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# FACTORS DRIVING THE POPULATION GROWTH AND DECLINE OF PORTUGUESE CITIES

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**ABSTRACT** Despite the worldwide trend of urbanisation, data reveal that some cities are growing whereas others are losing inhabitants. To assess such dynamics in Portuguese cities, demographic, employment, housing, and climate variables were analysed as possible drivers of population change for the period 1991–2011. Panel data models show that higher shares of employment in the secondary and tertiary sectors, higher maximum temperatures, and a higher proportion of middle-aged vacant houses act as pull factors attracting inhabitants, whereas a higher unemployment rate is a push factor for cities.

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# 1 **Introduction**

2 Cities that have achieved economic success tend to attract new inhabitants, and thus  
3 demographic growth is often related to economic growth (Begg 1999; Lutz 2001;  
4 Storper and Manville 2006). Cities with economic growth usually show an increase in  
5 the amount of accumulated wealth available for redistribution, better job opportunities,  
6 and a higher quality of life (Bhatta 2010; Blanc, Cahuzac, and Tahar 2008) by creating  
7 the conditions that are needed for businesses to become established (Hansen and  
8 Niedomysl 2009) and for public amenities to be provided (Kourtit, Nijkamp, and  
9 Scholten 2015). Jointly with economic opportunities, the provision of affordable  
10 housing (RWI 2010; Sasser 2010) and a friendly environment with pleasant climatic  
11 conditions (Cheshire and Magrini 2006; Rappaport 2007) also attract inhabitants into  
12 cities. Although some pull and push factors of cities may have universal relevance,  
13 some factors appear to differ territorially (e.g., Guimarães *et al.* 2016; Royuela, Moreno,  
14 and Vaya 2010). Therefore, identifying the specific factors that attract inhabitants into  
15 particular cities has become increasingly relevant for policy purposes.

16 The process of urbanisation has been prevalent in Portugal since the 1960s, as it  
17 has in most other parts of the world. The percentage of the Portuguese population living  
18 in cities was 23% in 1960 and 30% in 1981, subsequently rising to 43% in 1991 and to  
19 44% in 2011<sup>(i)</sup> (calculations based on INE – Portuguese National Statistics). However,  
20 despite the city-based population increasing as a percentage of the national total, not all  
21 cities have increased the number of their inhabitants. In fact, about one-fifth of  
22 Portuguese cities registered the reverse process of population decline between 1991 and  
23 2011 (Alves *et al.* 2016).

24 Although drivers of population growth and decline have been analysed in other  
25 countries (e.g., Rappaport 2003; Stansel 2011, for the US; Bosker and Marlet 2006, for

1 Europe), there are no known studies investigating these dynamics in Portugal.  
2 Moreover, with the exceptions of Ubareviciene, Van Ham, and Burneika (2016), for  
3 declining regions of Lithuania, and Ferguson (2005), for local Canadian communities,  
4 studies that have evaluated the impact of economic opportunities on population  
5 migration have not analysed how each economic sector evolves and how the changes in  
6 these sectors influence the choice of city of residence. Therefore, our study helps to fill  
7 these gaps in the Portuguese context and serves as an empirical case study for an  
8 approach that can be transposed to other realities.

9 The aim of the present study is to contribute to identifying the major drivers that  
10 explain why Portuguese cities have grown or declined. To this end, several empirical  
11 models are specified to relate city population growth to a set of variables that may affect  
12 each city's attractiveness as a place to live. Such variables include the active population  
13 (i.e., working-age inhabitants, 18–65 years old), the share of employment *per* economic  
14 sector (primary, secondary, or tertiary), the unemployment rate, the proportion of vacant  
15 dwellings in the housing stock and their corresponding age, and climatic characteristics.

16

## 17 **Literature Review**

18 In most countries of the world, an increasing number of individuals are living in  
19 cities. Economic transformations related to globalization, climate change, and the  
20 concentration of public facilities in large agglomerations in order to exploit scale  
21 economies all help explain the movement of inhabitants from rural or less urbanised  
22 areas into cities (Duranton and Puga 2004; Seto, Sánchez-Rodríguez, and Fragkias  
23 2010). The process of urbanisation is based largely on the fact that urban areas tend to  
24 have more jobs for skilled workers and higher wages (Blanc, Cahuzac, and Tahar 2008)

1 as well as improved public services and higher levels of social well-being  
2 (Panagopoulos, Duque, and Dan 2016).

3 Despite this tendency for population to be increasingly concentrated in or around  
4 cities, growing cities go hand in hand with declining cities (Cadwallader 1991). As a  
5 result of demographic transitions such as increased life expectancies and decreased birth  
6 rates, data reveal the existence of cities with increasing proportions of older residents  
7 and, more surprisingly, cities that are losing inhabitants. In fact, despite the rise of urban  
8 agglomerations, Turok and Mykhnenko (2007) found that the growth of European cities  
9 generally slowed down between 1960 and 2005.

10 Migration tends to be related to employment opportunities, and a causal  
11 relationship between employment and population growth is commonly observed (IOM  
12 2011; Lutz 2001; Storper and Manville 2006). As such, migration is often explained by  
13 the search for employment (Hunt 1993; Kourtit, Nijkamp, and Scholten 2015). Cities  
14 that are more economically active generate more job opportunities and emerge as more  
15 appealing places to live (Ferguson 2005; Panagopoulos, Duque, and Dan 2016),  
16 especially for those individuals of working age and in particular for the creative class  
17 (Blanc, Cahuzac, and Tahar 2008; Hansen and Niedomysl 2009). Moreover, individuals  
18 and families tend to locate themselves where the chances of finding jobs are maximised  
19 (Storper and Manville 2006). In Germany, Arntz, Gregory, and Lehmer (2013) found  
20 that the movements of working-age individuals across regions are driven mainly by  
21 differences in employment prospects. Even small changes in labour demand and in  
22 productivity are determinants of a persistent inflow of population into a city (Rappaport  
23 2004). In contrast, a high concentration of unemployment undermines population  
24 growth (Ubareviciene, Van Ham, and Burneika 2016) by causing higher levels of social  
25 deprivation (Andersen and van Kempen 2003). Accordingly, individuals and

1 households tend to choose places with low unemployment rates (Bhatta 2010; Hunt  
2 1993), with the need for employment being a driver of out-migration and city  
3 population decrease (Hoekveld 2012).

4 Despite the lack of studies addressing the impact of sectoral employment on  
5 population growth, an increase in the number of jobs in the industry and service sectors  
6 is expected to be a factor favouring in-migration, as these sectors are concentrated in  
7 cities (Annez and Buckley 2009). The exploitation of agglomeration economies  
8 provided by cities (Duranton and Puga 2004; Fujita and Thisse 2002) offers the right  
9 environment for the development of high-technology and creative industries as well as  
10 of financial and innovative services (Couch, Sykes, and Börstinghaus 2011; European  
11 Commission 2006, 2007), which has increasingly brought newcomers into cities. The  
12 only authors who have explicitly considered the influence of economic sectors on  
13 population movements in their studies are Ferguson (2005) and Ubareviciene, Van  
14 Ham, and Burneika (2016). The former author found for local Canadian communities  
15 that industry diversity has a positive effect on population growth whereas agricultural  
16 and resource extraction sectors have a negative effect. The latter authors examined the  
17 economic factors that explain population change in Lithuanian regions and found that  
18 populations are likely to expand in areas with increasing employment in the services  
19 sector and to decrease in areas with a high proportion of employment in the agricultural  
20 sector.

21 Together with economic attraction factors, the affordability of housing has also  
22 been found to be a major factor in migration flows (Sasser 2010). The number of vacant  
23 houses also seems to play an important role in both attracting and repelling inhabitants.  
24 Depending on the state of preservation (i.e., the condition) of the vacant houses, a city  
25 can be either an appealing location or a place from which to move. Two types of

1 vacancy are identified by Fielder and Smith (1996), namely, “transaction vacants” and  
2 “problematic vacants”, with houses of the latter type being in poor states of repair and  
3 expected to remain vacant. In more general terms, those cities that better reflect  
4 households’ housing needs more commonly show urban growth, with both affordability  
5 and the availability of new houses playing important roles. According to the Second  
6 State of European Cities Report (RWI 2010), the existence of affordable, high-quality  
7 housing may constitute an advantage for city population growth, in particular for  
8 smaller cities, thus partially negating disparities between small cities and large cities in  
9 income and poverty. Bhatta (2010) points out that the lack of affordable housing impels  
10 households to live in the areas surrounding cities (the outskirts), thus promoting urban  
11 sprawl.

12 Other factors influencing the quality of life in cities are also vital for encouraging  
13 in-migration or for preventing out-migration. One such factor is the process of de-  
14 industrialization due to the post-Fordist transformation that has affected the old  
15 industrial cities of Europe, a major consequence of which is the abundance of  
16 abandoned sites and empty houses (Friedrichs 1993; Oswalt 2005). Along with  
17 economic transformation, the phenomenon of suburbanization has also been a major  
18 driver of population decline in European cities. Suburbanization occurs when families  
19 choose to live outside the city in order to find more spacious or cheaper houses than are  
20 available in the city centre (Hesse 2006; Partridge, Ali, and Olfert 2010), thus  
21 generating inner cities that contain increasingly impoverished neighbourhoods and  
22 abandoned dwellings.

23 An out-migration of inhabitants may also occur when climatic factors challenge  
24 the quality of life. Rappaport (2007) found that temperatures play a role in the way that  
25 city populations evolve. By analysing the average maximum temperatures in January

1 and July for US counties from the 1880s to the 1990s, that author found that lower  
2 maximum and higher minimum temperatures helped explain patterns of population  
3 growth. Cadwallader (1991) discovered for US cities between 1975 and 1980 that the  
4 level of climatic attractiveness was greater in growing cities. For Europe, Cheshire and  
5 Magrini (2006), considering the former EU-12 countries, did not find any evidence that  
6 weather influenced mobility between countries but did find it relevant for mobility  
7 within countries, whereby “warm days” measured by an upper value of heat, dryness, or  
8 sunshine favour higher city population growth. In contrast, Mykhnenko and Turok  
9 (2008) studied Eastern European cities but failed to find any difference in population  
10 growth between cities in the sunnier, southern parts of Europe and those located in the  
11 cooler, northern parts.

12

### 13 **Portugal: Population, Housing, Employment, and Climate**

14 From 1991 to 2011, the population of Portugal increased from 9.87 to 10.56  
15 million inhabitants (INE – Statistics Portugal). Of Portugal’s 158 cities, 146 are located  
16 on the mainland, 7 in the Madeira Archipelago, and 5 in the Azores Archipelago. The  
17 146 mainland cities are distributed with 54 in the northern part of the country, 43 in the  
18 central part, and 49 in the southern part. In 2011, 44% of the resident population lived in  
19 cities and, relative to 1991, most of the cities had increased in population. The  
20 population of these growing cities increased by 25%, meaning that a net total of  
21 630,000 inhabitants moved to live in such cities between 1991 and 2011.

22 Despite the prevalence of cities that grew between 1991 and 2011, 31 cities  
23 showed population loss in that period, with 14 cities displaying a persistent decline  
24 (both decades). Moreover, during those two decades, Portugal’s two biggest cities,  
25 Lisbon and Oporto, experienced population declines of 17.4% and 21.5%, respectively.



1 Although the number of cities that are losing inhabitants is small, the fact that the  
2 country's two main cities are included within the 31 shrinking cities means that these  
3 shrinking cities overall lost 225,000 inhabitants between 1991 and 2011.

4 Considering the Portuguese division into regions according to the Nomenclature  
5 of Territorial Units for Statistics (NUTS III), whereby 29 out of 32 regions have cities,  
6 there is a diversity in the territorial distribution of cities growing and declining in  
7 population (1991–2011). Variation is also found when the changes in the number of  
8 inhabitants of cities and in the municipalities in which the cities are located are  
9 compared. Figure 1 shows this territorially heterogeneous distribution of growing and  
10 shrinking cities according to growing/shrinking regions and municipalities.

11 (Figure 1 here)

12 Portuguese cities also exhibit a wide diversity in size. In 2011, 8.2% (13) cities  
13 had fewer than 5,000 inhabitants, 20.3% (32) had 5,000–10,000 inhabitants, 60.8% (96)  
14 had 10,000–50,000 inhabitants, 6.3% (10) had 50,000–100,000 inhabitants, and 4.4%  
15 (7) had more than 100,000 inhabitants. The average size of Portuguese cities is 29,000  
16 inhabitants, meaning that Portuguese cities are relatively small when compared with the  
17 average size of European cities. Even the capital Lisbon, with 548,000 inhabitants in  
18 2011, can be considered only a medium-sized city on a European scale.

19 The population growth between 1991 and 2011 varied widely between cities.  
20 Caniço, on Madeira Island, increased by 240% (from 6,900 to 23,400 inhabitants), the  
21 maximum positive change, whereas Oporto, the second-most-populous city in the  
22 country, declined by 21.5% (from 302,500 to 237,600 inhabitants). On average,  
23 between 1991 and 2011, the population in Portuguese cities grew by 9%, but when only  
24 the growing (declining) cities are considered, they increased (decreased) on average by  
25 25% (13%). Considering the average growth of the growing cities, 48 have values

1 above the average and 79 have values below. Figures 2 and 3 show the locations of  
2 mainland growing cities with rates above and below average, respectively, and Figure 4  
3 shows the locations of cities that are declining in population (1991–2011).

4 (Figures 2, 3, and 4 here)

5 Between 1991 and 2011, the changes in the number of inhabitants in Portugal's  
6 cities were also accompanied by increases in the employment rate of between 38% and  
7 45%. Given the diversity in the size of Portuguese cities, rates of employment and  
8 unemployment also vary significantly between them. During this 20-year period  
9 (considering observations for 1991, 2001, and 2011), the cities presented an average  
10 unemployment rate of 7.6%, ranging from 18.7% in 2011 for Ponte de Sôr, a shrinking  
11 city, to 0.9% in 1991 for Chaves, a growing city. In Portuguese cities, the tertiary sector  
12 dominates employment, and the secondary sector is the second-most-important sector,  
13 although its importance decreased from 35.8% of all jobs in 1991 to 24.9% in 2011.  
14 Urban employment in the primary sector decreased from 6.8% in 1991 to 2.4% in 2011.

15 In 2011, the average number of houses in a city was 15,900, 13.4% of which were  
16 vacant (i.e., uninhabited). The oldest houses (>30 years of age) and the most recently  
17 constructed houses (<10 years of age) were the age categories that included a higher  
18 proportion of vacant houses (both 16%), whereas only 8.5% of the houses that are 10–  
19 30 years old were vacant.

20 Climatic conditions also vary between cities. Cities located near the coast are  
21 favoured by mild temperatures with narrow amplitudes, whereas cities in the hinterland  
22 have higher maximum and lower minimum average temperatures. The average  
23 temperature of Portuguese cities is 15.5°C, with Moura (an inland city with a long  
24 history of population decline) displaying the highest average temperature (21.3°C). The  
25 85 cities (54%) that have an average temperature below the national average (14.1°C)

1 are located mostly along the Portuguese coast. Above-average temperatures are  
2 experienced by 73 cities, located mostly in the hinterland areas, with an average  
3 temperature of 17.0°C. These values suggest that in most cities, the amplitude of  
4 temperature is relatively small. However, the difference between maximum and  
5 minimum temperatures ranges from 14.8°C in Mêda (an inland shrinking city in the  
6 central part of the country) to 4.1°C in Horta (an island of the Azores Archipelago). On  
7 average, the difference between the maximum and minimum temperatures for  
8 Portuguese cities is 9°C.

9

## 10 **Data and Methodology**

11 The ‘city’ is a recent statistical category in Portugal. Only since 2003 have  
12 resident population figures for cities started to be reported. More recently, in the 2011  
13 census, other data were also made available by city (e.g., population by age,  
14 employment, and number of houses, among others); however, such data do not allow  
15 comparisons to be made with the past as corresponding figures are unavailable for the  
16 censuses of 1991 and 2001. Other geographical configurations are more common in  
17 Portuguese statistics, including geographical areas according to the NUTS scheme,  
18 municipalities, parishes, and other smaller territorial units. However, none of these  
19 geographical configurations matches with the ‘city’, although the closest one is the  
20 parish. Therefore, and because some of the variables used in the empirical models  
21 described below are not available at the city level for all three censuses (1991, 2001,  
22 and 2011), the ‘city’ in all cases is considered as the sum of the predominantly urban  
23 parishes that compose it. The information on the parishes that are part of each ‘city’ is  
24 available online as a result of the 2013 parish reorganization that was undertaken in  
25 Portugal. Therefore, data presented regarding the ‘city’ are in fact an approximation

1 based on the boundaries of the constituent parishes. A comparison of the values of data  
2 available for ‘cities’ with those of the urban parishes that compose them for 2011 shows  
3 that the differences are small and not detrimental to the analysis.

4 A database was constructed for each city for the period 1991–2011, based on the  
5 corresponding 2011 parishes. Thus, the consistency of the analysis was ensured as cities  
6 were constructed with constant boundaries over time. Data from censuses before 1991,  
7 by parish, for all the considered variables, were not electronically available, limiting the  
8 analysis to the 20-year period for which electronic collection of data was feasible  
9 (1991–2011).

10 Data for resident population by parish were collected from the 1991, 2001, and  
11 2011 censuses. Taking into consideration the characteristics analysed in the studies  
12 reviewed, the other collected data measured: 1) total employment, and employment in  
13 each sector; 2) unemployment; 3) the housing stock, taking into consideration the ages  
14 of houses; 4) vacant houses, also distinguishing their ages; and 5) maximum and  
15 minimum temperatures. All the data were retrieved from the Statistics Portugal database  
16 (<https://www.ine.pt>) and correspond to census observations from 1991 to 2011, apart  
17 from climatic data, which were retrieved from the website <http://pt.climate-data.org>.  
18 The data refer to each of the current 158 Portuguese cities.

19 To explain the population growth of Portuguese cities, linear regression models  
20 were estimated, with the dependent variable ( $Y$ ) being defined as the percentage change  
21 in city population between censuses (termed  $dPop$ ). Since data are available from three  
22 censuses, for each city there are two observations on  $Y$ , and therefore econometric  
23 models appropriate for panel data are used. Because some of the explanatory variables  
24 are time invariant, the following random effects model was estimated:

$$25 \quad Y_{it} = x_{it}\beta + \alpha_i + u_{it},$$

1 where  $x_{it}$  is the vector of explanatory variables observed for city  $i$  in year  $t$ , with  $i =$   
2  $1, \dots, 158$  and  $t = 2001, 2011$ ;  $\beta$  is the vector of the parameters of interest;  $\alpha_i$  are city-  
3 specific effects; and  $u_{it}$  is the idiosyncratic error term.

4 The vector  $x_{it}$  comprises three different types of explanatory variables: economic  
5 activity, housing stock, and temperature. Concerning economic activity,  $x_{it}$  includes the  
6 following variables for each city: the share of the population who are of working age  
7 (*ActPop*); the rate of unemployment (*Unemp*); and the shares, taken with respect to the  
8 total active population, of the labour force employed in the primary sector (mainly  
9 agriculture and fishing, *LfEmp1*), in the secondary sector (mainly industry and  
10 construction, *LfEmp2*), and in the tertiary sector (mainly services, *LfEmp3*). These  
11 economic variables, along with the housing and climate variables, were considered as  
12 regressors in the estimation of a first model (Model 1). The labour force share variables  
13 were subsequently replaced by the shares of jobs in the primary and secondary sectors  
14 with respect to total employment (*JEmp1* and *JEmp2*) in the estimation of a second  
15 specification (Model 2).

16 Regarding the housing stock of each city, the following variables are included: the  
17 share of vacant houses in the total housing stock between two consecutive censuses  
18 (*VacancyRate*); the proportion of old houses (>30 years old) that are vacant  
19 (*OldVacant*); the proportion of middle-aged houses (10–30 years old) that are vacant  
20 (*MidVacant*); and the proportion of new houses (<10 years old) that are vacant  
21 (*NewVacant*).

22 Finally,  $x_{it}$  also includes time-invariant climate-related variables for each city,  
23 namely, the average monthly maximum temperature (*MaxTemp*) and the average  
24 monthly minimum temperature (*MinTemp*).

1 Unlike the dependent variable, which is defined as a growth rate, all economic  
2 and housing variables are measured in shares, taken at the beginning of each 10-year  
3 period (1991 and 2001). Clearly, the starting values of these variables in a given period  
4 may be important conditioning factors for city population changes during the following  
5 decade. Another reason for using shares for measuring the explanatory variables is to  
6 reduce the potential for simultaneity bias. Indeed, the growth rates of the economic and  
7 housing variables are expected to be influenced by population changes. For example,  
8 changes in the number of dwellings and vacant houses are likely to be predicted by  
9 changes in population. Using shares observed at the beginning of each period instead of  
10 growth rates for  $x_{it}$  should eliminate this endogeneity problem.

11 To assess the suitability of each model, the RESET test was applied. While the  
12 RESET test is typically used for testing functional form assumptions, it is, in fact, a  
13 general test for model mis-specification, including random effects, fixed effects, and  
14 endogeneity issues. For example, Ramalho and Ramalho (2012) showed that the  
15 RESET test is able to detect a wide range of mis-specifications, including the omission  
16 of relevant covariates, heteroskedasticity, covariate measurement error, response  
17 misclassification, endogenous stratification, and missing data. Therefore, if the RESET  
18 test fails to reject the hypothesis of correct specification of a given model, one can be  
19 reasonably confident that a sound econometric model, from a statistical point of view, is  
20 being used. The versions of the RESET test implemented in this paper used two fitted  
21 powers of  $x_{it}\beta$  in the associated auxiliary regressions.

22 The coefficients of the explanatory variables and of the RESET tests were  
23 obtained using the software package STATA.

24 Table 1 reports the means and other statistics for the dependent variable and  
25 explanatory variables.

1  
2 TABLE 1. DESCRIPTIVE STATISTICS FOR THE DEPENDENT VARIABLE AND  
3 EXPLANATORY VARIABLES.

Variable	Obs.	Mean	St. Dev.	Min	Max
dPop	316	9.99	14.58	-15.79	101.69
ActPop	316	52.47	3.54	38.35	67.58
Unemp	316	5.61	1.95	0.85	12.45
LfEmp1	316	4.26	5.20	0.20	50.36
LfEmp2	316	29.62	14.88	3.47	86.45
LfEmp3	316	51.39	13.08	10.59	118.55
JEmp1	316	5.18	6.33	0.24	57.11
JEmp2	316	34.09	14.69	11.10	80.50
VacancyRate	316	11.12	3.50	2.84	28.93
OldVacant	316	13.30	5.08	2.69	37.08
MidVacant	316	8.98	4.04	1.28	27.88
NewVacant	316	11.72	5.07	1.35	34.35
MaxTemp	316	20.12	2.15	15.10	29.20
MinTemp	316	10.95	2.34	3.70	17.00

4  
5 **Results and Discussion**

6 Table 2 reports the coefficients of the explanatory variables for the random effects  
7 models specified in the previous section (Model 1 and Model 2). The respective results  
8 of the RESET test show that both models can be considered to be correctly specified.  
9 Based on the usual significance levels (1%, 5%, and 10%), the results of Model 1 show  
10 that the main drivers explaining city population growth are the variables unemployment  
11 rate (*Unemp*), shares of employment in the secondary (*LfEmp2*) and tertiary (*LfEmp3*)  
12 sectors, middle-aged vacant houses (*MidVacant*), and maximum temperature  
13 (*MaxTemp*).

14 Table 2 reveals that the higher the rate of unemployment, the lower the city  
15 population growth. This result suggests that the dynamics of population change and the  
16 economic strength of a city are directly related to the generation of employment.  
17 Citizens follow job opportunities, and, as such, cities with higher employment rates are

1 more appealing for prospective residents. Conversely, high unemployment rates impel  
 2 households to find other cities. This result agrees with the literature, in which  
 3 employment works as a pull factor (Arntz, Gregory, and Lehmer 2013; Hunt 1993)  
 4 whereas unemployment acts as a push factor (Bhatta 2010; Hoekveld 2012).

5

6 TABLE 2. DETERMINANTS OF POPULATION CHANGE IN PORTUGUESE

7

CITIES.

	Model 1	Model 2
ActPop	0.196 (0.297)	0.177 (0.304)
Unemp	-1.834*** (0.584)	-1.836*** (0.581)
LfEmp1	-0.067 (0.222)	---
LfEmp2	0.171* (0.087)	---
LfEmp3	0.220** (0.096)	---
JEmp1	---	-0.296** (0.146)
JEmp2	---	-0.007 (0.072)
VacancyRate	-0.693 (0.924)	-0.671 (0.935)
OldVacant	-0.118 (0.325)	-0.125 (0.323)
MidVacant	1.549*** (0.417)	1.502*** (0.420)
NewVacant	0.033 (0.287)	0.006 (0.285)
MaxTemp	0.787* (0.413)	0.722* (0.429)
MinTemp	0.554 (0.544)	0.659 (0.559)
intercept	-32.960 (20.625)	-13.403 (19.416)
N. observations	316	316
RESET test	3.44	2.27

8  
 9  
 10  
 11

Note: Standard deviations are in parentheses below the respective coefficients; \*\*\*, \*\*, and \* denote variables or test statistics that are statistically significant at the 1%, 5%, and 10% levels of significance, respectively.



1           The results also corroborate the policies introduced by the governments of those  
2 Portuguese municipalities that have been declining in population in recent years in  
3 attempts to avoid the population loss. Such policies have been based mostly on  
4 incentives directed towards the attraction or retention of a business fabric to improve or  
5 maintain jobs. Policies based on tourism and handicraft activities have been particularly  
6 supported (see Panagopoulos and Barreira 2012). Indeed, while the proportion of  
7 working-age inhabitants does not seem to be a relevant factor for explaining changes in  
8 city populations, any measure aiming to reduce the unemployment rate of cities will be  
9 important for promoting population growth. Clearly, cities must be active in generating  
10 job opportunities if they want to attract new inhabitants.

11           Our results also show that higher shares of employment in the secondary and  
12 tertiary sectors are pull factors for Portuguese cities, leading to population growth. On  
13 the other hand, employment in the primary sector does not promote population growth  
14 in cities, supporting the previous findings of Ferguson (2005) and Ubareviciene, Van  
15 Ham, and Burneika (2016). Jobs in the primary sector pay lower-than-average wages,  
16 which may explain why cities creating job opportunities in the primary sector have  
17 failed to attract new inhabitants in a significant way. Moreover, because Portuguese  
18 cities, similar to most other cities around the globe, are places of agglomeration of  
19 industry and service activities (Annez and Buckley 2009), employment in the primary  
20 sector does not have enough relevance (representing on average just 4% of the labour  
21 force employed – see Table 1) to influence movements from rural and surrounding areas  
22 into cities. The most relevant economic sector in explaining population growth is  
23 employment in the tertiary sector (services), followed by employment in the secondary  
24 sector (industry), which reflects the economic structure of the Portuguese cities whereby  
25 more than half of the employment generated is in the tertiary sector (see Table 1).

1           To further examine the contribution of the employment profile to explaining  
2 population dynamics, Model 2 was estimated. The only difference compared with  
3 Model 1 is the definition of the sectoral employment variables. In Model 1, the shares  
4 were calculated over the total active population, so increasing the share of a sector by a  
5 percentage point implies decreasing the share of the active population not employed by  
6 the same amount. In Model 2, the shares of employment in each sector were calculated  
7 relative to total employment (see descriptive statistics in Table 1), which means that the  
8 shares of the three sectors sum to unity. Thus, only the shares of jobs in the primary and  
9 secondary sectors are explicitly included in the regression model ( $JEmp1$  and  $JEmp2$ ),  
10 and a percentage point increment in one of those sectors implies decreasing the share of  
11 employment in the tertiary sector by the same amount. The results show that policies  
12 aimed at increasing the importance of employment in the primary sector relative to the  
13 tertiary sector lead to city population decline. In contrast, jobs in the secondary and  
14 tertiary sectors may be interchanged without consequences for city population growth.  
15 Overall, the results of both models suggest that those cities that successfully made a  
16 transition from an economy characterized by a higher number of jobs in the agriculture  
17 sector to one relying mainly on industry and services became more attractive to citizens  
18 as places to work and live compared with other cities.

19           The proportion of vacant houses in a city does not significantly affect its  
20 population dynamics. However, cities with a higher share of middle-aged vacant houses  
21 appear to be more likely to exhibit population growth. A possible reason for this is that  
22 these houses to purchase or to rent are usually not as expensive as similar newer houses  
23 and tend to be in better condition than older houses, so cities with a higher proportion of  
24 such middle-aged houses available in the housing market are better placed to attract new  
25 inhabitants. Therefore, it is important to distinguish vacant houses that can enter the

1 market from those in poor condition whose entrance is less likely (Fielder and Smith  
2 1996). The absence of habitable houses or the existence only of houses that are too  
3 expensive (usually the newer ones) promotes urban sprawl, thus decreasing population  
4 in cities, in accordance with previous predictions (Bhatta 2010; RWI 2010).

5 Finally, climatic factors also seem to be relevant in explaining the population  
6 changes of Portuguese cities. In particular, cities with higher average maximum  
7 temperatures are more likely to have experienced population growth, but average  
8 minimum temperatures are not statistically significant. These results contrast with the  
9 literature (Rappaport 2007), which has identified higher minimum and lower maximum  
10 temperatures as pull factors for city population growth. A possible explanation for this  
11 difference may be the different ranges of temperatures observed in the studies.  
12 Rappaport (2007) considered the average maximum temperatures in January (5.2°C)  
13 and July (36.8°C) for the US. In contrast, the present study considered annual average  
14 monthly maximum temperatures for Portuguese cities, which show an overall average  
15 maximum temperature of 20°C with a standard deviation of approximately 2°C (see  
16 Table 1). Moreover, while in some countries low temperatures reach negative values on  
17 average, in Portugal the average minimum temperature is 11°C with a standard  
18 deviation of approximately 2°C. Thus, the results for the Portuguese cities are more in  
19 line with the findings of Cheshire and Magrini (2006) that warmer conditions favour  
20 city population growth.

21

## 22 **Robustness Checks**

23 As discussed above, Portuguese cities are very heterogeneous. On the one hand,  
24 these cities display a wide diversity in size, with almost 30% containing fewer than  
25 10,000 inhabitants. On the other hand, the phenomenon of suburbanization has led to

1 the growth of some cities but has promoted population decline in others, most notably in  
2 the two biggest cities, Lisbon and Oporto. Thus, to examine whether the aforementioned  
3 findings are generally applicable to the Portuguese context or, rather, they are valid only  
4 for specific groups of Portuguese cities, Model 1 was re-estimated for three sub-samples  
5 of the initial dataset.

6 Table 3 reports the results obtained for three distinct sub-samples of Portuguese  
7 cities. In the first two models, the smallest cities (less than 10,000 inhabitants) and the  
8 biggest cities (Lisbon and Oporto) were respectively dropped from the sample. Then, to  
9 examine the robustness of the results with respect to the suburbanization process that  
10 has affected the urban growth of some cities, in the third model all cities in the Lisbon  
11 and Oporto metropolitan areas were excluded from the sample.

12 In general, the factors identified above as the main drivers of city population  
13 changes remain important when each of the three aforementioned three groups of cities  
14 is dropped from the sample. In all cases when a group of cities is dropped, a higher  
15 proportion of employment in the tertiary sector and a higher share of middle-aged  
16 vacant houses are, as in Model 1, significant determinants of population growth in  
17 cities, and a higher unemployment rate is again a factor inducing population decline. In  
18 fact, when compared with Model 1, there are only minor changes in the estimation  
19 results, which concern only variables that were, or are now, marginally significant from  
20 a statistical point of view (10% level). Some of these changes may be a consequence of  
21 a reduced sample size, which decreases the precision of the estimation and therefore (in  
22 a statistical sense) makes it more difficult to obtain significant variables. Other changes  
23 may be the result of excluding cities with specific characteristics from the sample.

24

1 TABLE 3. DETERMINANTS OF POPULATION CHANGE IN SUB-SAMPLES OF  
 2 PORTUGUESE CITIES.

	Sample excludes		
	Cities of <10,000 inhabitants (1)	Lisbon and Oporto (2)	Lisbon and Oporto metropolitan areas (3)
ActPop	0.757* (0.422)	0.174 (0.300)	0.320 (0.323)
Unemp	-2.158*** (0.808)	-1.769*** (0.596)	-1.667*** (0.648)
LfEmp1	0.601 (0.392)	-0.111 (0.218)	-0.262 (0.187)
LfEmp2	0.127 (0.093)	0.154* (0.089)	0.106 (0.085)
LfEmp3	0.183** (0.092)	0.227** (0.099)	0.186** (0.090)
VacancyRate	-0.434 (1.219)	-0.668 (0.933)	-1.178 (1.047)
OldVacant	-0.126 (0.398)	-0.158 (0.328)	-0.068 (0.371)
MidVacant	1.465*** (0.521)	1.564*** (0.421)	1.810*** (0.475)
NewVacant	-0.157 (0.384)	0.011 (0.287)	0.116 (0.353)
MaxTemp	0.219 (0.463)	0.626 (0.416)	0.778* (0.418)
MinTemp	0.630 (0.691)	0.513 (0.545)	0.718 (0.575)
Intercept	-48.005* (27.630)	-27.607 (20.848)	-35.586* (21.331)
No. observations	226	312	264
RESET test	2.79	3.34	2.60

3 Note: \*\*\*, \*\*, and \* denote variables that are statistically significant at the 1%, 5%, and 10%  
 4 levels of significance, respectively.  
 5

6 When small cities are excluded from the sample (column 1 of Table 3), the  
 7 proportion of the population represented by working-age inhabitants becomes a  
 8 determinant of population growth. Thus, policies focused on the working-age  
 9 population, even when not related to the creation of employment opportunities, may  
 10 promote population growth in medium-sized and large cities. Moreover, the negative  
 11 effect on population growth of a high unemployment rate appears to be more relevant  
 12 for cities containing more than 10,000 inhabitants. In contrast, the creation of

1 employment in the secondary sector seems to be an important factor in the population  
2 growth of small and medium-sized cities (column 2 of Table 3). Finally, a higher  
3 maximum temperature appears to be a relevant driver of population growth only in  
4 cities outside the Lisbon and Oporto metropolitan areas (column 3 of Table 3). Clearly,  
5 these two larger cities have achieved a state where climate is no longer an influence on  
6 their population dynamics.

7

## 8 **Concluding Remarks**

9 This study examined the determinants that make some cities more appealing  
10 places to live compared with others. We tested whether explanatory variables related to  
11 employment, housing, and climatic conditions are drivers of urban population growth  
12 and decline, and found that greater employment opportunities in the secondary and  
13 tertiary sectors, a higher share of middle-aged vacant houses, and higher average  
14 temperatures favour population growth, whereas a higher unemployment rate helps to  
15 explain population decline.

16 To increase their populations, cities must be active in generating job  
17 opportunities. If those job opportunities are created mainly in the secondary and tertiary  
18 sectors, then cities will have a higher probability of experiencing population growth.  
19 Regarding the secondary sector, urban planners should contemplate promoting this  
20 sector in designated areas where the impacts on the landscape and on the environment  
21 are properly addressed. Technologies that are environmentally friendly and which lead  
22 to higher productivity would help to change the usual negative image associated with  
23 heavy industrial activity, and thus the implementation of high-technology industries  
24 should be favoured. Such technology-driven industries, which are associated with

1 promoting gains in the quality of life, should attract more workers and inhabitants to  
2 cities with industrial potential.

3 The share of middle-aged vacant housing is a pull factor for Portuguese cities,  
4 whereas old vacant housing, despite constraining population growth, does not have a  
5 significant effect on population evolution. The irrelevance of old vacant housing as a  
6 push factor of cities might be due to the underlying process of shrinkage in Portugal,  
7 which is at an early stage. In other countries, where the shrinkage phenomenon is more  
8 evenly distributed geographically, such as the US and Germany (Haase *et al.* 2012;  
9 Mallach 2011), the existence of old vacant houses seems to have a more important role  
10 in pushing away inhabitants, compared with the case of Portugal, which has encouraged  
11 the adoption of house-demolition policies.

12 Cities with higher average temperatures emerge as being more appealing places to  
13 live compared with other cities. However, cities in the same region reveal different  
14 patterns regarding the capability of attracting inhabitants. This reinforces the importance  
15 of the other factors affecting city population growth as revealed by the regression  
16 models, namely, those related to the economic activity of the city and the affordability  
17 of housing.

18 The process of urbanisation across the globe shows different patterns. While  
19 population growth in the cities of Europe and North America accelerated in the  
20 nineteenth century, most had stabilized by the mid-twentieth century, and others are  
21 continuing to urbanise, as in the Portuguese case (source: World Bank 2016). However,  
22 because of the decreasing fertility rate, most European countries are likely to experience  
23 a decline in population in the near future, thus increasing the likelihood of having a  
24 wider dichotomy between cities gaining inhabitants and cities losing them. This paper  
25 highlights that distinguishing these two processes, one of growth and one of decline, is

1 not an easy task. Governments will need to conceive new policies and planning  
2 approaches to deal with these different realities.

3 To further understand the differences found between the dynamics of population  
4 growth and decline, future work would also need to consider some subjective indicators  
5 of urban quality, such as inhabitants' emotional attachment to their cities and the level  
6 of residential satisfaction. Such an analysis would help to more accurately define  
7 suitable policies for dealing with the realities of city shrinkage and with the differences  
8 in population decline/growth between cities.

9

10

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#### NOTES

<sup>(i)</sup> These values are lower than the world and European values of about 50% and 70% of urban inhabitants, respectively. However, it should be noted that in Portugal, some towns do not have the status of ‘city’ in spite of having an urban profile and even in some cases a higher number of inhabitants (e.g., Gouveia is a city with around 3,000 inhabitants whereas Algueirão and Corroios are towns with approximately 66,000 and 47,000 inhabitants, respectively). When cities and towns are considered together, the urban population of Portugal in 2011 constituted more than 60% of the total population (World Bank 2016).

FIGURES

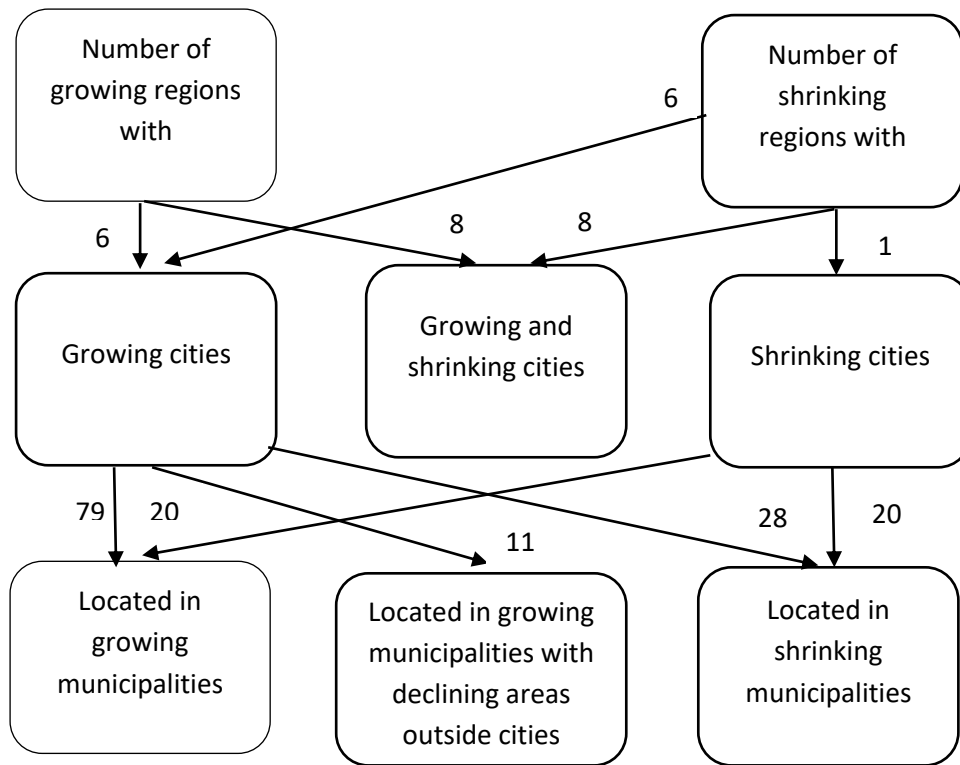


FIGURE 1. DISTRIBUTION OF GROWING AND SHRINKING CITIES BY GROWING/SHRINKING REGIONS AND MUNICIPALITIES

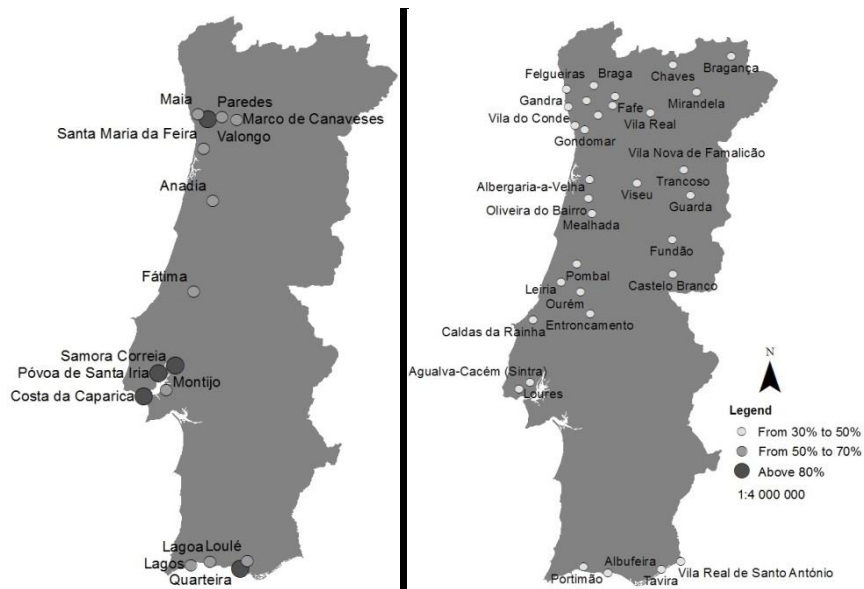
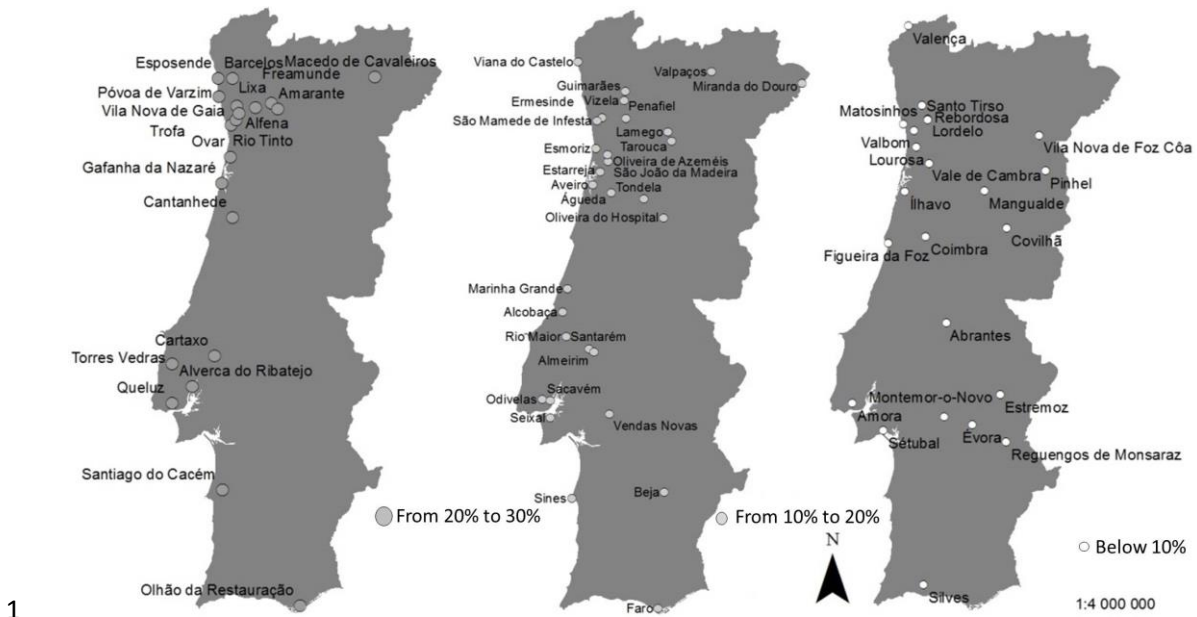


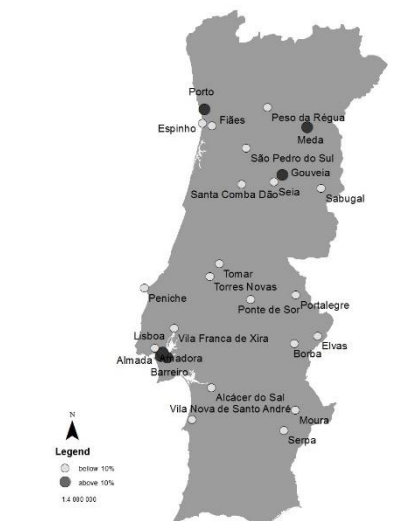
FIGURE 2. CITIES WITH HIGH (ABOVE-AVERAGE) POPULATION GROWTH IN PORTUGAL BETWEEN 1991 AND 2011.



1

2 FIGURE 3. CITIES WITH SLOW (BELOW-AVERAGE) POPULATION GROWTH  
 3 IN PORTUGAL BETWEEN 1991 AND 2011.

4



5

6 FIGURE 4. CITIES WITH POPULATION DECLINE IN PORTUGAL BETWEEN  
 7 1991 AND 2011.

8