

Arauzo-Carod, Josep-Maria; Liviano-Solís, Daniel

Conference Paper

Migration Determinants at a Local Level

52nd Congress of the European Regional Science Association: "Regions in Motion - Breaking the Path", 21-25 August 2012, Bratislava, Slovakia

Provided in Cooperation with:

European Regional Science Association (ERSA)

Suggested Citation: Arauzo-Carod, Josep-Maria; Liviano-Solís, Daniel (2012) : Migration Determinants at a Local Level, 52nd Congress of the European Regional Science Association: "Regions in Motion - Breaking the Path", 21-25 August 2012, Bratislava, Slovakia, European Regional Science Association (ERSA), Louvain-la-Neuve

This Version is available at:

<https://hdl.handle.net/10419/120613>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

Migration Determinants at a Local Level*

(Very preliminary version. Please, do not quote)

Josep-Maria Arauzo-Carod (♣,♦): josepmaria.arauzo@urv.cat

Daniel Liviano-Solís (♥): dliviano@uoc.edu

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 of population between 2004 and 2010. Our results show the importance of counterurbanization and suggest that migration determinants do not affect all types of municipalities in the same way.

Keywords: population dynamics, spatial econometrics.

(♣) Universitat Rovira i Virgili, Departament d'Economia (QURE-CREIP); Av. Universitat, 1; 43204 - Reus (Catalonia, Spain); Phone +34 977 758902; Fax +34 977 759 810.

(♦) Institut d'Economia de Barcelona (IEB); Av. Diagonal, 690; 08034 - Barcelona (Catalonia, Spain).

(♥) Universitat Oberta de Catalunya, Av. Tibidabo 39-43, 08035 - Barcelona (Catalonia, Spain).

This research was partially funded by CICYT's SEJ2010-19088/ECON and SEJ2010-16934/ECON), the "Xarxa de Referència d'R+D+I en Economia i Polítiques Públiques" and the SGR Program (2009-SGR-322) of the Catalan Government. Any errors are, of course, our own.

1. Introduction

Population migration is an important topic inside Population Economics that has received considerable research attention in recent years. This importance is, partially, due to the fact that this is a wide topic that includes quite heterogeneous behaviours. Concretely, it is not the same to talk about internal than external migration, or about rural vs. urban migration and so on.

Additionally, there is an interesting debate about whether migration determinants rely mainly on economic-based (e.g., differences in labour markets or in wages, among others) or in amenity-based ones (e.g., differences in quality of life or in recreational opportunities, among others).

The contribution of this paper is to present an empirical application made 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 international 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. Given the characteristics and typologies of Catalan migration movements, in this paper we will focus at 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 (2012), who found that, during the 1980s, population growth can be mainly explained in terms of economics conditions, rather than on 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.

As stated above, population migrations are hypothesized to be caused by different determinants depending on the type of migrations and, concretely, short migrations (like intraregional ones) are assumed to be explained by amenities. In any case, this assumption is not widely agreed by researchers (Chi and Marcouiller, 2012) since some of them consider that natural amenities are quite important in explaining such population change phenomena, while

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 by both type of determinants (Shields et al., 2005; Cushing, 1987).

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), 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 (Rickman and Rickman, 2011).

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 the expected net benefits (Greenwood, 1975), which can be proxied, for instance, by higher wages (Smith et al., 2000) or on increased availability on local employment opportunities (Fuguitt and Beale, 1996). 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")¹. 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

¹ See, among others, Deitz (1998), Carlino and Mills (1987), Mills and Price (1984) and Steinnes (1982).

necessary to control for jobs distribution at the same geographical level. Additionally, Carlini and Mills (1987) argue that such interactions are not constant over time, the explanation being that people tend to follow jobs only in periods of decreasing economic activity, while in booming economic periods jobs tend to follow people.

In order to better understand migration, it is also important to take into account personal demographic 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 aggregated data is used. In any case, among these demographic characteristics, probability of short-distance migrations decreases with age: 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."

To sum up, there are different categories of variables hypothesized to influence migration decisions (Chi and Marcouiller, 2012): demographic (population density, age structure, racial and 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.).

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 push unemployed individuals to migrate from high to low unemployment regions² (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 are 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).

Apart from previous discussion about how local and regional characteristics influence migrations' decisions, most of empirical contributions lack a spatial approach when dealing with such determinants (Chi and Marcouiller, 2012), 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).

3. A brief overview of population and migration dynamics at local level 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.

² 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).

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, we show (see Map 2) how areas with stronger municipality growth³ are those medium-sized and seaside areas close to bigger urban areas: close enough to get 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 is also known as “ruralisation”, “turnaround migration”, “nonmetropolitan turnaround” or “rural renaissance” (Chi and Ventura, 2011).⁴

[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 until 50,000 inhabitants) have grown over the mean (10.26%) between 2004

³ 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.

⁴ There is a lot of empirical evidence about population deconcentration for 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).

and 2010, the three upper population groups (those with more than 50,000 inhabitants) have grown under the mean. Therefore, Catalan urban system is slightly moving to 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 GRAPH 1]

Additionally, we show direct relationship between population level in 2004 and population growth in 2004-2010 (see Graph 1). In order to better illustrate what happens in Catalonia we have omitted Barcelona given that that its size is 6 times the next municipality.

[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 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

higher 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 key issue when analysing population distribution inside metropolitan areas.⁵ 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-Figueres. 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.

[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)

⁵ 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.

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. Data and model

4.1 Data

The empirical application carried out in this paper corresponds to Catalan⁶ municipalities. Concretely, we use all the 946 municipalities existent between 2004 and 2010⁷. 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

⁶ Catalonia is an autonomous region of Spain with about 6 million inhabitants (15% of the Spanish population) and an area of 31,895 km². It contributes 19% of Spanish GDP. The capital of Catalonia is the city of Barcelona.

⁷ Except the newly added La Canonja, created in 2010, and for which there is lack of data.

Cartographical Institute (ICC), Catalan Register of Manufacturing Establishments (REIC) and Trullén and Boix.

The variables used in this model are selected according to both theoretical (departing from previous discussion on empirical findings) and empirical significance.

4.2 Model

In this paper we depart from the general idea proposed by Tiebout (1956), 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. 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 taxing data, for which we have no information), we consider that the rationality of potential migrants is roughly the same: 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 (advantages) and profits (disadvantages).

Based on previous discussion and empirical findings of the literature on migration, we can propose a reduced form equation for migration determinants at a municipality level in which a migration ratio (MIG) between 2004 and 2010 is explained in terms of several exogenous determinants:⁸

$$\text{MIG} = \alpha + \beta_0 \text{DEN} + \beta_1 \text{CAP} + \beta_2 \text{SEA} + \beta_3 \text{DIS} + \beta_4 \text{SER} + \beta_5 \text{SME} + \beta_6 \text{ISA} + \beta_7 \text{LOC} + \beta_8 \text{W_SEA} + \beta_9 \text{W_ISA} + \beta_{10} \text{W_MIG} + v$$

⁸ See data description at the appendices.

Where MIG is a migration ratio measured using cumulated immigration between 2004 and 2010 relative to population in 2004, DEN measures population density in 2004, CAP shows if the municipality is a “comarca” capital, SEA is a dummy variable showing if the municipality is at sea-side, DIS is the distance to the nearest city with a population of at least 100,000 inhabitants, SER is the percentage of workforce at the services industries, SME is the percentage of workers at SMEs firms (up to 49 employees), ISA is a measure of industry specialization and LOC is the number of new manufacturing plants located between 2001 and 2003. It is important to notice that these variables can be grouped into economic-based determinants (DEN, SER, SME, ISA and LOC) and amenity-based determinants (CAP, SEA and DIS). These variables are measured at 2004 levels⁹ because migration decisions have an important degree of inertia (Greenwood, 1985). Table 4 shows raw correlation coefficients among previous explanatory variables.

[INSERT TABLE 4 HERE]

Population density (DEN) proxies agglomeration economies (Leichenko, 2001). It is important to notice that these can be both positive and negative (agglomeration diseconomies), so the expected sign is unknown a priori. Being the capital of a “comarca” (CAP) is hypothesised to attract a higher stock of migrants in view of the existence of institutional amenities like public administrations and public services. Proximity to the sea-side (SEA) tries to proxy quality-of-life, which has been assumed to be an important determinant of, among others, individuals’ decisions to migrate (Royuela et al., 2010; Partridge et al., 2008; Greenwood and Hunt, 1989). Distance to bigger cities (DIS) tries to measure balance between agglomeration economies and diseconomies existent in large urban areas (Royuela et al., 2010). The expected effect of distance over migration rates is, a priori, unclear since one can hypothesize either that distant locations imply lower land prices or

⁹ Except those that are non-temporal, like CAP, SEA and DIS, and LOC, which is measured at 2001-2003.

congestion, among other shortcomings that boost migration. According to this assumption, near locations should deter migrations, but it is also reasonable to approach distance in a very different way: distant (near) location means less (more) accessibility to urban amenities, which diminishes (increases) migration (Greenwood, 1975). Percentage of workforce at the services industries (SER) captures industrial structure and is expected to act positively over migration, since growing areas are those specialised in services (Leichenko, 2001). 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. Role played by industrial diversity (ISA) is not clear a priori, but it seems reasonable to expect that more specialised areas (namely smaller municipalities) are more prone to attract migrants. Finally, previous location of manufacturing firms (LOC) can identify those areas that show a growing pattern and, potentially, offer new job opportunities (Arauzo-Carod, 2007). We have also included spatial lagged variables of some of previous covariates. This empirical strategy is explained in detail in section 5.1.

Regarding the overall estimation strategy, firstly we estimate the previous equation by OLS and, secondly, we use a Quantile Regression (QR) model (Koenker and Bassett, 1978). This methodology enables us to overcome inconvenience of OLS because it allows the investigation of several conditional quantiles of the response variable, rather than only one as in OLS. By this way it is possible to obtain a wider analysis of the relations among variables. In this Paper, QR method permits us to consider heterogeneity among the different expansive dynamics of the population, which is not caught by explanatory variables. Additionally, OLS can be sensitive to deviations of the residuals from normality, whilst QR is robust, which is another advantage of this estimation procedure.

Specifically, QR methodology divides population in n parts (as many parts as quantiles are), and allows to analyse conditional quantiles of the dependent variable, and not just the conditional mean, which is what OLS does.

If we assume (Koenker and Bassett, 1978) that y_t (where $t = 1, \dots, T$) is a random sample of the regression process $u_t = y_t - x_t\beta$ with distribution function F , the θ^{th} regression quantile ($0 < \theta < 1$) is defined as any solution to the following minimization problem:

$$\min_{\beta \in R^k} \left[\sum_{t \in \{t: y_t \geq x_t \beta\}} \theta |y_t - x_t \beta| + \sum_{t \in \{t: y_t < x_t \beta\}} (1 - \theta) |y_t - x_t \beta| \right],$$

This is normally expressed in this way:

$$\min_{\beta \in R^k} \sum_t \rho_\theta(y_t - x_t \beta)$$

Where,

$$\rho_\theta(\varepsilon) = \begin{cases} \theta \varepsilon & \text{if } \varepsilon \geq 0 \\ (\theta - 1) \varepsilon & \text{if } \varepsilon < 0 \end{cases}$$

We define y_t as the size of the municipality. With this model we can specify the θ^{th} quantile of the conditional distribution of y_t , for independent variables x_t (it is assumed that the θ^{th} quantile is linear in x_t).

$$Q_{y_t}(\theta|x) = x_t \beta(\theta)$$

Where $Q_{y_t}(\cdot)$ is the quantile function and $\beta(\theta)$ is an unknown vector of parameters that can be estimated for different values of θ in $(0,1)$. The first

quantile is obtained by setting $\theta = 0.15$, and so on. As θ increases from 0 to 1, we obtain the complete distribution of y conditional on X .

5. Empirical approach and results

5.1 Spatial Exploratory Analysis

In order to account for spatial dependence of migration determinants, we have also considered the spatial lagged variables of most of these determinants. Concretely, we have estimated them in the following way: $W_X = WX$, where X is a matrix containing the independent variables and W is an appropriate (row-standardised) spatial-neighbour matrix. Although W can be approached in different ways like distance-based neighbours or k-nearest neighbours among others (Getis and Aldstat, 2004; LeSage, 2004), we follow the strategy adopted in previous research on spatial dependence in the same geographical area (Arauzo-Carod and Manjón-Antolín, 2012), where we decided to build W as a distance-based matrix using a neighbouring criterion of 60 km (i.e., two municipalities are considered neighbours if they fall within 60 km of one another). Once W is identified, we can calculate whether the variables are spatially related by calculating a global measure of spatial autocorrelation, namely Moran's I (Moran, 1948):

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

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.

[INSERT TABLE 5 HERE]

Table 5 shows Moran's I results for the independent variables that are also used in their lagged versions. As it is shown, all of them have some degree of spatial dependence (although not so strong), so it is reasonable to include their spatial lagged counterparts at the econometric estimations.

[INSERT MAP 5]

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., 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 Immigration Rate (see Map 5), 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. In this sense, map 5 shows that spatial dependence on dependent variable is not the same across Catalonia: while at the more rural areas (southern-western and inland) the spatial autocorrelation is type low-low, at the most populated areas (at the sea side, around the metropolitan areas of Barcelona, Reus-Tarragona and Girona-Figuera) 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 (2012), in which the population growth rate at the minor civil division (towns, cities and villages) in Wisconsin (USA) is spatially autocorrelated.

5.2 Econometric estimation

Econometric results are displayed in Table 6.¹⁰ First and second columns show results from an OLS estimation procedure, the first one without taking into account spatial dependence, and the second one including spatial lags of some explanatory variables. From the third column, the results come from five regressions corresponding to different quantiles (0.15, 0.25, 0.50, 0.75 and 0.90) that include previous spatial lags. According to previous analysis of data on population dynamics, it seems clear that small and medium municipalities do not behave in the same way than bigger ones, so that it is important to accurately check the role played by the hypothesised migration dynamics at different population sizes, which is provided by QR.

[INSERT TABLE 6 HERE]

First insight into Table 6 allows to identify some variables that, in some ways, influence migration patterns (DEN, SEA, DIS, SER, SME, ISA, W_SEA, W_MIG), whilst other do not influence them (CAP, LOC, W_ISA). If we focus on QR, it is shown that some of previous variables do not show a regular pattern in terms of municipalities that are influenced by them in terms of migration (DEN), and these for which influence exists mainly on higher (SEA, SER, ISA, W_MIG) or lower quantiles (DIS) or all the quantiles (SME, W_SEA).

Although it seems clear than coefficients differ among quantiles (basically, the value of coefficients increases for the higher quantiles), we need to verify this differences. In Table 7 we present the results of an interquantile regression (i.e., a regression of the difference in quantiles) in order to examine whether the effects of the explanatory variables are the same for all the quantiles.¹¹

¹⁰ Due to multicollinearity problems we have dropped W_DEN and W_LOC.

¹¹ For instance, lets consider the 0.15 and 0.90 quantile:

$$Q_{0.90} = a_{0.9} + b_{0.90}x$$

$$Q_{0.15} = a_{0.15} + b_{0.15}x$$

The difference in quantiles is $(Q_{0.90} - Q_{0.15}) = (a_{0.90} - a_{0.15}) + (b_{0.90} - b_{0.15})x$. The coefficients reported at Table 7 show the difference in coefficients of the two previous quantile regressions.

Specifically, we have made 6 interquantile regressions: 4 of them between adjacent quantiles (0.15 and 0.25; 0.25 and 0.50; 0.50 and 0.75; 0.75 and 0.90), the fifth between second and fourth quantile (0.25 and 0.75) and the sixth between first and last quantile (0.15 and 0.90).

Before detailing the results it is necessary to say that it is possible to have a bias due to number of quantiles in which we have divided the Municipalities (it is not exactly the same to divide them into 4 quantiles than into 10, for instance). For this reason we have compared both neighbour quantiles and first and last quantile, and second and fourth quantiles.

[INSERT TABLE 7 HERE]

Results at Table 7 indicate that most of differences exist for extreme quantiles as for quantiles 0.15 and 0.9, on the one side, and 0.25 and 0.75, on the other side, while for closer quantiles significance levels are lower. Although previous differences are not quite big enough, they suggest the existence of some different patterns according to municipalities' size, so there is room for trying to analyse what explains migrations patterns for different types of municipalities.

Therefore, we have shown that not all the municipalities have the same sensibility to the explanatory variables that influence their migration dynamics. Specifically, it is observed as for attracting migrants according to spatial OLS results, it is not enough of benefit from lower population densities, or to be located close to sea side, or to have a high employment share in services, or to be close to other municipalities that also attract migrants, because not all the municipalities are equally profiting by fulfilling these requirements.

6. Conclusions

To sum up, when analysing migration determinants the results of QR complete and clarify initial conclusions obtained by OLS by taking account of possible heterogeneity across municipalities.

It is well known that urban areas exist because individuals living and working there can achieve higher productivity levels, but empirical evidence showed in this paper illustrates that these benefits, although real, nowadays are used in a different way, given the counterurbanization process.

About policy implications that arise from our preliminary results, mainly it is possible to say that local characteristics should be taken into account when designing such policies, in view that the same local characteristic can affect in a different way the capacity of migrants' attraction according to the size of each municipality.

References

- Anselin, L. (1988): *Spatial Econometrics: Methods and Models*, Springer.
- Antolin, P. and Bover, O. (1997): "Regional Migration in Spain: The Effect of Personal Characteristics and of Unemployment, Wage and House Price Differentials Using Pooled Cross-Sections", *Oxford Bulletin of Economics and Statistics* **59**: 215-235.
- Arauzo-Carod, J.-M. (2007): "Determinants of population and jobs at a local level", *Annals of Regional Science* **41**: 87-104.
- Arauzo-Carod, J.-M. and Manjón-Antolín, M. (2012): "(Optimal) Spatial Aggregation in the Determinants of Industrial Location", *Small Business Economics*, forthcoming.
- Bover, O. and Arellano, M. (2002): "Learning about migration decisions from the migrants: Using complementary datasets to model intra-regional migrations in Spain", *Journal of Population Economics* **15**: 357-380.
- Carlino, G. and Mills, E. (1987): "The determinants of county growth", *Journal of Regional Science* **27 (1)**: 39-54.
- Chi, G. and Marcouiller, D.W. (2012): "Isolating the Effect of Natural Amenities on Population Change at the Local Level", *Regional Studies*: forthcoming.
- Chi, G. and Ventura, S.J. (2011): "An Integrated Framework of Population Change: Influential Factors, Spatial Dynamics, and Temporal Variation", *Growth and Change* **42 (4)**: 549-570.
- Chi, G. and Zhu, J. (2008): "Spatial Regression Models for Demographic Analysis", *Population Research and Policy Review* **27**: 17-42.
- Colwell, P.F.; Dehring, C.A. and Turnbull, G.K. (2002): "Recreation demand and residential location", *Journal of Urban Economics* **51**: 418-428.
- Cushing, B. (1987): "A note on the specification of climate variables in models of population migration", *Journal of Regional Science* **27**: 641-649.
- Deitz, R. (1998): "A joint model of residential and employment location in urban areas" *Journal of Urban Economics* **44**: 197-215.
- Fuguitt, G. and Beale, C. (1996): "Recent trends in nonmetropolitan migration: toward a new turnaround?", *Growth and Change* **27**: 156-174.
- Freeman, D.G. (2001): "Sources of fluctuations in regional growth", *Annals of Regional Science* **35**: 249-266.

- Fuguitt, G. and Brown, D. (1990): "Residential preferences and population redistribution", *Demography* **27**: 589-600.
- Getis, A. and Aldstadt, J. (2004): "Constructing the spatial weights matrix using a local statistic", *Geographical Analysis* **36(2)**: 90-104.
- Greenwood, M.J. (1975): "Research on Internal Migration in the United States: A Survey", *Journal of Economic Literature* **13 (2)**: 397-433.
- Greenwood, M.J. and Hunt, G.L. (1989): "Jobs versus amenities in the analysis of metropolitan migration", *Journal of Urban Economics* **25**: 1-16.
- Greenwood, M.J. and Stock, R. (1990): "Patterns of change in the intrametropolitan location of population, jobs, and housing: 1950 to 1980", *Journal of Urban Economics* **28**: 243-276.
- Greenwood, M. (1975): "Research on internal migration in the United States: a survey", *Journal of Economic Literature* **13**: 397-433.
- Hernández, A. and León, C.J. (2012): "Determinants of Internal and External Immigration to the Canary Islands", *Regional Studies*, forthcoming.
- Hierro, M. (2009): "Modelling the dynamics of internal migration flows in Spain", *Papers in Regional Science* **88 (3)**: 683-693.
- Kupiszewski, M.; Durham, H. and Rees, P. (1998): "Internal Migration and Urban Change in Poland", *European Journal of Population* **14**: 265-290.
- Leichenko, R.M. (2001): "Growth and Change in U.S. Cities and Suburbs", *Growth and Change* **32**: 326-354.
- LeSage, J.P. (2004): "A family of geographically weighted regression models", in L. Anselin, R. Florax and S. Rey (eds.), *Advances in Spatial Econometrics: Methodology, Tools and Applications*, Springer.
- Mathur, V.J. and Song, F. (1995): "The dynamics of regional populations and employment growth", *Review of Urban and Regional Development Studies* **7**: 70-88.
- Mills, E.S. and Price, R. (1984): "Metropolitan suburbanization and central city problems", *Journal of Urban Economics* **15 (1)**: 1-17.
- Moran, P. (1948): "The interpretation of statistical maps", *Journal of the Royal Statistical Society* **59**: 185-193.

Muth, R.F. (1968): "Differential growth among large U.S. cities", in Quirk, J.P. and Zarley, A.M. (eds.), *Papers in quantitative economics*, University of Kansas: Lawrence.

Muth, R.F. (1971): "Migration: chicken or egg?", *Southern Economic Journal* **37**: 295-306.

Nivalainen, S. (2004): "Determinants of family migration: short moves vs. long moves", *Journal of Population Economics* **17**: 157-175.

Royuela, V.; Moreno, R. and Vayá, E. (2010): "Influence of Quality of Life on Urban Growth: A Case Study of Barcelona, Spain", *Regional Studies* **44 (5)**: 551-567.

Shields M.; Goetz S. and Wang Q. (2005): "Out-migration from the Northeast US: the relative roles of economic and amenity differentials". In Green, G.; Deller S. and Marcouiller, D. (Eds.), *Amenities and Rural Development: Theory, Methods, and Public Policy*, 78–94, Edward Elgar: Northampton, MA.

Smith, S.; Tayman, J. and Swanson, D. (2000): *State and Local Population Projections: Methodology and Analysis*, Kluwer/Plenum: New York.

Stilwell, J. and García Coll, A. (2000): "Inter-provincial Migration of the Spanish Workforce in 1988 and 1994", *Regional Studies* **34 (7)**: 693-711.

Reibel, M. (2007): "Geographic Information Systems and spatial data processing in demography: A review", *Population Research and Policy Review* **26**: 601-618.

Rickman, D.S. and Rickman, S.D. (2011): "Population Growth in High-Amenity Nonmetropolitan Areas: What's the Prognosis?", *Journal of Regional Science* **51 (5)**: 863-879.

Romaní, J.; Suriñach, J. and Artís, M. (2003): "Are Commuting and Residential Mobility Decisions Simultaneous?: The Case of Catalonia, Spain", *Regional Studies* **37 (8)**: 813-826.

Royuela, V.; Moreno, R. and Vayá, E. (2010): "Influence of Quality of Life on Urban Growth: A Case Study of Barcelona, Spain", *Regional Studies* **44 (5)**: 551-567.

Smith, S.; Tayman, J. and Swanson, D. (2000): *State and Local Population Projections: Methodology and Analysis*, Kluwer/Plenum: New York.

Steinnes, D. (1982): "Do 'people follow jobs' or do 'jobs follow people'? A causality issue in urban economics", *Urban Studies* **19**: 187-192.

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 5: Spatial autocorrelation of independent variables

Variables	Moran's I	P-value
POP	0.0166	0.0010
DEN	0.0937	0.0010
CAP	0.0036	0.1710
SEA	0.0594	0.0010
ISA	0.0306	0.0010
LOC	0.0714	0.0010
MIG*	0.0187	0.0010

*MIG is referred to the total number of migrants and not to this number relative to the population.

Source: own calculations.

Table 6: regression results (OLS + QR)

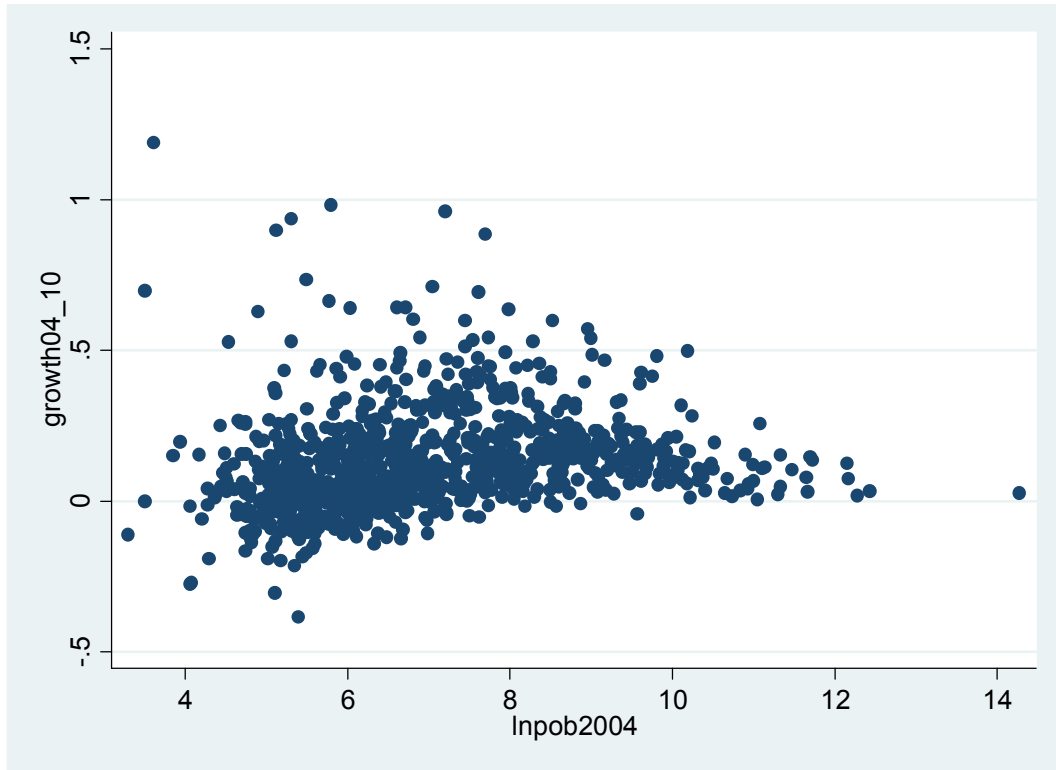
	OLS	OLS_spatial	QR_spatial (0.15)	QR_spatial (0.25)	QR_spatial (0.5)	QR_spatial (0.75)	QR_spatial (0.9)
DEN	-0.000** (0.00)	-0.000*** (0.00)	-0.000** (0.00)	-0.000 (0.00)	-0.000*** (0.00)	-0.000** (0.00)	-0.000 (0.00)
CAP	-0.048 (0.04)	-0.009 (0.04)	0.031 (0.03)	0.012 (0.02)	0.010 (0.03)	-0.014 (0.04)	-0.100 (0.08)
SEA	0.141*** (0.03)	0.089*** (0.03)	0.048 (0.04)	0.023 (0.02)	0.065** (0.04)	0.124** (0.07)	0.149* (0.10)
DIS	-0.000** (0.00)	0.000 (0.00)	0.000 (0.00)	0.000* (0.00)	0.000 (0.00)	-0.000 (0.00)	-0.000 (0.00)
SER	0.087* (0.04)	0.124*** (0.04)	0.010 (0.05)	0.029 (0.05)	0.146*** (0.03)	0.209*** (0.07)	0.389*** (0.15)
SME	-0.183*** (0.04)	-0.133*** (0.04)	-0.111** (0.05)	-0.084*** (0.04)	-0.086*** (0.03)	-0.146* (0.06)	-0.238* (0.07)
ISA	-0.058 (0.06)	0.015 (0.06)	-0.130* (0.05)	-0.111 (0.04)	0.024 (0.04)	0.099 (0.10)	0.305 (0.19)
LOC	-0.001** (0.00)	-0.002** (0.00)	-0.000 (0.00)	-0.001 (0.00)	-0.001 (0.00)	-0.002 (0.00)	-0.002 (0.00)
W_SEA		0.772*** (0.21)	0.756*** (0.16)	0.983*** (0.16)	0.846*** (0.11)	0.823* (0.32)	0.065** (0.31)
W_ISA		0.074 (0.59)	0.758 (0.52)	0.839 (0.50)	0.352 (0.59)	-0.485 (1.07)	-2.790 (1.44)
W_MIG		0.000** (0.00)	0.000*** (0.00)	0.000*** (0.00)	0.000** (0.00)	0.000 (0.00)	0.000 (0.00)
_cons	0.689*** (0.05)	0.470** (0.22)	0.079 (0.19)	0.069 (0.19)	0.252 (0.21)	0.689 (0.42)	1.654*** (0.43)
R2 adjusted	0.063***	0.102***					
Pseudo R2			0.096	0.094	0.080	0.069	0.074
N	946	946	946	946	946	946	946

Table 7: interquartile regression results (QR)

	QR_15_25	QR_25_5	QR_5_75	QR_75_9	QR_15_9	QR_25_75
DEN	0.000*	-0.000*	-0.000	0.000	-0.000	-0.000*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
CAP	-0.020	-0.002	-0.024	-0.086	-0.132	-0.026
	(0.02)	(0.03)	(0.04)	(0.05)	(0.10)	(0.04)
SEA	-0.024	0.042	0.059	0.025	0.102	0.101
	(0.02)	(0.03)	(0.07)	(0.09)	(0.09)	(0.07)
DIS	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
SER	0.018	0.117***	0.064	0.180	0.379**	0.181**
	(0.05)	(0.05)	(0.06)	(0.14)	(0.16)	(0.09)
SME	0.028	-0.003	-0.060	-0.092	-0.127	-0.062
	(0.03)	(0.03)	(0.07)	(0.10)	(0.07)	(0.09)
ISA	0.019	0.135**	0.075	0.207	0.435**	0.210*
	(0.06)	(0.05)	(0.07)	(0.16)	(0.20)	(0.11)
LOC	-0.000	-0.001	-0.001	0.000	-0.001	-0.001
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
W_SEA	0.226	-0.136	-0.023	-0.758	-0.691*	-0.160
	(0.18)	(0.11)	(0.25)	(0.51)	(0.44)	(0.31)
W_ISA	0.081	-0.486	-0.837	-2.305*	-3.548***	-1.323
	(0.40)	(0.68)	(0.86)	(1.46)	(1.57)	(0.86)
W_MIG	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
_cons	-0.010	0.183	0.436	0.965**	1.575***	0.620
	(0.14)	(0.24)	(0.32)	(0.47)	(0.59)	(0.33)
N	946	946	946	946	946	946

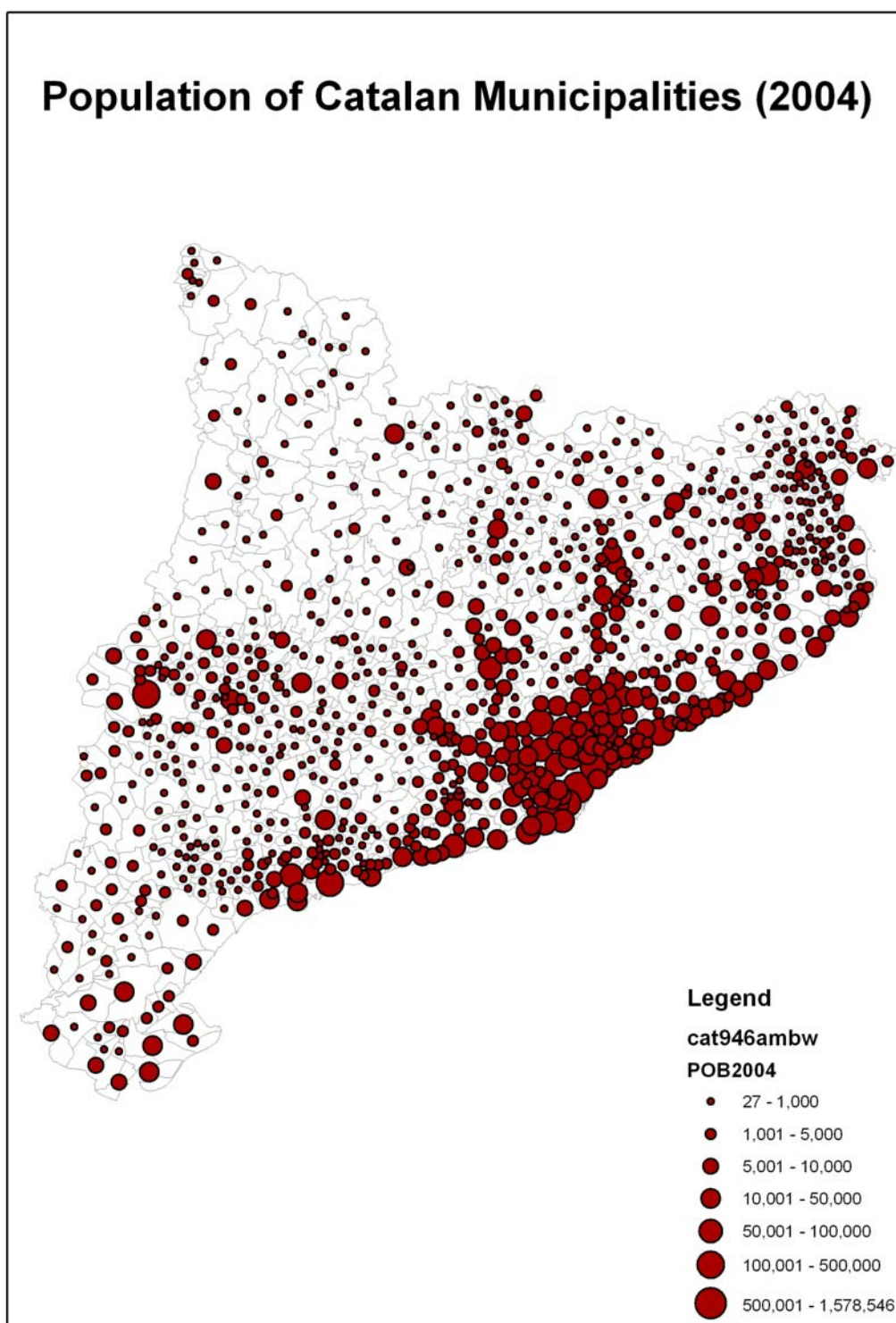
Figures

Graph 1: Relationship between population in 2004 and population growth in 2004-2010



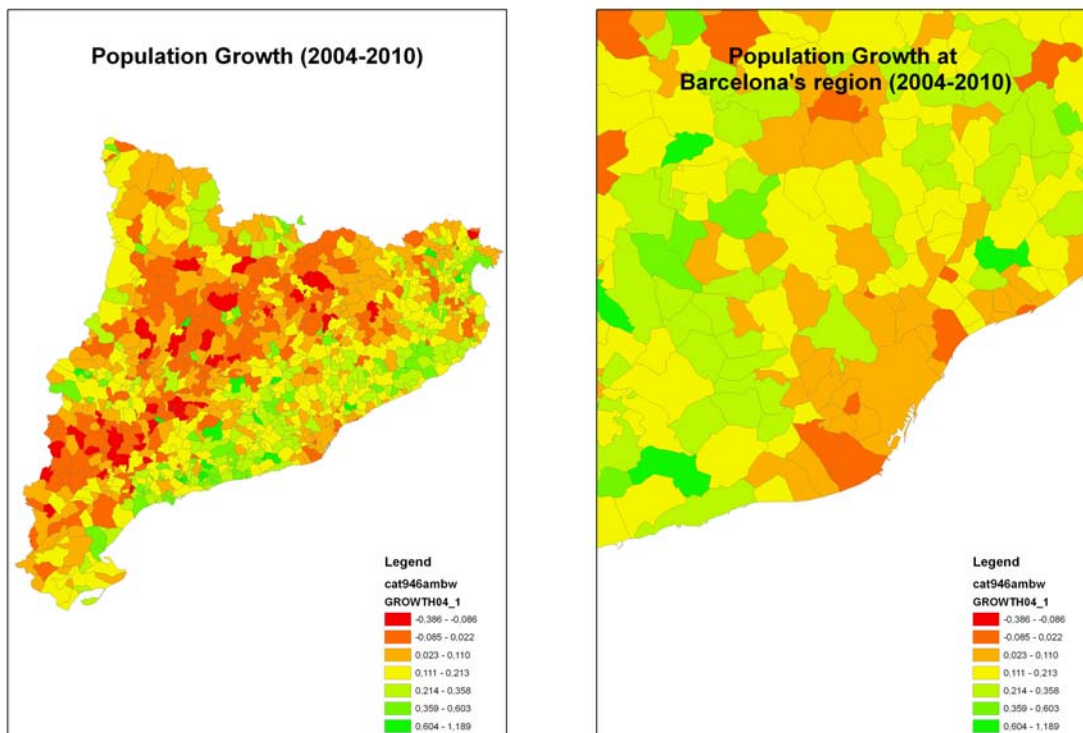
Source: own elaboration with data from IDESCAT.

Map 1



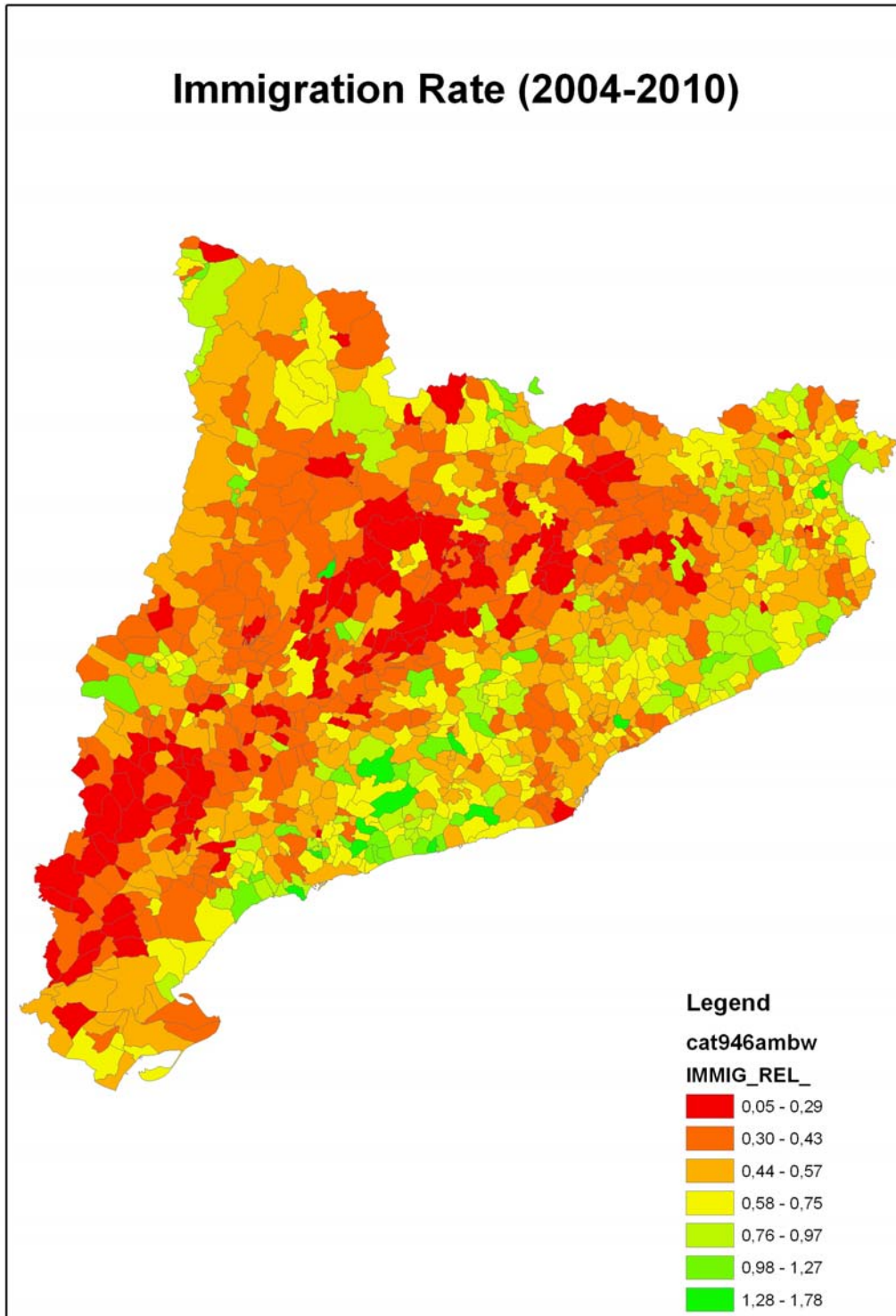
Source: own elaboration with data from IDESCAT.

Map 2: Population growth between 2004 and 2010



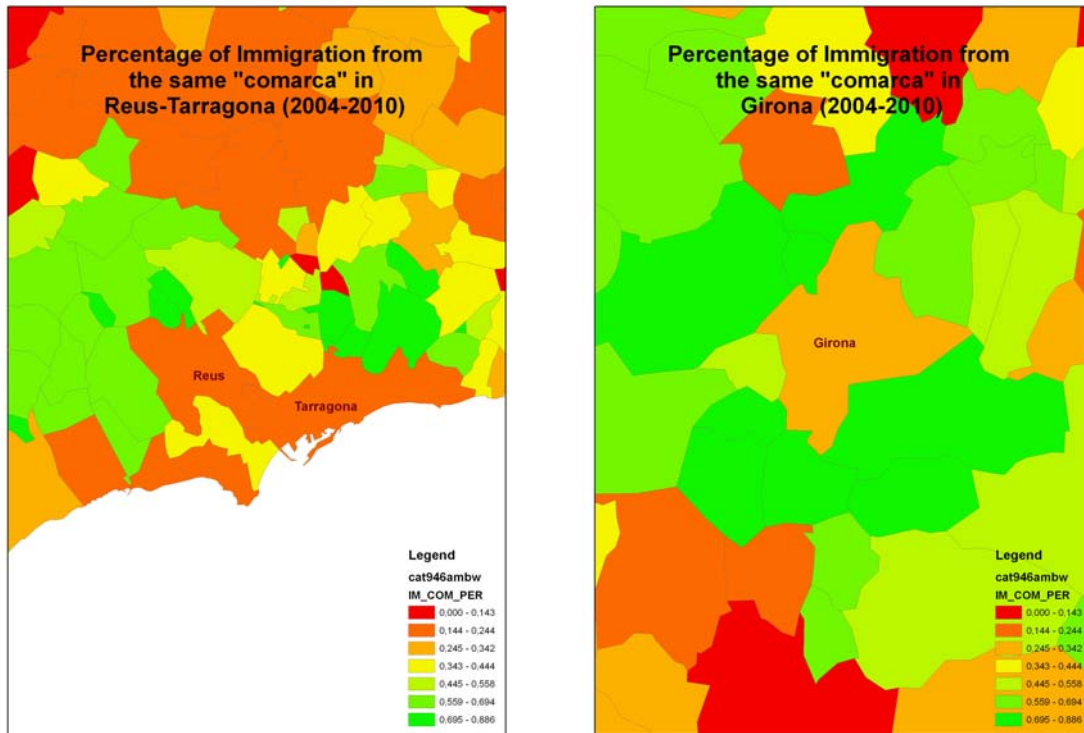
Source: own elaboration with data from IDESCAT.

Map 3



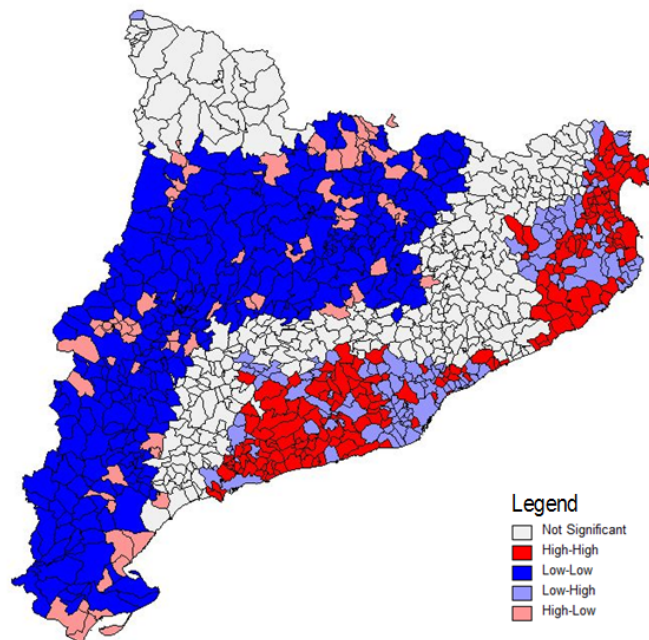
Source: own elaboration with data from IDESCAT.

Map 4: Some examples of urban-rural shift



Source: own elaboration with data from IDESCAT.

Map 5: Local Spatial Autocorrelation (LISA) of Immigration Rate (2004-2010)



Source: own elaboration with data from IDESCAT.

Annexes

Table A.1: Explanatory variables: definition and sources

Variables	Definition	Source
MIG	Migration ratio (cumulated migration between 2004-2010 relative to population in 2004)	IDESCAT
DEN	Population density (2004)	IDESCAT
CAP	Dummy variable indicating if the municipality is a "comarca" capital (1: yes, 0: no)	Own elaboration
SEA	Dummy variable indicating if the municipality is at sea-side (1: yes, 0: no)	Own elaboration
DIS	Distance to the nearest city with a population of at least 100,000 inhabitants	ICC
SER	Percentage of workforce at the service industries (2004)	IDESCAT
SME	Percentage of workers at SMEs firms (up to 49 employees) (2004)	IDESCAT
ISA	Measure of industry specialization (2004)	Trullén and Boix
LOC	Number of new manufacturing plants located between 2001 and 2003	REIC
W_SEA	Spatial lag of SEA	Own elaboration
W_ISA	Spatial lag of ISA	Own elaboration
W_MIG	Spatial lag of MIG	Own elaboration

Source: own calculations.