

ACCESSIBILITY, POPULATION AGEING, AND FOREIGN PRESENCE: A FIRST INVESTIGATION ACROSS LOCAL HETEROGENEITIES IN ITALY

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ABSTRACT

Accessibility plays a crucial role in the overall dynamics of local development. In this regard, the interplay between accessibility and population dynamics at the local level represents a new and understudied subject in academic research in Italy. The present contribution proposes a preliminary assessment of accessibility and its relationship with two of the most relevant demographic processes in Italy: population ageing and foreign presence. Using official data provided by the Italian National Institute of Statistics, we explore the spatial distribution of two indicators of land accessibility – the indexes of potential and real accessibility – and relate them to the spatial distribution of indexes on population ageing and foreign presence. In doing so, we use a local scale of analysis and a spatial approach, two crucial aspects in the definition of analytical tools useful for setting up place-based policies.

KEY-WORDS

Territorial imbalances, local demography, potential and real accessibility, municipalities, spatial analysis.

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1. INTRODUCTION

Italy is characterised by marked geographical variability in relation to both demographic and socio-economic processes. These differences are amplified at the local level (Armenise *et al.*, 2022). Although some studies have shown that poor accessibility does not necessarily imply greater demographic and socio-economic vulnerability (Benassi *et al.*, 2021), it is widely recognised that a low level of accessibility is a major driver of the demographic decline of large areas in Italy, implying their progressive marginalisation and isolation (Reynaud *et al.*, 2020). The present contribution proposes an initial assessment of accessibility and its spatial relations with two of the most relevant demographic processes in Italy: population ageing and foreign presence. Using a local scale of analysis (i.e., municipality level), we explore the spatial distribution and identify local clusters related to accessibility, population ageing, and foreign presence. The results identify territorial taxonomies that could provide insight into accessibility and local demography, an area that is still relatively understudied in Italy. They also point out the crucial role played by accessibility, described as a “malleable form” of territorial capital, in reshaping population change at the local level.

2. THEORETICAL CONSIDERATIONS

The concept of accessibility is frequently utilised and plays a crucial role in the overall dynamics of local development (Rokicki & Stępnia, 2018). Building upon the pioneering work of Hansen (1959), the definition of accessibility emphasizes two key elements: reachable destinations from specific starting points and the attributes of the transportation system (Caschili *et al.*, 2013). The central concept is that accessibility can serve as a potential driver of opportunities (De Montis & Reggiani, 2012). This suggests that geographical areas with more efficient access to various locations may exhibit greater competitiveness compared to isolated areas. Empirically, measuring accessibility presents challenges. Typically, three measurement categories are used: 1) isochrones, which are based on the number of destinations reachable within a certain travel time/physical distance or costs perspective from a specific starting point; 2) gravity-based models, which assign penalties to harder-to-reach destinations; 3) individual-level models, which are grounded in individual utility (Vulevic, 2016).

A large number of studies have investigated the correlation between degrees of accessibility and economic indicators (Karou & Hill, 2014). The literature indicates that an increased degree of accessibility positively influences the economic growth of an area (Van den Heuvel *et al.*, 2014). As changes in accessibility could result in alterations to the economic conditions of a specific area, accessibility also plays a role in population growth. Alamà-Sabater *et al.* (2019) reveal that the lack of accessibility in certain rural areas within the Valencia region is associated with a higher risk of depopulation. In the same vein, Melo *et al.* (2021) explore the role of road accessibility in population changes in Portugal. Furthermore, regarding settlement patterns of the foreign or non-native population, the potential lack of transit could emerge as a facet of accessibility-related social exclusion (Vezina & Houle, 2017). Building upon this, a limited body of research examined the relationship between transport accessibility and the presence of immigrants, with findings indicating a positive correlation (Allen *et al.*, 2021).

In the context of Italy, it is widely recognised that a low level of accessibility serves as a significant driver of demographic decline in extensive areas of the country, contributing to their gradual marginalisation (Reynaud *et al.*, 2020). Nevertheless, to the best of our knowledge, studies on the accessibility and (local) demography of Italy are still few and limited.

3. METHODOLOGY

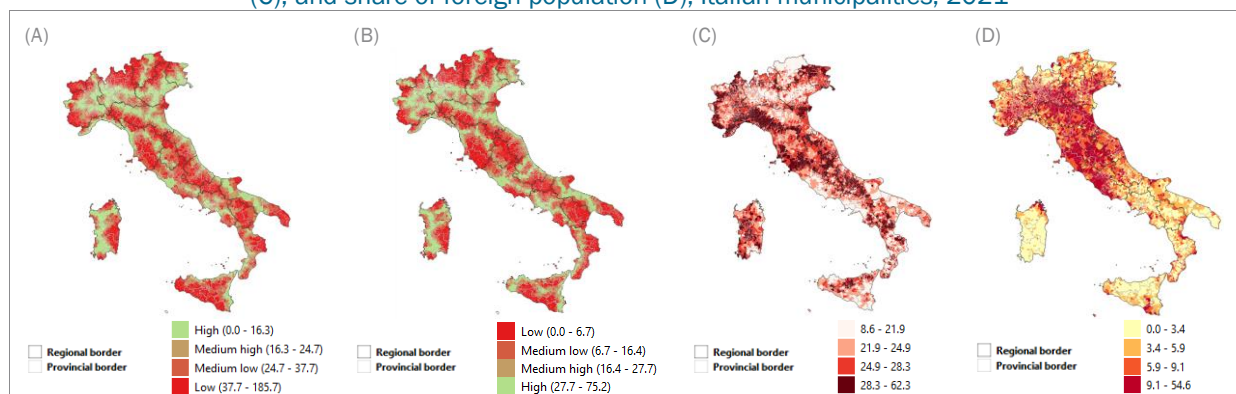
The data used in this study are provided by the Italian National Institute of Statistics (Istat) and consist in two different datasets. The first dataset pertains to the resident population categorized by age and country of citizenship. The second dataset was provided by Istat as part of a 2021

municipal-level study on accessibility to infrastructure nodes related to four transport networks: road, railway, maritime, and air (Istat, 2023). The analysis is carried out at the municipality level, encompassing almost 8,000 statistical units. The geographical data (shape files) for these municipalities were also provided by Istat. The demographic indices are related to the degree of population ageing (defined as the ratio of the resident population aged 65 and older to the total resident population) and the share of the foreign population (foreign resident population by country of citizenship to the total resident population). The combined analysis of these indicators, along with the accessibility indices, enables us to offer valuable insights into the relationships at the meso level between the accessibility of territories and the population indicators mentioned. Given the aims of this study, we focused on the motorway and rail transport networks. Istat computed two distinct accessibility measures for each municipality: the distance (in minutes) to reach the nearest infrastructure, defined as "cost to closest", and the opportunities offered by reaching the nearest infrastructure, as determined by the gravitational model. The first measure treats all infrastructures equally in terms of services and offerings, representing a form of "potential" land accessibility. The second measure considers the actual services and offerings provided by these infrastructures, influencing an individual's willingness to reach them. This latter measure represents a more accurate measure of "real" accessibility to land infrastructure¹. For a better comparison of the results, we utilised appropriate methods primarily based on max-min transformation, starting from Istat data. Initially, we created thematic maps of the different indexes computed, followed by an explorative spatial data analysis (ESDA). The latter analysis aimed to assess the global and local levels of bivariate spatial autocorrelation between the degree of accessibility (real or potential) and the level of ageing and/or attractiveness to foreign population. To achieve this, we computed both the global and local version of bivariate Moran's I index of spatial autocorrelation (Anselin *et al.* 2002), using the Queen contiguity matrix as the spatial weight matrix. The spatial autocorrelation analysis was conducted with GeoDa, while all the maps were created using Qgis.

4. RESULTS

Concerning the spatial distribution of the potential land accessibility index, Figure 1 (a) illustrates that high values tend to concentrate predominantly near major Italian cities such as Milan, Rome, Naples, Turin, and Florence, among others. Not surprisingly, there is a discernible gradual decline in accessibility levels as one moves away from these urban centres towards more remote areas. This trend is particularly pronounced when examining the "inner areas," which encompass municipalities situated near the Apennine Mountain chain and the mountainous border regions of the Alps.

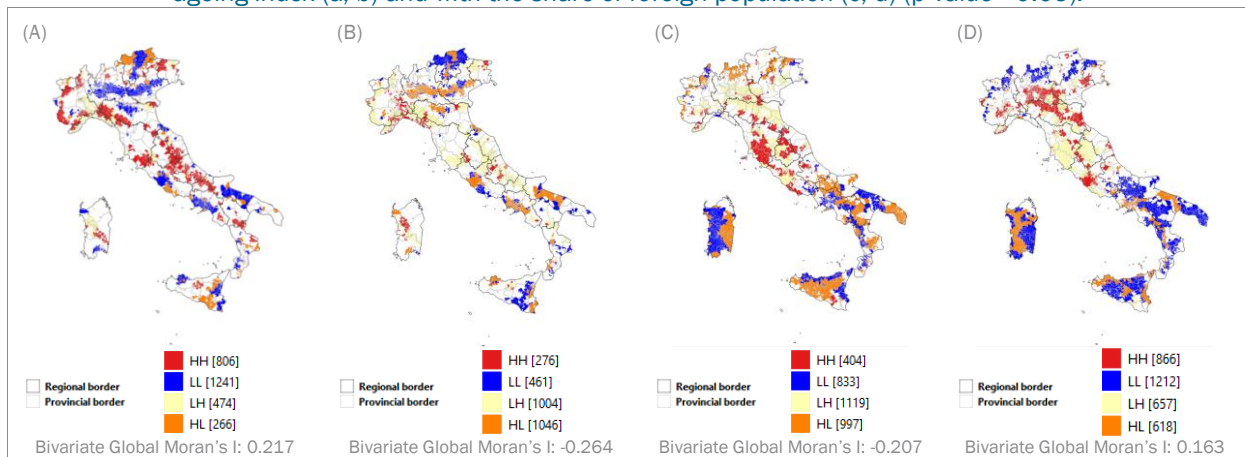
Figure 1. Thematic quintile maps of the land accessibility indices (potential (A) and real (B), ageing index (C), and share of foreign population (D), Italian municipalities, 2021



¹ Istat provided accessibility data for each of the 15 municipalities within the city of Rome, rather than for the municipality as a whole. To address this, we aggregated the accessibility measures for each municipality using a weighted average, with the population of each municipality serving as the weighting factor. Additionally, the municipalities of Lampedusa and Pantelleria were excluded from the analysis due to their significant distance from land infrastructure.

A similar pattern emerges in the case of the real land accessibility index (Figure 1, b). However, it is notable that the range of opportunities offered by increased accessibility extends over a broader radius than the physical presence of land infrastructure, such as rail and motorways. Regarding the spatial distribution of the ageing index (Figure 1, c), major Italian cities exhibit a population with lower levels of ageing. This trend is likely influenced by the availability of employment opportunities that attract a youthful demographic in search of work, both from other parts of Italy (internal migration) and from abroad (international migration) (Buonomo *et al.*, 2024). Turning to the share of foreign population, Figure 1 (d) reveals a clear North-South divide, with higher values concentrated in the northern part of the country. Particularly, these values are prominent near major cities and areas with a strong industrial presence. It is not a coincidence that these areas are considered the most dynamic regions of the country from both a demographic and economic perspective (Strozza *et al.*, 2016). Subsequently, we inspected how the degree of accessibility is spatially correlated with the demographic indices, with results shown in Figures 2. The global bivariate Moran's I coefficient between the potential land accessibility index and the ageing index is positive (0.217), indicating the presence of a moderate global positive spatial clustering between accessibility and ageing. Additionally, locally important heterogeneities emerge. These include local clusters of negative bivariate spatial autocorrelation, as observed, for example, between Rome and its surrounding area (Figure 2, a). An interesting cluster also emerges along the inner areas between Liguria and Emilia Romagna. Conversely, areas with lower travel times (indicative of higher potential accessibility) and lower ageing levels are observed near major cities and in most industrialized zones of the country. The global bivariate Moran's I coefficient between the real land accessibility index and the ageing index is instead negative (-0.264) (Figure 2, b). Its local version reveals a pattern in major Italian cities where high values for the land accessibility index coincide with low values for the ageing index. Conversely, in remote and inland areas of the peninsula, there is a prevalence of poor land accessibility in real terms, alongside a pronounced ageing population. Interestingly, the importance of suburban context emerges: the areas surrounding major cities tend to exhibit similarly high accessibility values in terms of achievable opportunities (real) and comparatively low levels of ageing among the resident population, underscoring the importance of the urban-suburban dimension (Salvati *et al.*, 2020).

Figure 2. Global and local bivariate Moran's I between land accessibility indices (potential and real) and the ageing index (a, b) and with the share of foreign population (c, d) (p-value <0.05).



Upon examining the spatial correlation between the degree of accessibility levels and the presence of foreign population (Figure 2, c and d), a significant North-South divide becomes apparent. Elevated values of the land accessibility index (both in terms of potential and real accessibility) and increased percentage of foreign population are observed in the central regions of Northern Italy. Conversely, a lower foreign population presence is documented in Southern Italy. In this context, the global bivariate Moran's I coefficient between the potential land accessibility index and the share of foreign population is negative (-0.207; Figure 2, b). This tendency seems to persist even in scenarios involving real land accessibility, although a small positive Global Mo-

ran's I index is observed (0.163; Figure 2, c).

5. DISCUSSION AND CONCLUSION

This study investigated the spatial distribution of two specific indicators of land accessibility recently proposed by the Italian National Institute of Statistics and examined their spatial correlations with population ageing and foreign presence.

Our findings indicate a spatial correlation between varying degrees of land accessibility and the ageing of the resident population at the municipal level. Territorial areas with higher land accessibility tend to spatially associate with regions characterized by lower levels of ageing among the resident population. Conversely, the most remote areas of the country characterized by lower levels of land accessibility are also those that are spatially associated with higher rates of ageing. This finding aligns with earlier studies (Alamà-Sabater *et al.*, 2019), which suggest that inadequate accessibility, especially in rural areas, plays a role in ageing depopulation trends. From this perspective, the central role of accessibility, as a modifiable territorial capital, emerges as a crucial factor in altering the ageing trends at the local level (Benassi *et al.*, 2021). Notably, our results also pointed out the importance of the suburban areas in the relationship between land accessibility and ageing: from a “real” point of view, the regions neighbouring major cities show comparably elevated accessibility levels in terms of feasible opportunities (real) and diminished levels of ageing among their resident populations, showing a potential implication of the urban-suburban dynamic. Finally, considering the share of foreign presence, it is worth noting that the spatial distribution of the foreign population in Italy seems to be spatially less related to specific levels of land accessibility. Instead, it appears closely tied to the economic and productive landscape of the region, concentrating predominantly on areas with robust economic activity and a large labour supply. This result is partially consistent with studies (Allen *et al.*, 2021) that found a relationship between immigrant settlement and accessibility levels, to the extent in which they highlight the role that the economic context can play in the decisions to settle (Lucas, 2012; Melo *et al.*, 2022). Several policy indications that include a combination of targeted support for ageing communities alongside regional development strategies can be provided. Prioritising investments in transport infrastructure, such as roads, railways, and public transit systems as well as initiatives such as age-friendly infrastructure is crucial. Additionally, given the role of land accessibility in shaping demographic trends, enhancing connectivity to remote and less accessible areas also has the potential to mitigate population ageing and drive economic growth, making these areas attractive to foreign populations.

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