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Migration Determinants at a Local Level*

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Abstract:

This paper is about determinants of migration at a local level. We use data from Catalan municipalities in order to understand what explains migration patterns trying to identify whether they are mainly explained by amenities or economic characteristics. We distinguish three typologies of migration in terms of distance travelled: short-distance, short-medium-distance and medium-distance and we hypothesize whether migration determinants vary across these groups. Our results show that, effectively, there are some noticeable differences, suggest that spatial issues must be taken into account and provide some insights for future research.

Keywords: population dynamics, spatial econometrics.

JEL codes: C21, R0, R23

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1. Introduction

Population migration is an important topic inside Regional Economics that has a great potential for research purposes, even if some scholars do consider that in recent years publications in this area have retreated (Newbold, 2012). This importance is, partially, due to the fact that this is a wide and heterogeneous field with so different areas that deserve specific attention according to their specificities as, for instance, internal vs. external migrations, rural vs. urban migrations, and short distance vs. long distance migrations (Nivalainen, 2004), among others, being that what explains migration movements in some of previous migration typologies may not have any impact on some other ones. Consequently, there is still room for further contributions trying to better understand what's behind people's decisions to migrate according to the specific characteristics of each type of migration. In line with previous research debates, there is also an interesting controversy about whether migration determinants rely mainly on economic-based (e.g., differences in labour markets or in wages) or in amenity-based ones (e.g., differences in quality of life¹ or in recreational opportunities), being that answer to these issues relies on the specific characteristics of each migration typology.

Nowadays, migration issues are over the table of EU policy makers as flows of individuals from Eastern European countries spread over the rest of the EU (partially thanks to disappearance of bureaucratic hassles), especially towards countries, as Germany, with a shortage of skilled workers. The existence of a large number of individuals moving from some areas to other ones implies also demand changes in a spatial way (housing, education, retail, public services, etc.) at the same time that supply moves to the same direction (labour market). Therefore, public policies not only should take into account these population

¹ An analysis of literature shows that there is no an agreement about what is called quality of life, being that while some researchers focus on economic issues (e.g., wages and income), other restrict this term only to non pecuniary or amenity-based characteristics (Douglas, 1997). In this paper we will refer to quality of life according to this second approach, mainly in order to differentiate it from economic characteristics that could affect individuals' well-being.

movements but they should anticipate them in order to improve matching of provision and demand of public services. But at the same time that thousands of people migrate longer distances crossing several European borders, there are also other short-distance movements, usually not longer than some few kilometres which have also plenty of policy implications, albeit they respond to a very different motivations.

The aim of this paper is to shed light on this later type of migratory movements, mainly intraregional, where individuals could even maintain their previous in case of shorter movements. Concretely, we present an empirical application of migration at a local level using data from municipalities in Catalonia between 2004 and 2010. This is a period in which economic activity increases considerably, with the exception of the period 2008-2010, characterised by the start of the economic crisis. The growth in terms of GDP and workforce attracted a lot of foreign migrants due to a growing demand of low-skilled jobs. At the same time, house prices rose considerably at the main urban areas, a situation that pushed young educated couples from the centre of these areas to the surrounding (cheaper) municipalities, in a typical example of counterurbanization, where migrations movements are from urban to rural areas. In order to control for the business cycle and its considerable influence over migration decisions we distinguish migrations of the growth stage (2004 to 2007) from those of downturn (2008 to 2010). Given the characteristics and typologies of Catalan migration movements, in this paper we will focus on intra-regional migrations, which are of considerable importance during the period analysed here.

We have structured the paper as follows. In Section 2 we discuss the literature regarding determinants of population migration. In Section 3 we briefly show recent trends in population dynamics at the considered area. In Section 4 we present the model and the data. In Section 5 we present and discuss the spatial exploratory analysis, the econometric estimation and their results. Finally, in Section 6 we summarise our main conclusions.

2. Literature Review

When analysing migration determinants it is necessary to distinguish among different types of migrations, since their determinants are not strictly the same. In this sense, we can group them into international migrations and national migrations, and the later group can be distributed into inter-regional migrations and intra-regional migrations. Accordingly, their determinants also differ. Although there is an important academic debate, as we will see later, at this point we can summarise these determinants by saying that international migrations rely mainly on strong differences between countries (in terms of development levels, for instance), while inter-regional migrations are mainly explained by differences in labour markets and intra-regional migrations are mainly caused by amenity-based determinants. There are also other determinants explaining migrations, like physical and social environment, which can influence economic behaviour, happiness and well-being of individuals (Royuela et al., 2010). Nevertheless, the debate of economic vs. amenity-based characteristics as major determinants of population dynamics includes surprising results, as those of Chi and Marcouiller (2011), who found that, during the 1980s, population growth can be mainly explained in terms of economic conditions, rather than in terms of natural amenities, which were rarely significant, while during the 1990s, the opposite results were obtained. So, it seems that both types of determinants can be of high importance in the same area.

There is an important number of academic contributions suggesting the importance of the role played by natural amenities (Rickman and Rickman, 2011) like landscapes, climate (Hernández and León, 2012; Rappaport, 2007; Graves, 1980 and 1979), water availability, seaside areas, and forests, among others, by sociocultural amenities like parks, shopping opportunities and attractions, among others or by recreational amenities like golf, rock climbing,

skiing or scuba diving (Colwell et al., 2002). Additionally, it is widely agreed that these natural amenities attract both the elderly and the most skilled individuals and as Rickman and Rickman (2011, p. 863) state :“(...) Continued increases in consumption demand for amenities and recreational activities, fueled by rising income, increased wealth and aging of the population, could be expected to be the engine of future growth in high-amenity areas”, so such migration issues are of key interest in terms of local consumption.

Apart from previous contributions, scholars that consider the importance of economic conditions (Greenwood and Hunt, 1989) assume that migrants' decisions are made trying to maximize their expected net benefits (Greenwood, 1975), which can be proxied, for instance, by higher wages (Smith et al., 2000) or by increased availability on local employment opportunities (Fuguitt and Beale, 1996). The influence of such differences in economic conditions is especially important when dealing with interregional migration, as in Italy (Etzo, 2011), Slovakia (Janotka and Gazda, 2012) or in Baltic countries (Hazans, 2003), among others. Also in economic terms, the causality relationship between location of population and employment has been traditionally discussed among scholars (Freeman, 2001) and, mainly, two theories have been supported (Muth, 1971). From a demand-side approach it is argued that changes in labour demand cause changes in population who migrates trying to find a job (“people-follow-jobs approach”), while from a supply-side approach it is argued that variations in the labour supply (in terms of changes of population structures) cause changes in employment (“jobs-follow-people approach”)². Previous research for the same area (Arauzo-Carod, 2007, p. 88) shows that “although the location of population and jobs is simultaneously determined, the location of population is more important for the location of jobs than vice versa”, which means that, in any case, when analysing population distribution among municipalities, it is necessary to control for jobs distribution at the same geographical level. Additionally, Carlino and Mills (1987) argue that such interactions are not constant over time, the explanation being that people tend

² See, among others, Deitz (1998), Carlino and Mills (1987), Mills and Price (1984) and Steinnes (1982).

to follow jobs only in periods of decreasing economic activity, while in boosting economic periods jobs tend to follow people.

Nevertheless, the assumption that short-distance migrations (like intraregional ones) are mainly determined by amenities is not widely agreed by researchers (Chi and Marcouiller, 2011). Concretely, whilst some of them consider that natural amenities are quite important in explaining these population change phenomena others rely mainly on economic conditions as migration drivers (e.g., income and employment opportunities), being that there are also some researchers supporting the role played simultaneously by both type of determinants (Shields et al., 2005; Cushing, 1987).

In order to better understand migration processes, it is also important to take into account individual characteristics of migrants, since these are expected to influence their individual's decision to migrate (Greenwood, 1975). However, this particular is far beyond the scope of this paper, in which aggregate data is used. In any case, among these demographic characteristics, probability of short-distance migrations decreases with age as individuals between 20 and 29 have a moving probability which is between 15 and 20% higher than those between 30 and 44, as it is shown for the Spanish case (Bover and Arellano, 2002). This result is quite reasonable (Greenwood, 1975, p. 406), "(...) since older persons have a shorter expected working life over which to realize the advantages of migrating, which makes the rate of return on migration lower for them."

Notwithstanding previous distinction between short and long-distance determinants, it is also reasonable to group the wide range of variables hypothesized to influence migration decisions into several categories (Chi and Marcouiller, 2011): demographic (population density, age structure, racial and

⁴ Generally speaking, reasons behind this lack of spatial mobility are mainly in terms of sociological attitudes against inter-regional migration as well as the existence of strong family ties, as other scholars have previously identified for other countries as, for instance, U.S. (Fuguitt and Brown, 1990; Greenwood, 1975), Spain (Stillwell and García Coll, 2000) and Finland (Nivalainen, 2004).

ethnic composition, educational attainments), socio-economic (school performance, criminality, public infrastructures, retail, real state), accessibility (highway and road infrastructures, commuting, public transportation system) and land availability (water availability, built-up land, zoning, etc.).

As the reader can easily guess, these determinants have a spatial pattern (i.e., they refer to characteristics that vary along different regions or spatial areas) but unfortunately most of empirical contributions lack a spatial approach when dealing with such determinants (Chi and Marcouiller, 2011), although spatial tools are increasingly available for population research (Chi and Zhu, 2008). Concretely, so far it has not been considered the fact that characteristics of near areas also matter for decisions about whether to migrate or not, on the one hand, and if so, where to go, on the other hand. In order to make a step further, in this paper we will consider both local characteristics of each municipality of the data set as well of characteristics of neighbour municipalities. This is achieved by means of a weights matrix, which takes into account the weighted effect of neighbouring observations (see Anselin, 1988, for an introduction to spatial econometrics).

An analysis of the Spanish case (Bover and Arellano, 2002) shows that intra-regional migrations have considerably increased since the 1980's, and are mainly explained in terms of proportion in the service industry, unemployment, housing prices and education. It is important to notice that although unemployment levels are quite high at the Spanish economy in terms of OECD standards, this situation do not pushed unemployed individuals to migrate from high to low unemployment regions⁴ (Antolin and Bover, 1997), whilst important migration movements did exist between large metropolitan areas and their surrounding smaller urban area and even rural ones (Hierro, 2009). Some of these movements were due to direct relationship between increases in housing prices at larger urban areas and migration to their hinterlands (Bover and Arellano, 2002; Antolin and Bover, 1997).

3. Data and overview of population and migration dynamics in Catalonia

3.1 Data

The empirical application carried out in this paper corresponds to Catalan municipalities. Concretely, we use all the 946 municipalities existent between 2004 and 2010. The average surface of these municipalities is 33.98km² and the population mean was 7,202 inhabitants in 2004. Data used in this paper comes from National Statistical Office of Catalonia (IDESCAT), Catalan Cartographical Institute (ICC), Catalan Register of Manufacturing Establishments (REIC) and Trullén and Boix (2005).

3.2 Migration dynamics in Catalonia

When looking at population distribution among Catalan municipalities in 2004 (see Map 1) it seems clear that there is a huge concentration at the seaside and around metropolitan area of Barcelona where most of big cities are located. Apart from these areas, there are some medium-sized cities spread across the territory, but usually without any kind of urban system (except solely for some agglomerations like Tarragona-Reus and Girona-Figueres).

[INSERT MAP 1]

Population distribution existent in 2010 is quite similar to that of 2004, mainly because the 6-year lag is a small period of time to account for big transformations. In this sense, Map 2 shows areas with stronger municipality growth⁵ are those medium-sized and seaside areas close to bigger urban areas: close enough to benefit from agglomeration economies at these sites and far away enough to avoid agglomeration diseconomies also extant there. This population deconcentration is very typical of mature urban systems and it

⁵ When analysing urban growth at metropolitan area of Barcelona during the nineties Royuela et al. (2010) found a positive relationship between population growth and quality of life.

is also known as “ruralisation”, “turnaround migration”, “nonmetropolitan turnaround” or “rural renaissance” (Chi and Ventura, 2011).⁶

[INSERT MAP 2]

In order to better analyse growth patterns of Catalan municipalities, we have divided them into 6 groups (see Table 1): less than 2,001 inhabitants, from 2,001 to 10,000 inhabitants, from 10,001 to 50,000 inhabitants, from 50,001 to 100,000 inhabitants, from 100,001 to 500,000 inhabitants and more than 500,000 inhabitants (i.e., the city of Barcelona).

[INSERT TABLE 1]

Data from Table 1 shows that while the lower three population groups (those up to 50,000 inhabitants) have grown over the mean (10.26%) between 2004 and 2010, the three upper population groups (those with more than 50,000 inhabitants) have grown under the mean. Therefore, Catalan urban system (see Table 2) is slightly moving towards a more balanced pattern where small and medium municipalities are growing faster, but this change does not affect all the small and medium municipalities in the same way, because while the number of smaller ones (those with less than 2,000 inhabitants) diminishes from 631 in 2004 to 600 in 2010, medium sized ones (those in between 2,001 and 10,000 and 10,001 and 50,000 inhabitants) grow from 211 to 225 and from 81 to 98, respectively.

[INSERT TABLE 2]

Data from National Statistical Office of Catalonia (IDESCAT) shows that there are several migrations trends that coexist and make migration a quite complex

⁶ There is a lot of empirical evidence about population deconcentration for several countries like, among others, U.S. (Chi and Ventura, 2011; Rickman and Rickman, 2011; Partridge et al., 2009; Fuguitt and Beale, 1996; Fuguitt and Brown, 1990), Catalonia (Royuela et al., 2010) and Poland (Kupiszewski et al., 1998). It is important to notice that this phenomenon started around the 90s in Catalonia, whilst its origins go back to the 70s at the U.S..

phenomenon. First, in absolute values most of migrants concentrate on larger urban areas, where there is a higher supply of housing and employment opportunities. Second, in relative values migrants go mainly to intermediate municipalities quite well balanced in terms of accessibility to both rural and big urban areas. Third, areas close to seaside concentrate most of migrations movements, while mountain areas receive a small proportion of migrants. Fourth, although there is a preference for medium sized municipalities, migrants tend to follow the extant population distribution trend.

If we take into account migration rates (see Map 3), this is, cumulated number of immigrants from 2004 to 2010 relative to population in 2004, it is shown that an important number of migrants locate mainly at the seaside or close to the seaside, except for the core municipalities of the metropolitan area of Barcelona, for which there are strong congestion effects that reduce attractiveness of these areas. Apart from these areas, high immigration rates are also found at some county capitals at the rural areas. This population swift from the economic centre of the country to its periphery is also followed (although slowly) by a job location swift (Romaní et al., 2003).

[INSERT MAP 3]

As we have stated in previous sections, urban-rural shift is a key issue when analysing population distribution inside metropolitan areas.⁷ In this sense, Map 4 provides clear evidence for this phenomenon for a couple of metropolitan areas outside metropolitan area of Barcelona: Reus-Tarragona and Girona-Figuera. At both areas one can observe that apart from the capacity to attract immigrants of these regional capitals, there is a phenomenon in which smaller towns surrounding such capitals attract mainly immigrants from de same county and, concretely, from these regional capitals.

⁷ See Rickman and Rickman (2011), Leichenko (2001), Fuguitt and Beale (1996) and Fuguitt and Brown (1990) for an analysis of the U.S. case regarding population distribution between metropolitan and non metropolitan areas during the nineties; seventies, eighties and nineties; eighties and nineties and eighties and nineties, respectively.

[INSERT MAP 4]

Data about entering and exiting migrants by municipality class (see Table 3) illustrates previous differences among each type of municipality. Concretely, the smaller the municipality, the bigger the ratio between immigrants and emigrants. This result shows that these smaller municipalities are much more able to attract new individuals than to deter them. In detail, for the municipalities lower than 10,000 inhabitants the total number of immigrants between 2004 and 2010 is twice the number of emigrants in the same period of time. This ratio (2.17 for those less than 2,001 inhabitants and 2.00 for those between 2,001 and 10,000) diminishes regularly until 0,47 for those between 100,001 and 500,000, which means that larger municipalities are losing population that is moving to smaller ones. This assumption can not be directly checked from our data since we have just aggregated data at a municipality level (not individual data about flows between different sites), but all the empirical results point into this direction (see, among others, Romaní et al., 2003).

[INSERT TABLE 3]

The only exception to this behaviour is the capital, the city of Barcelona, which corresponds to the upper category (more than 500,000 inhabitants). In this case, the rate immigration / emigration rate is 1.11, which is clearly higher than the one of the previous category (0.47). This rate can be easily explained in terms of balance between agglomeration economies and diseconomies. In particular, although congestion and other negatives effects linked to city size push away individuals, strong agglomeration effects prevail (like job and recreational opportunities, city's image, etc.), and therefore its capacity to attract regularly new migrants is larger, so that the ratio is greater than 1.

4. Model

In this paper we share the general idea initially proposed by Tiebout (1956) and later developed by Wall (2001) and Douglas (1997), who argued that individuals choose where to live according to the amount of taxes to pay at alternative locations and the quality of public services offered there, in an approach also known as “voting-with-your-feet”.¹¹ An important assumption of this approach is that individuals are absolutely free to move if they feel that they are paying too much in taxes or if they are receiving poor quality public services. Accordingly (and without using specific taxing data, for which we have no information), we consider that the rationality of potential migrants is roughly the same, since they migrate trying to achieve the best quality of life: they will move if they consider that the prices they are paying (housing, commuting, general expenditures, etc.) are quite high and/or if they consider that the quality/quantity of services they do receive (job opportunities, amenities, quality of life, safety, housing, accessibility, leisure activities, educational opportunities, etc.) is quite low. Concretely, there is some kind of trade-off between expenditures (disadvantages) and profits (advantages) at alternative locations, so individuals behave rationally and take their location decisions according to both advantages and disadvantages of potential sites trying to maximise their quality of life (Maza, 2006).

Based on previous discussion and empirical findings of the literature on migration and population change (see, among others, Chi and Ventura 2011 for a discussion), we can propose a reduced form equation for migration

¹¹ See also Royuela et al. (2010) and Lambiri et al. (2007) for a similar approach. A related approach is that of Greenwood (1987) in which migrants chose their destinations trying to maximise expected net benefits.

determinants at a municipality level in which migration phenomenon is proxied considering total number of immigrants between 2004 and 2010 (IMMI). We have considered alternative measures of migration as, among others, migrants relative to total population, migrants relative to total workforce or percentage of migrants coming from different administrative units¹², but we have finally decided that the log of total number of immigrants was the more direct way to measure this phenomenon.

It is important to notice that we are estimating determinants of migration movements considering three different types of migration in terms of distance travelled by migrants (see Map 5): migrants coming from other municipalities of the same county (COU), migrants coming from other counties of the same province (PRO) and migrants coming from other provinces of Catalonia (CAT). As we have said before, we expect that previous different types of migrations might be influenced in a different way by local characteristics.

[INSERT MAP 5]

Migration movements portrayed in Map 5 show that there is a clear concentration of arrivals around main urban areas (specially at the metropolitan area of Barcelona) and alongside the sea-side, while inland mountain areas are less prone to receive immigrants. Additionally, spatial autocorrelation graphs show that these movements are spatially autocorrelated, being that municipalities that receive a high (low) number of immigrants are surrounded by municipalities that also receive a high (low) number of immigrants.

Therefore, according to previous data and theoretical assumptions immigration can be explained according to the following determinants:¹³

¹² Concretely, migrants coming from the rest of the county, from the rest of the province, from the rest of Catalonia, and from other Spanish regions apart than Catalonia.

¹³ Initially we considered also other explanatory variables as the stock of human capital, the mean surface of dwellings, the percentage of population aged below 19 years old, the income level, the percentage of small and medium sized firms and the percentage of service firms, but

$$\begin{aligned} \text{IMMI} = & \alpha + \beta_1 \text{ DENSI} + \beta_2 \text{ POP} + \beta_3 \text{ LOC} + \beta_4 \text{ SME} + \\ & + \beta_5 \text{ INCO} + \beta_6 \text{ METRO} + \beta_7 \text{ SEA} + \\ & + \beta_8 \text{ ALT} + \beta_9 \text{ DEW} + \beta_{10} \text{ SUPDEW} + v \end{aligned}$$

Where DENSI measures population density in 2004, POP is the number of inhabitants in 2004, LOC is the number of new manufacturing plants located between 2001 and 2003, SME is the percentage of workers in SMEs firms (up to 49 employees), INCO is the income level proxied by income taxes paid by local residents in 2004, METRO is a dummy showing if the municipality belongs to a metropolitan area, SEA is a dummy variable showing if the municipality is at sea-side, ALT is the altitude (in km) of the municipality, DEW is the number of dwellings finished between 2003 and 2009 and SUPDEW is the mean surface of dwellings in 2001. It is important to notice that these variables can be grouped into economic-based determinants (DENSI, POP, LOC, SME and INCO) and amenity-based determinants (METRO, SEA, ALT, DEW and SUPDEW). Most of these variables are measured at 2004 levels¹⁴ because migration decisions have an important degree of inertia (Greenwood, 1985). Table 4 shows some descriptive statistics of previous variables¹⁵ and Map 6 pictures them.

[INSERT TABLE 4 HERE]

Population density (DENSI) proxies land prices. In view that detailed data about land prices is not available for the whole range of our data set we have decided to proxy them using population density as done previously by several researchers (see, among them, Barrios et al., 2006; Figueiredo et al., 2002; Coughlin and Segev, 2000; Guimarães et al., 2004, 2000 and Bartik, 1985).

after carrying out analysis of variance inflation factors its results suggested dropping them out. See data description at the annexes for the details.

¹⁴ Except those that are non-temporal, like SEA, MET, ALT and DIS, and LOC, which is measured at 2001-2003.

¹⁵ See the annexes for definition and sources of explanatory variables (Table A.1) and for correlation of dependent and explanatory variables (Table A.2).

Concretely, it is argued that land costs are usually higher in areas where population density is greater, due to stronger competition for scarce land. Number of inhabitants (POP) controls for size affects in view that size range of Catalan municipalities is quite important and also for agglomeration economies (Leichenko, 2001). Previous location of manufacturing firms (LOC) can identify those areas that show a growing pattern and, potentially, offer new job opportunities (Arauzo-Carod, 2007). A higher percentage of workers in SME's (SME) is expected to attract a bigger number of migrants since type of urban areas that can offer better quality-of-life standards use to be specialised in this type of firms. Income level (INCO) proxies municipality quality (Greenwood and Stock, 1990) and is expected to attract new migrants given that Catalonia was in an economy expanding period, so richer areas were more able to provide access to better services demanded by income growing individuals.

[INSERT MAP 6]

Metropolitan area (MET) proxies for urban amenities (like public administrations and public services) located in metropolitan areas that could influence quality of life (Chi and Ventura, 2011; Isserman et al., 2009). Proximity to the sea-side (SEA) tries to proxy quality-of-life, which has been assumed to be an important determinant of individuals' decisions to migrate (Royuela et al., 2010; Partridge et al., 2008; McGranahan and Wojan, 2007; Greenwood and Hunt, 1989). Altitude (ALT) captures environmental amenities located at mountain areas as well as lower levels of accessibility (Chi and Marcouiller, 2011; Partridge et al., 2008). As migration movements rely on availability of housing (Zhang and Goldman, 2010), higher levels of dwelling construction (DEW) allow to allocate additional migrants (González and Ortega, 2013; Chi and Marcouiller, 2011; Portnov, 2004). Additionally, these migrants usually look for higher quality houses, proxied here by mean surface of dwellings (SUPDEW) which is expected to positively influence immigrants' arrival (Rickman and Rickman, 2011; Royuela et al., 2003).

Regarding the overall estimation strategy, firstly we estimate the previous equation by OLS¹⁶ and later we estimate Spatial Lag and Spatial Error specifications.¹⁷ As we explain in section 5.2, Lagrange Multiplier tests are used in order to discriminate among these specifications.

Concretely, Spatial Lag models (Anselin, 1988) can be summarised in the following way:

$$y = \rho W y + x \beta + \varepsilon$$

Where y is the dependent variable, Wy is the spatially lagged dependent variable, x are the explanatory variables, ε is a vector of i.i.d. errors and ρ and β are parameters.

Spatial Error models can be defined as:

$$y = x \beta + \varepsilon \quad , \quad \varepsilon = \lambda W \varepsilon + u$$

Where y is the dependent variable, W is a spatial weights matrix, x are the explanatory variables, ε is a vector of spatially autocorrelated error terms, u is a vector of i.i.d. errors and β and λ are parameters.

5. Empirical approach and results

5.1 Spatial Exploratory Analysis

In order to account for spatial dependence of migration determinants we need to define spatial range of such interactions. In this sense we use a row-standardised spatial-neighbour matrix (W). Although W can be approached in

¹⁶ In order to save space we omit OLS results but they are available upon request.

¹⁷ Spatial Lag models are estimated through the generalized spatial two-stage least squares (GS2SLS) (Kelejian and Prucha, 1998), which produces a consistent and asymptotically normal estimator with specified large-sample properties while for Spatial Error models the S2SLS estimation method utilizes the generalized moments estimator proposed by Kelejian and Prucha (1999).

different ways like distance-based neighbours or k-nearest neighbours among others (Getis and Aldstat, 2004; LeSage, 2004), we assume a contiguity criteria, so two municipalities are neighbours if they share a common border, but it is important to notice that our results were quite robust to other W matrices. Once W is identified, we can calculate whether the explanatory variables are spatially related by calculating a global measure of spatial autocorrelation, namely Moran's I (Moran, 1948) as shown in Table 4:

$$Moran's I = \frac{\sum_{i \neq j} c_{ij} (x_i - \bar{x})(x_j - \bar{x})}{\frac{\sum_i (x_i - \bar{x})^2}{n}}, \quad \text{where } Y = \sum_{i \neq j} c_{ij} .$$

The numerator is the covariance between contiguity observations (each contiguity weight is c_{ij}/Y). This covariance is null if there is no spatial autocorrelation, positive if there is positive spatial autocorrelation and negative if there is negative spatial autocorrelation. The covariance is normalised using the total variance of the series (denominator). The values of Moran's I range from -1 (dispersion) to 1 (autocorrelation), whilst values close to 0 indicate a random and aspatial distribution.

As Table 4 shows most of variables (both dependent ones and explanatory ones) have some degree of spatial dependence, so it is necessary to use an econometric method able to tackle these spatial issues.

Additionally to global spatial autocorrelation measures (Moran's I), it is also necessary to check whether previous spatial dependence could have also a local nature, i.e., if that spatial autocorrelation is explained in terms of specific local characteristics that exist only in some areas. Accordingly, we have estimated a Local Index of Spatial Association (LISA) for the cumulative immigration (see Map 7), where red areas mean high-high spatial autocorrelation, dark blue areas low-low spatial autocorrelation, light blue areas

low-high spatial autocorrelation, light red areas high-low spatial autocorrelation and white areas mean that spatial autocorrelation is not significant.

[INSERT MAP 7]

In this sense, Map 7 shows *i)* that spatial autocorrelation on migration does exist for Catalonia at a local level and *ii)* that this spatial dependence on the dependent variable is not the same across Catalonia: while at the more rural areas (southern-western and inland) the spatial autocorrelation is mainly of type low-low, at the most populated areas (around the metropolitan area of Barcelona and at the sea-side region of Reus-Tarragona) the spatial autocorrelation is both high-high and low-high and, finally, for the rest of Catalonia it is not significant. These results seem to be reasonable according to spatial distribution of population and differences in population dynamics in these areas. A similar result is provided by Chi and Marcouiller (2011), in which the population growth rate at the minor civil division (towns, cities and villages) in Wisconsin (USA) is spatially autocorrelated. Consequently, when analysing migration phenomena and how local characteristics influence over migrants' movements, it is important to consider that spatial dependence in these determinants do exist only for selected areas.

5.2 Econometric estimation

Estimation procedure will adjust to the following strategy (see Chi and Ventura, 2011, for further details): firstly we perform several Lagrange Multiplier test statistics in order to discriminate between a typical OLS model and a Spatial Lag model (LM-Lag and Robust LM-Lag) and between a typical OLS model and a Spatial Error model (LM-Error and Robust LM-Error) and, secondly, we analyse values of Moran statistic.

[INSERT TABLE 5 HERE]

Firstly, we look at Moran's I residuals displayed in Table 5 where it is shown that for the three econometric estimations (COU, PRO and CAT) the reported values are significant, so there is a clear problem of spatial autocorrelation that needs to be solved and, consequently, a typical estimation by OLS would be biased.

Secondly, we try to identify whether a Spatial Error estimation or an Spatial Lag estimation would better handle the reported spatial effects. Results of Table 5 show that spatial autoregressive coefficients are significant for both types of estimations, indicating that there is some kind of spatial dependence of migrations on spatial interaction between the different spatial areas considered, and also the existence of unobserved factors influencing such migrations. As both Spatial Error and Spatial Lag models seemed to be appropriated we ended up choosing Spatial Error model according to AIC values, which were slightly better for this procedure.

As we have explained before, we assume that migration determinants may depend on distance travelled by migrants, so we will focus our analysis on whether are differences among migrations inside counties (COU), provinces (PRO) and Catalonia (PC). Taking our results in a general way, they illustrate how short (COU), short-medium (PRO) and medium (CAT) distance migrations differ among them, although they share some similarities.

[INSERT TABLE 6 HERE]

A first insight into results (Table 6) shows that economic-based determinants have roughly the same (positive) results for all types of migration, so migrants travelling across different distances are affected in a similar way by these economic characteristics of municipalities. By the contrary, amenity-based variables differ considerably on their effects over migration decisions depending on the type of migration considered, as reported by other scholars (Nivalainen,

2004) and are, generally speaking, of less importance (Greenwood and Hunt, 1989). In this sense, only these ones referred to real state characteristics have the same effect, whilst the other ones are only partially significant and with different signs. These result need to be managed with care as previous research has identified that balance between significance of both economic and amenity characteristics may vary according to specific periods analysed (Chi and Marcouiller, 2011).

Regarding economic-based determinants, our results show that no matter the type of migration, size of local economics positively influences attraction of new migrants, which is in any case quite reasonable (Chi and Ventura, 2011). In terms of specific covariates, for instance, there is one that can easily summarise some of the effects covered by all of them: population at the beginning of the analysed period (POP) which influences immigration in a positive way, as said. This is, obviously, an expected and reasonable result, as higher is an area in terms of inhabitants higher will be its capacity (e.g., housing market, job market, public services, recreational amenities, etc.) to accommodate new migrants. Population density (DENSI) and previous entry of manufacturing establishments (LOC) act in the same direction, capturing size effects of local economies: as bigger are the densities and higher are the quantity of firms located in a municipality higher will be its activity level and, consequently, its capacity to accommodate new migrants. In terms of income level of an area, when higher is the income (INCO) higher will be attraction of new individuals, which is also reasonable if we assume that high-income areas have more dynamic markets and job opportunities that allow to attract additional inhabitants (Hierro, 2009), but we should also consider that this local welfare could repel low-income migrants (Zhang and Guldman, 2010 and Arauzo-Carod, 2007). Surprisingly, municipalities which rely more intensively in SMEs (SME) are less prone to attract new migrants, no matter their migration type.

Heterogeneity arises when considering amenity-based determinants, as for them results vary considerably depending on migration types. Among variables

considered into this category, only those referred to real state show similar effect across different types of migrations. Ratio between recent finished dwellings and extant dwellings before the analysed period (DEW) shows, as expected, a positive effect, illustrating that any growth of immigrants needs a dynamic housing market in order to accommodate new arrivals¹⁹. In any case, coefficient is considerably higher for short-distance migrations, which reflects that vitality of house construction may be triggered by such short-distance movements looking for higher quality standards. Additionally, mean surface of dwellings (SUPDEW) limits immigrants' arrival, which in turn suggests a profile in which such movements have benefited municipalities characterised by smaller properties. This seems to be a structural effect, as there is empirical evidence pointing to the same direction for the previous decade (Arauzo-Carod, 2007).

Furthermore, there are other specific amenities of municipalities that influence migrants in a different way according to the distance travelled. Altitude of the municipality (ALT) has a negative affect over short-distance migrations, a positive effect over medium-distance migrations and it is no significant for short-medium-distance migrations. These results suggest that preference for municipalities located in mountain areas comes mainly from medium-distance migrants, whilst those migrating shorter distances prefer municipalities located at lower altitude, although not at sea-side. Moreover, being at sea-side (SEA) allows capturing migrants coming from short-medium and medium distances (Partridge et al., 2008; Greenwood and Hunt, 1989). Whether the municipality is or not inside a metropolitan area (METRO) influences in a different way depending on migration types: positively for short-medium-distances, negatively for medium-distances and not significant for short-distances. These results can be understood in terms of suburbanization (counterurbanization) process. If we combine previous results with descriptive ones at table 3, it seems clear that there is some kind of process in which migrants travelling longer distances try to avoid metropolitan areas and prefer to locate in other type of urban

¹⁹ Nevertheless, empirical evidence also provides insignificant results of housing availability (Zhang and Guldmann, 2010).

environments, while short-medium-distance migrants could use to travel inside the same metropolitan area.

In order to sum up, our preliminary results illustrate that both socio-economic and amenity-based determinants help to explain migration patterns at a local level. These results fit into other previous analysis (as in Chi and Marcouiller, 2011, for instance) that demonstrated the significant role played by both type of determinants, although with different intensities depending on the specific periods analysed. It is important to take into account that in this period we can report empirical evidence both of urbanization and counterurbanization process in terms of migration, so it is possible that simultaneity of both effects could have blurred our results making difficult to observe a clear pattern of internal migrations.

6. Conclusions

This paper aims to analyse whether local characteristics influence in the same way migrants travelling different distances using data from Catalan municipalities. As a way of simplicity we have grouped such migrants into short-distance migrants (i.e., those coming from the same county but from a different municipality), short-medium-distance migrants (i.e., those coming from other counties inside the same province) and medium-distance migrants (i.e., those coming from other provinces inside Catalonia) in order to demonstrate that their determinants differ. Accordingly, motivations for, individuals that migrate just 10 or 20 km are not the same than those of individuals moving, for instance, more than 150 km.

In order to do that, we have analysed different econometric specifications in order to properly account for existence of spatial dependence phenomenon, being that spatial error and spatial lag models complete and clarify initial conclusions obtained by initial OLS estimations.

Our preliminary results show that local amenity-based characteristics influence in a different way migrations coming from different distances, so we guess that the profile of migrants is not the same and it is related with the distance they do travel. Nevertheless, local economic-based characteristics influence in the same way different migration types, so more research needs to be done in order to put some light into local determinants of such migrations.

About policy implications (i.e., migration policies) that arise from our results, it is possible to say that local characteristics should be taken into account when designing such policies given that migration determinants differ for the several migrations' profiles considered in this paper. A possible shortcoming of our approach is that we are not able to distinguish some individual-specific characteristics potentially influencing migration patterns (Silvestre and Reher, 2013; Nivalainen, 2004), or role played by unemployment (Stilwell and Garcia, 2000), so these are issues to be explored in future research. Finally, from a technical point of view, future research should consider whether in view of the aforementioned specificities it is necessary to introduce different specifications (i.e., in terms of explanatory variables) for each one of migrations' typologies.

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Tables

Table 1: Population growth by municipality class (%)

Municipalities (inhabitants)	2004-2007	2007-2010	2004-2010
Less than 2,001	8.87	5.59	14.95
2,001 – 10,000	11.40	6.80	18.98
10,001 – 50,000	8.57	5.46	14.50
50,001 – 100,000	5.38	3.64	9.22
100,001 – 500,000	3.56	3.58	7.26
More than 500,000	1.05	1.52	2.58
Total	5.83	4.19	10.26

Source: own calculations with data from IDESCAT.

Note: the growth rates were calculated based on sizes of municipalities as in 2004.

Table 2: Municipality size distribution

Municipalities (inhabitants)	2004	2005	2006	2007	2008	2009	2010
Less than 2,001	631	620	612	608	602	601	600
2,001 – 10,000	211	218	223	225	225	225	225
10,001 – 50,000	81	85	88	90	96	97	98
50,001 – 100,000	14	14	13	13	13	13	13
100,001 – 500,000	8	8	9	9	9	9	9
More than 500,000	1	1	1	1	1	1	1
Total	946	946	946	946	946	946	946
Min	27	28	32	30	29	29	24
Max	1,578,546	1,593,075	1,605,602	1,595,110	1,615,908	1,621,537	1,619,337
Average	7,202	7,395	7,542	7,622	7,784	7,902	7,941

Source: own calculations with data from IDESCAT.

Table 3: Net migration by municipality class (2004-2010)

Municipalities (inhabitants)	Immigration	Emigration	Immigration / Emigration
Less than 2,001	325,743	150,230	2.17
2,001 – 10,000	772,652	386,266	2.00
10,001 – 50,000	980,078	691,911	1.42
50,001 – 100,000	379,753	370,809	1.02
100,001 – 500,000	258,103	546,524	0.47
More than 500,000	710,590	642,770	1.11
Total	3,426,919	2,788,510	1.23

Source: own calculations with data from IDESCAT.

Note: the municipality sizes were calculated as in 2004; external emigration is only from 2005.

Table 4: Descriptive statistics

Variables	Mean	SD	Moran's I	pvalue
Immigration from county (IM_COU)*	4,927	1,954	0,622	0,000
Immigration from province (IM_PRO)*	4,525	2,020	0,599	0,000
Immigration from Catalonia (IM_CAT)*	4,218	1,654	0,402	0,000
Population density (DENSI)*	3,894	1,906	0,636	0,000
Population (POP)	0,720	5,435	0,147	0,000
New manufacturing establishments (LOC)*	0,625	1,040	0,458	0,000
Percentage of workers in SMEs (SME)	0,836	0,232	0,190	0,000
Income taxes paid by residents (INCO)	13,171	4,107	0,532	0,000
Metropolitan area (METRO)	0,475	0,500	0,680	0,000
Sea side municipalities (SEA)	0,074	0,262	0,518	0,000
Altitude (ALT)	369,036	319,861	0,858	0,000
Finished dwellings (DEW)*	4,155	2,336	0,497	0,000
Mean surface of dwellings (SUPDEW)	114,590	16,172	0,310	0,000

*Data in logarithms.

Source: own calculations.

Table 5: Measures of fit for OLS

Variables	Equation		
	Immigration from county (IM_COU)	Immigration from province (IM_PRO)	Immigration from Catalonia (IM_CAT)
Moran's I residuals	0,22 (0,00)	0,25 (0,00)	0,33 (0,00)
Lagrange Multiplier Error	130,18 (0,00)	165,20 (0,00)	282,91 (0,00)
Robust Lagrange Multiplier Error	42,79 (0,00)	72,78 (0,00)	194,21 (0,00)
Lagrange Multiplier Lag	109,43 (0,00)	98,50 (0,00)	98,80 (0,00)
Robust Lagrange Multiplier Lag	22,04 (0,00)	6,08 (0,01)	10,10 (0,00)
SARMA	152,22 (0,00)	171,28 (0,00)	293,01 (0,00)
AIC: OLS	2513	2738	2824
AIC: Spatial Lag Model	2411	2656	2747
AIC: Spatial Error Model	2400	2606	2585

Source: own calculations. p-values between brackets.

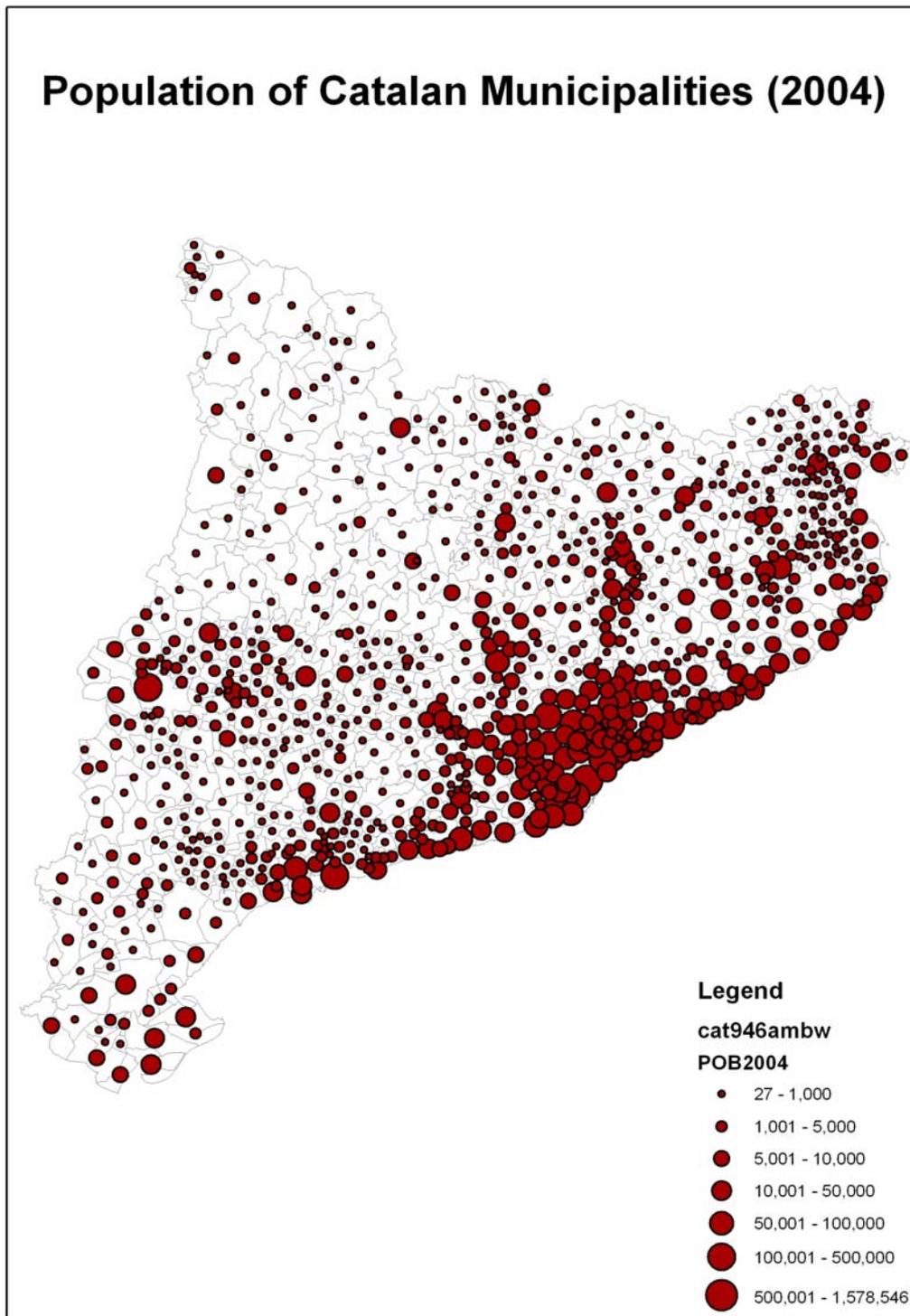
Table 6: Spatial Error estimation

	Immigration from county (IM_COU)	Immigration from province (IM_PRO)	Immigration from Catalonia (IM_CAT)
<i>Economic-based variables</i>			
Population density (DENSI)	0.530*** (0.030)	0.511*** (0.033)	0.471*** (0.033)
Population (POP)	0.018*** (0.005)	0.023*** (0.006)	0.029*** (0.005)
New manufacturing establishments (LOC)	0.452*** (0.070)	0.514*** (0.078)	0.310*** (0.075)
Percentage of workers in SMEs (SME)	-0.610*** (0.128)	-0.653*** (0.142)	-0.750*** (0.136)
Income taxes paid by residents (INCO)	0.062*** (0.009)	0.050*** (0.010)	0.026** (0.010)
<i>Amenity-based variables</i>			
Metropolitan area (METRO)	-0.085 (0.078)	0.382*** (0.087)	-0.164* (0.092)
Sea side municipalities (SEA)	0.221 (0.140)	0.431*** (0.157)	0.756*** (0.160)
Altitude (ALT)	-0.589*** (0.163)	-0.217 (0.184)	0.347* (0.206)
Finished dwellings (DEW)	1.239*** (0.153)	0.615*** (0.171)	0.595*** (0.168)
Mean surface of dwellings (SUPDEW)	-0.008*** (0.002)	-0.017*** (0.003)	-0.022*** (0.003)
Constant	3.129*** (0.369)	3.662*** (0.412)	4.554*** (0.414)
Lambda	0.49678*** (0.040)	0.506*** (0.039)	0.641*** (0.033)
Log-likelihood	1187.133	1290.159	1279.952
AIC	2400.3	2606.3	2585.9
N	946	946	946

*** Significance at 1%, ** significance at 5% and * significance at 10%. Standard errors between brackets.

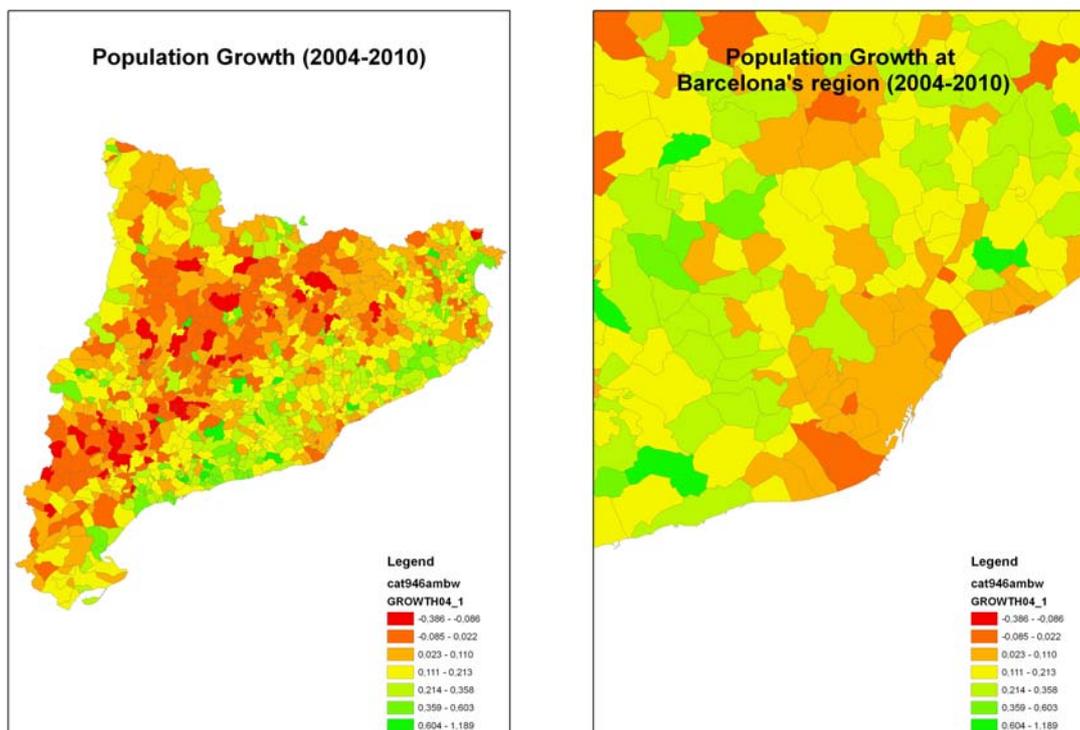
Figures

Map 1



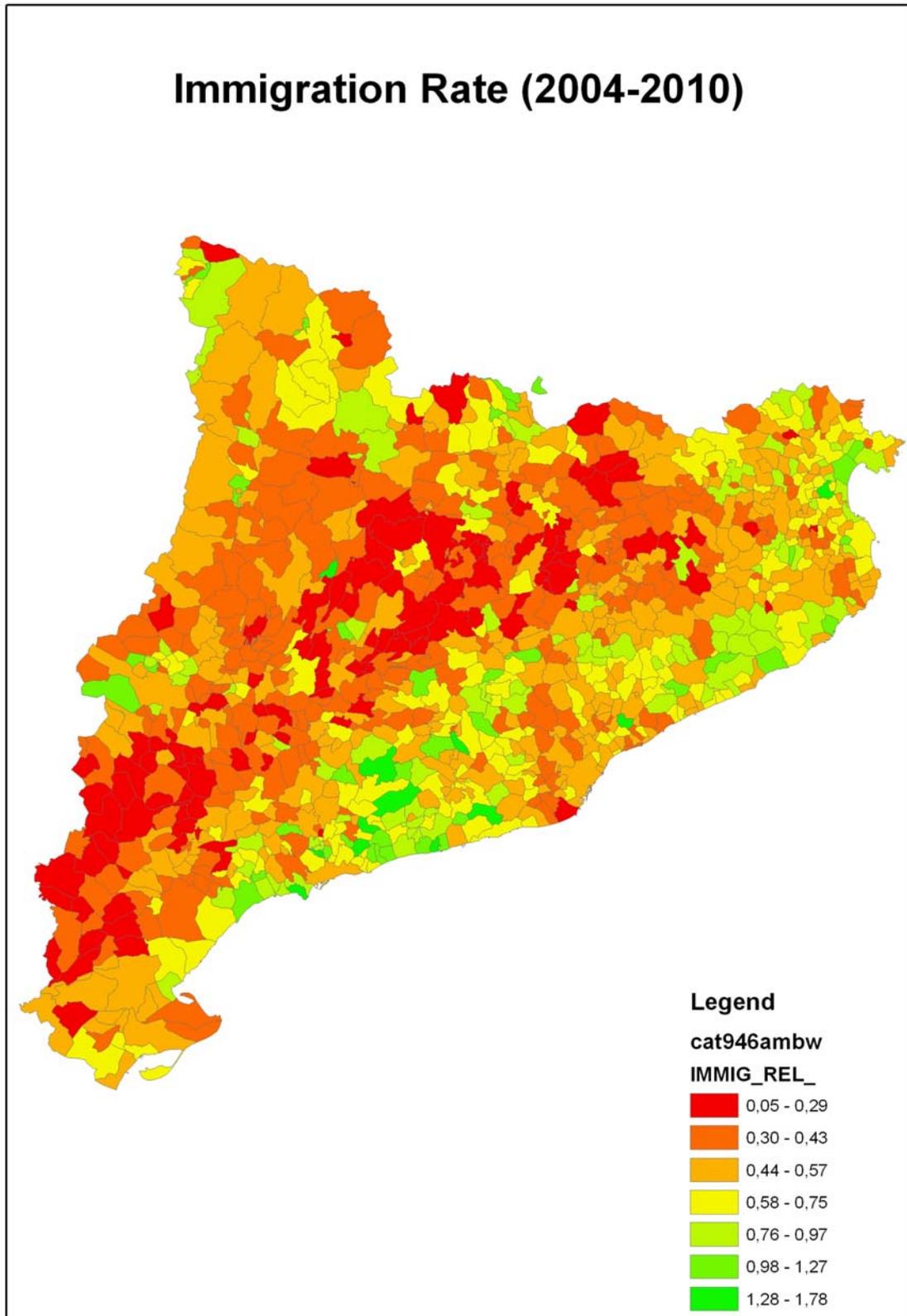
Source: own elaboration with data from IDESCAT.

Map 2: Population growth between 2004 and 2010



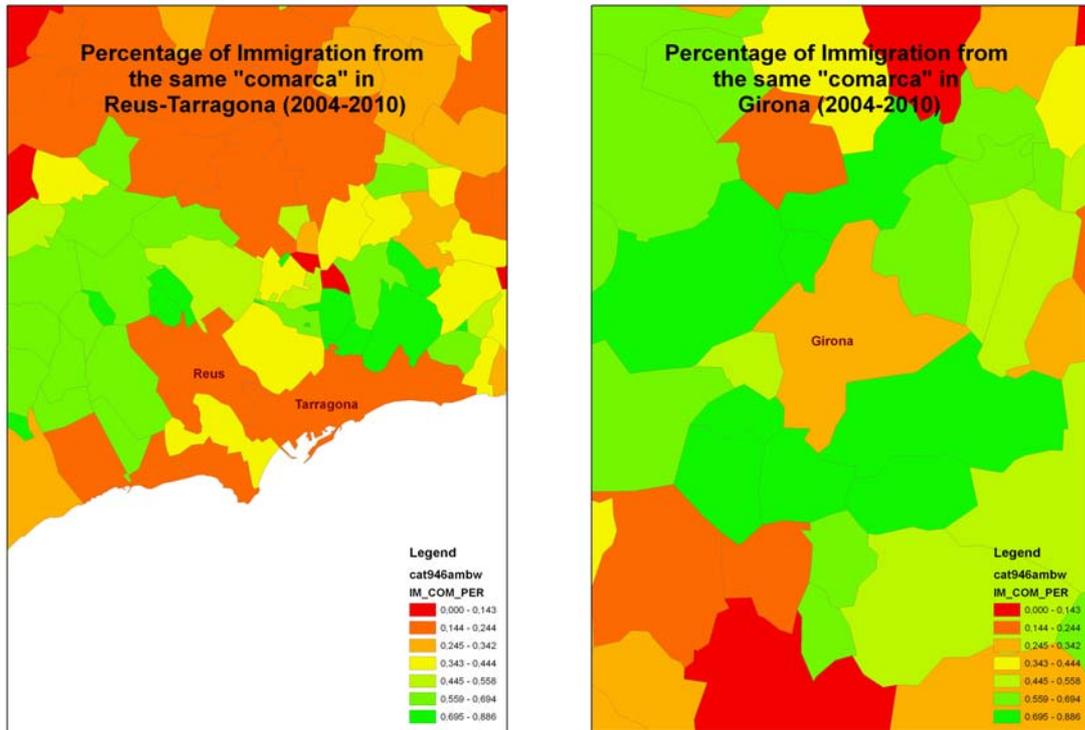
Source: own elaboration with data from IDESCAT.

Map 3



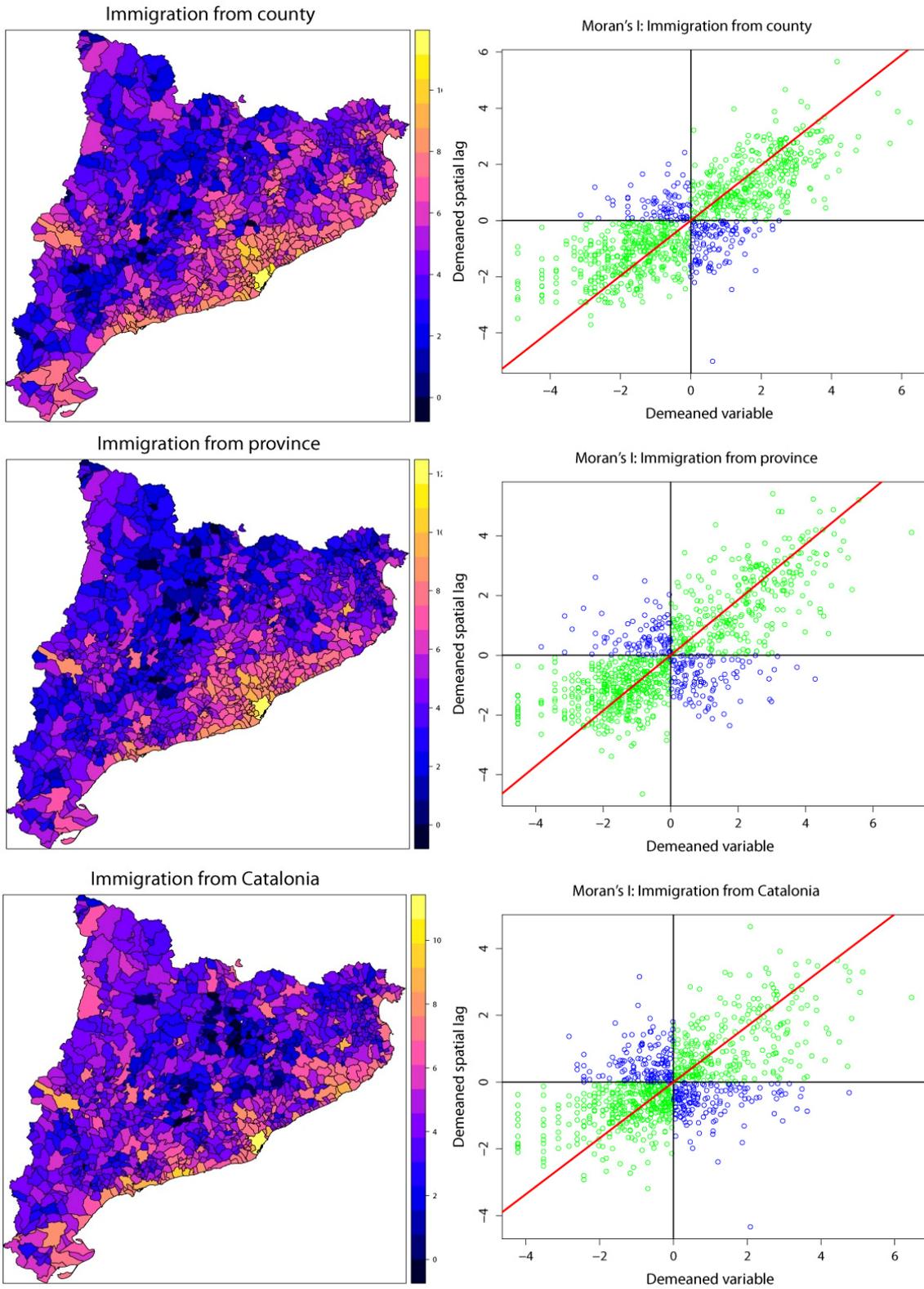
Source: own elaboration with data from IDESCAT.

Map 4: Some examples of urban-rural shift



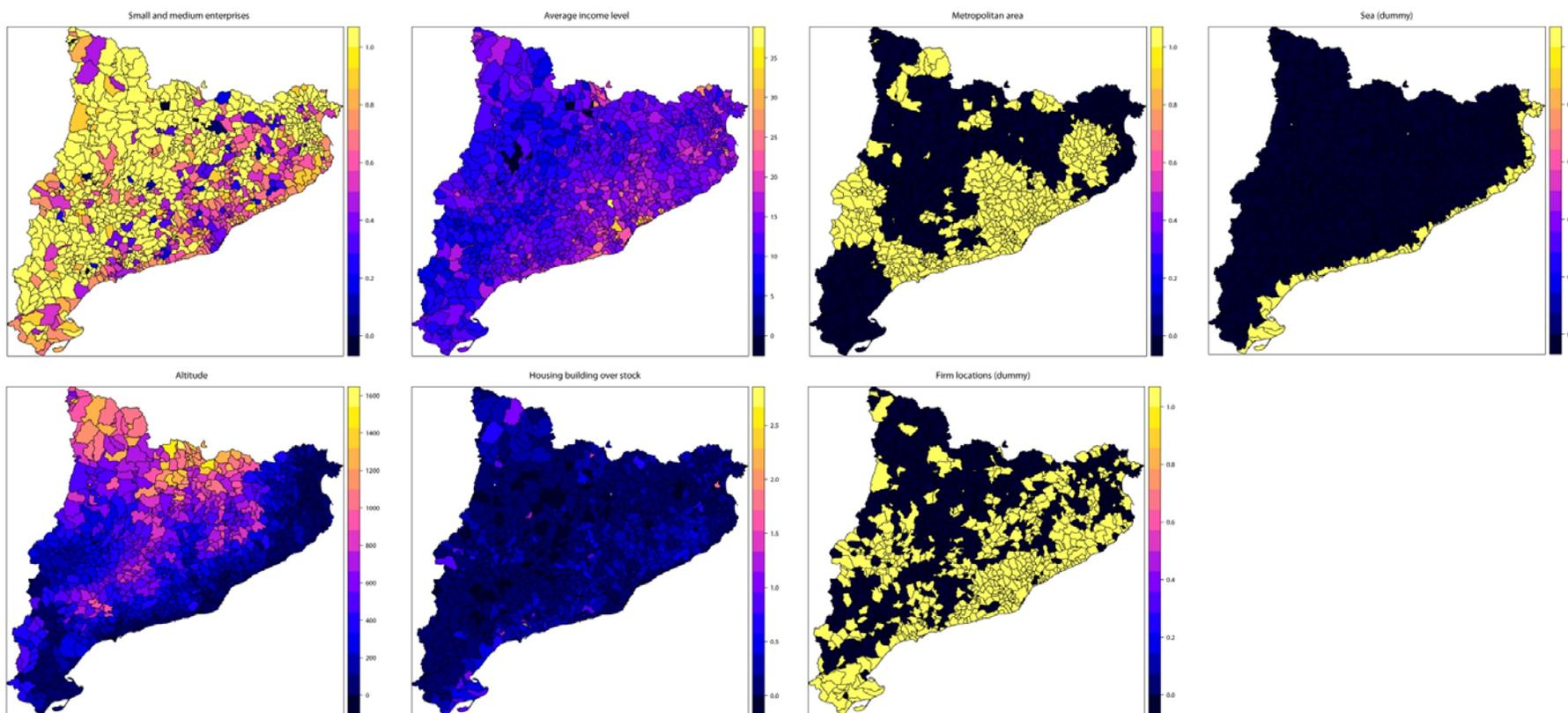
Source: own elaboration with data from IDESCAT.

Map 5: Immigration flows: data and spatial autocorrelation (2004-2010)



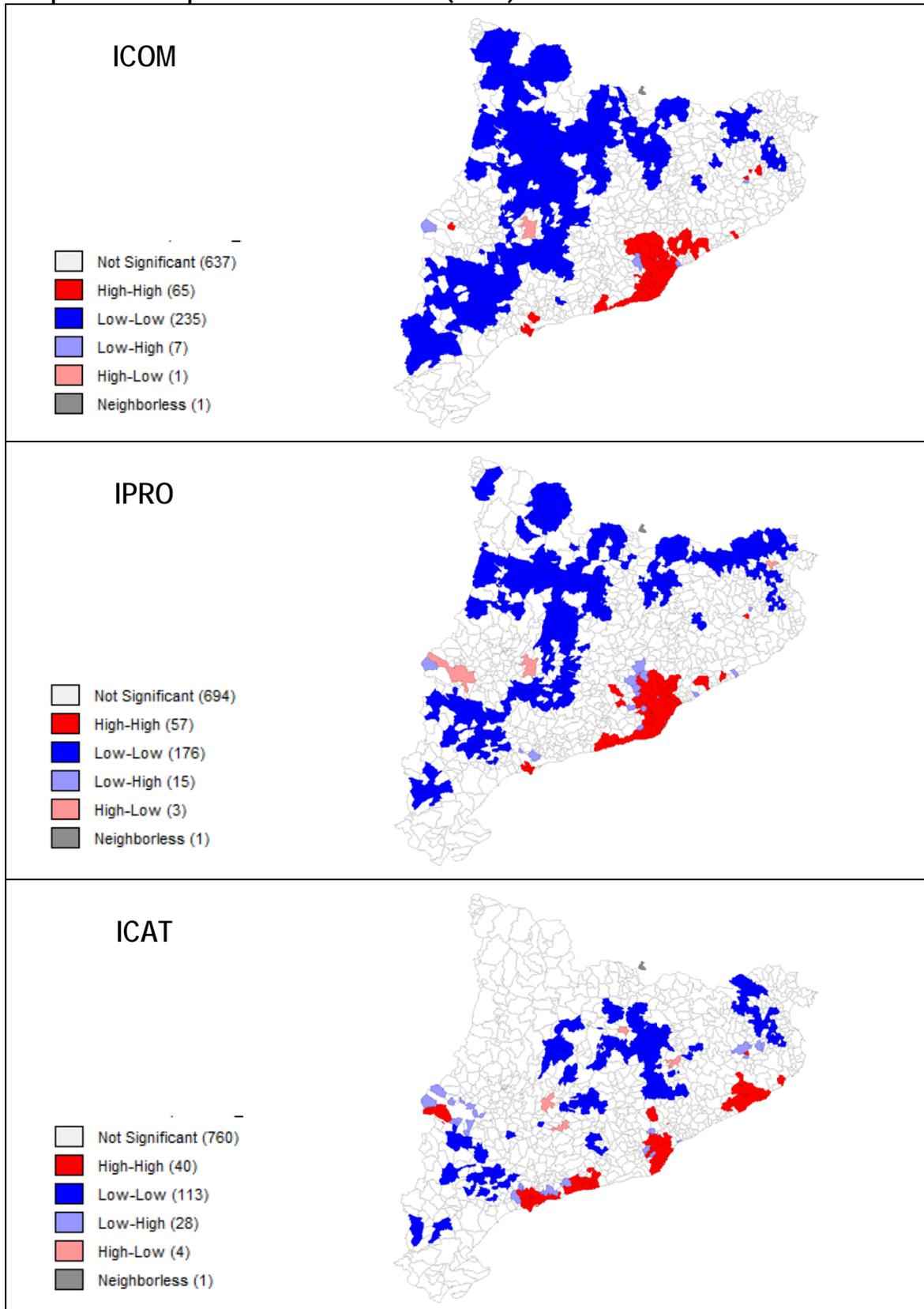
Source: own elaboration with data from IDESCAT.

Map 6: Independent variables

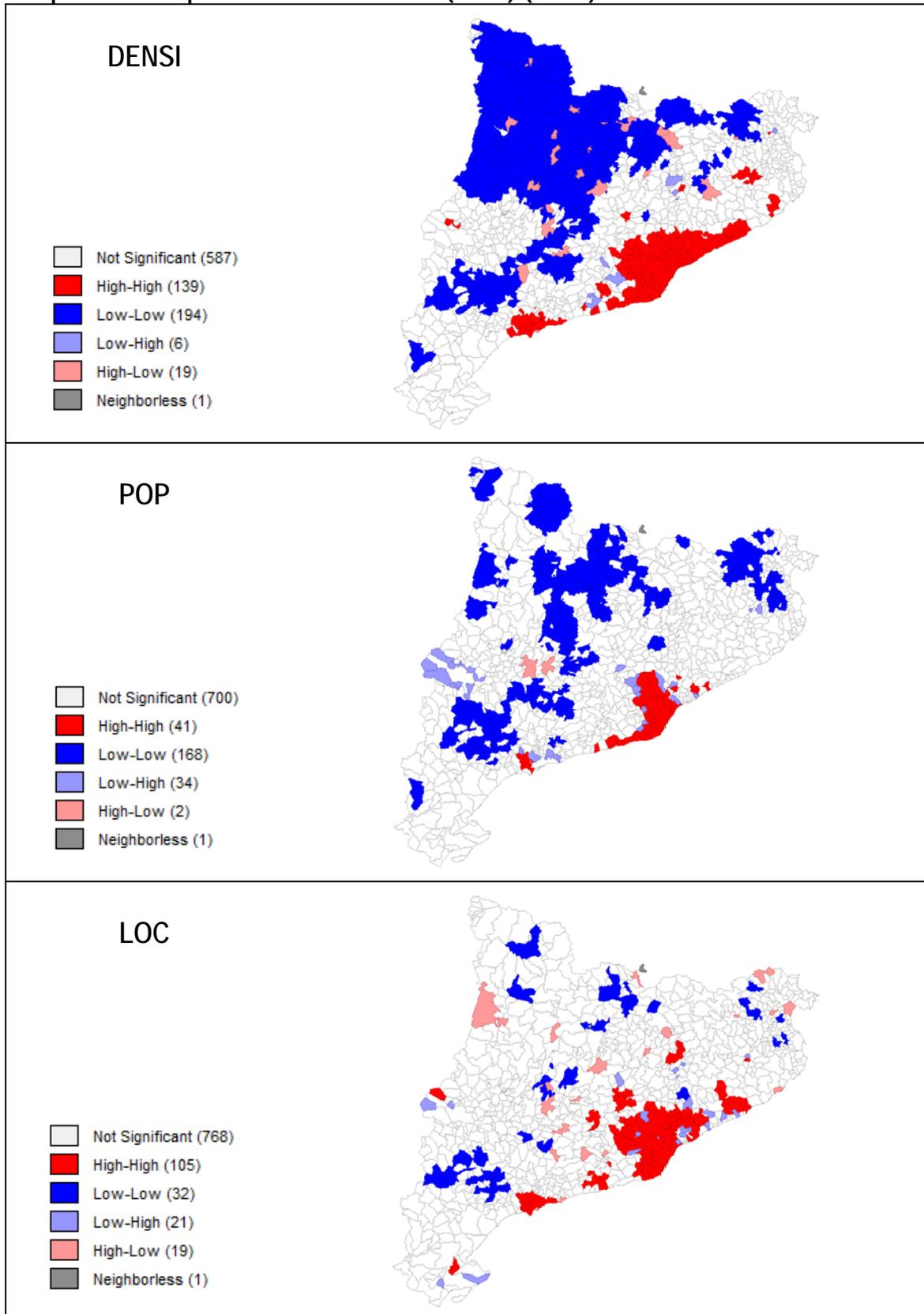


Source: own elaboration with data from IDESCAT.

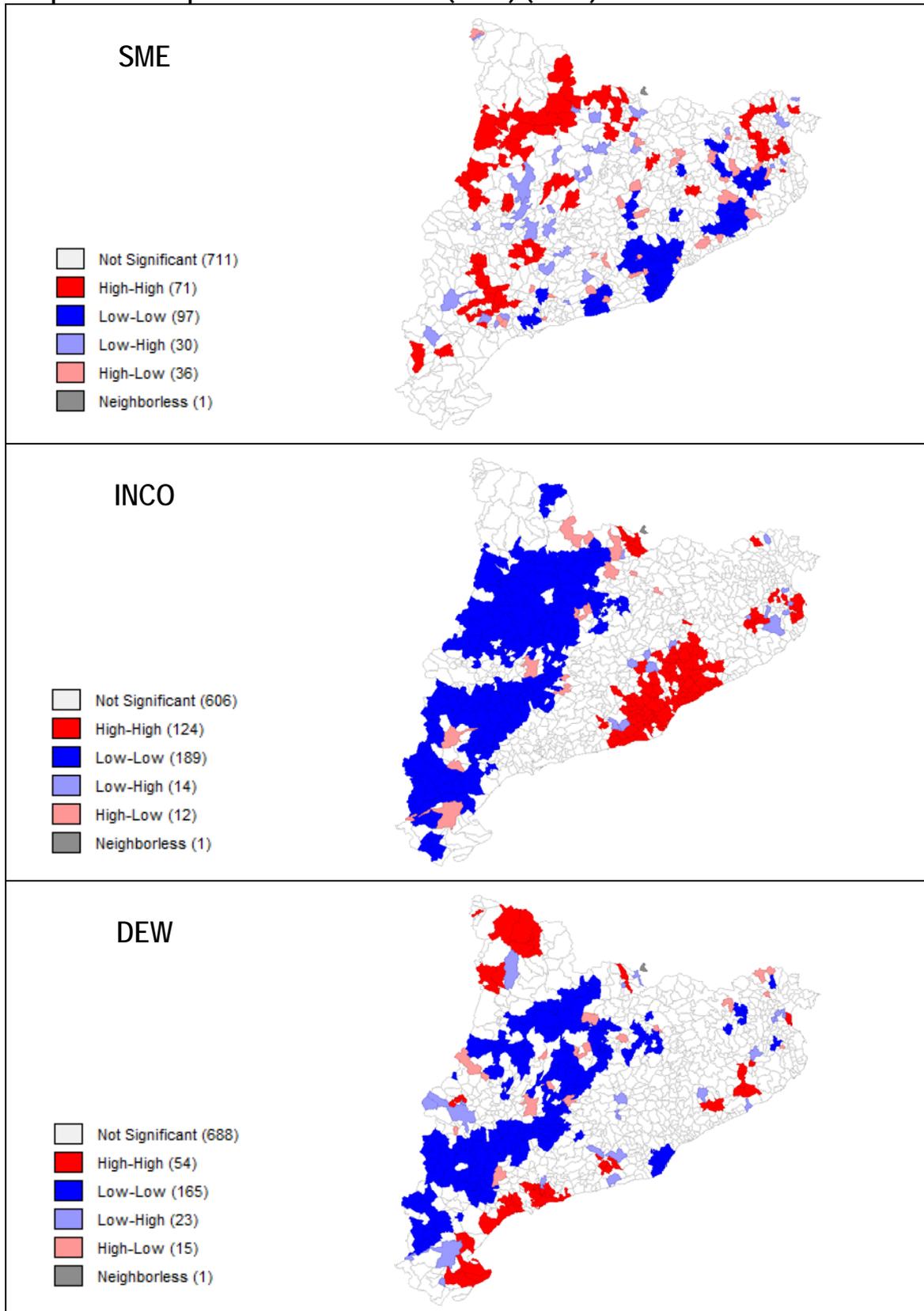
Map 7: Local Spatial Autocorrelation (LISA)



Map 7: Local Spatial Autocorrelation (LISA) (cont.)



Map 7: Local Spatial Autocorrelation (LISA) (cont.)



Source: own elaboration with data from IDESCAT.

Annexes

Table A.1: Explanatory variables: definition and sources

Variables	Definition	Typology	Source
<i>Economic-based</i>			
DENSI	Population density: Inhabitants per km ² (2004)	Agglomeration Economies	TB2005 and OC
POP	Population (2004)	Agglomeration Economies	IDESCAT
LOC	New manufacturing establishments (2001-2003)	Firms' structure	REIC
SME	Percentage of workers in SMEs (2004)	Firms' structure	TB2005
INCO	Income taxes paid by resident (2004)	Economic structure	IDESCAT
<i>Amenity-based</i>			
METRO	Dummy showing if the municipality belongs to a metropolitan area	Institutional	TB2005 and OC
SEA	Dummy showing if the municipality is at the sea side	Nature	ICC and OC
ALT	Altitude (km)	Nature	IDESCAT
DEW	Finished dwellings (2003-2009) / Extant dwellings (2001)	Real State	IDESCAT
SUPDEW	Mean surface of dwellings (2001)	Real State	IDESCAT

REIC Catalan Register of Industrial Establishments, *OC* own calculations, *TB2005* Trullén and Boix (2005), *IDESCAT* Catalan Statistical Institute, *ICC* Catalan Cartographical Institute

Table A.2: Correlation of independent variables

Variables	InIM_COU	InIM_PRO	InIM_CAT	InDENSI	POP	LOC	SUPDEW	InDEW	SME	INCO	METRO	SEA	ALT
InIM_COU	1.00	0.83	0.70	0.84	0.26	0.69	-0.46	0.87	-0.45	0.53	0.28	0.34	-0.50
InIM_PRO	0.83	1.00	0.68	0.82	0.28	0.73	-0.51	0.82	-0.44	0.48	0.38	0.33	-0.45
InIM_CAT	0.70	0.68	1.00	0.66	0.28	0.61	-0.58	0.78	-0.36	0.25	0.12	0.43	-0.34
InDENSI	0.84	0.82	0.66	1.00	0.26	0.69	-0.52	0.77	-0.41	0.48	0.32	0.36	-0.57
POP	0.26	0.28	0.28	0.26	1.00	0.35	-0.19	0.22	-0.14	0.12	0.10	0.19	-0.10
LOC	0.69	0.73	0.61	0.69	0.35	1.00	-0.45	0.65	-0.43	0.30	0.25	0.22	-0.31
SUPDEW	-0.46	-0.51	-0.58	-0.52	-0.19	-0.45	1.00	-0.52	0.25	-0.02	-0.09	-0.26	0.16
InDEW	0.87	0.82	0.78	0.77	0.22	0.65	-0.52	1.00	-0.41	0.48	0.24	0.37	-0.36
SME	-0.45	-0.44	-0.36	-0.41	-0.14	-0.43	0.25	-0.41	1.00	-0.26	-0.19	-0.09	0.20
INCO	0.53	0.48	0.25	0.48	0.12	0.30	-0.02	0.48	-0.26	1.00	0.28	0.20	-0.25
METRO	0.28	0.38	0.12	0.32	0.10	0.25	-0.09	0.24	-0.19	0.28	1.00	0.05	-0.23
SEA	0.34	0.33	0.43	0.36	0.19	0.22	-0.26	0.37	-0.09	0.20	0.05	1.00	-0.30
ALT	-0.50	-0.45	-0.34	-0.57	-0.10	-0.31	0.16	-0.36	0.20	-0.25	-0.23	-0.30	1.00

Source: own calculations with data from IDESCAT.