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Demographic Change and the Urban–Rural Divide: Understanding the Role of Density and Agglomeration in Fertility Transitions

Samaneh Sadat Nickayin [1], Bogdana Nosova [2], Rosario Turco [3], Massimiliano Giacalone [4] and Luca Salvati [5,*]

[1] Planning and Design Faculty, Agricultural University of Iceland, Hvanneyri, 311 Borgarbyggð, Iceland
[2] Department of Social Communications, Institute of Journalism, Taras Shevchenko National University of Kyiv, 64/13, Volodymyrska Street, 01601 Kyiv, Ukraine
[3] Council for Agricultural Research and Economics (CREA), Centre for Forestry and Wood, Contrada Li Rocchi Vermicelli, I-87036 Rende, Italy
[4] Dipartimento di Economia, Università degli Studi della Campania Luigi Vanvitelli, Corso Gran Priorato di Malta, I-81043 Capua, Italy
[5] Dipartimento di Metodi e Modelli per l'Economia, il Territorio e la Finanza, Facoltà di Economia, Sapienza University of Rome, Via del Castro Laurenziano 9, I-00161 Rome, Italy
* Correspondence: luca.salvati@uniroma1.it

Abstract: Assuming fertility variations across urban–rural gradients, our study focuses on the traditional polarization in urban and rural fertility, offering a refined interpretation of demographic processes associated with population density. More specifically, we tested the intimate relationship between local fertility and population density, comparing the outcomes of a classical urban–rural model (reflecting a linear relationship between the two variables) with those of a more complex quadratic model (implying the so-called 'suburban fertility hypothesis') in Greece. We considered fertility dynamics in three districts (urban, suburban, and rural) of 51 Greek prefectures for the last two decades (2000–2009 and 2010–2019) and controlled for the diverging impact of local contexts at different population density levels. Taken as a measure of 'maturity' of regional systems, urban fertility surpassed rural fertility in almost all prefectures of Greece. An additional sign of maturity in metropolitan systems indicates that suburban birth rates are higher than urban birth rates in prefectures with high population density (Athens, Thessaloniki, Heraklion, and Patras). The regression outcomes document a specific response of fertility to regional development, evidencing a spatially differentiated shift from classical urban–rural disparities toward a more complex model with the emergence of suburban poles. From this perspective, fertility divides reflect the evolutions of socioeconomic forces (more or less rapidly) along the urban gradient.

Keywords: population dynamics; fertility differentials; local context; concentration; Greece

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1. Introduction

A complex interplay of socioeconomic forces has characterized long-run metropolitan development in advanced countries [1–4]. During the first demographic transition, economic growth augmented metropolitan expansion thanks to both immigration and natural population increase [5–9]. Changes in rural fertility behaviors justified the decline in the overall fertility rate over long time horizons [10–13]. Forecasts indicate that urbanization will become the primary factor driving future declines in rural fertility [14]. Conversely, the second demographic transition reflected social change [15] and intense population mobility, both within and across (neighbor) regions [16–19], resulting in increased spatial heterogeneity, e.g., with respect to the individual choice of marriage or cohabitation [20–22]. Heterogeneous dynamics related to the second demographic transition have involved new family relationships, resulting in decreased birth rates [23] and population aging [24–26].

A comparative analysis of fertility dynamics along the density gradient may clarify the role of natural and migratory components as drivers of economic development and social change [27–29]. Fertility levels have been shown to vary considerably across urban–rural gradients, responding to differentiated social, political, cultural, and territorial drivers of change, with particular sensitivity to economic downturns [30–32]. Fertility differences across settlements may also reflect limitations on family size and work-related configurations [33–35]. Education composition is considered another relevant factor contributing to urban–rural fertility patterns [36–38]. A comprehensive investigation of the spatial polarization in urban and rural fertility traditionally observed in advanced economies [39] provides a refined interpretation of demographic processes associated with population density [40–42]. Fertility divides also indicate the strength of periurban development at the regional scale and the intensity (and spatial direction) of suburbanization processes at the country scale [43–45]. Despite the assumed relevance of demographic trends in contemporary societies [46–48], local fertility remains underinvestigated along urban–rural gradients [49].

Recently, suburbs have been frequently found to have higher fertility rates than central districts and neighboring rural areas [36,50,51], in line with the so-called ‘suburban fertility hypothesis’. Although earlier studies have supported this assumption with empirical evidence, especially for Europe [52], such an assumption justifies a specific focus on economic dynamics within the broader perspective of urban–rural fertility divides [53]. In the present study, we assume that diachronic investigation of fertility dynamics over sequential economic downturns is crucial to demonstrate the validity of a ‘suburban fertility hypothesis’ in less investigated socioeconomic contexts, such as Mediterranean Europe [54], possibly clarifying the latent mechanisms underlying persistent fertility divides across settlement types [55]. From this perspective, we performed an exploratory analysis of gross birth rate at both the district and prefectural level in Greece, comparing two sequential periods representative of economic expansion (2000–2009) and stagnation (2010–2019). Given the financial crisis affecting the country in recent years [56], results of our study document how regional development and urban/suburban growth have shaped multifaceted population dynamics [57–59], with implications for socioeconomic growth of the southern European region at large.

2. Methodology

2.1. Study Area

The investigated area covers the whole of Greece (131,982 km^2), a Mediterranean country partitioned into 51 prefectures (‘nomoi’ in Greek), corresponding to the NUTS-3 level of the European Nomenclature of Territorial Statistical Units [60]. Prefectures are regarded as appropriate spatial domains for a comprehensive analysis of fertility differentials at varying population density levels (Figure 1) and in distinctive local contexts [61,62]. More than half of the Greek population (10.5 million inhabitants at the time of the 2021 census) is settled in the Greater Athens and Thessaloniki regions [63–65]. Regional capital cities (Iraklio, Patras, and Larisa) and other important towns, such as Volos, Kalamata, Chania, Kavala, Ioannina, and Kozani, grew intensively in the 1970s and the 1980s [66]. Internal districts were exposed to depopulation and economic decline in the 1990s [67]. Dynamic, tourism-specialized districts, especially in the Aegean region (Crete, Cyclades, and Dodecanese) started growing in the 2000s after a relatively long period of stagnation [4]. Fertility in Greece has exhibited evident fluctuations since World War II [68], with spatial heterogeneity in birth rates rising continuously since the 1960s [69].

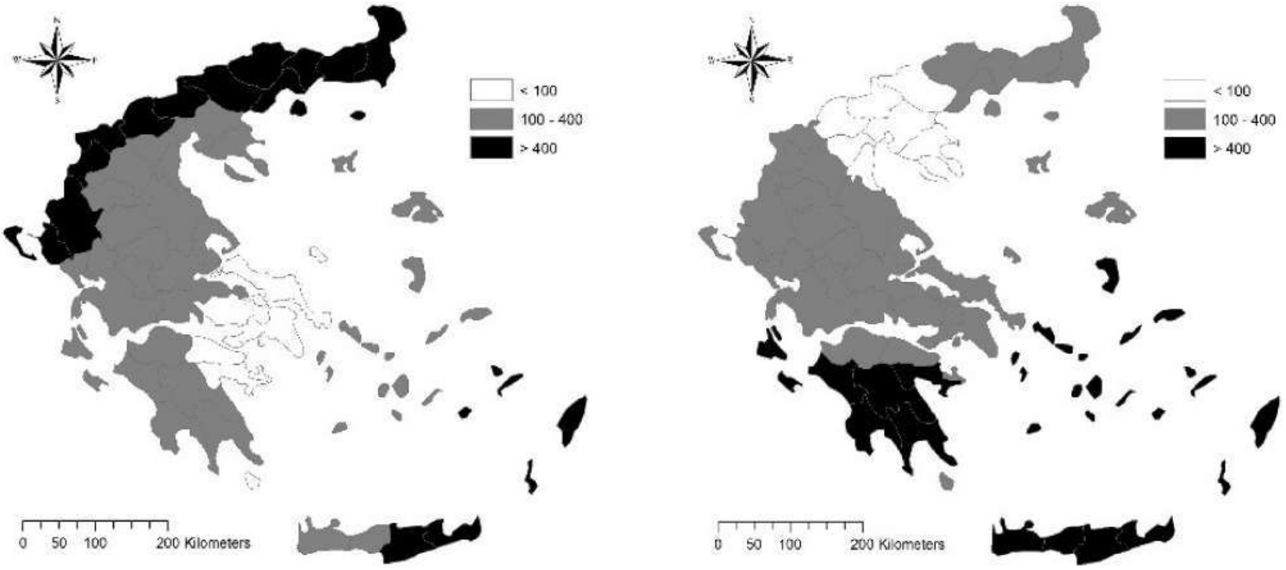


Figure 1. Map of Greek prefectures based on ELSTAT shapefiles, indicating the average distance (km) from Athens (**left**) and Thessaloniki (**right**).

2.2. Data and Indicators

The study was carried out adopting two territorial partitions: (i) 51 prefectures and (ii) 142 local districts derived from the intersection of Greek prefectures with a layer identifying urban, suburban, and rural settlements in the country [34]. This approach benefited from an official classification of settlement types adopted by the Greek National Statistical Authority (ELSTAT) and expanded to broader settlement classifications based on standard approaches to census data (e.g., derived from Eurostat, OECD, or FAO). These approaches basically consider settlement density, accessibility, and spatial concentration of economic activities as relevant variables as the basis for classification outputs [67]. Prefectural and district boundaries in Greece remained stable during the study period [27]. For illustrative and descriptive purposes, maps were prepared to reflect selected demographic attributes of Greek prefectures [67]. As a factor used largely in regional demography, we computed a ‘general fertility rate’ based on the number of children relative to the total number of women in the fertile age (15–49 years) calculated separately for two decades (2000–2009 and 2010–2019) and for each prefecture of Greece [70]. Urban, suburban, and rural districts were also identified in each prefecture, and general fertility rates were consequently calculated at this disaggregate analysis level [59].

Although age-specific fertility rates are preferred in demographic analysis, the use of a general fertility rate was envisaged as a compromise [71] between the need for accurate information in the analysis of regional fertility and the limited availability of vital statistics on a prefectural and especially sub-prefectural (e.g., local district or municipal) scale. Separately considering results in different territorial partitions (prefectures and local districts reflecting distinctive settlement types) may reduce the impact of partial, incomplete, or poorly comparable information in some official statistics [27,34,67,72]. The total number of births was derived from vital statistics released annually by the Hellenic Statistical Authority (ELSTAT) at the same territorial scale [73]. Additional information (total population and population structure by sex and age class) were derived from data reported in the National Censuses of Population and Households, which is conducted every 10 years in Greece [72]. Following the operational indications of previous studies [66,74–76], the local context was profiled separately for the two study intervals considering a relatively vast set of variables. Regarded as the most important descriptor of the local context in this study [77], population density (inhabitants/km^2) was calculated for each decade as a time-series average at the same spatial resolution mentioned above (Figure 2).

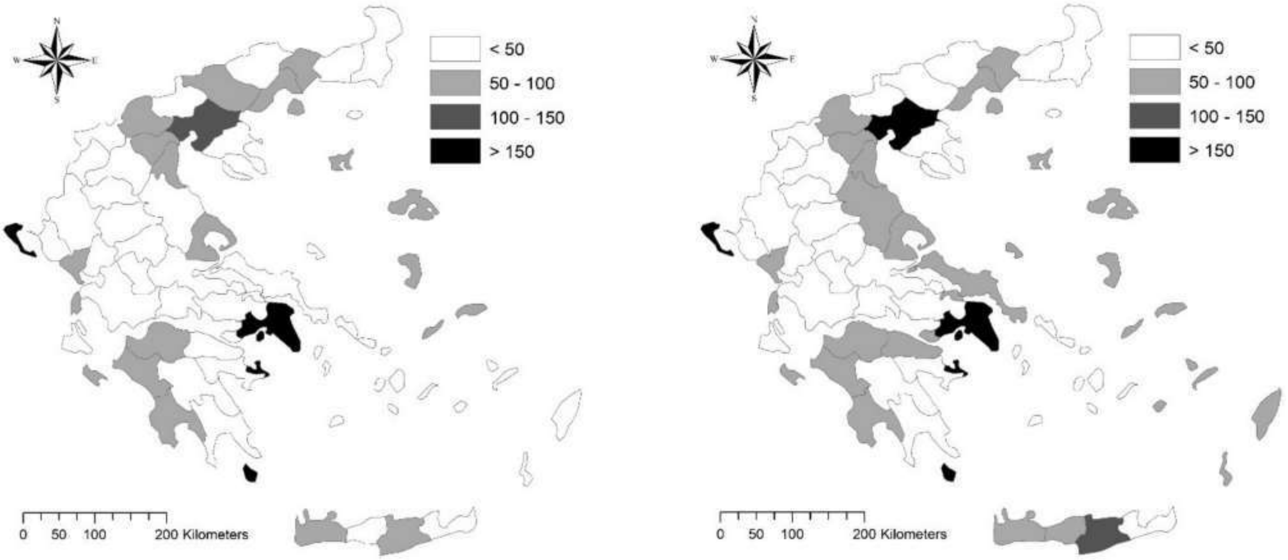


Figure 2. Map of Greek prefectures based on ELSTAT shapefiles, indicating population density (inhabitants/km^2) in 2000 (**left**) and 2020 (**right**).

2.3. Logical Framework

To preliminary test the ‘suburban fertility hypothesis’ [78], the correlation between regional (i.e., prefectural or local district) birth rates and population density was investigated for both (decadal) time intervals using log–log scatterplots. These plots were used to visually identify a linear (or non-linear) relationship between the two variables. We tested three possible cases, as illustrated in Figure 3. The left graph delineates a linear relationship underlying a continuous decrease in birth rates with population density. Given the higher rural than urban fertility rate and the lack of evidence of differential fertility of suburbs [79], this spatial model was regarded as the most traditional in the recent history of regional demography [80], possibly associated with pretransitional demographic scenarios dominated by low-density socioeconomic contexts and medium–low urbanization rates [5,81,82]. The middle graph represents a linear relationship underlying a continuous increase in birth rates with population density [4], reflecting a higher urban than rural fertility rate, with no evidence of differential fertility in suburban areas [83–85]. This model was associated with a burst, compact, and dense urbanization typical of the first stages of any metropolitan cycle [86–88].

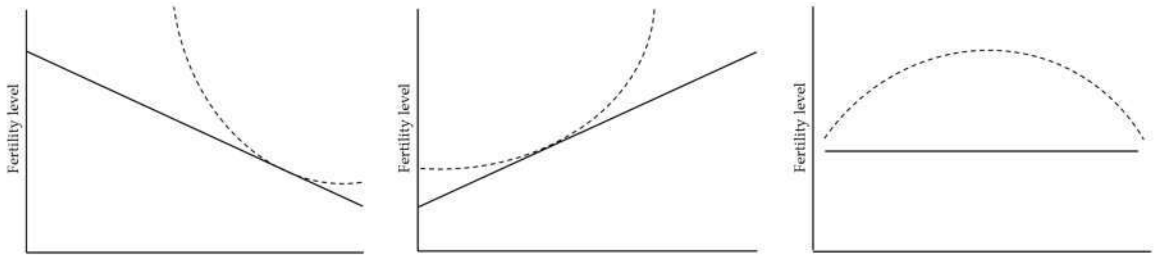


Figure 3. The assumed relationship between fertility level (y-axis) and population density (x-axis), distinguishing three possible configurations of linear and non-linear patterns (the right panel reflects the main assumptions of suburban fertility).

The right graph indicates a reverse, U-shaped distribution, assuming the highest fertility at intermediate density levels reflect suburban locations [89], thus providing preliminary evidence in favor of the ‘suburban fertility hypothesis’ [36]. This model is taken as an indirect signal of the ‘demographic’ maturity of local socioeconomic systems [90], having reached a more balanced spatial structure of birth rates and, possibly, a less polarized fertility divide in urban and rural settlements [91]. In order to obtain further evidence of such trends, scatterplots were also constructed with the aim of illustrating the statistical distribution of Greek prefectures in terms of fertility differentials [92] for pairwise comparison of urban vs. rural settlements (x-axis) and suburban vs. urban settlements (y-axis) for both time intervals. Such plots definitely provided a preliminary and descriptive analysis of fertility patterns and trends in the study area [93].

2.4. Econometric Analysis

The relationship between birth rates (dependent variable) and selected predictors of fertility rates was analyzed across (i) 51 prefectures and (ii) 142 local districts (see Section 2.2), with prefectures partitioned as homogeneous urban, suburban, and rural settlements over two decades (2000–2009 and 2010–2019). In other words, the relevance of two different territorial partitions ((i) and (ii)) was tested using, in both cases, a linear specification that links the dependent variable with predictors [66,94,95]. The adopted predictors slightly differed in the two partitions because of the heterogeneous availability of official statistics at the two geographical scales, with evident constraints, especially at the district level. Considering the relevance to different aspects of the local context, prefectures represent an aggregate territorial partition delineating the regional diversification in socioeconomic dynamics. Local districts are territorial partitions that are sufficiently disaggregated to describe fertility divides as a result of topical differences in socioeconomic paths [96–98].

Comparison of model outcomes (in terms of, e.g., goodness of fit and statistical significance of regression coefficients) at the two territorial levels introduced above can provide indications of the most relevant observation scale for the dependent variable [99]. This may, in turn, reflect the most pertinent territorial partition describing the associated background (economic, demographic, social, or environmental) context [71]. Taken as a less investigated but particularly interesting and novel research issue [57], identification of the optimal scaling for analysis of demographic processes is an additional contribution of this study to regional science [100]. We assumed an ordinary least square (OLS) regression as a baseline model, controlling for spatial dependence (Moran's test), serial cross correlation (Durbin–Watson test), and heteroskedasticity (Breusch–Pagan test, assuming the error terms as normally distributed). Irrespective of the spatial observation scale, the OLS model (Equation (1)) was estimated as follows:

$$\mathrm{Y} = \alpha_{\mathrm{i}}\mathrm{N} + \mathrm{X}\beta + \epsilon \tag{1}$$

where Y denotes an N × 1 vector consisting of one observation of the dependent variable for every spatial unit in the sample (i = 1 . . . , 51), X indicates am N × K matrix of predictors associated with the K × 1 parameter vector (β), $_{\mathrm{i}}$N is an N × 1 vector of ones associated with the constant term parameter (α), and ϵ is an Nx1 vector of disturbance terms with zero mean and variance (σ^2) [101]. Cross-sectional models were estimated separately for each of the two time spans (2000–2009 and 2010–2019). Regression models were estimated using the forward stepwise technique with a threshold to select (i.e., enter or remove) relevant predictors corresponding with a p-level of 0.05 associated with the related Fisher–Snedecor F-test for each variable. Testing at $p < 0.05$, the null hypothesis (H_0) indicates null (or randomly close-to-zero) regression coefficients. Predictors were tested step by step, and irrelevant variables were progressively removed from the final model, which hosts only the most significant predictors explaining the variability of the dependent variable [72]. Models referring to both prefectures and local districts were run with this analytical strategy in mind [102].

Period birth rates (as described in Section 2.2) were assumed as the dependent variable in each regression model. At the prefectural scale (territorial partition (i), n = 51 units), 9 predictors were considered: (i) the average population size (total resident inhabitants) by municipal unit ('pop/com'), (ii) the absolute population size ('pop_siz'), (iii) population density (inhabitants/km^2, 'den'), (iv) squared population density ('den2'), the proportion of potentially fertile women (15–49 years old) in (v) urban settlements (‘wo_urb’) among the total population of women residing in the respective prefecture (i.e., summing population in urban, suburban, and rural settlements), the proportion of potentially fertile women (15–49 years old) in (vi) rural settlements (‘wo_rur’) among the total population of women residing in the respective prefecture, (vii) a variable quantifying the absolute density divide (inhabitants/km^2) between municipalities of the same prefecture (‘den_div’), (viii) a variable quantifying the absolute divide in a crude index of fertility between municipalities of the same prefecture (‘div_fer’), and finally, (ix) the average elevation (meters above sea level, ‘Ele’) of each prefecture.

Variables (i)–(iv), (vii), and (ix) were log-transformed prior to analysis. Specifically, variable (vii) was calculated for each prefecture as the absolute difference (max–min) between the highest and lowest population density values (inhabitants/km^2) observed at the municipal level in a given prefecture and referring to the first (2000–2009) or the second (2010–2019) time intervals. Variable (viii) was calculated for each prefecture as the absolute difference between the highest and lowest gross birth rate (i.e., the total number of births relative to the total resident population) observed at the municipal level in a given prefecture and referring to the first (2000–2009) or the second (2010–2019) time intervals.

At the district scale (territorial partition (ii), $n = 142$ units), 7 predictors were considered: (i) the absolute population size, (ii) population density, (iii) squared population density, two proxy variables indicating (iv) urban (‘Urb’) districts with the value ‘1’ and the remaining districts (e.g., suburban, rural) with the value ‘0’, (v) suburban (‘Sub’) districts with the value ‘1’ and the remaining districts (e.g., urban, rural) with the value ‘0’, (vi) the birth rate recorded for the nearest neighboring district (‘A’) at the same time scale, and (vii) the average elevation of each local district. Variables (i)–(iii) and (vii) were log-transformed prior to analysis. All these variables were made available from the National Statistical Authority of Greece (ELSTAT).

Taken together, the predictors selected in this study illustrate the territorial structure of Greece, with a focus on population concentration, accessibility, and urban–rural divides as indicators of dynamic (or marginal) contexts along the density gradient [103–106]. With the goal of reduced (i.e., informatively parsimonious) model specification [101], these predictors were also selected to maximize the informative power of the official statistics in the description of the background context. This rationale has the indirect advantage of limiting—as much as possible—redundancy among variables [107–109], which is assumed to bias the results of multiple regressions [110]. The residual multicollinearity among variables was further controlled through the use of stepwise multiple regression models that tolerate a higher redundancy among variables [111].

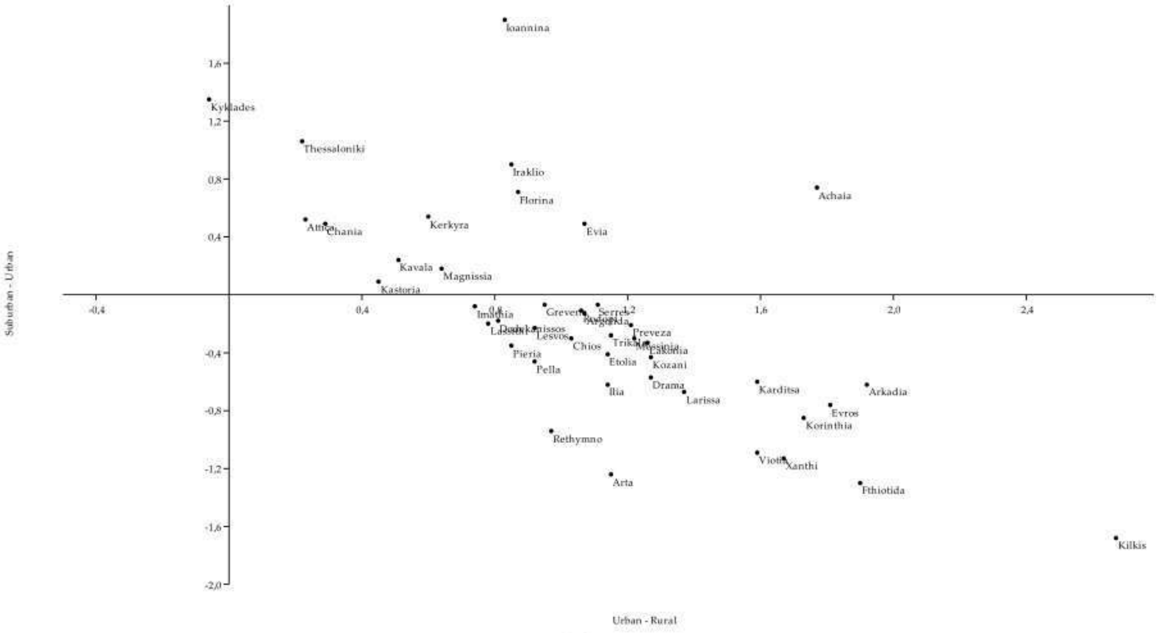
Finally, the selection of a reduced econometric specification (Equation (1)) was the result of the limited availability of official statistics dealing with relevant socioeconomic processes in Greece [67]. A restricted length of relevant time series at the desired spatial level, a partial comparability between economic aggregates released time by time, and the specific lack of some key variables aimed at constructing an appropriate dataset at a sufficiently disaggregated territorial partition (e.g., distinguishing among urban, suburban, and rural settlement types) limited the opportunity for a broader econometric specification of fertility variations in the country [62]. For instance, no specific job market and income indicators were available (nor are they currently available) at the district level or, in some cases, at the prefectural level [102]. Unemployment rates are only released at the level of administrative regions (slightly more than 10 territorial domains), and the sample size of the labor force survey does not allow for a further disaggregation of the most relevant indicators through small-area estimation [110]. Even at the prefectural level, although gross domestic product data are available—although perfectly comparable over the last twenty years of investigation—constructing a per-capita indicator is potentially difficult, owing to the slightly differing geographical partitions adopted in the initial release and the yearly update of economic and population time series [60].

An exploratory approach focusing on population density as the target variable augmented with some relevant variables characteristic of the background context seems to be an appropriate compromise to overcome such restrictions [71]. Moreover, some of the predictors used in this study can be considered as proxies of economic variables that are (more or less strictly) adherent to the geographical gradient (urban–rural) studied herein [34,112,113]. Population density and the spatial distribution of settlements (i.e., settlement types) was documented to be influenced largely the geographic distribution of income and wealth in Greece [75]. A similar effect has been observed in the labor market dynamics, which are still affected by an evident rural–urban gap [27,73,103].

3. Results

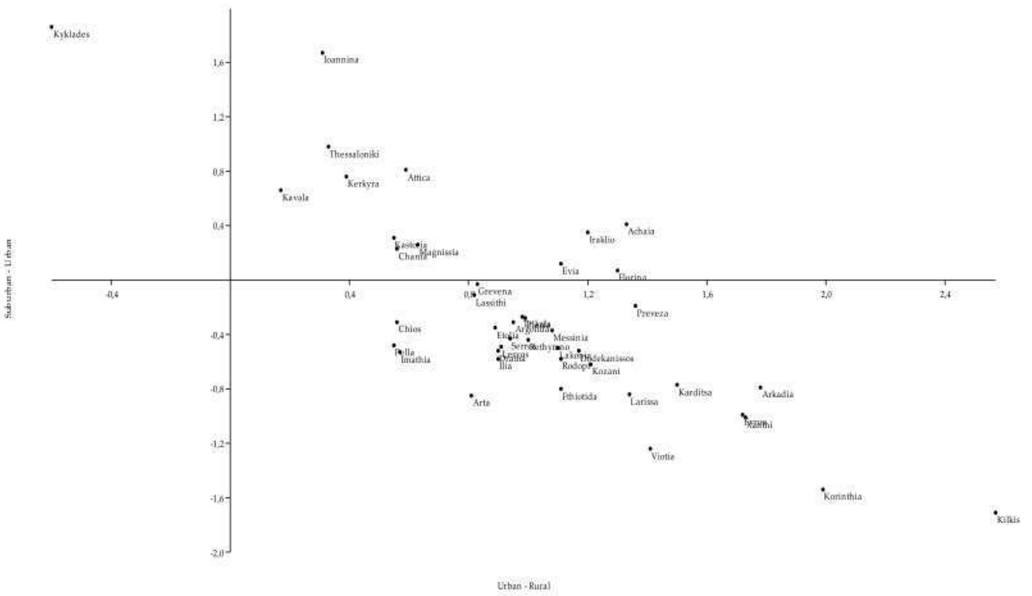
3.1. Descriptive Statistics and Exploratory Correlation Analysis

Fertility differentials based on generalized fertility rates were analyzed for all Greek prefectures (Figure 4), distinguishing the first period of economic expansion (2000–2009) from the second period of economic stagnation (2010–2019). Scatterplots identified different demographic behaviors in the four quadrants (I to IV), distinguishing more demographically mature and economically dynamic locations (i.e., with a systematically higher suburban fertility rate than elsewhere in Greece) from traditional and less developed regions (i.e., with a higher rural fertility rate than elsewhere in Greece). Quadrant I includes territories with a clear fertility gradient (suburban > urban > rural) associated with metropolitan areas (Athens, Thessaloniki, Patras, Iraklio, Volos, Chania, Kavala, and Ioannina) and other medium-sized urban centers (Florina, Kastoria, and Kerkyra). This group was found to be exceptionally stable over time. The Cyclades is the only prefecture in the fourth quadrant (i.e., with urban > rural > suburban fertility).



(a)

Figure 4. *Cont.*



(**b**)

Figure 4. The relationship between fertility differentials in urban-to-rural districts and in suburban-to-urban districts for each Greek prefecture in (**a**) 2000–2009 and (**b**) 2010–2019.

This result is in line with the peculiar characteristics of the area (a context with medium–low density settlements specialized in the tourism sector), distinguishing it from the metropolitan regions of the country. Quadrant II includes all other prefectures of Greece showing urban > rural and urban > suburban fertility. These prefectures have an intermediate population density and include small-to-medium-sized cities. Many of these territories, with the exceptions of Larisa, Korinthia, and Argolida, are predominantly agricultural regions, where intrinsic levels of fertility were found to be higher in urban settlements than in surrounding rural areas. Suburbanization processes in these areas were rather weak and late in comparison with metropolitan regions. The intrinsic concordance of fertility divides (i.e., correlating urban–suburban with urban–rural divides in fertility rates) was relatively high in both 2000–2009 (Pearson r = −0.70; Spearman $r_s = -0.74$; Kendall $\tau = -0.59$) and 2010–2019 (Pearson r = −0.80; Spearman $r_s = -0.66$; Kendall $\tau = -0.51$).

A preliminary graph associating the spatial distribution of birth rates with the level of population density by local district is shown in Figure 5, representing the periods of 2000–2009 and 2010–2019 separately but with on the same graphical scale. An inverse U trend was observed in both periods, which was slightly more marked in the first time interval. This trend justifies the use of regression models that explain birth rates (taken as the dependent variable) with respect to population density (testing for both linear and quadratic effects) and other predictors of the local context.

3.2. Explaining the Spatial Variability of Birth Rates at the Prefectural Level

The stepwise regression identifying the most significant predictors of fertility at the prefectural level (Table 1) highlights a simplified model with a single relevant variable (mean elevation). This means that the level of fertility at the aggregate level drops in hilly and mountainous regions—potentially less dynamic from an economic point of view and marginal from a social perspective. The significance of this predictor was high for both years, and the associated regression coefficient (slope) was fully comparable (−0.47 vs. −0.49), with homogeneous estimation errors. However, the goodness of fit of the stepwise model was low in the first period (adjusted $R^2 = 0.22$) and increased slightly in the second period (adjusted $R^2 = 0.24$). The stepwise strategy rejected all remaining predictors, including density, indicating a substantial heterogeneity in the sample of prefectures considered in this study. The regression presents negligible cross-correlation rates (Durbin–Watson statistic within the expected range (1.9–2.1) for data with no serial correlation), substantial homoskedasticity (Breusch-Pagan test, $p > 0.05$), and negligible spatial effects (Moran I test, $p > 0.05$).

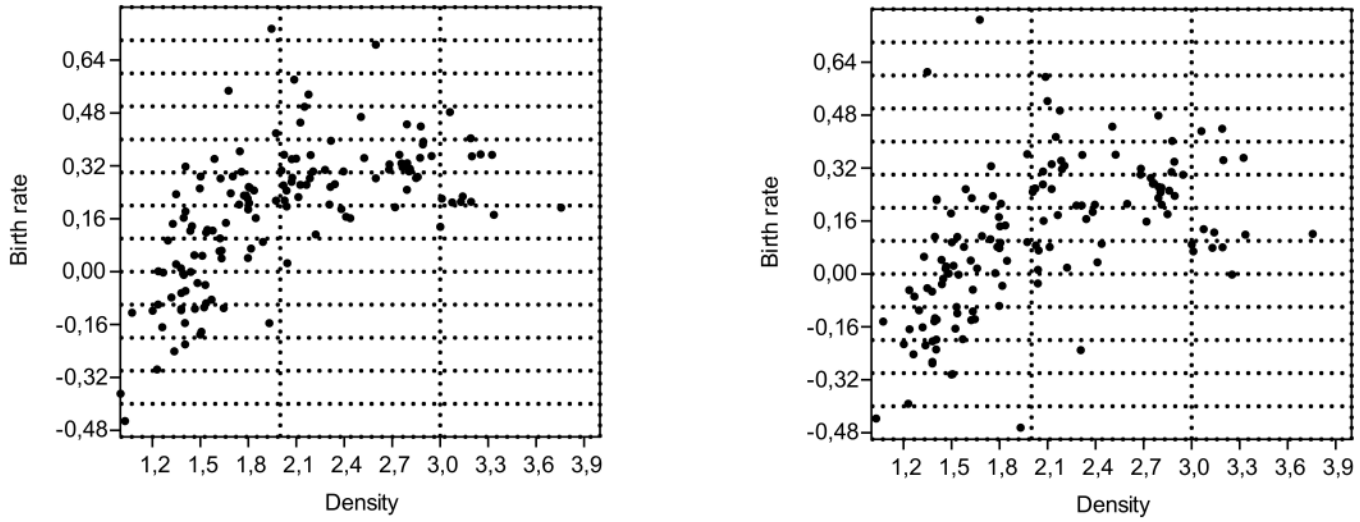


Figure 5. A reverse U-shaped form of the log-log relationship between birth rate and population density characteristic of urban, suburban, and rural districts in Greek prefectures (**left**: 2000–2009, **right**: 2010–2019).

Table 1. Results of a forward stepwise regression analysis identifying the most relevant predictors of general fertility rates in Greek prefectures ($n = 51$); standard errors in parentheses; * $p < 0.05$.

Predictor	2000–2009	2010–2019
Elevation	−0.466 (0.125) *	−0.492 (0.123) *
Fisher–Snedecor F (df)	13.86 $_{(1.50)}$	16.0 $_{(1.50)}$
Adjusted R^2	0.217 *	0.242 *

* Variables excluded from the model: 'pop/com', 'pop_siz', 'den', 'den2', 'wo_urb', 'wo_rur', 'den_div', and 'div_fer'.

3.3. Explaining the Spatial Variability of Birth Rates at the District Level

The stepwise regression identifying the most significant predictors of fertility rates at the local district level (Table 2) shows a more articulated and complex model with four and three significant predictors for 2000–2009 and 2010–2019, respectively. A negative impact of population size was observed (a possible result of urban concentration processes typical of large metropolitan areas in Greece), combined with a positive and linear impact of population density. The linear impact of density was recorded as stronger for the 2000–2009 decade than for the following decade. The quadratic term of density was significant and negative for the first observation decade. The value of the quadratic coefficient was in line with the inverted U shape observed in Figure 4. Conversely, the quadratic term of population density was insignificant in the second observation decade. Finally, the dummy variable identifying suburban districts was significant in both periods, assuming largely positive coefficients, and more intense in the first decade and declining rapidly in the second decade. In both models, mean elevation (unlike the prefecture model), strictly urban contexts (Urb), and the average birth rate in neighboring areas (A) were insignificant predictors of district fertility levels. The goodness of fit of the stepwise model was satisfactory in the first period (adjusted $R^2 = 0.58$) and slightly lower in the second period (adjusted $R^2 = 0.39$). Both models exhibited negligible cross-correlation rates (Durbin–Watson within the range 1.9–2.1), substantial homoskedasticity (Breusch-Pagan test, $p > 0.05$), and insignificant spatial effects (Moran I test, $p > 0.05$).

Table 2. Results of a forward stepwise regression analysis identifying the most relevant predictors of general fertility rates in urban, suburban, and rural districts of Greek prefectures (n = 142); standard errors in parentheses; * $p < 0.05$.

Predictor	**2000–2009**	**2010–2019**
Population size	−0.210 (0.064) *	−0.260 (0.076) *
Density	0.695 (0.059) *	0.534 (0.066) *
Density (square term)	−0.100 (0.042) *	
Suburbs (dummy)	0.247 (0.066) *	0.175 (0.076) *
Fisher–Snedecor F $_{(df)}$	49.54 $_{(4.138)}$	30.26 $_{(3.139)}$
Adjusted R^2	0.581 *	0.386 *

* Variables excluded from the model: ‘Ele’, ‘Urb’, and ‘A’.

4. Discussion

The empirical analysis proposed in our work suggests that fertility divides reflect socioeconomic forces evolving along urban–rural gradients and underlying the emergence of complex paths toward suburbanization [114–116]. The varying outcomes of the statistical analysis for both observation periods outline relevant socioeconomic transformations [117–120] and a less important role of economic agglomeration [121–123]. Fertility displayed distinctive dynamics from those of the amenity-driven suburbanization wave typical of the 1980s in Greece. Rural fertility was low in Greece, with a few exceptions [27,124,125]. Fertility in urban settlements maintained relatively high levels during the last decades [53]. An additional sign of ‘demographic maturity’ in metropolitan systems [126] was reflected in suburban birth rates being higher than urban birth rates in prefectures with high population density and hosting large cities (Athens and Thessaloniki), regional head towns (Heraklion, Patras, Volos, and Ioannina), or other important urban poles (Chania).

The results of the regression analysis indicate how, unlike the prefectural scale, the use of the district scale explains the spatial variations of fertility relative to population density and other contextual variables [71], providing an adequate econometric specification and a coherent distinction between the two observation decades [100]. In other words, settlement districts represent—compared with prefectures—the most appropriate spatial scale for analysis of the relationship between fertility rates, population density, and other contextual variables, allowing for a sufficiently adequate representation of the urban–rural gradient [102]. These results suggest that regions, prefectures, provinces, and other geographic aggregates with low spatial detail are statistical units that incorporate a high demographic heterogeneity that seems to be ineffectively managed through econometric analysis [73]. Smaller spatial units, such as municipalities, on the other hand, may enhance a spatial heterogeneity, representing a disturbance in econometric models [72,127,128], reducing their goodness-of-fit, and likely biasing regression coefficient estimates, even under optimal conditions with appropriately large sample sizes [67]. Generalizing our results to broader contexts [98], settlement districts seem to be a reasonable compromise between spatial detail and internal homogeneity/coherence of the indicators used in most demographic applications [62].

From the substantive point of view, the outcomes of the ‘local district’ regression clearly highlight the role of population density in fertility variations over space [43]. Higher birth rates were associated with medium-to-high density levels, and suburban contexts, in turn, positively affected the fertility rates themselves [103]. Furthermore, the quadratic trend of the relationship between fertility and density is significant was the first decade (in line with empirical observations presented in Figure 4), whereas this trend was not as evident in the following decade, when the effect of suburban contexts on fertility rates was slightly reduced [34]. Collectively, these macro-scale results highlight how the fertility–density relationship was more intense in a period of economic expansion and gradually decreased in both intensity and significance over the following decade [119] characterized by a spatially imbalanced recession affecting urban and suburban districts more intensively than rural areas [108].

Taken together, the empirical findings of our study suggest how the Greek socioeconomic context was increasingly associated with a sort of 'territorial entropy' [75] reflected in spatially heterogeneous fertility regimes [129]. For instance, in Spain and—more latently—in Italy, suburbanized areas showed high fertility, in contrast with medium-sized and smaller urban centers with lower birth rates [48,130–133]. Despite contributing significantly to such dynamics, suburban fertility seems to be a persistent trait of local communities during economic expansion, decreasing in intensity with economic stagnation and thus being less representative of such dynamics [134–136]. In this sense, recession led—among other effects—to heterogeneous fertility patterns, possibly consolidating regional demographic divides and the impact of local contexts [137–139].

Based on these premises, our study results suggest that spatial planning and developmental policies should prepare for a new (regional) developmental cycle [140–143], with population dynamics less associated with economic agglomeration or density gradients [112,113,144] and increasingly coupled with heterogeneous—and rapidly changing—territorial contexts [54,145,146]. For instance, economic change has recently led to a sudden modification of housing preferences [147–149]. Important spatial variability in European demography outlines that suburban birth rates stabilize at higher levels than urban rates [31], especially in regions with late suburbanization, such as eastern and southern countries [150]. This trend exerts an additional (and likely more unpredictable) impact on fertility divides across the density gradient.

5. Conclusions

The present study provides empirical evidence in favor of the suburban fertility hypothesis from a macro-demographic perspective in Greece. Aggregate fertility levels in suburbs were demonstrated to be higher than strictly urban and rural birth rates. We used descriptive statistics, correlation analysis, graphs, and maps to visually confirm this hypothesis, at least in a preliminary step. A second research step included a preliminary investigation of the territorial factors associated with the superior fertility in suburbs. These factors seem to be multifaceted, encompassing the economic and social dimensions of regional change; a limited consensus exists with respect to the main drivers of this process. Additionally, a broad but still not conclusive body of literature has focused on urban–rural fertility divides in advanced economies. With this perspective in mind, we attempted to reconnect these two issues, providing an exploratory model that comparatively investigates the impact of some economic (expansion vs. recession), sociodemographic, and territorial predictors on aggregated birth rates. The impact of the spatial scale was also verified, and a local district level of investigation proved to be more appropriate than a (geographically aggregate) prefectural level in assessing the relationship between birth rates, population density, and the underlying territorial context. Future studies should focus on comprehensive and spatially explicit analysis of age-specific fertility rates in order to fully control for the intrinsic effect of aging within the cohorts of potentially fertile women. Women can be relatively young or old within the considered age range (15–49 years), and it is likely that in a progressively aging society, such as in Greece, the average cohort age in the 2010–2019 period could be (at least slightly) higher than in the 2000–2009 period.

Results of a refined analysis of birth rates delineate new opportunities for (as well as constraints to) local development strategies. Identifying the socioeconomic features of urban, suburban, and rural contexts provides the necessary knowledge to inform such policies. The empirical analysis proposed in our work reformulates the theoretical and conceptual linkage between local birth rates and agglomeration factors, evidencing the role of socioeconomic forces that evolve along the urban gradient. The empirical evidence presented in this study delineates a comparative picture of relevant factors underlying local fertility variations across Greece. By underlying the emergence of complex paths toward suburbanization, future research should further investigate the intensity and motivations underlying the fertility decline in suburban locations of Mediterranean Europe, including but not limited to exurban development. With this perspective in mind, fertility divides may indicate—likely better than other socioeconomic variables—the strength of periurban development at the regional scale, as well as the intensity and spatial direction of suburbanization processes at the country scale.

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