MAPPING TERRITORIAL ATTRACTIVENESS USING A MULTIDIMENSIONAL INDEX: Findings on the Phenomenon of Littoralization in Spain

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Abstract:

The term "*territorial attractiveness*" has recently emerged in the literature as a fundamental concept that allows a better comprehension of depopulation processes, understanding that a territory is attractive when it possesses certain characteristics that contribute to attract and retain population in it.

Therefore, the aim of this research is to analyze the phenomenon of depopulation in Spain based on the construction of a Multidimensional Attractiveness Index for the 8131 Spanish municipalities. The Index, composed of a total of 41 variables and 7 dimensions, has been constructed following the Adjusted Mazziotta-Pareto Method (AMPI) using municipal data extracted from official sources.

The results provided demonstrate that the processes of demographic concentration and depopulation are not exclusively an urban-rural matter, but are also affected by other factors, such as the proximity to the coast. In fact, this paper shows evidence of the presence of a littoralization phenomenon in Spain, visible through the higher levels of attractiveness of coastal municipalities compared to inland ones.

1. Introduction

The aim of this research is to analyze the phenomenon of depopulation in Spain based on the construction of a Multidimensional Attractiveness Index for the 8131 Spanish municipalities. This index is composed of 7 dimensions and 41 variables, which incorporate the main data available at the municipal level that are related to the dynamics of attraction, retention and expulsion of population in the territories.

The results of this index allow us not only to analyze the attractiveness of each territory separately, which can be of great use in guiding policy decisions, but also to explore the existence of patterns in the way attractiveness scores are distributed across the country, in order to deepen the analysis of depopulation in Spain.

2. Theoretical framework

Due to their gregarious nature, humans have historically tended to concentrate in a small number of nuclei (Livi-Bacci, 1994), but in recent decades an unprecedented process of high demographic concentration has taken place, involving a number of externalities which are particularly harmful to the survival of many sparsely populated area (Camarero, 2020). The demographic concentration experienced in Spain has been particularly striking, being higher than that of the neighboring European countries (Banco de España, 2020), which has led to serious depopulation processes in an important part of its territory. This has made depopulation an issue of great national concern, both politically and academically.

Although migratory movements have undoubtedly been of great historical importance, in the current context, in which fertility has reached minimum values, the population dynamics of the territories depend more than ever on migration. In line with this idea, the term "*territorial attractiveness*" has recently emerged in the literature as a fundamental concept that allows a better comprehension of depopulation processes, understanding that a territory is attractive when it possesses certain characteristics that contribute to attract and retain population in it (Faugnerova & Hume, 2019).

Accordingly, from this perspective, depopulation can be considered a consequence of the lack of attractiveness of a territory, due to factors such as lack of services, job opportunities, communication infrastructure, etc., thus "pushing out" some of its residents to more attractive territories, which have more desirable attributes (greater supply of services, labor, etc.). Therefore, we can understand contemporary migratory movements under this prism of competition between territories, so, as Melece et al. point out, an essential part of territorial development research should aim to identify the roles played by different attributes in enhancing or reducing the attractiveness of territories (PoliRural, 2019); this will enable them to implement more effective strategies to improve their demographic situation.

Along these lines, the use of benchmark indicators is key in the context of decision making, as it makes it possible to monitor phenomena, identify trends, make comparisons and, above all, detect which aspects should be addressed as a priority (OECD, 2008). Given that territorial attractiveness is a multidimensional concept that is not fully captured by any individual variable, the need arises to construct composite indexes that summarize its different dimensions and components in an aggregate manner. Due to the lack of composite indexes that measure the territorial attractiveness of Spanish territories, this article presents a proposal for a Multidimensional Attractiveness Index for Spain, based on a comprehensive review of the literature on territorial attractiveness.

3. Methodology

3.1. Data:

Since internal migration patterns in Spain are mostly short-distance (Navarro-Azorín & Artal-Tur, 2015), when assesing the Spanish case the priority focus should be on the attractiveness of the territories at the local level and not so much at the regional level (Niedomysl, 2010). Taking this into account, the geographical unit chosen to construct the aggregate indicator is the municipality, since it is the smallest territorial level for which exhaustive data are available in Spain. The use of municipal data also has the advantage of making it possible to analyze relatively small portions of the territory, while at the same time opening up the possibility of calculating supra-municipal indicators by aggregating the data. Thus, the sample used for the construction of our Multidimensional Attractiveness Index is made up of the 8131 Spanish municipalities.

When selecting the variables to be included in the aggregate index, two main criteria have been followed: 1) they must be related to territorial attractiveness and 2) they must be available for all the municipalities, or if there are missing data, they must be few in number and easily imputable. This greatly reduces the range of possible variables, since there are many interesting issues for which information is not available at the municipal level, or which are only available for certain territories but not for others. Following these criteria, we have selected a total of 41 variables, whose data have been extracted from various official statistical sources, such as the National Institute of Statistics, the Center for Demographic Studies, the Spanish Chamber of Commerce, or the databases of different Ministries (Health, Education, etc.).

3.2. Aggregation:

The Index has been calculated by applying a method widely used in this type of context, which is the one developed by Mazziotta and Pareto in its adjusted version (abbreviated as AMPI). Although there are a multitude of methods that allow the construction of multidimensional indicators, the AMPI has been selected because it is a robust method whose calculation is simple and transparent, which is easily interpretable and also allows comparisons between territories and/or periods (Mazziotta & Pareto, 2018). The construction of the indicators through this method requires the application of three successive phases: 1) the normalization of the variables on a 70-130 scale, where 100 corresponds to a reference value (in our case the average); 2) the aggregation of the variables to build the dimensions, which act as sub-indexes; and 3) the aggregation of the dimensions to build the global indicator.

Following the AMPI method, the Multidimensional Attractiveness Index has been constructed through a total of 7 dimensions, each focusing on an aspect considered relevant from the point of view of territorial attractiveness: 1) demographics, 2) economy, 3) general services, 4) health services, 5) educational services, 6) communications and 7) environment. This differentiation by dimensions, together with the global index, allow us to analyze the situation of each territory in greater depth.

3.3. Analysis:

In order to analyze the results and extract relevant findings from the attractiveness scores, several multivariate analysis and geostatistical techniques have been applied using different tools (ArcGIS Pro, R, SPSS, Tableau…). The methods employed for this purpose range from classical techniques like regressions to more specific analyses such as spatial autocorrelation.

Although a significant number of external variables have been considered during the research, in this article we mainly show the findings related to a dichotomous variable that indicates whether a municipality is located in the coast or not.

4. Preliminary findings

The results of the Multidimensional Attractiveness Index allow us to explore the unequal situation of Spanish municipalities in terms of territorial attractiveness. One of the most striking findings is that nearly three out of every five municipalities have scores below 100, while the number of territories with very high values (>115) does not even reach 600. This indicates that although there are municipalities that score high in the vast majority of the variables, most territories show deficiencies in some areas of attractiveness. This shows the existence of a concentration of favorable attributes in a small number of (mainly urban) territories, while municipalities currently or potentially affected by the phenomenon of depopulation in Spain are numerous.

Another finding that can be deduced from the Index is the existence of a significant territorial imbalance in Spain, which is clearly visible in Figure 1: even though there are municipalities in each Spanish province that experience some lack of attractiveness, some regions mostly enjoy good scores in the index, while others concentrate a high number of municipalities that experience serious attractiveness problems. Therefore, it is clear that while depopulation is an issue of great national interest, there are some regions that are considerably more affected by it than others.

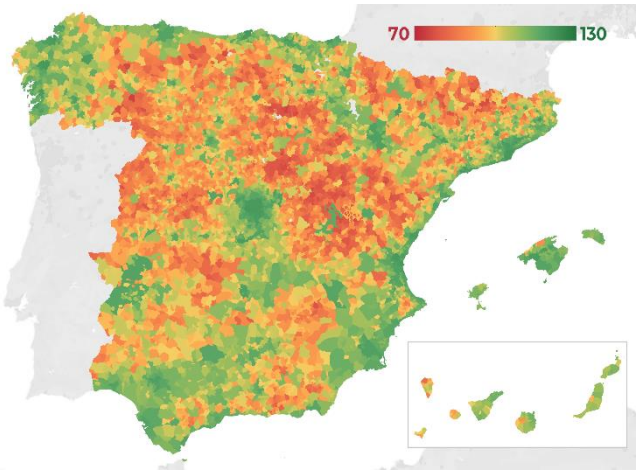

Figure 1. Spanish municipalities' scores in the Multidimensional Attractiveness Index.

We can confirm that geographically close municipalities tend to show similar levels of attractiveness in Spain by subjecting our data to spatial autocorrelation tests: Moran's I yields highly significant results ($p<0.001$) regardless of the neighborhood conceptualization used, and reaches a high value of 0.74 when considering only bordering municipalities as neighbors. This is to be expected due to the high presence of distance variables in the Index (i.e. access time to a hospital), but the dimensions that do not include these types of variables, such as the demographic or economic sub-indexes, also show significantly positive spatial autocorrelations.

In this regard, an analysis of statistically significant hot and cold spots using the Getis-Ord Gi* statistic corroborates the existence of clearly differentiated clusters of attractiveness in the country. Figure 2 shows a significant concentration of low attractiveness scores in the interior of the peninsula, especially in the northern half, which contrasts with the high presence of hot spots of attractiveness in the surroundings of the main cities, in the islands and in the coastal strip.

The latter, together with Figure 3, evidence the existence of a marked pattern of attractiveness littoralization in Spain, as municipalities located on the coast tend to show higher levels of attractiveness than those located inland. In fact, the calculation of logistic regressions show that coastal municipalities have a much higher probability of achieving higher attractiveness scores than inland municipalities, as shown by the corresponding odd ratio (OR) values. Specifically, coastal territories are 63.1, 19.2 and 10.9 times more likely to have an attractiveness index above 85, 100 and 115 respectively than inland municipalities.

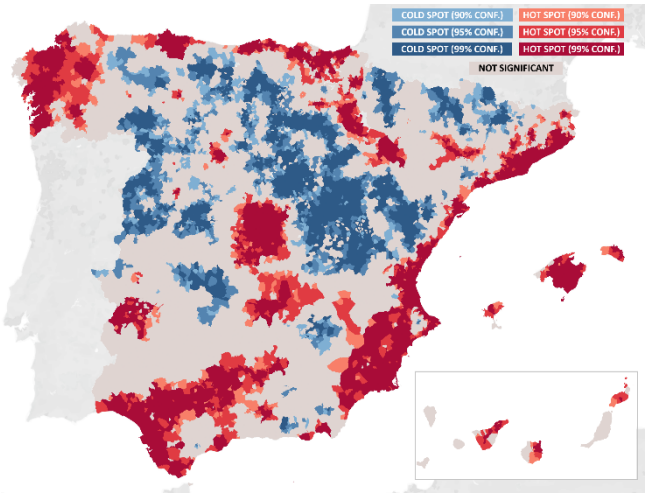

Figure 2. Results of the Hotspot analysis using queen contiguity.

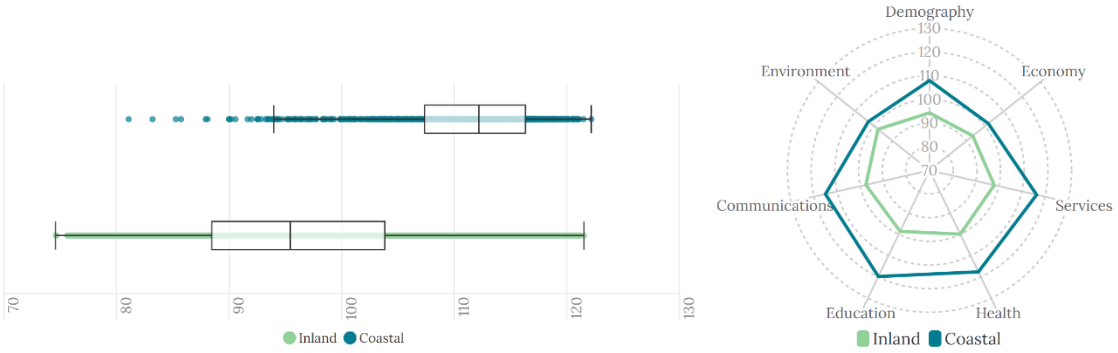

Figure 3. Comparison of the scores of coastal and inland municipalities in the multidimensional attractiveness index (left) and its dimensions (right, mean values are shown).

It is remarkable that the gap does not only occur at the global level, but is even maintained in each and every one of the seven dimensions included in the Index: coastal municipalities tend to show better demographic, economic and environmental conditions, at the same time as they are prone to enjoy a greater presence of services and communication infrastructures. From all this we can conclude that Spanish coastal territories show a greater capacity to attract and retain population in them, and therefore are less vulnerable to depopulation.

Furthermore, we need to take into consideration that, when introduced into a linear regression model, the inland/coastal variable appears as a highly significant predictor of attractiveness ($p<0.001$) even after controlling for population size, degree of urbanisation, average slope and metropolitan area membership. This finding suggests that the very proximity to the coast may act as an attractive factor in itself.

Our results are in line with the demographic reality of the country: currently one third of Spanish citizens live in municipalities with direct access to the sea, although these municipalities account for only 6% of the total (Goerlich & Mollá, 2021). This is also in line with what has been found in other territories, as the literature shows that population littoralization -the concentration of population in the coastal territories- is a noticeable phenomenon in countries with extensive coastlines, such as Portugal (Patacchini & Zenou, 2009), Italy (Oliva & Camarero, 2019), the United States (Rappaport & Sachs, 2003), Brazil (Marques & Hogland, 2004), Japan (Cicin-Sain et al., 1999) or Algeria (Ghodbani & Berrahi-Midoun, 2013).

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