# In-Between 'Smart' Urban Growth and 'Sluggish' Rural Development? Reframing Population Dynamics in Greece, 1940–2019

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**Abstract:** Multifaceted demographic dynamics have shaped population growth in Mediterranean Europe, reflecting a metropolitan cycle from urbanization to re-urbanization. To assess the distinctive impact of economic downturns on population dynamics, the present study illustrates the results of an exploratory analysis that assesses urban expansion and rural decline at various temporal scales in Greece, a peripheral country in southeastern Europe. Statistical analysis based on multivariate exploratory techniques outlined the persistent increase of regional populations, evidencing the distinctive role of agglomeration/scale with urbanization and early suburbanization phases (1940–1980) and accessibility/amenities with late suburbanization and re-urbanization phases (1981–2019). Recession accompanied (and, in some way, consolidated) the decline of agglomeration economies, leading to counter-urbanization in some cases. As an indirect result of counter-urbanization, the population increased more rapidly in low-density coastal areas with moderate accessibility and tourism specialization. Consistently, settlement expansion has altered the persistent gap in central and peripheral locations. A polarized urban hierarchy centered on the capital city, Athens, was replaced with a more diffused growth of medium-sized cities and attractive rural locations, depicting a new development path for lagging countries in the European Union and other socioeconomic contexts worldwide.

**Keywords:** polycentrism; socioeconomic resilience; recession; Mediterranean Europe

## 1. Introduction

With economic downturns influencing population structures and consolidating a spatially polarized distribution of jobs and activities, the spatial outcomes of demographic transitions diverged largely in affluent societies [1–4]. Scholars have frequently demonstrated how demographic change reflects socioeconomic processes exalting urban–rural divides [5–9]. In this regard, the city life cycle theory has been traditionally proposed with the aim at delineating and characterizing long-term metropolitan trends in advanced countries [10–13]. This theory describes four stages of urban development: urbanization, suburbanization, de-urbanization and re-urbanization

through the processes of concentration/de-concentration and growth/decline of entire functional urban regions [14–18]. However, a comprehensive investigation of metropolitan cycles linking, e.g., urbanization to suburbanization or counter-urbanization to re-urbanization [10–13] suggests that a linear interpretation of socioeconomic forces underlying population growth would be inappropriate to illustrate and understand regional demography patterns [19–21]. Apparent and latent mechanisms of population redistribution within countries and regions were investigated adopting multi-disciplinary approaches, distinctive indicators and refined statistical methodologies [22–25]. Economic downturns, internal and international migrations, social impulses, urban cycles, enhanced volatility in land and housing prices—together with the progressive gentrification of inner cities and latent social filtering in peri-urban areas—were recognized as factors responsible for complex (and less predictable) patterns of population redistribution over larger areas [26–28]. These forces have been investigated at different geographic levels, outlining (i) demographic dynamics that leverage heterogeneous impacts on population expansion under specific social contexts and (ii) economic processes influencing urban–rural demographic structures at wider spatial scales [29–32].

Although spatial inequalities persist at both continental and country scales, reducing territorial disparities and containing density divides were fundamental objectives of national strategies of regional development in European countries [33–35]. For instance, important divides have been observed among neighboring regions in Mediterranean Europe, providing a paradigmatic example of structural gaps that were (and still are) alimented by differential production structures [36–40], the unequal development of metropolitan hierarchies, asymmetric market-state interactions [41,42], demographic transitions and political instability [43–45]. Internal divides have been even more intense in regions with traditional economic structures and secularized sociocultural contexts, limited access to infrastructure and reduced accessibility, aging, fertility, unemployment, as well as low-quality human capital [21,46–51]. Analysis of territorial divides in population density has sometimes demised the role of external shocks shaping socioeconomic dynamics at local scales [52–54]. Assuming a variable impact of these shocks across regions [55–57], local systems were more (or less) able to resist short-term disturbances when confronted with long-term demographic shrinkage and economic stagnation. The intrinsic ability to overcome shocks was often demonstrated to depend on the socioeconomic diversification of local contexts. Earlier works have estimated the linkage between economic downturns, metropolitan cycles and population dynamics to identify the socioeconomic profile of demographically resilient regions [21] and desertification risk [58].

The combined effect of population dynamics at multiple spatial levels has been rarely investigated in light of demographic transitions, international migrations and metropolitan cycles, from urbanization to re-urbanization [59,60]. By reconnecting applied economics to regional demography, results of this analysis shed light on the latent mechanisms underlying territorial disparities and local systems' resilience. In this line of thinking, the present study identifies distinctive factors shaping population growth over different time windows. These findings may inform the design of fine-tuned development policies and spatial planning in Mediterranean Europe. Focusing on Greece, the present study specifically tests different models of population growth over both longer and shorter time scales, assuming a nonlinear evolution toward a complex metropolitan hierarchy with increasingly asymmetric spatial structures [61,62].

By this way, our work integrates a traditional investigation of metropolitan growth in Greece with a multitemporal analysis of population dynamics, reconnecting demographic processes over longer and shorter time scales. More specifically, our study adopted multiple statistical techniques prefiguring a comprehensive picture of population expansion (and shrinkage) in 51 Greek prefectures between 1940 and 2019. By deriving population dynamics from annual vital statistics, socioeconomic forces influencing demographic rebalance at the national scale were identified, contributing to a better knowledge of demographically resilient regions. The present study relates demographic growth with socioeconomic resilience of regional and local systems, classifying them on the base of long-term population expansion or decline. Socioeconomic resilience is an intrinsic property of

complex systems and was traditionally estimated using different indicators and approaches. In the present study, socioeconomic resilience was estimated according to long-term population dynamics. Considering a sufficiently long and representative time window, assumptions on the level of resilience of local districts and communities were delineated based on three different demographic contexts: (i) continuously attracting population, (ii) maintaining a stable population stock and (iii) losing population. By explaining (apparent and latent) mechanisms that underlie population redistribution and demographic restructuring over larger and larger regions [63–65], these contexts (i to iii) were hypothesized to be associated with a decreasing level of regional socioeconomic resilience.

## 2. Methodology

### 2.1. Study Area

Being partitioned in 51 districts ('nomoi' or prefectures) corresponding to the Eurostat NUTS-3 level, Greece (131,982 km$^2$) coincided with the area investigated in the present study. Prefectures in Greece are a sufficiently detailed administrative spatial level to evaluate changes in population distribution as a function of socioeconomic transition (Figure 1). The regions of Athens and Thessaloniki concentrate nearly 50% of the Greek population [66,67]. Medium-sized cities (Iraklio, Patras) and prefectural head towns (e.g., Larisa, Volos, Kalamata, Chania, Kavala, Ioannina) grew substantially [27,32]. By displaying population dynamics contrasting with what was characteristic of tourism-specialized districts in the Aegean region, marginal districts experienced diffused land abandonment, depopulation and economic decline [68].

### 2.2. Data and Indicators

The resident population was derived from ten-year censuses of population and buildings whose results were disseminated by the Hellenic Statistical Authority (ELSTAT, the former ESYE, National Statistical Service of Greece). The analyzed period encompasses eight decades between 1940 and 2019 reflecting a cycle from urbanization to re-urbanization with sequential economic expansion and stagnation waves. For a few prefectures, the population at the beginning of the study period (1940) was reconstructed using published census reports of population count at municipal and village scale for the respective geographic area or administrative region.

Despite small changes over time, census sources were widely selected in the analysis of long-term population dynamics at the regional scale. In our case, the population census was the most authoritative source of demographic information for Greece, being under the continuous scientific supervision and technical realization of the national statistical service since a very long time. An intermediate spatial scale of the investigation was selected (prefectures) to assure a refined comparison of demographic trends over time instead of more detailed domains (e.g., municipalities), which revealed sometimes less stable in the first two decades of study. Annual population growth rates over each decade (1940–1951, 1951–1961, 1961–1971, 1971–1981, 1981–1991, 1991–2001, 2001–2011, 2011–2019) were calculated and normalized subtracting the column mean and then dividing by the column standard deviation before analysis. Population density (inhabitants/km$^2$) at prefectural level was computed for each year in the time series, deriving the total surface area of each analysis' spatial unit from a shapefile provided by ELSTAT. The same shapefile was used to regionalize demographic indicators and selected results of the analysis run in our work.

(a)

(b)

(c)
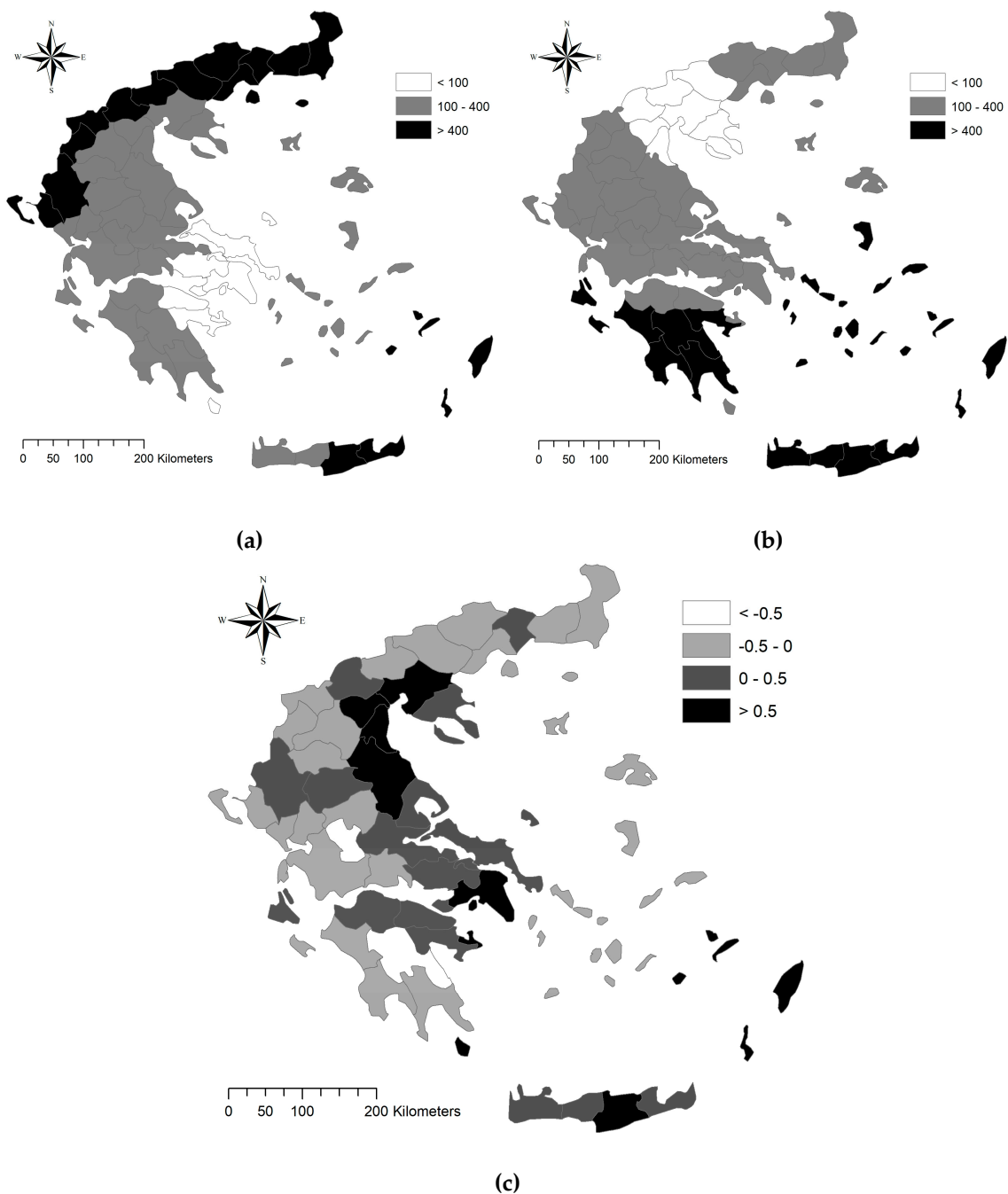
**Figure 1.** Maps of Greek prefectures illustrating (**a**) the linear distance (km) from downtown Athens; (**b**) the linear distance (km) from downtown Thessaloniki; (**c**) annual population growth rates (%) between 1940 and 2019.

### 2.3. Contextual Variables

The territorial context that characterizes each prefecture in Greece was delineated considering eight ancillary variables: (i) population density ('Den'), linear distance from (ii) downtown Athens ('DistAth') and (iii) downtown Thessaloniki ('DistSal'), (iv) a dummy illustrating the North–South gradient in Greece and classifying prefectures as belonging to Northern regions (1: Trace, Macedonia, Epirus) or Southern regions (0: the rest of the country), (v) a dummy illustrating the East–West (Aegean-Ionian gradient) and classifying prefectures bordering the Aegean Sea with 1 and the remaining prefectures with 0, (vi) a dummy identifying prefectures hosting the head town of 13 administrative regions of Greece, considered as the largest cities in the country (1) compared with the remaining prefectures

(0), (vii) a dummy identifying internal districts, i.e., mainland prefectures that do not have borders in common with the Ionian or the Aegean Sea (1) in respect with coastal prefectures (0) and, finally, (viii) a dummy identifying prefectures that include only islands (1) in respect with all the remaining prefectures (0). All these variables were made available from official statistics or derived from digital maps (www.geodata.gov.gr) using tools available in ArcGIS software (Redlands, USA). Considering the long time interval investigated in this study and the evident heterogeneity in the time series of many other relevant indicators, these variables—sometimes based on proxies of more complex demographic and socioeconomic processes—represent a satisfactory information ensemble contributing to clarify spatiotemporal population dynamics in Greek prefectures.

*2.4. Data Analysis*

Maps were prepared on the base of elementary data including annual rates of demographic increase by time window and prefecture, with the aim at identifying spatial similarities in population dynamics over shorter and longer time scales. A simplified framework was proposed with the aim at classifying prefectures on the base of long-term population trends. Criteria were oriented toward the identification of resilient territories under the assumption that prefectures attracting population over a sufficiently long time interval are considered demographically resilient and vice versa. Two criteria were adopted, considering 80 years (1940–2019) and two sub-periods of 40 years each (1940–1980; 1981–2019), representing, respectively compact-dense/radio-centric urbanization and decentralized suburbanization/counter-urbanization in Greece. Prefectures were classified as demographically resilient over the whole time interval (80 years) if the resident population increased for six, seven or eight decades; the reverse pattern characterized nonresilient districts with persistent population shrinkage. A similar framework was adopted over the two sub-periods, classifying prefectures as 'resilient' or 'nonresilient' if population, respectively grew (or declined) continuously for all the four decades in each sub-period. A pair-wise correlation analysis (based on Spearman nonparametric rank coefficients) was computed between each contextual variable (Section 2.3) and the annual rate of population variation (%) over (i) the whole study interval (1940–2019) or, separately, (ii) the two sub-periods (1940–1980 and 1981–2019). Significant correlations were delineated at $p < 0.05$ applying a Bonferroni's correction for multiple comparisons [69].

A hierarchical clustering (based on Euclidean similarity matrix under Ward's amalgamation approach) was run on a database constituted of population growth rates with the aim at classifying temporal units (years) and spatial units (prefectures). Assumed as a relevant dimension of demographic resilience, similar spatiotemporal structures characterize long-term population trends. Persistence (or change) in specific demographic trends was considered indicative of different background conditions. A principal component analysis (PCA) was carried out on a collection of variables including (i) population growth rates at eight decades, (ii) population density at the beginning of each decade and (iii) the remaining eight contextual variables (Section 2.3) at each prefecture. PCA was aimed at containing redundancy, evaluating changes over time in the multivariate relationship between variables at the same time. The PCA characterized research dimensions and distinctive demographic structures in Greece. components with eigenvalue > 1 were selected according to the results of the spectral decomposition of the correlation matrix [70]. The latent structure of variables and prefectures was finally illustrated adopting a biplot that depicts component loadings and scores. Multiple linear regression models were run for each decade and identified the predictors most associated with population growth in Greece. For each decade, predictors include the variables described in Section 2.3 and were standardized before analysis (e.g., [29]). Model's goodness-of-fit was estimated via adjusted $R^2$ tested for significance (against the null hypothesis of a statistically insignificant model) at $p < 0.01$ using a Fisher–Snedecor F statistic. Slope coefficient estimates and the related significance level at $p < 0.1$ were reported testing for the null-hypothesis of statistically insignificant coefficient based on a Student's *t* statistic.

## 3. Results

### *3.1. A Descriptive Analysis of Population Growth and Decline in Greece, 1940–2019*

The resident population grew continuously in Greece between 1940 and 2001, declining slightly in the subsequent two decades (2001–2019). Figure 2 classified the investigated decades on the base of spatial diffusion (or concentration) of the population in Greek prefectures. A particularly rapid population increase in a few prefectures was observed during three decades (1951–1961, 1961–1971 and 1971–1981). Conversely, the population increase in the remaining five decades was slower and more dispersed over space. The largest diffusion of positive growth rates at the prefectural level was observed for the last two decades of investigation, corresponding with slightly negative growth rates at the national scale.
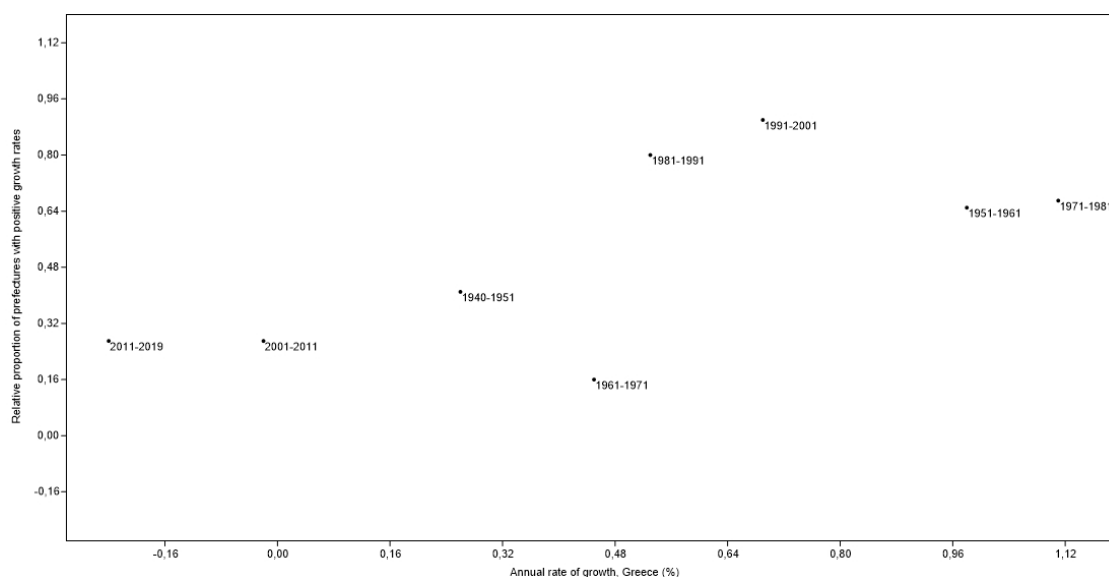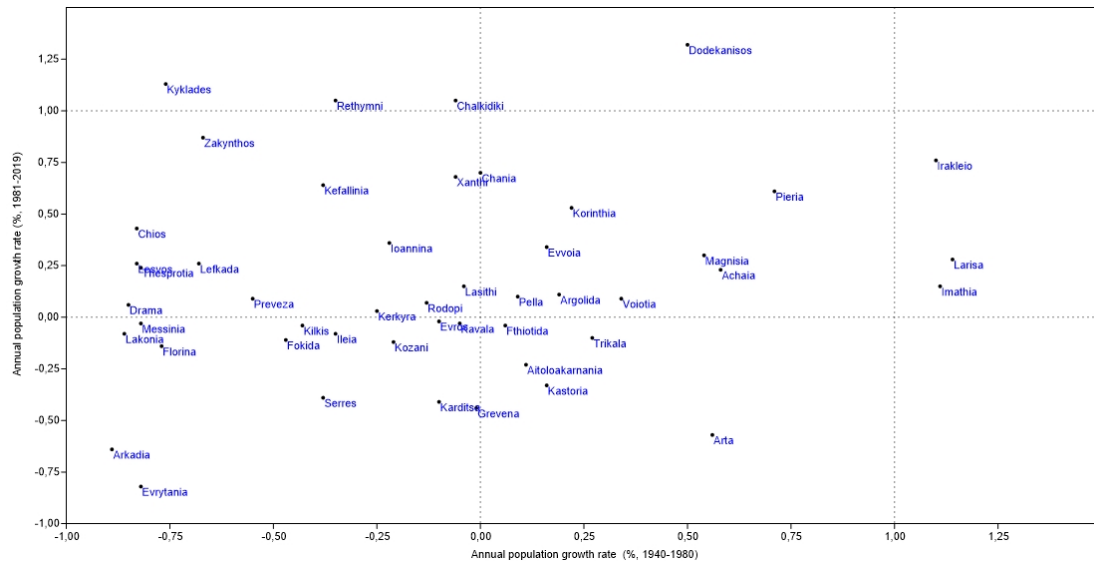


**Figure 2.** Relationship between the percent annual rate of population growth (%) in Greece and the relative proportion of prefectures with positive growth rates.

By partitioning the investigated period in two-time windows, Figure 3 illustrates a substantial similarity in the geography of population expansion in Greece. Positive rates were observed in prefectures along the Aegean side from Macedonia to Crete, being more intense during 1940–1980 and less intense during 1981–2019. Marginal prefectures in Central Greece and Peloponnese have totalized the highest decrease in the country. A total of 18 prefectures (including Attica and Thessaloniki) were classified in the lowest right quadrant of Figure 3, indicating higher growth rates during 1940–1980 than during 1981–2019.

These prefectures include urban, high-density areas (Athens, Thessaloniki, Iraklio, Patras, Larisa, Viotia, Argolida) expanding mostly with compact urbanization (1940–1960). A total of 33 prefectures were classified in the highest left quadrant of Figure 3, indicating higher growth rates during 1981–2019 than during 1940–1980. These prefectures include rural, coastal districts and islands with low and moderate density settlements, expanding mostly in the subsequent suburbanization phase (Figure 4).

Spatial persistence in growth rates was illustrated in Figure 5 considering together the whole study period and two separate time intervals. Prefectures with continuous population growth over six, seven or eight decades concentrated along the Aegean side from Macedonia to Crete. These prefectures (*n* = 13 out of 51) host cities constituting the highest rank of the Greek metropolitan hierarchy. Prefectures with continuous population decline (*n* = 4) were located in Central-Western Greece and Peloponnese. Between 1940 and 1980, continuously positive population growth rates at the decadal scale were observed in six prefectures that include urban areas around Athens and Thessaloniki, as well as in Crete (Iraklio), reflecting the tumultuous expansion of the three largest cities in Greece.

Continuously negative rates of population increase were observed in Central Greece, Peloponnese and Northern Aegean region (*n* = 7). Between 1981 and 2019, continuously positive rates of population expansion were recorded only in the Cyclades and Eastern Macedonia (*n* = 2 prefectures). Continuously negative population growth rates were recorded in one prefecture of Western Greece.



**Figure 3.** Relationship between the annual population growth rate (%) over two-time intervals in the recent history of Greece.



(**a**)　　　　　　　　　　　　　　　　　　　　　　　(**b**)
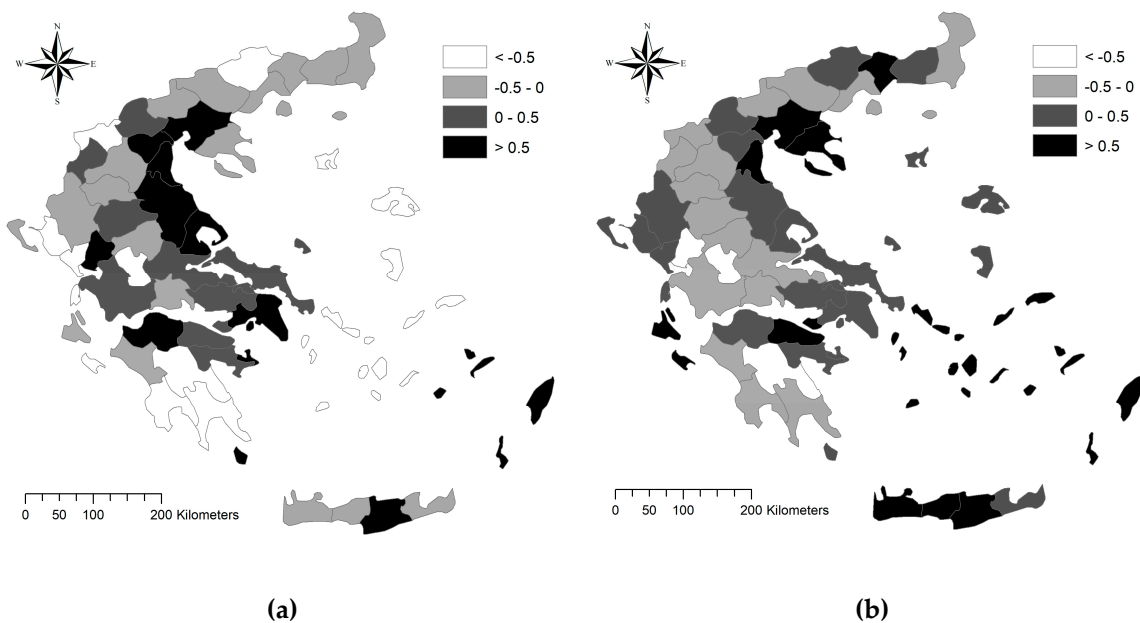
**Figure 4.** Spatial distribution of annual population growth rates (%) in Greek prefectures over 1940–1980 (**a**) and 1981–2019 (**b**).
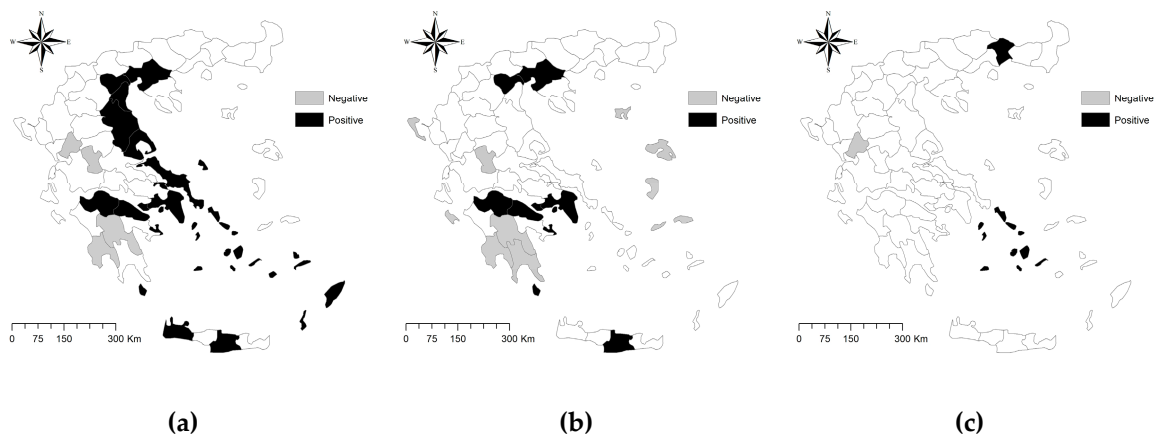
**Figure 5.** Temporal persistence of population growth rates in Greek prefectures (**a**) prefectures with at least six decades with positive (or negative) growth rates over 1940–2019; (**b**) prefectures with four decades with positive (or negative) growth rates over 1940–1980; (**c**) prefectures with four decades with positive (or negative) growth rates over 1981–2019.

### 3.2. Spatial Regime of Long-Term Population Growth (or Decline) in Greece

Hierarchical clustering illustrates similarities in long-term population dynamics across Greek prefectures. The analysis separated Attica and Thessaloniki, the largest urban areas in the country, from the remaining prefectures. Coastal areas and islands (from Kefallinia to Iraklio), expanding the most during the last decades, were also separated from the rest of the sample. However, island prefectures (Chios, Samos, Lesvos) in more peripheral locations of Northern Aegean were clustered together with coastal and inland prefectures in Peloponnese, depicting areas that experienced a more recent population expansion in response to suburbanization, decentralization of economic activities and development policies improving the attractiveness of peripheral coastal places (Figure 6). The remaining prefectures, representing the 'core' of the dendrogram, were mainly internal areas with variable population dynamics that are less correlated with the main waves of urbanization and suburbanization at the national scale.
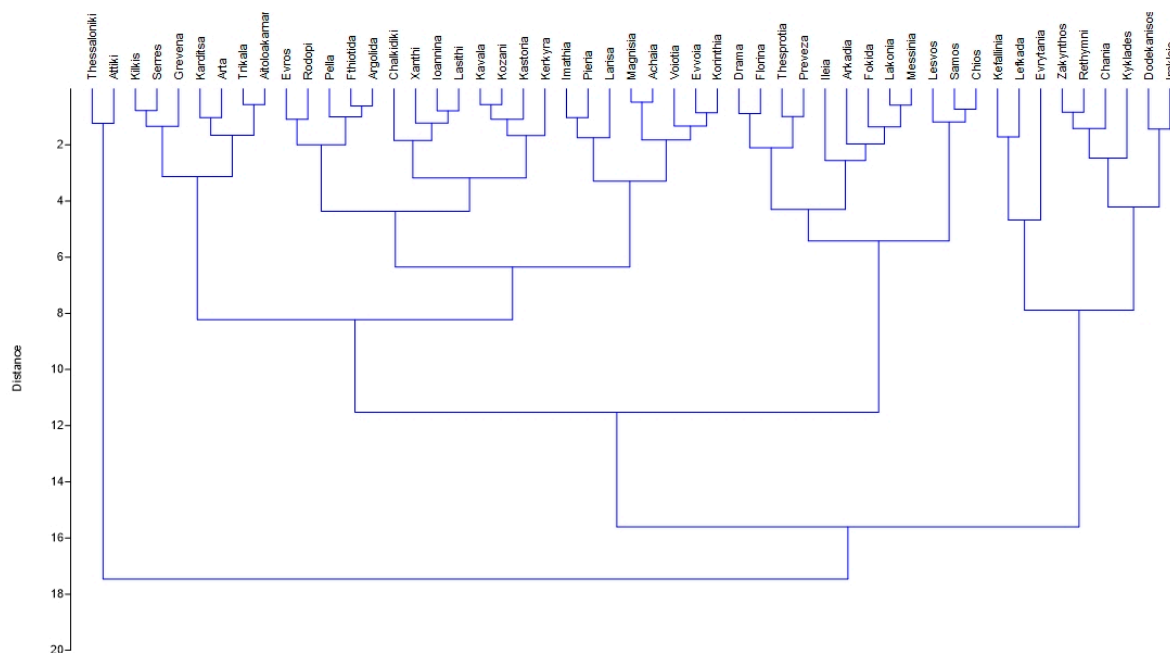


**Figure 6.** Hierarchical clustering (Ward's agglomeration rule, Euclidean distance) classifying Greek prefectures on the base of long-term population dynamics.

The relationship between population increase and background conditions in each prefecture was investigated considering nonparametric Spearman coefficients (Table 1). The West–East gradient and the presence of a regional capital city had the highest (positive) impact on population growth in Greece. Population density, the distance from Thessaloniki and being an island district had a positive impact only in the most recent period (1981–2019). Internal districts harmed population growth during 1981–2019.

**Table 1.** Spearman rank correlation analysis between the percent rate of population growth by time interval and selected predictors of the local context (* indicates significance at $p < 0.05$).

| Variable | Percent Rate of Population Growth | | |
| --- | --- | --- | --- |
| | 1940–2019 | 1940–1980 | 1981–2019 |
| Density | 0.05 | −0.07 | 0.36 * |
| North–South | 0.04 | 0.19 | −0.23 |
| West–East | 0.44 * | 0.31 * | 0.37 * |
| DistAthens | −0.04 | −0.05 | 0.00 |
| DistSalonika | −0.06 | −0.25 | 0.32 * |
| RegCapital | 0.42 * | 0.39 * | 0.31 * |
| Internal dis. | −0.22 | 0.01 | −0.49 * |
| Island | 0.04 | −0.25 | 0.55 * |

### 3.3. Population Growth and Territorial Background

A principal component analysis of population growth rates and territorial variables corroborates earlier results of this work (Figure 7). principal component analysis (Table 2) selected two axes accounting for 57.5% of the total variance. This analysis decomposed the most relevant processes of urban expansion (and the underlying drivers) in two independent gradients based on (i) population density and distance from Athens (component 1) and (ii) population dynamics and distance from Thessaloniki (component 2). component 2 discriminated between earlier phases of population growth (positive loadings) in turn associated with the North–South gradient, and later phases of growth (negative loadings).
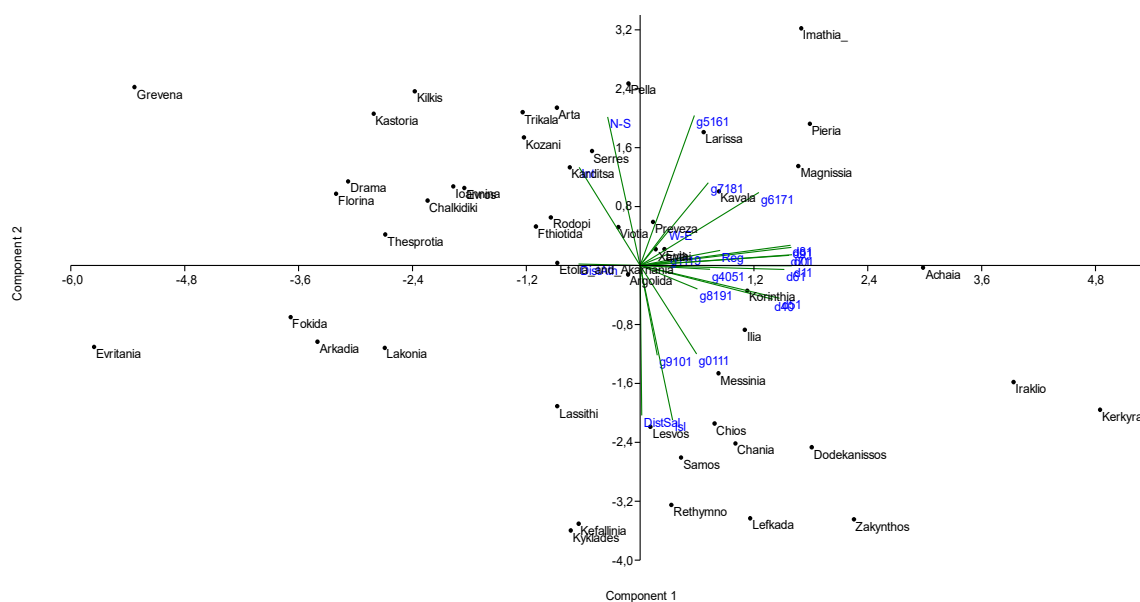


**Figure 7.** Biplot of a principal component analysis decomposing population dynamics (1940–2019) in two independent dimensions of metropolitan growth in Greece.

**Table 2.** Results of multiple regression models between the annual population growth rate (%) and predictors delineating the socioeconomic characteristics of prefectures in Greece (* indicates significant coefficient at $p < 0.1$).

| Variable | Coeff. | Std. err. | $t$ | $p$ | Variable | Coeff. | Std. err. | $t$ | $p$ |
|---|---|---|---|---|---|---|---|---|---|
| 1940–1951: Adj-$R^2$ = 0.19; F = 2.43; $p$ = 0.03 | | | | | 1951–1961: Adj-$R^2$ = 0.47; F = 6.53; $p < 0.01$ | | | | |
| Constant | 0.00 | 0.13 | 0.01 | 0.99 | Constant | 0.00 | 0.10 | −0.01 | 0.99 |
| Density | −0.22 | 0.17 | −1.31 | 0.20 | Density | 0.26 * | 0.15 | 1.74 | 0.09 |
| North–South | 0.19 | 0.28 | 0.69 | 0.49 | North–South | 0.43 * | 0.22 | 1.91 | 0.06 |
| West–East | −0.17 | 0.15 | −1.13 | 0.26 | West–East | 0.22 * | 0.12 | 1.83 | 0.07 |
| DistAthens | −0.55 * | 0.22 | −2.48 | 0.02 | DistAthens | −0.15 | 0.18 | −0.81 | 0.42 |
| DistSalonika | −0.43 * | 0.21 | −2.07 | 0.04 | DistSalonika | 0.01 | 0.17 | 0.04 | 0.97 |
| RegCapital | 0.36 * | 0.13 | 2.70 | 0.01 | RegCapital | 0.20 * | 0.11 | 1.79 | 0.08 |
| Internal dist. | −0.03 | 0.16 | −0.19 | 0.85 | Internal dist. | 0.13 | 0.13 | 0.94 | 0.35 |
| Island | 0.71 * | 0.25 | 2.84 | 0.01 | Island | −0.30 | 0.21 | −1.42 | 0.16 |
| 1961–1971: Adj-$R^2$ = 0.60; F = 10.48; $p < 0.001$ | | | | | 1971–1981: Adj-$R^2$ = 0.33; F = 4.12; $p < 0.001$ | | | | |
| Constant | 0.00 | 0.09 | 0.01 | 0.99 | Constant | 0.00 | 0.11 | 0.00 | 1.00 |
| Density | 0.37 * | 0.12 | 2.96 | 0.01 | Density | 0.15 | 0.17 | 0.88 | 0.38 |
| North–South | 0.10 | 0.20 | 0.50 | 0.62 | North–South | 0.10 | 0.25 | 0.40 | 0.69 |
| West–East | 0.21 * | 0.10 | 2.00 | 0.05 | West–East | 0.36 * | 0.13 | 2.71 | 0.01 |
| DistAthens | −0.34 * | 0.16 | −2.12 | 0.04 | DistAthens | −0.02 | 0.21 | −0.11 | 0.91 |
| DistSalonika | -0.18 | 0.15 | −1.25 | 0.22 | DistSalonika | −0.01 | 0.19 | −0.06 | 0.96 |
| RegCapital | 0.31 * | 0.10 | 3.16 | 0.00 | RegCapital | 0.40 * | 0.13 | 3.08 | 0.00 |
| Internal dist. | −0.07 | 0.11 | −0.66 | 0.51 | Internal dist. | −0.01 | 0.15 | −0.05 | 0.96 |
| Island | −0.07 | 0.18 | −0.38 | 0.70 | Island | −0.21 | 0.23 | −0.93 | 0.36 |
| 1981–1991: Adj-$R^2$ = 0.08; F = 1.57; $p$ = 0.16 | | | | | 1991–2001: Adj-$R^2$ = 0.14; F = 1.98; $p$ = 0.08 | | | | |
| Constant | 0.00 | 0.13 | 0.00 | 1.00 | Constant | 0.00 | 0.13 | 0.01 | 0.99 |
| Density | −0.05 | 0.20 | −0.23 | 0.82 | Density | −0.27 | 0.20 | −1.36 | 0.18 |
| North–South | −0.05 | 0.30 | −0.17 | 0.87 | North–South | −0.15 | 0.29 | −0.52 | 0.61 |
| West–East | 0.12 | 0.15 | 0.79 | 0.43 | West–East | −0.01 | 0.15 | −0.07 | 0.95 |
| DistAthens | −0.19 | 0.25 | −0.76 | 0.45 | DistAthens | −0.06 | 0.24 | −0.23 | 0.82 |
| DistSalonika | −0.19 | 0.22 | −0.84 | 0.41 | DistSalonika | −0.39 * | 0.22 | −1.78 | 0.08 |
| RegCapital | 0.23 | 0.16 | 1.49 | 0.14 | RegCapital | 0.24 | 0.15 | 1.53 | 0.13 |
| Internal dist. | −0.26 | 0.17 | −1.47 | 0.15 | Internal dist. | −0.14 | 0.17 | −0.83 | 0.41 |
| Island | 0.17 | 0.26 | 0.64 | 0.53 | Island | 0.56 * | 0.25 | 2.22 | 0.03 |
| 2001–2011: Adj-$R^2$ = 0.56; F = 9.08; $p < 0.001$ | | | | | 2011–2019: Adj-$R^2$ = 0.22; F = 2.81; $p < 0.01$ | | | | |
| Constant | 0.00 | 0.09 | 0.00 | 1.00 | Constant | 0.00 | 0.12 | −0.01 | 0.99 |
| Density | 0.09 | 0.14 | 0.66 | 0.51 | Density | −0.22 | 0.20 | −1.12 | 0.27 |
| North–South | 0.36 * | 0.21 | 1.78 | 0.08 | North–South | 0.57 * | 0.28 | 2.07 | 0.05 |
| West–East | 0.12 | 0.11 | 1.15 | 0.26 | West–East | 0.25 * | 0.14 | 1.76 | 0.09 |
| DistAthens | 0.07 | 0.17 | 0.39 | 0.70 | DistAthens | −0.43 * | 0.23 | −1.88 | 0.07 |
| DistSalonika | 0.14 | 0.16 | 0.86 | 0.39 | DistSalonika | −0.13 | 0.21 | −0.63 | 0.53 |
| RegCapital | 0.29 * | 0.11 | 2.60 | 0.01 | RegCapital | 0.01 | 0.15 | 0.09 | 0.93 |
| Internal dist. | −0.14 | 0.12 | −1.18 | 0.25 | Internal dist. | −0.46 * | 0.16 | −2.85 | 0.01 |
| Island | 0.70 * | 0.18 | 3.79 | 0.00 | Island | 0.40 | 0.25 | 1.58 | 0.12 |

Multiple linear regression was carried out to delineate the predictors of population growth over each investigated decade in Greece (Table 2). Regression models were particularly significant for specific decades (1951–1961, 1961–1971, 1971–1981, 2001–2011) and less significant for the remaining time intervals. Regression analysis identified distance from Athens and Thessaloniki (negative impact), the regional capital city and insular contexts (positive impact) as the main factors associated with population growth during 1940–1951. Geographic gradients including the North–South and the East–West gradient and the presence of a regional capital city were identified as the main drivers of population increase during 1951–1961. Density, distance from Athens, the regional capital city and the East–West gradient were found significant predictors of population growth for 1961–1971. These last two variables were found significant also for 1971–1981. No significant variables were detected for 1981–1991. Distance from Thessaloniki and insular contexts were found significant during 1991–2001. North–south gradient, the regional capital city and insular contexts were significant during 2001–2011.

Conversely, internal districts, together with the two geographic gradients and the distance from Athens, influenced population growth rates during the last decade (2011–2019).

## 4. Discussion

Advanced economies experienced intense demographic changes leveraging sequential urbanization and suburbanization waves [71–75]. In Europe, multifaceted migration trends, new household structures and a particularly heterogeneous natural balance over space shaped regional population trends [76–79]. In these regards, understanding how demographic processes, metropolitan cycles and economic downturns interact shaping regional competitiveness and location attractiveness, may contribute to a refined understanding of local development mechanisms [80–85]. When comparing population dynamics over sequential waves of urban expansion and rural shrinkage [86–88], Greece is exemplificative of traditional Mediterranean societies with a polarized economy along urban–rural gradients that reflect territorial divides between coastal and inland districts. Despite a persistent spatial configuration at the country scale, such divides had reduced during the last 80 years, fortifying—especially between 1940 and 1980—the role of few urban nodes (Athens-Piraeus and Thessaloniki) inserted in broader continental (or global) networks. This process consolidated in the subsequent four decades (1980–2019) reflecting the West–East gradient in Greece and the importance of (low-density) coastal districts attracting new population and economic activities (Figure 8).
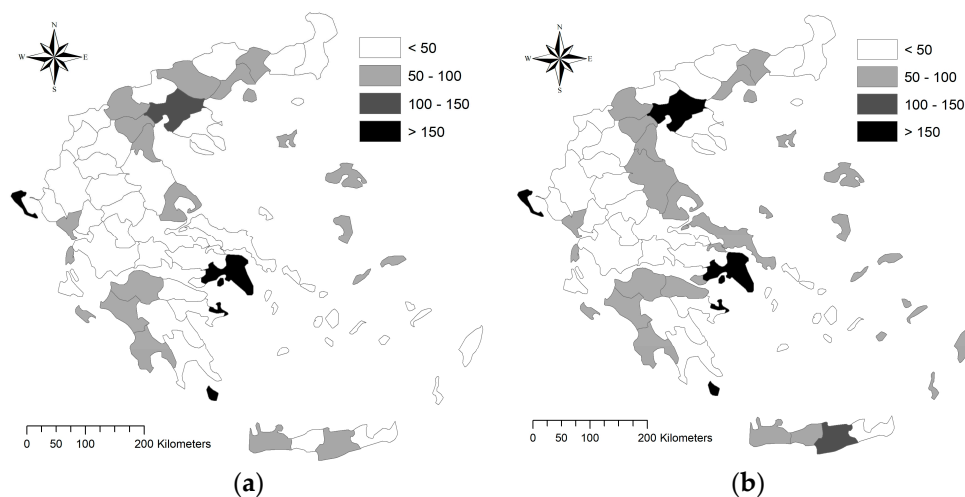


**Figure 8.** Population growth rate (%) in Greek municipalities by time interval (**a**) 1940–1980; (**b**) 1981–2019.

A spatially heterogeneous population growth has been observed in Greece, being related with a comprehensive set of background predictors. Regional population growth in Greece has reflected mechanisms of local development leveraging spatial disparities (e.g., [12]). As a matter of fact, the empirical results of our study outlined a strong difference in population dynamics between urban and rural areas, especially from 1940 to 1980 [26]. Accessibility, as well as economic specialization and advanced productive functions were assumed to be significant factors shaping demographic dynamics in such decades, since they have alimented a compact and radio-centric settlement growth in metropolitan regions and rural-to-urban mobility determining rural shrinkage [89]. The following dynamics (1981–2019) were less associated with central cities, suggesting a less important role for agglomeration and scale factors. After a continuous increase of resident population, a less intense gap between urban and rural areas was observed since the early 1990s.

Population redistribution over wider regions was evident in Greece since the late 1990s, reflecting spatially heterogeneous socioeconomic transformations increasingly decoupled from traditional geographic gradients (e.g., urban–rural, coastal-inland). Since the 1990s, population increased in rural districts and low-density touristic coastal areas, especially large and

medium-sized islands, as well as lowland, internal districts devoted to intensive cropland. More intense urban-to-rural internal movements were specifically observed in the last decade as a result of progressive counter-urbanization and shrinkage of central cities associated with worse socioeconomic conditions in metropolitan regions, mainly in Athens and, partly, Thessaloniki [13,32,90]. However, the overall impact of these processes on the Greek urban hierarchy was rather modest [21]. In such a context, the possible role of unregistered or partially registered (i) emigration abroad and (ii) illegal international immigration should be evaluated further.

As a result of economic processes and mixed socio-demographic contexts, spatial heterogeneity in population growth rates was persistently observed in both urban and rural districts. However, this process was clearly asymmetric over time, being more intense in the second time interval (1980–2019) corresponding with late suburbanization, counter-urbanization and early re-urbanization and less intense in the first time interval (1940–1980) corresponding with urbanization and early suburbanization in Greece. Tapia et al. [91] investigated population trends in Spain at different time windows between 1860 and 1991 with the aim at testing if population at the beginning of each time window affects population growth during the same time window. According to the authors' results (p. 81) "while such a relationship between these two variables hardly existed during the second half of the nineteenth century, this link increased significantly between 1910 and 1970, although this trend was abruptly interrupted by the Civil War and the autarkic period that followed [92,93]. The intensity of this relationship decreased in the 1970s, a process that continued during the 1980s ( . . . ); agglomeration economies were stronger in medium-sized districts, especially from 1960 onwards".

In Greece, a slightly different spatial model was observed, based on the specific socioeconomic context and the distinctive development path. Population decline in urban, industrial and intensive agricultural districts was more intense than in rural districts experiencing long depopulation, suggesting that central locations display a lower demographic attractiveness than peripheral locations with dynamic economic sectors, e.g., tourism [94–96]. In these regards, a mix of factors that includes industrial decline, informal economies and dependence on external funds, especially in agriculture, determined population shrinkage in Southern Europe [97–102], suggesting a lower demographic resilience of the locations (mostly rural) experiencing this kind of development path.

A better knowledge of new demographic scenarios opens up a key reflection on the intimate mechanisms of long-term change in population redistribution over wider regions [7,103–106] and may delineate opportunities for regional development policy. In these regards, newly emergent issues such as resurging internal migration, declining immigration flows from abroad and re-approaching the lowest-low fertility levels, suggest a thorough rethinking of sustainable urbanization [107–111]. Planning strategies stimulating a polycentric expansion of human settlements should incorporate policy measures improving local development in regions exposed to demographic and economic stagnation [29,112,113]. A comparative, long-term analysis of population distribution over space proved to be a necessary tool identifying the emergent socioeconomic dynamics and delineating the most appropriate policies to face with [114,115]. A refined investigation of the negative impact of recession on local socioeconomic structures is therefore meaningful to shed light on future population dynamics in a post-crisis Mediterranean Europe.

Taken together, results of this study, at least for the first time interval (1940–1980), suggest how "being closely intertwined with the policy debate, the concept of agglomeration economies and its relation with spatial economic performance has maintained a central role" in regional science [116]. However, the empirical results for the most recent time horizon (1981–2019) reflect more complex demographic and settlement processes over space. According with Berliant and Wang [117], "while basic questions such as 'does urbanization cause growth or does growth cause urbanization?' or 'does supporting urbanization imply neglecting rural areas?' are still valid and need a more comprehensive research and immediate policy response, our study definitely contributes to a better understanding of the role of urbanization in population distribution and economic growth, informing policies that tackle the formidable challenges it poses".

## 5. Conclusions

Results of our study illustrate long-term demographic dynamics in 51 Greek prefectures (1940–2019) providing evidence to settlement (re)distribution along basic geographic gradients. Prefectures are comprehensive and homogeneous spatial units when investigating patterns of population (re)distribution in Greece under different economic conditions, having empirical relevance to demographic issues. Exploratory data analysis indicates a particularly complex regional framework with diversified metropolitan dimensions. Going beyond traditional theories linking urbanization with scale/agglomeration economies, these findings suggest the importance of a comparative analysis of demographic processes aimed at confirming (or confuting) such trends. This analysis contributes to interpret the other phases of the urban cycle (from suburbanization to re-urbanization) as primarily associated with 'soft' economic and alternative non-economic aspects of local development, including amenities, specialization in advanced services, the increased impact of economic downturns, as well as gentrification, class segregation and social filtering.

By reverting the paradigm of growth in high-density areas, the specificity of the 'Greek' model delineates new developmental paths going beyond the traditional dichotomy in compact and dispersed settlements. Highlighting the role of 'intermediate' districts, in-between large cities and economically depressed rural areas, our findings outline how a long process of spatial redistribution of settlements led—directly or indirectly—to a sort of (functional) polycentric development. Non-urban prefectures in coastal regions and in accessible, rural areas were the engine of such development path. These districts were also regarded as resilient, since they attract population in a context of demographic stagnation at the country scale, with intense shrinkage of the main urban centers. Our study definitely confirms the informative power of a multiscale investigation of the differential impact of metropolitan cycles and economic downturns in past, present and future population growth. In such perspectives, future studies are increasingly required to develop a refined analysis of the intrinsic linkage between demographic growth and long-term economic development at an enough detailed scale of investigation (prefectures, local districts, municipalities) and based on appropriate socioeconomic indicators.

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