible and geographical ones.

(iv) *Model D:* distance is introduced by the simple way of linear distance to a *LLM1* (main metropolitan areas).

(v) *Model E:* more complex way of measure distances by *incremental distances* to *LLM1*, *LLM2* and *LLM3*, the three higher ranked regions in Spanish urban system in terms of population size.

(vi) *Model E_U:* same variables of *model E*, but only for the sample of places with more than 50.000 inhabitants (urban places).

(vii) *Model E_R:* same idea for rural areas with less than 50.000 inhabitants.

Finally, all these models do not consider any spatial dependence in their specification. Anselin, (1988), Cliff and Ord (1981), Griffith (1988, 2003), Haining (1990) and Anselin *et al.* (2004) are some seminal works that proposed a way to consider and introduce the spatial auto-regressive processes. We apply two of these methods in our analysis:

(viii) *Model G* or *spatial lag* method, including the same variables of *Model E* but considering the influence of neighbours employment growth. To do that a matrix *W* of proximity is calculated applying the standard rule of "queen contiguity". We estimate equation [3] like in *model E*, but with WG_{emp} as a new explanatory variable.

(xix) In *Model F*, we introduce the spatial auto-regressive component in *model E* through a *spatial error* method, which allows the existence of spatial dependence in the error term of equation [3], split out from the "white noise" error through a *Lamba* parameter in the estimation.

Comparing the results of the different estimations could give us some answers to the questions that motivate this research.

4. Main results: giving some answers to understand local employment growth in the Spanish economy.

Checking the available data on employment growth, some facts arise as first hints. Figure 7 shows the spatial distribution of employment growth in the Spanish LLMs separated by percentiles, and some trends can be already recognized in this basic information. The Mediterranean coast gathers many regions above the middle of the distribution, advancing as a growth pole. Around Madrid and Barcelona there are also some growing areas. Other groups appear also in the North, West and South.

Figure 7. Spatial distribution of logarithmic employment growth rates (1991-2001) for Spanish *LLMs*. Percentile division.
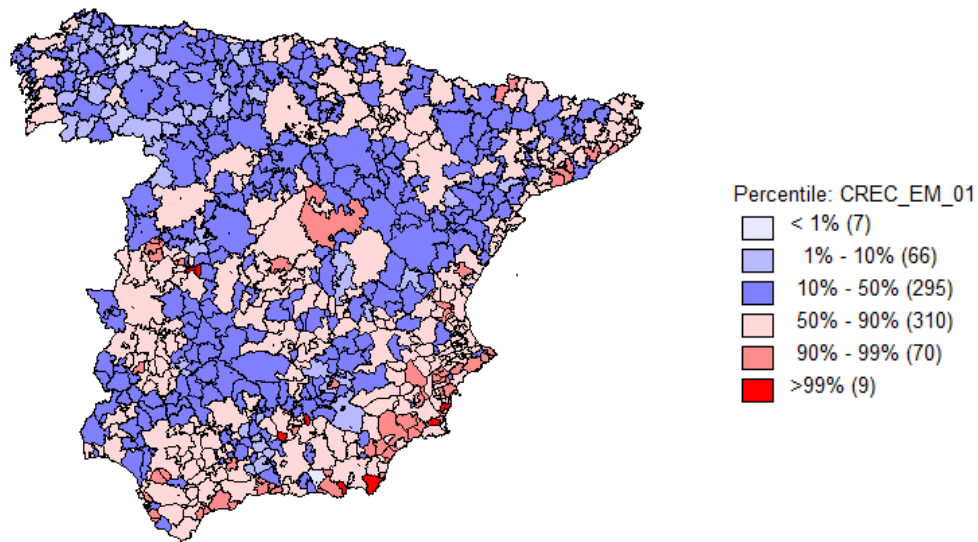
Source: Own elaboration with data from 2001 Spanish Census, published by INE (2007), and Boix and Galleto (2006) methodology.

In sum, the location of the areas growing faster does not seem to be arbitrary. Our aim is to find regularities that could characterize those areas, as common features (political and geographical attributes) or certain relationships between them (spatial dependence). If the following regressions give robust results, it will be possible to describe a growing area and to remark the factors improving employment growth. Another important conclusion might be linked to policy implications and margin of maneuver.

Model estimations.

In this last section we estimate the nine models proposed at the end of the previous section, they all referred to the equation [3] discussed and explained in section 2. Tables 3, 4 and 5 present the results of these estimations.

Table 3. Local employment growth analysis for the Spanish economy: geographical and local factors, with no spatial dependence context.

Dependent variable: Logarithmic growth rate of employment (G_{emp})

	A	B	C	D	E
	Local	Geography	A+B	C + Linear distance	C+ Incremental distance
Constant	-0.065	0.184***	-0.140	-0.142	0.015
P (LOG Population)	-0.017**		-0.018**	-0.019**	-0.007***
Ed (Education level)	-5.492***		-1.297	-1.348	-1.432 *
I (Capital) (1/0)	0.006		0.026	0.027	0.030
S (Specialisation index)	0.104**		0.085**	0.084**	0.086**
S^2 (sqr Specialisation index)	-0.014***		-0.011***	-0.011***	-0.011***
LQ values					
LQ Manufacturing	0.001***		0.001***	0.001***	0.001***
LQ Construction	0.001***		0.001***	0.001***	0.001***
LQ Gov. related services	0.002***		0.001***	0.001***	0.001***
LQ Transport and storing	0.000		0.000**	0.000**	0.001**
LQ RS and business services	0.003***		0.001***	0.001***	0.001***
LQ Financial services	0.000		0.000	0.000	0.000
AC (Atlantic coastal) (1/0)		0.176***	0.125***	0.112***	0.133***
MC (Mediterranean c.) (1/0)		0.149***	0.117***	0.110***	0.099***
X (Longitude)		-0.025***	-0.012***	-0.015***	-0.010***
Y (Latitude)		0.039***	0.035***	0.034***	0.033***
LD_{LLM1}				0.011	
ID_{LLM1}					-0.006
ID_{LLM2}					-0.009
ID_{LLM3}					-0.028**
I-Moran	10.317***	9.772***	7.063***	5.248***	7.387***
Adjusted R²	0.318	0.342	0.458	0.459	0.486
F-Snedecor	32.989***	98.923***	43.512***	41.049***	36.756***

Note: local and spatially lagged variables are for 1991. The dependent variable, logarithm of the growth in employed population, is calculated over 1991-2001.

*/**/*** Significance at 10 / 5 /1% level. In F-Snedecor case is the global significance of the regression at the same levels.

Source: own from data summarized on table 2.

How relevant are the geographical factors to local employment growth and how effective could be the political action?

As can be observed by comparing *A* and *B* models, just geographical variables without any additional information have almost the same explanatory capability as all the policy-susceptible variables. This shows that geographical characteristics are clearly relevant in the understanding of local employment growth. *Model C* gathers *A* and *B*, so we are going to put our attention on the results obtained by this more complete estimation.

All the geographical variables are significant. As expected, the coast is clearly relevant: coastal *LLMs* grow faster than inland *LLMs*. Distinguishing between Mediterranean and Atlantic littoral is also relevant: the *LLMs* of the Mediterranean coast grow faster than the *LLMs* of the Atlantic one, what is easily understandable taking into account the better climatology of the former, that enhance tourism industry. Longitude (*X*) and Latitude (*Y*) coordinates indicate that the territories located in the north-east of the country grow faster than the rest. This is the more developed an urbanized area of the country, located close to the French and European border (commercial corridor).

Regarding the political variables, it can be seen that the local economic structure is crucial to understand the local employment growth as the level of specialization of the territory has a positive influence: the more specialized the territory is, the faster is the growth. Nevertheless, this effect tends to stabilize as shown by its decreasing growth rate. Coefficient of *LQ* variables gives us some clues about which sectors are the best to specialize in. Manufacturing and Construction has a positive influence but also Public services and Business Services. Being a province or Autonomous Community capital city is not significant, but maybe this effect is being captured by Public services *Location Quotient*.

Population (*P*) and Education (*E*) deserve a careful interpretation. In the case of Population the result is significant but negative, which indicate the presence of agglomeration diseconomies: the bigger is the *LLM* the higher is the expulsion of employment. According to this result centrifugal forces are superior to centripetal ones, at least at a very local level. Concerning the Educational level, the estimation shows that it does not have a significant effect on local employment growth, which represents an unexpected result provided that this factor is one of the main policy-susceptible variables and it usually relates to a positive impact.

Summarizing all the results of this part of the study, it can be said that the profile of a successful local area in terms of growth corresponds with the territories located in the north-east of the country, especially along the coast, with an very specialized and an important presence of certain sectors like manufacturing, public or business services with a high degrees of urbanization, but not specially the largest cities. These basic conclusions are maintained in the rest of models, including spatial auto-regressive processes.

How important is the city size and how important is the distance to largest cities?

Conclusions of *model C* about population effect show that city size is not relevant to employment growth, having even a negative effect that may indicate some kind of crowding-out effect. This result is a bit counterintuitive and deserves a deeper analysis.

Probably the own size is not as important as being close to, at least, a minimum size city. We can check this idea using the *models D* and *E* that maintain all the variables of *C* but introducing linear distances (*model D*) and *incremental distances* (*model E*). The linear distance to LLM_1 is not significant, but using the *incremental distances* approach we can observe how relevant it is to be close to a minimum size area, at least a LLM_3 which facilitates the access to basic goods and services.

These facts indicate that the higher employment growth is found relatively close to a large urban area, but it is not necessary for the area under consideration being itself a big city. Small or medium sized cities well located regarding the main metropolis of the countries present a stronger tendency of grow faster.

Table 4. Local employment growth analysis for the Spanish economy distinguishing between rural and urban areas

Dependent variable: Logarithmic growth rate of employment (G_{emp})

		E_R E model only with rural areas	E_U E model only with urban areas
Constant		-0.078	0.655**
P (LOG Population)		-0.022**	-0.048**
Ed (Education level)		-2.080**	-0.290
I (Capital)	(1/0)		0.073*
S (Specialisation index)		0.088*	0.042
S^2 (sqr Specialisation index)		-0.012**	-0.006
LQ values			
LQ Manufacturing		0.001***	0.000
LQ Construction		0.001***	0.000
LQ Gov. related services		0.001***	-0.001
LQ Transport and storing		0.001***	-0.001
LQ RS and business services		0.001***	0.001**
LQ Financial services		0.001	0.001
AC (Atlantic coastal)	(1/0)	0.128***	0.055
MC (Mediterranean c.)	(1/0)	0.153***	0.054*
X (Longitude)		-0.010***	-0.002
Y (Latitude)		0.033***	0.031***
ID_{LLM1}		0.001	-0.017*
ID_{LLM2}		-0.013	0.004
ID_{LLM3}		-0.017***	-0.044
I-Moran		7.140***	1.794**
Adjusted R²		0.454	0.398
F-Snedecor		32.831	4.818

Note: local and spatially lagged variables are for 1991. The dependent variable, logarithm of the growth in employed population, is calculated over 1991-2001.

*/**/*** Significance at 10 / 5 /1% level. In F-Snedecor case is the global significance of the regression at the same levels.

Source: own from data summarized on table 2.

Do the same factors have the same influence on the growth of urban and rural areas?

Other possible explanation of some counterintuitive effects observed in *Model E* is that our sample of places includes rural and urban areas. It is possible that the factors explaining employment growth in two environments that are so different are not the same either. So in Table 4 the sample is split out into two groups, applying the same model for each one: *Model E_U*, for the sample of places with more than 50.000 inhabitants, and *Model E_R*, for the sample of places with less than 50.000 in inhabitants. The results are very interesting and clarify the conclusions.

In urban areas, the model and the variables considered are less capable to explain the employment growth process. That probably happens because these areas present processes of endogenous growth, less affected by the geographical and economic environment. Population and the fact of being a capital city have a significant and positive effect on the dependant variable. The coastal condition, but only in the Mediterranean case, looks like also relevant but with less significance. Finally, being near a *LLM1* rise the growth rate as it translates into complementarities with a bigger city that provides more diverse and higher quality goods and services.

On the other hand, rural areas could be much more clearly explained with the selected variables. Employment growth relies deeply on Specialization in different low level sectors as Manufacturing, Construction, etc. All the geographical aspects have a great impact: being on the Coast and located in the North favours employment growth, while being located in the West lessens it. Something interesting is that for these small size areas it is enough to be located near medium-sized *LLMs*, not necessarily to a large city as occurs with the urban sample.

Some circumstances that deserve a special attention are the roll of education and distance. With respect to the university education, our intuition is that its effect on general employment growth is biased by the effect on rural *LLMs*, as it shows a highly negative and significant impact. In regard to distance, the differing criteria for urban and rural regions are marking the relativity in the size scale of reference, which depends on the size of the region under consideration.

Under these circumstances we may say that patterns of rural Spain employment growth are different than those of urban Spain. Level of qualification is relevant for urban areas, but this is not so clear for rural ones. Geographical factors are crucial for rural or small places, but not so much for urban areas. The size reference changes: in rural areas it is enough to be close to a small-medium region, while the successful urban areas in terms of employment growth are close to a large metropolis.

Table 5. Local employment growth analysis for the Spanish economy: geographical and local factors, with spatial dependence.

Dependent variable: Logarithmic growth rate of employment (G_{emp})

	F		G	
	Spatial Lag Model		Spatial Error Model	
	Lin. Dist	Inc. Dist	Lin. Dist	Inc. Dist
Constant	2.169***	0.118	2.241***	0.153
WY (Neighbours employment growth)	0.209***	0.213***	-	-
Lambda	-	-	0.268***	0.318***
P (LOG Population)	-0.113***	-0.028***	-0.115***	-0.023***
Ed (Education level)	-2.810***	-1.831**	-3.047***	-2.302***
I (Capital) (1/0)	0.110**	0.047	0.107**	0.040
S (Specialisation index)	-0.400***	0.046	-0.394***	0.046
S^2 (sqr Specialisation index)	0.033***	-0.008**	0.032***	-0.008**
LQ values				
LQ Manufacturing	0.000	0.001***	0.000	0.001***
LQ Construction	-0.000	0.001***	-0.000	0.001***
LQ Gov. related services	0.000	0.001***	0.000	0.001***
LQ Transport and storing	-0.000	0.000*	-0.000	0.000
LQ RS and business services	0.002***	0.001***	0.002***	0.001***
LQ Financial services	0.000	0.000	0.000	0.000
AC (Atlantic coastal) (1/0)	0.248***	0.124***	0.264***	0.135***
MC (Mediterranean c.) (1/0)	0.105***	0.104***	0.110***	0.095***
X (Longitude)	-0.004	-0.008**	-0.010*	-0.014***
Y (Latitude)	0.031***	0.027***	0.036***	0.035***
LD_{LLM1}	0.016**		0.024**	
ID_{LLM1}		-0.003		-0.004
ID_{LLM2}		-0.004		-0.004
ID_{LLM3}		-0.022		-0.033*
Likelihood Ratio Test	18.280***	29.922***	26.454***	44.590***

Note: local and spatially lagged variables are for 1991. The dependent variable, logarithm of the growth in employed population, is calculated over 1991-2001.

The W contiguity matrix was calculated using the Queen proximity rule (order 1).

Source: own from data summarized on table 2.

How relevant is the regional economic environment to the local growth?

This last question was partly answered in terms of geographical position. To be more precise, the answer that we are interested in finding out is how important is the employment growth and the evolution of the characteristics of the neighbouring regions to the local behaviour. Or, explained in econometrical terms, how relevant are the spatial auto-regressive processes.

Models G and *F* reproduce again the *Model E*, using the complete sample (urban and rural) but with a spatial lag approach in *Model G* and spatial error method in *Model F*. The application of these methods is completely justified by the values obtained in the I-Moran test in all the previous

regression that reject the null hypothesis of random spatial distribution of the dependant variable and corroborate the existence of spatial autocorrelation. As expected, the results show the capital relevance of the behaviour of the neighbours.

In the *spatial lag* model the dependent variable is introduced also as an explicative term with the W "queen" contiguity weights matrix. Its effect is significant and positive, leading to the conclusion that the employment growth of surrounding regions enhance own employment growth. In the *spatial error* model, the Lambda parameter which informs about the neighbouring independent variables also has a significant and positive value. It means that the omission of relevant variables, namely spatial lags of the explanatory factors, results in a spatially autocorrelated error term. This effect points out the connection between employment growth and the features of neighbouring areas. The rest of the variables maintain the significance in the same terms as preceding models. The Spatial Error model with incremental distances seems to explain better the territorial dependence according to the likelihood ratio test.

So, apart of the different factors considered throughout this paper, we conclude clearly that each local area employment growth strongly depends on neighbours employment growth and policies.

5. So, what places grow faster in Spain? Main conclusions and future research lines.

The aim of the analysis developed here was to shed some light on the processes underlying local employment growth in Spain. As there is not GDP data for the territorial level considered, the study of employment growth may serve as a means to obtain some clues concerning local growth as a whole. Following this purpose, Spanish Local Labour Markets served as basic spatial units, and data from the Spanish Censuses of 1991 and 2001, and from the Spanish National Centre for Geographical Research were used. Those elements allowed the estimation of the empirical model proposed. The specification has a logarithmic employment growth rate as dependent variable, including a compendium of policy-susceptible and geographical variables as explanatory terms. To account for the distance to bigger regions, we used incremental distances alternatively to the traditional linear approach. We estimated nine models increasing in complexity: the first five represent simple linear regressions (gradually adding variables), the following two are versions of the last previous specification but for rural and urban subsamples, and the last two are estimated using spatial econometric methods which account for the impact of the surrounding areas.

When considered separately, policy-susceptible variables and geographical factors have a similar explanatory power. It shows that policies may be effective in stimulating employment growth to some extent, but a comparable part of the growth comes from features that cannot be affected

by political decisions, namely, the geographical characteristics of an area. The geographical terms are significant, stating the significance of being located near the European commercial corridor (north-east) and in the coasts (specially the Mediterranean one). Regarding policy-susceptible variables, it seems that the attention should go to the industrial structure: being a specialized economy has a positive effect on employment growth, and sectors as Manufacturing, Construction, Public services and Business services enhance this effect. Educational level negative effect is unexpected, but it can be explained when the sample is divided into urban and rural regions.

Population has a negative impact that may be due to agglomeration diseconomies, leading to a possible employment expulsion favoring medium size regions. It means that size by itself does not translate into employment growth. The key role in this case is played by the size of the neighbours and the distance to the different size tiers defined, which is captured by incremental distances. The results tell that it is important for employment growth to be near minimum size regions (LLM3) where some goods and services of higher level are provided.

When the estimation is done separately for urban and rural areas, it is shown that the model proposed fits the rural case better. It seems that urban areas follow a path of endogenous growth affected only by its own size and the capital condition of the city. Real State and Business Services sectors enhance employment growth in these regions, as is done by being located north or in the Mediterranean littoral. For the rural areas, all the policy-susceptible and geographical variables have a significant impact. The negative effect of the educational level in the rural case is remarkable and may be biasing the results of the estimations for the complete sample, which can serve as an explanation for the unexpected previous outcome. These two kinds of area also differ in the distance-to-size reference, pointing out the relativity of this dimension: urban areas benefit from being located near the biggest cities, while rural ones are better near medium size regions in terms of employment growth.

Spatial dependence tests confirm our thoughts about the significance of location since the territorial distribution of the employment growth does not seem to be random. The Spatial Lag estimation asserts the positive relationship between own employment growth and the employment growth of neighbouring regions, while the Spatial Error estimation remarks the relevance of the characteristics of neighbours.

Having in mind the results obtained throughout this analysis, an answer for the question that inspires it (What places grow faster?) may be shaped. The profile of a successful region regarding employment growth would be represented by an area located north-east, preferable in the coast, with a specialized economy and near actively growing places. For urban places, Real State and Business Services sector and being near a big region intensifies employment growth. Rural areas would be better specializing in

basic sector and near medium-small size regions. Own population and high educational level do not seem to improve employment growth.

Next steps to follow in this research line would be analyzing local employment sectorial evolution, as there might be interesting concentration or diversification movements related to the growth of urban areas (clusters specialized in a certain activity, or multi-industrial clusters). The study of local population dynamics related to employment and its changing trends over time may also be a relevant topic leading to significant conclusions about past and present behaviours.

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