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*Published in:*
Population Space and Place

*DOI:*
10.1002/psp.2209



*Publication date:*
2019

Accepted: 11 August 2018
DOI: 10.1002/psp.2209

RESEARCH ARTICLE

WILEY

# Spatial segregation and migration in the city of Athens: Investigating the evolution of urban socio-spatial immigrant structures

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## Abstract

Migration has long had an impact on spatial segregation within the metropolitan area of Athens. This process has also been affected by local economic restructuring mechanisms, which, in recent years, have evolved within the context of the 2008 economic crisis. This study attempts to shed light on the evolution of the spatial segregation of immigrants within the metropolitan area of Athens, during a period of a rapid urban transformation, using data from the last two census waves (2001 and 2011). Given that previous evidence indicates both vertical segregation in the immigrant labour market structure and diffused immigrant settlements, the work presented here investigates the ways in which urban migrant structures have evolved through local economic restructuring processes, as well as throughout space. The study presents a set of quantitative urban segregation indicators, covering the aspects of evenness, exposure, concentration, and centralisation. It also captures the most significant occupational changes between different migrant-status groups (non-EU and EU immigrants), during a crucial period for Athens. Evidence indicates that there has been an overall raise in immigrant settlement segregation, accompanied by an increased centralisation trend. Moreover, the urban transformation through economic restructuring that took place in Athens, following the general EU trend towards a knowledge-based economic model, has altered the immigrant labour market structure, leading to vertical segregation patterns, driven by professionalisation.

**KEYWORDS**

Athens, migration, urban transformation, vertical segregation

## 1 | INTRODUCTION

It has long been argued that the socio-spatial compositions of large metropolitan areas have been, to a large extent, affected by three crucial forces: post-industrialisation, globalisation, and migration (Hall, 2004; Jordan & Redley, 1994; Kempen, 1994; Kesteloot, 1995; Walks, 2001; Wessel, 2000). Within this framework, the relationship between migration and urban transformation outcomes, such as spatial segregation, could be considered bidirectional. Developmental processes taking place within urban areas have influenced the evolution of migration flows, both between and within cities, whereas, at the same time, migration, as a phenomenon, has played an essential role in the (re)shaping processes of urban spaces (Portes, 2000). Thus, the impact of migration and its socio-spatial outcomes should be acknowledged and addressed when trying to capture the effects of transformation processes within urban spaces, alongside economic restructuring and internationalisation.

However, the spatial effects that immigrants may have on the dynamics of urban change have largely been overlooked in most empirical studies to date (Hatziprokopiou, Frangopoulos, & Montagna, 2016). The role of urban diversity as an outcome of migration, resulting from social and cultural disparities, has received many

  

different explanations. For many, diversity is as a powerful advantage for urban development and planning that has not yet been fully exploited (Arapoglou, 2012; Hatziprokopiou et al., 2016; Landry & Wood, 2012; Syrett & Sepulveda, 2011), whereas for others, diversity may lead to spatial segregation phenomena. Thus, it is considered a potential source of inequality within cities, working complementarily with existing socio-economic disparities.

Until recently, the strategic design of inclusion policies has been largely underestimated within the broader political and urban agenda (Arbaci, 2008; La Cecla, 1998; Maloutas, 2003; Pareja & San Martın, 2000). However, new policies and interventions aiming to promote migrants' integration into local contexts have been developed over the last decade (Rebelo, 2012; Williams, 2009; Wills et al., 2009). The Urban Agenda for the EU (European Commission, 2016; p. 4) emphasises the importance of acknowledging the polycentric structure of Europe and its urban diversity, through prioritising the inclusion of migrants and refugees in local societies. Its design was based on the EU contribution to the wider context of Sustainable Development Goals, introduced by the UN 2030 Agenda (UN, 2015), specifically Goal 11 "Make cities inclusive, safe, resilient and sustainable," alongside the global New Urban Agenda, as part of the Habitat III process.

Despite the development and implementation of EU policies to monitor and promote ethnic integration within European cities (European Commission, 2010, 2013; Council of the European Union, 2004, 2010), the evidence so far suggests that there is still a significant link between increasing levels of poverty and deprivation and ethnic diversity characteristics (Arapoglou, 2012; Bolt, 2009). The lack of policy effectiveness, in cases like this, is reflected in various levels of social and spatial inequalities, as well as patterns of spatial segregation, revealing the underlying complex socio-economic framework of cities (Burgers & Musterd, 2002; Tammaru, Musterd, Van Ham, & Marcińczak, 2016; van Gent & Musterd, 2016). The interplay of forces acting not only at a global but also at a local scale has been an important factor which plays a key role in the production of the urban socio-spatial inequality framework (Arapoglou, 2012).

Given that existing theoretical frameworks tend to be focused mostly on exploring the evolution of urban dynamics in the most affluent cities of the Global West, this study attempts to bring an additional viewpoint from the global semiperiphery into the discussion, focusing on the case of Athens, which does not follow the rising segregation trends of other Western European cities that are the most common (Musterd & Ostendorf, 2013; Aesopos & Simeoforidis, 1999; Cassiers & Kesteloot, 2012; Leontidou, 1990). Furthermore, the work presented here attempts to explore these issues building on previous efforts to highlight patterns of social segregation (Maloutas, 1993; Maloutas, 2004; Maloutas & Karadimitriou, 2001), which indicate vertical segregation and diffused immigrant settlements in Athens' industrial core and periphery (Kandylis, Maloutas, & Sayas, 2012). To that end, exploring the evolution of urban socio-spatial immigrant structures in Athens can offer valuable background information to researchers and policymakers attempting to investigate whether the spatial segregation of immigrants, in a semiperipheral South European city, is mostly related to socio-demographic characteristics, such as migrant status, or labour market structure.

The article is organised as follows. First, the theoretical framework is presented in Sections 2 and 3, illustrating the evolution of diversity and urban change interactions, along with issues pertaining to economic restructuring and the case of Athens, focusing on key aspects of relevant literature. Section 4 describes the key methodological aspects, as well as the data sources, being used in the study. Results are illustrated and discussed in Section 5, whereas Section 6 offers some concluding comments.

## 2 | MIGRANT SEGREGATION IN THE URBAN CONTEXT

Local spatial outputs, such as residential segregation, have been largely affected by wider global phenomena related to economic restructuring, globalisation, and migration. There is a considerable body of literature on urban (re)shaping and change, highlighting existing underlying mechanisms that affect continuously evolving segregation processes, as well as their socio-spatial outcomes.

Predominant theoretical frameworks of migrant segregation have been mostly inspired by western-centric approaches, trying to shed light on evolutionary processes of inclusion. Starting from the Chicago school, the *city mosaic* approach was adopted to examine urban segregation as a process of *little worlds which touch but do not interpenetrate* (Park, 1921). In this context, spatial distance is considered to be similar to social distance between different social subgroups (Peach, 2005). The *melting pot* metaphor was used to express the fact that assimilation was an effective solution for the segregation phenomena (Arapoglou, 2012).

However, it is often argued that the city mosaic approach ignores the political economy aspects of urban processes. In response to this criticism, the *global* and the *dual city* theses try to encompass globalisation processes, economic restructuring, and the neoliberalisation framework, attempting to provide theory for the relationship between urban diversity and segregation. Segregation is now perceived as a spatial expression of rising social polarisation (Sassen, 1996, 2001), as well as a form of exclusion of disadvantaged groups (Massey, 2007a; Massey & Denton, 1993). The key metaphor in this case, which is related to increasing social divisions, especially in western cities, is based on a *core and periphery* model (Mollenkopf & Castells, 1991; Sassen, 2001). Under this framework, any existing type of polarisation is a product of a complex network of differences, each one of which could work as a trigger for spatial segregation (Hall, 2004; Mollenkopf & Castells, 1991).

To that end, it can be argued that because migrants are able to modify commercial and residential spaces, they constitute a potential force for change within and outside the city core (Sassen, 2005). Based on this role of migration and its impact on spatial segregation, the Los Angeles school of thought attempted to highlight the ways in which cultural heterogeneity and economic disparities interact and produce new fragmented urban spaces (Soja, 2000). The dynamics of migration, alongside the existing social geography of cities, produce uneven patterns of urban restructuring, affecting established relations between the up-til-now core-periphery model in western cities (Davis, 2001; Li, 2009). Furthermore, the instability of socio-spatial geography

within a city has been captured through the *fractal city* concept (Soja, 2000), which explores the continuous shifts in ethnic distributions, within the labour market structure and space. Soja (2000) argues the case for a comprehensive definition of *exopolis*, stating that it represents, on the one hand, *the city turned inside-out*, through the urbanisation of the suburbs and the rise of the outer city, while at the same time, it represents *the city turned outside-in*, through the globalisation of the inner city.

Moreover, the concept of *superdiversity* adds to the overall discourse by highlighting the transnational dimension of contemporary migration flows, as well as their rising level of complexity due to existing dynamic interactions (Vertovec, 2007). Urban space is considered a meeting place of interconnected diversified trajectories, whose resultant force forms the final spatial outcomes (Massey, 2007b). Syrett and Sepulveda (2012) highlight the importance of superdiversity, pointing out that modern western cities do not comprise solely multiple ethnic fragmentations, but instead, they are also characterised by multi-ethnic localities. In this context, it can be argued that the existence of diversified local trajectories requires a continuous adjustment of local policies.

Nevertheless, most previous theories tend to reflect a western-centric approach to the conceptualisation of the interaction between the migration and urban segregation phenomena. Moving one step further, the study presented here offers a unique opportunity to investigate the applicability of these approaches to a southern European, semiperipheral city, where the synthesis of migration flows is largely diversified, and broad economic restructuring processes are still ongoing. Additional theories, reflecting the particularities of Athens, have been adopted in recent studies, emphasising the role of vertical segregation within the city, in terms of labour market structure. These are discussed in the following section.

It is also essential to highlight the role of the welfare state in shaping the socio-spatial outcomes of urban dynamic processes, including migration, globalisation, and transition to post-Fordist economic structures. Hamnett's (1996, 2004) contribution has been crucial, especially, in highlighting the distinction between the professionalisation and polarisation phenomena within cities. Social and cultural outcomes at the urban and intraurban level are strongly affected by the overall welfare state and its related policies (Ballas & Clarke, 2001; Ballas, Clarke, Dorling, & Rossiter, 2007; Bourdieu, 2005; Burgers & Musterd, 2002). In particular, in Europe, welfare regimes have strong impacts on urban conditions (Musterd & Ostendorf, 1998; Tai, 2006). In more neoliberal welfare state contexts, such us that of the United States, social and ethnic inequalities tend to be expressed directly in urban space. These spatial patterns are characterised by diversified social and cultural groups, clearly separated from each other (Musterd, 2005). In contrast to the United States, most welfare regimes in Europe are characterised by high levels of social protection and income redistribution mechanisms, mitigating the effects of dynamic processes (Musterd & Ostendorf, 1998). Within this context, social and ethnic segregation trends are less noticeable in European-type forms of welfare state, compared with the neoliberal-oriented paradigm (Arbaci, 2007; Musterd, 2005; Tammaru et al., 2016).

At the same time, metropolises located in Southern Europe, such as the city of Athens, have increasingly become major destinations for a significant number of transnational migrants (Arapoglou & Sayas, 2009). Thus, the intersection of a wide variety of cultural and social differences produces new patterns of urban segregation, which, in combination with the 2008 economic crisis and the austerity measures associated with increased economic insecurity and uncertainty, have put a significant strain on community relations, fostering extreme attitudes (Arapoglou, 2012) and support for far-right parties (Doxiadis & Matsaganis, 2012; Georgiadou, Rori, & Roumanias, 2018; Halikiopoulou & Vlandas, 2016).

## 3 | LABOUR MARKET STRUCTURE AND MIGRANT SEGREGATION

As is also noted above, the local economic structure is an essential parameter for understanding urban social dynamics, including socio-spatial outcomes and conditions in areas of immigrant settlement (Bourdieu, 2005). Therefore, it is important to investigate the extent to which urban economies have shifted to a post-industrial structure, accompanied by changes in their labour market structure, in order to identify whether existing the migrant segregation phenomena occur as a result of vertical segregation.

From a theoretical perspective, professionalisation seems to be a key driving force that shapes urban labour markets in post-Fordist economies (Burgers & Musterd, 2002). At the same time, economic restructuring in European countries has been guided by a common vision towards building knowledge-intensive urban economies, affecting both occupational activities and social compositions (van Gent & Musterd, 2016). To that end, jobs related to the tertiary sector of production, such as business and consumer services, as well as high-tech and white-collar jobs, have started to dominate urban labour markets, triggering this post-industrial shift.

However, when considering migration processes, it is interesting to note that the impacts of the restructuring processes briefly discussed above on local labour markets are not evenly distributed across space, as they largely depend on the skill structure of immigrant and native populations, as well as the type of vacancies at the time of their arrival. A common skill structure in a local labour market may lead to an increased competition between immigrant and native workers, resulting in a more explicit local effect on wages. This could result an uneven distributional effect of immigrant settlement throughout space (Dustmann, Glitz, & Frattini, 2008). At the same time, the positioning of newly arrived low-skilled migrants, combined with the existing vacancies at the time of their arrival, enables them in many cases mostly to take up jobs at the lower income end of the post-industrial vacancy chains (Burgers & Musterd, 2002; Waldinger, 1996).

Nevertheless, it can be argued that there is a relative paucity of studies on the effects on urban segregation that are triggered by shifts in the industrial and ethnic division of labour, especially in a European context. In the case of large U.S. metropolitan areas, spatial segregation seems to result through a suburbanisation process of increasing job opportunities. This, in combination with the fact that residential mobility of immigrants is highly associated with issues of residence and work proximity, resulted in trapped groups of low-skilled migrants in inner city neighbourhoods (Kasarda, 1989; Wilson, 1996).

However, the case of southern European cities is distinctively different in many respects. Increased internal migration processes, which were crucial for their transformation into metropolises, have been followed by immigration waves over the last decades. As Malheiros (2002) points out, the emergence of the residential segregation of ethnic minorities is a recent phenomenon in the developmental process of the southern European cities, that is, in many cases related to geographical manifestations of social exclusion. Several southern European cities, including Athens, are characterised by a dual spatial distribution of migrant and native groups and a higher degree of relative suburbanisation and over-representation of non-EU immigrants in the inner city. Incorporating the ethnic dimension into the exploration of the spatial organisation of the southern European metropolises is not only altering the present understanding of these urban spaces but is also leading to urban policy shifts (Malheiros, 2002).

To this end, Athens offers a unique opportunity to investigate the effect of migration on the socio-spatial outcomes in a southern European semiperipheral city, which has been significantly affected by the processes of globalisation and economic restructuring, over recent decades (Beaverstock, Smith, & Taylor, 2015). Both the suburbanisation and professionalisation processes have fostered the social polarisation and spatial segregation phenomena, resulting in an East–West division of Athens (Maloutas, 2001; Panori, 2017; Panori & Psycharis, 2017; Pantazis & Psycharis, 2016). Recent work by Maloutas (2015) has provided a comprehensive presentation of the evolution of socio-economic segregation in Athens from the 1960s until the 2000s. This work also highlighted the discrete spatial socio-economic distribution patterns within Athens, where high-income areas are concentrated in the north-eastern and southern-eastern parts of the city, whereas low-income areas are traditionally located in its western parts. In terms of labour market structure, the traditional location of the working class in western city districts was further intensified during the 1990s (Arapoglou & Sayas, 2009), whereas highly skilled workers, such professionals and managers, tend to relocate in the northern suburbs of Athens, reinforcing the existing spatial segregation. In this context, migration should be treated as an additional focal parameter of economic growth and socio-spatial transformation taking place in Athens, over the most recent years (Arapoglou, 2005; Lianos, 2001; Rovolis & Tragaki, 2006).

Table 1 gives a brief description of the main findings of Maloutas (2015) regarding the spatial segregation process within Athens in recent decades. In terms of urban core and suburban development, the inflow pattern towards the city centre prior to the 1970s seems to have been replaced by a movement of middle and high social classes towards suburban areas, between 1970 and 1990. This trend is followed by a significant arrival of immigrants during the 1990s who settled largely in the inner city of Athens, where they could find affordable housing, leading to a class desegregation period within the city centre. Another important finding is the fact that from 2000 to 2010, there were no significant changes in the existing spatial segregation patterns, despite the high level of social mobility in working-class areas. This could be due to several reasons, including family solidarity networks, importance of spatial proximity with family, and the fact that (and this is particularly relevant to younger populations) existing parental property is often located in the same area as the original family home.

Moreover, Athens illustrates several interesting additional features, in terms of ethnic diversity, distinguishing it not only from international standards but also from other southern European cities. First, the high percentage of Albanian nationals among the total immigrant population (Figure 1) is a special characteristic of Athens and other Greek cities (Arapoglou, 2006; Pratsinakis, 2005; Hatziprokopiou, 2003; Labrianidis, Lyberaki, Tinios, & Hatziprokopiou, 2001), distinguishing them from other southern European cities. Second, segregation levels within Athens during the 1990s, quantified with suitable dissimilarity and Gini indices, were low compared with

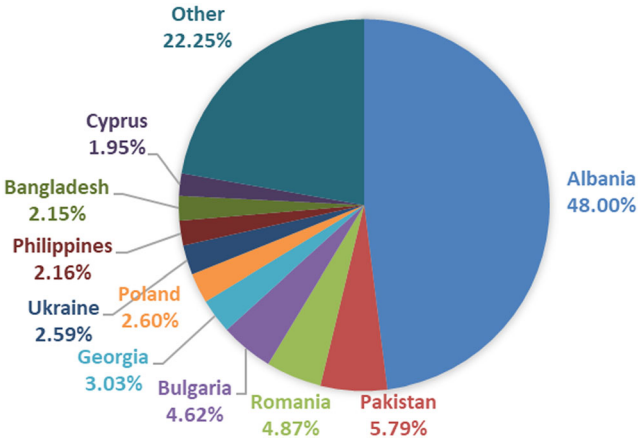


**FIGURE 1** Ethnic structure of immigrants in Attica region (2011). Source: Greek Census 2011 and authors' calculations.

**TABLE 1** Evolution of the spatial segregation process within the metropolitan area of Athens (Maloutas, 2015)

| Period | Description of segregation process |
|---|---|
| Before 1970s | Rapid urbanisation process, leading to a deterioration of the living conditions in the inner city of Athens. |
| 1970–1990 | Geography of social segregation started to change. (Maloutas, 2000)<br>Suburbanisation trend. People belonging to high- and middle-class groups start to move to the suburbs, mostly the north-east and south-east areas. Suburban growth period. |
| 1990–2000 | Presence of a large share of immigrants in the inner city has led to lower levels of social segregation, as immigrants could only find affordable apartments in particular areas of central Athens. (Maloutas, 2007; Maloutas, Arapoglou, Kandylis, & Sayas, 2012) |
| During 2000s | No essential changes in the traditional social division of Athens, between east and west.<br>Increased social mobility movements in working-class suburbs, not followed by high levels of residential mobility (Maloutas, Emmanuel, & Pantelidou-Malouta, 2006). Spatial entrapment of socially mobile groups due to family solidarity networks, importance of spatial proximity with family, and the fact that parental property is located in the same area (Maloutas, 2004). |

international standards and other southern European cities, in terms of ethnic diversity (Arapoglou, 2006). Finally, immigrant groups including nationals from high-income countries illustrate an increased segregation trend, specifically around the most affluent parts of Athens (Arapoglou, 2006).

Furthermore, Table 2 presents some of the main migrant demographic characteristics of in Attica region, where the metropolitan area of Athens is located, using data from the Greek census of 2011. Three distinct groups have been used as a baseline upon which we explore the key demographic characteristics: (a) migrants from other EU member states; (b) migrants from other European countries, but non-EU member states; and (c) migrants from non-European countries. As can be seen, there is a significant diversification in terms of the age and educational structure between these groups. More specifically, immigrants from EU member states indicate a lower percentage of individuals between 20 and 39 years of age (47.74% compared with 62.57% of group c), whereas at the same time increased percentages of people with tertiary education (22.61% compared with 10.23% of group b). At the same time, data referring to activity and marital status also illustrate some significant differences, especially between the EU and the non-EU categories, highlighting the need to distinguish these groups of immigrants when investigating patterns of migration within Athens.

Overall, migration inflows and their structure have exerted significant influence on spatial segregation within the metropolitan area of Athens. However, this process was also affected by the economic restructuring mechanisms that were implemented at the same time, and continue to evolve. The study presented in this article attempts to address these issues, in order to better understand whether a spatial segregation of immigrants exists within the metropolitan area of Athens, and the ways in which it has evolved between the last two census years, 2001 and 2011. Moreover, it presents a research effort to establish a broad picture of the most significant occupational changes between different migrant-status groups, during the period 2001–2011, and compares them to the EU-27 average to highlight any notable existing differences. In this context, it is possible to define specific occupational areas where economic restructuring took place, as well as the ways in which the labour market position of immigrants changed between 2001 and 2011.

## 4 | DATA AND METHODOLOGY

There have long been studies and methods for measuring diversity in an urban setting. One of the key studies is the work of Massey and Denton (1988) who defined a set of five key dimensions, attempting to capture a wide variety of different urban residential segregation aspects: evenness, exposure, concentration, centralisation, and clustering. In addition, Dorling and Rees (2003) and Dorling, Vickers, Thomas, Pritchard, and Ballas (2008) have used indexes of dissimilarity to highlight socio-spatial polarisation in Britain, whereas Jivraj and Simpson (2005) edited a comprehensive volume containing relevant studies that used data from three U.K. population censuses over a period of 30 years to analyse ethnic identity and inequalities. More recent relevant studies include the work of Simpson (2017) and Darlington-Pollock, Norman, and Ballas (2017).

Drawing upon and building on this work, we have calculated a set of quantitative indicators referring to all Massey and Denton defined dimensions for the case of Athens, using migrant and occupational status as the main grouping parameters. These indicators are then used to investigate the extent to which urban segregation is affected by ethnic diversity and economic structural characteristics, within the metropolitan area of Athens. Moreover, comparisons between the census years 2001 and 2011 help us explore whether the 2008 economic crisis has played an essential role in these distributional features with a small and local area level analysis, building upon the relevant work that mostly focused on regional level impacts (Hadjimichalis, 2011; Monastiriotis, 2011). Census data from the years 2001 and 2011 have been used for calculating the selected segregation indices.

Starting with the definition of the indices being used here, we follow the annotation of Massey and Denton (1988). According to their study, overrepresentation or underrepresentation of a minority group within space is a feature related to *evenness*, which, in other words, is related to distributional differences between social groups among urban areal units. The most commonly used measure of evenness is the dissimilarity index (*D*), which is given below (Equation 1):

**TABLE 2** Demographic structure for Greek, EU, and non-EU citizens in Athens (2011)

| | Greek population | EU member states | Non-EU member states | Other non-European countries |
|---|---|---|---|---|
| Age group: 20–39 | 34.12 | 47.74 | 54.73 | 62.57 |
| Age group: 40–59 | 34.98 | 40.63 | 37.78 | 31.30 |
| Age group: 60+ | 30.90 | 11.64 | 7.49 | 6.14 |
| Tertiary education | 23.43 | 22.61 | 10.23 | 13.80 |
| Secondary education | 36.27 | 48.69 | 38.64 | 32.03 |
| Primary education | 40.30 | 28.70 | 51.13 | 54.17 |
| Employed | 37.19 | 48.36 | 39.42 | 51.48 |
| Unemployed | 7.55 | 11.70 | 13.98 | 19.23 |
| Other activity | 55.26 | 39.95 | 46.60 | 29.29 |
| Married | 46.61 | 49.34 | 53.66 | 47.27 |
| Not married | 40.73 | 38.03 | 40.61 | 46.54 |
| Other marital status | 12.66 | 12.63 | 5.73 | 6.19 |

Source: Greek Census (2011) and authors' calculations.

$$D = \frac{\sum_{i=1}^{n}[t_i|(p_i - P)|]}{[2TP(1-P)]}, \quad (1)$$

where $t_i$ and $p_i$ are the total population and minority share of a spatial unit $i$ = 1, 2 …, $n$ and $T$ and $P$ are the population size and minority share of the total urban area. The dissimilarity index represents the maximum vertical distance between the equality line and the Lorentz curve, derived by the cumulative proportions of the minority and the majority groups. The index varies from 0 (complete integration) to 1 (complete segregation).

Additional indicators for evenness include the Gini, entropy, and Atkinson indices. We also chose to calculate the entropy index ($E$) for the case of Athens, proposed originally by Theil (1972). The total urban entropy of an area is given by Equation (2):

$$E = \sum_{i=1}^{n}\left[\frac{t_i(E - E_i)}{ET}\right], \quad (2)$$

where $E_i = p_i \ln\left(\frac{1}{p_i}\right) + (1 - p_i)\ln\left(\frac{1}{1-p_i}\right)$ and $E = P\ln\left(\frac{1}{P}\right) + (1-P)\ln\left(\frac{1}{1-P}\right)$.

The entropy index measures the weighted average deviation of each unit's $i$ entropy ($E_i$) from the total metropolitan area's entropy ($E$), based on diversity criteria. It also varies between 0 (all areas have the same composition) and 1 (all areas contain one group only).

At the same time, *exposure* to the majority members is another segregation characteristic, indicating the degree of interaction or isolation between the minority and the majority groups. The two basic indicators used in this case are based on these two aspects of exposure (Lieberson & Carter, 1982; Lieberson, Peach, Robinson, & Smith, 1981). First, the interaction index reflects the probability for a person belonging to the minority group to share a unit area with majority group person. It is expressed as the minority-weighted average of the majority share in each area. The formula for calculating the interaction index is given in Equation (3):

$$Inter = \sum_{i=1}^{n}\left[\left(\frac{x_i}{X}\right)\left(\frac{y_i}{t_i}\right)\right], \quad (3)$$

where $x_i$, $y_i$ are the minority and majority populations of area $i$ and $X$ is the total minority population within the overall metropolitan area. In the case of the isolation index, the coefficient represents the probability for the minority group members to be exposed only to one another. Both indices vary between 0 (no probability) and 1 (certainty). The isolation index is expressed as the minority-weighted average of the minority share in each area (Equation 4):

$$Isol = \sum_{i=1}^{n}\left[\left(\frac{x_i}{X}\right)\left(\frac{x_i}{t_i}\right)\right]. \quad (4)$$

*Concentration* and *centralisation* are also two additional dimensions that should be taken into consideration when exploring urban diversity. The first one is related to the extent to which members of the minority group occupy a small amount of physical space, whereas the latter one reflects the probability for the minority group to locate around the urban core of the metropolitan area. In the case of concentration, two simple indicators are referred to in the literature representing the absolute and the relative concentration of a group. In the first case, the absolute concentration index (ACO) tries to capture the degree to which a minority group has reached the highest possible spatial concentration. The formula for calculating the index is (Equation 5):

$$ACO = 1 - \left\{\frac{\left[\sum_{i=1}^{n}\left(\frac{x_i a_i}{X}\right) - \sum_{i=1}^{n_1}\left(\frac{t_i a_i}{T_1}\right)\right]}{\left[\sum_{i=n_2}^{n}\left(\frac{t_i a_i}{T_2}\right) - \sum_{i=1}^{n_1}\left(\frac{t_i a_i}{T_1}\right)\right]}\right\}, \quad (5)$$

where $a_i$ is the land area of unit $i$ and the areal units are ranked by geographical size. Moreover, $n_1$ refers to the rank of the area where the cumulative total population of areal units ($t_i$) equals the total population of the minority group ($X$), starting from the smallest unit, and $n_2$ refers to the rank of the area where the cumulative total population of areal units ($t_i$) equals the total population of the minority group ($X$), starting from the largest unit. $T_1$ is the sum of all $t_i$ from 1 to $n_1$, and $T_2$ is the sum of all $t_i$ from $n_2$ to $n$.

The index varies from 0 (maximum possible spatial de-concentration) to 1 (maximum possible spatial concentration). This index provides evidence the spatial concentration of the minority group; however, it is essential to compare this concentration relatively to the corresponding concentration of the majority group. Thus, the calculation of the relative concentration index adds to the overall segregation discussion, when it comes to comparative analysis, between different social groups. The formula for calculating the relative concentration index (RCO) is given below (Equation 6):

$$RCO = \left\{\frac{\left[\frac{\sum_{i=1}^{n}\left(\frac{x_i a_i}{X}\right)}{\sum_{i=1}^{n}\left(\frac{y_i a_i}{Y}\right)}\right] - 1}{\left[\frac{\sum_{i=1}^{n_1}\left(\frac{t_i a_i}{T_1}\right)}{\sum_{i=n_2}^{n}\left(\frac{t_i a_i}{T_2}\right)}\right] - 1}\right\}, \quad (6)$$

where $n_1$, $n_2$, $T_1$, and $T_2$ are defined as above. In this case, the values of the index vary between −1 and 1, as it refers to a comparative analysis between two groups. A value of −1 means that the concentration of the majority group ($Y$) exceeds that of the minority group ($X$) to the maximum extent, whereas 1 illustrates the opposite. A 0 value of this index indicates that the two groups are equally concentrated in space. Massey and Denton (1988) point out that *the relative concentration index measures the share of urban space occupied by group X compared to group Y*.

Furthermore, absolute and relative centralisation indicate the degree to which a group is located close to the urban core of the metropolitan area, in absolute and relative terms respectively. The equation for calculating absolute centralisation (ACE), proposed by Duncan and Duncan (1955), is given below (Equation 7):

$$ACE = \sum_{i=1}^{m}(X_{i-1}A_i) - \sum_{i=1}^{m}(X_i A_{i-1}), \quad (7)$$

where $m$ represents the areal units of the metropolitan area, ranked by increasing distance from the central business district, and $A_i$ refers to the cumulative proportion of the land area from unit 1 to $i$. Its values

vary from −1 to 1, with positive values indicating a tendency for members belonging to group *X* to reside close to the city centre (Massey & Denton, 1988). At the same time, the calculation formula for the relative centralisation index (RCE) is (Equation 8)

$$\mathrm{RCE} = \sum_{i=1}^{m} (X_{i-1}Y_i) - \sum_{i=1}^{m} (X_i Y_{i-1}), \tag{8}$$

where *m* is defined as above. The values for this index also vary from −1 to 1, with positive values indicating a tendency for members belonging to group *X* to reside closer to the city centre when compared with members of group *Y* (Massey & Denton, 1988).

Finally, *clustering* has been calculated using the absolute clustering index (ACL; Massey & Denton, 1988) and the spatial proximity index (SP; White, 1986). Both indicators try to capture the degree to which minorities live in areas that adjoin one another, or in other words the degree to which minorities live disproportionately in contiguous areas. The indexes have been calculated based on the following formulas (Equations 9 and 10):

$$\mathrm{ACL} = \frac{\left\{\sum_{i=1}^{n}\left[\frac{x_i}{X}\sum_{j=1}^{n} c_{ij}x_j\right] - \left[\frac{X}{n^2}\sum_{i=1}^{n}\sum_{j=1}^{n} c_{ij}\right]\right\}}{\left\{\sum_{i=1}^{n}\left[\frac{x_i}{X}\sum_{j=1}^{n} c_{ij}t_j\right] - \left[\frac{X}{n^2}\sum_{i=1}^{n}\sum_{j=1}^{n} c_{ij}\right]\right\}}, \tag{9}$$

where $c_{ij} = exp\ (-d_{ij})$ and $d_{ij}$ is the distance between areal unit centroids. Moreover,

$$\mathrm{SP} = \frac{(XP_{xx} + YP_{yy})}{TP_{tt}}, \tag{10}$$

where $P_{xx} = \sum_{i=1}^{n}\sum_{j=1}^{n}\frac{x_i x_j c_{ij}}{XY}$ is the average proximity between members of group *X*.

It is important to note that the definition of minority groups in these cases can be based on different selection criteria. In our case, first, we choose to use three different migrant-status groups: non-EU and EU immigrants (defined as immigrants coming to Greece from other EU member states), as well as Greek nationals. Second, occupational status is also used as a defining parameter for the social grouping of the population, including the 9 ISCO-08 categories: (1) managers; (2) professionals; (3) technicians and associate professionals; (4) clerical support workers; (5) service and sales workers; (6) skilled agricultural, forestry, and fishery workers; (7) craft and related trades workers; (8) plant and machine operators and assemblers; and (9) elementary occupations. The main findings regarding the distribution of immigrants, as well as the occupational structure, within the metropolitan area of Athens are presented in the following section.

## 5 | EMPIRICAL FINDINGS

Table 3 presents some of the outputs of the empirical analysis, illustrating the evolution of the indices of urban segregation between 2001 and 2011 for the non-EU and EU immigrant groups. The empirical findings illustrate that the distributions of these two groups of immigrants changed during the period under investigation. In terms of *evenness*, there seems to be a shift towards a higher socio-spatial segregation pattern, as both the dissimilarity and the entropy index have risen between 2001 and 2011. It is interesting to note that the rise in these indicators is slightly higher in the case of non-EU immigrant group, indicating higher polarisation trends for them within the metropolitan area of Athens.

In terms of *exposure*, the non-EU immigrant groups seem to be more isolated, when compared with EU immigrants, in both cases. When looking at the relative differences, the interaction and isolation indices indicate, as expected, opposite trends, with the isolation pattern being the one that is positively affected throughout the period 2001–2011. In the case of EU immigrant groups, their very low isolation values illustrate a sharp relative increase during the economic crisis period.

*Concentration* in absolute terms, indicates an opposite movement for the two migrant-status groups. There seems to be a rise in spatial concentration for non-EU immigrants in 2011, whereas the EU immigrants have experienced a de-concentration period. Despite the contrast between these movements, both groups present similar levels of absolute concentration in space, but this is does not occur in the case of relative concentration. When comparing the minority groups' concentration with that of the Greek nationals, the findings reveal that in all cases, the concentration of the majority group exceeds that of the minority groups. Moving to *centralisation*, it appears that both immigrant groups tend to reside closer to the urban core of Athens, as the values of ACE are positive in all cases. Moreover, non-EU immigrants are traditionally more centralised than Greek and other EU nationals, a pattern that seems to have intensified during the period

**TABLE 3** Indices for urban residential segregation for non-EU and EU citizens in Athens (2001 and 2011)

| Dimension | Indicators of segregation | Non-EU immigrants | | | EU immigrants | | |
|---|---|---|---|---|---|---|---|
| | | 2001 | 2011 | Diff (%) | 2001 | 2011 | Diff (%) |
| Evenness | Dissimilarity index | 0.235 | 0.260 | 10.64 | 0.251 | 0.276 | 9.96 |
| | Entropy | 0.040 | 0.053 | 32.50 | 0.031 | 0.040 | 29.03 |
| Exposure | Interaction | 0.881 | 0.853 | −3.18 | 0.890 | 0.851 | −4.38 |
| | Isolation | 0.105 | 0.119 | 13.33 | 0.016 | 0.029 | 81.25 |
| Concentration | ACO | 0.446 | 0.456 | 2.24 | 0.475 | 0.407 | −14.32 |
| | RCO | −0.450 | −0.499 | 10.89 | −0.343 | −0.594 | 73.18 |
| Centralisation | ACE | 0.543 | 0.549 | 1.10 | 0.399 | 0.523 | 31.08 |
| | RCE | 0.247 | 0.297 | 20.24 | 0.089 | 0.281 | 215.73 |
| Clustering | ACL | 0.050 | 0.057 | 15.11 | 0.006 | 0.011 | 41.51 |
| | SP | 0.721 | 0.744 | 3.25 | 0.889 | 0.680 | −23.47 |

Source: Greek Census (2001, 2011) and authors' calculations.

2001–2011. However, EU immigrants experience a much sharper shift during this period, towards a more centralised spatial distribution.

In terms of *clustering*, there is no evidence suggesting the existence of ghettos or enclaves within Athens, as both indicators, ACL and SP, indicate very low values for both non-EU and EU immigrant groups. This is consistent with previous findings suggesting that Athens does not experience the phenomena of extreme segregation of minority groups, when compared with other western-European and U.S. cities (Arapoglou, 2012; Kandylis et al., 2012; Arbaci & Malheiros, 2010).

As has been shown in Table 3, the differences between the spatial distribution patterns of non-EU and EU immigrants have evened out during the period under investigation. Given that traditional variations within their segregation patterns originated from an existing vertical segregation pattern within the overall immigrant population, it is essential to explore whether there have been any significant changes in terms of economic restructuring in the overall labour market structure, but also within these two immigrant groups, that could possibly have affected them.

Table 4 can be used to examine the overall labour market structure for the case of Athens, relative to the E.U. general trend. It presents the occupational distribution within the metropolitan area, as well as the EU-27 shares, in order to understand more clearly the changes that took place during this decade. The recorded changes and trends of the labour market restructuring process have been similar in both cases. First, during the period 2001–2011, there was an essential economic restructuring process, in terms of the labour market structure, within the area of Athens. More specifically, there was a rise in the labour market share related to professionals (Group 2) and service and sale workers (Group 5), whereas the shares of managers (Group 1), clerks (Group 4), and craft and related trades workers, plant and machine operators and assemblers, and elementary occupations (Groups 7, 8, and 9) decreased.

It is particularly important to note that the changes between 2001 and 2011 have led to a diversified structure of the shares of Groups 2, 4, and 7, 8, and 9, which have come to demonstrate similar values in 2011. This process highlights a significant economic restructuring period for Athens, towards a more knowledge-based labour market structure, where professionals and service workers start playing an increasingly important role throughout the overall economic structure of the labour market. Within this new framework, jobs related to lower skills, such as crafts, machine operators, and elementary occupations, are losing ground and become less dominant to the market structure.

Regarding the occupational structure of the overall immigrant population, it is very interesting to point out the differences, not only between 2001 and 2011 but also between non-EU and EU migrant-status groups (Table 5). Although their trends follow the overall labour market trend, it is crucial to note that there is a structural difference between them. The EU migrant-status group demonstrates higher than the average values in highly skilled jobs, such as managers (Group 1);

**TABLE 4** Occupational distribution (%) of total labour market in Athens (2001–2011)

| | EU-27 countries | | | Athens | | |
|---|---|---|---|---|---|---|
| Occupational category (ISCO-08) | 2001 | 2011 | Diff. | 2001 | 2011 | Diff. |
| 1. Managers | 7.60 | 6.15 | −1.44 | 10.18 | 6.09 | −4.09 |
| 2. Professionals | 12.22 | 17.99 | 5.77 | 16.24 | 22.80 | 6.56 |
| 3. Technicians and associate professionals | 15.00 | 15.53 | 0.54 | 11.13 | 11.96 | 0.83 |
| 4. Clerical support workers | 11.71 | 9.99 | −1.73 | 14.55 | 10.82 | −3.73 |
| 5. Service and sales workers | 13.28 | 17.17 | 3.89 | 15.72 | 22.66 | 6.94 |
| 6. Skilled agricultural, forestry and fishery workers | 6.45 | 4.13 | −2.33 | 0.88 | 0.61 | −0.27 |
| 7. Craft and related trades workers | 33.74 | 29.04 | −4.70 | 31.31 | 25.05 | −6.26 |
| 8. Plant and machine operators and assemblers | | | | | | |
| 9. Elementary occupations | | | | | | |

Source: Greek Census (2001, 2011), Eurostat [lfsa_egais] and authors' calculations.

**TABLE 5** Occupational distribution of total, non-EU, and EU immigrants in Athens (2001–2011)

| Occupational category (ISCO-08) | 2001 | | | 2011 | | |
|---|---|---|---|---|---|---|
| | Total immigrants | Non-EU | EU | Total immigrants | Non-EU | EU |
| 1 | 3.27 | 2.49 | 7.60 | 1.16 | 0.90 | 2.29 |
| 2 | 4.49 | 2.69 | 14.60 | 10.02 | 4.99 | 32.65 |
| 3 | 2.74 | 2.03 | 6.74 | 3.35 | 2.04 | 9.22 |
| 4 | 3.20 | 2.64 | 6.36 | 3.44 | 2.50 | 7.70 |
| 5 | 13.20 | 13.42 | 11.93 | 36.62 | 37.13 | 34.32 |
| 6 | 1.33 | 1.46 | 0.58 | 0.13 | 0.15 | 0.03 |
| 7, 8 & 9 | 71.78 | 75.26 | 52.19 | 45.28 | 52.28 | 13.79 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Source: Greek Census (2001, 2011) and authors' calculations.

professionals (Group 2); technicians and associate professionals (Group 3); and clerical support workers (Group 4). On the other hand, non-EU immigrants are mostly related to what may generally be considered lower social status jobs, including service and sales (Group 5); craft and related trade (Group 7); plant and machine operators and assemblers (Group 8), and elementary occupations (Group 9).

The hierarchical structure of the occupations of non-EU immigrants remains the same between 2001 and 2011, with only a slightly higher increase in the professional group (Group 2), whereas the EU migrant-status group experiences a structural change during this period. The shift occurs between the groups of professionals (Group 2), the service and sales workers (Group 5), the craft and related trades (Group 7), plant and machine operators and assemblers (Group 8), and elementary occupations (Group 9). More specifically, the composition of the EU migrant group shifts towards an even more definite structure, characterised mainly by professionals and service workers, instead of the lower paid social status occupations. These changes can also be seen more clearly in the bar chart of Figure 2, where the differences between the distribution of occupations during the period 2001–2011, especially for the EU migrant group, are illustrated.

Given the existing deviations in terms of occupational status between the two immigrant groups being investigated in this study, it is crucial to include an exploration of the spatial segregation patterns in terms of the different occupational groups. This is an important step towards a better understanding of the residential segregation patterns within Athens. Table 6 presents the calculated values for each occupational group, referring to the total working population, the non-EU and the EU immigrant groups. As can be seen, both groups demonstrate higher values of segregation when compared to the overall labour market population. Furthermore, when comparing the two migrant-status groups, the EU group is characterised by higher values of residential segregation.

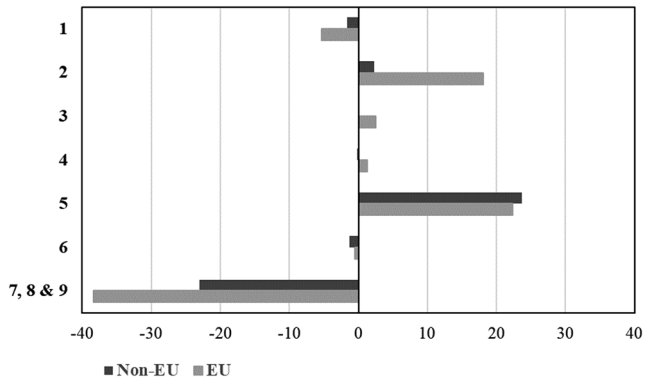


**FIGURE 2** Differences in occupational structure for the non-EU and EU migrant-status groups in Athens between 2001 and 2011. Source: Greek Census (2001, 2011) and authors' calculations.

In terms of occupational status, managers and professionals (Groups 1 and 2) and craft and related trades workers, plant and machine, and workers classified as being in elementary occupations (Groups 7, 8, and 9) seem to be more spatially segregated in all cases. This was expected, as similar social status working groups tend to locate close to each other, leading to a more uneven distribution within the metropolitan area of Athens. The lowest values for the dissimilarity index have been calculated for technicians and clerks. This is in line with the findings of Arapoglou (2006) for the year 2001. Moreover, values calculated for the skilled agricultural, forestry, and fishery workers (Group 6) are not very indicative for the two immigrant groups, as they refer to a very small number of residents.

The dissimilarity index provides information regarding the distribution of immigrants in terms of different occupations, by comparing it to the overall active population. In order to further explore urban occupational segregation, we have also calculated the absolute centralisation index for the different occupational groups. As shown in Table 7, there is a tendency for people working in the so called lower social status occupations to reside closer to the city centre of Athens. It is important to note that the absolute centralisation index values decline as we move to higher social status occupations.

When we compare the two immigrant groups, this trend continues to exist, but to a greater extent, illustrating a higher tendency of immigrants to locate closer to the city centre, throughout all occupational groups. Thus, the hypothesis of a suburbanisation trend of the non-EU migrants cannot be supported by this study. This is in alignment with the findings of Arapoglou (2006) for Athens in the year 2001, rejecting the hypothesis of Malheiros (2002), regarding the higher degree of suburbanisation of migrants from less developed and non-EU countries.

Overall, it can be argued that the level of centralisation indicates similar values between the two minority groups, meaning that there is no deviation in location choices between different migrant-status groups, when comparing the same occupational groups. This may suggest that there is an emerging spatial segregation outcome within the metropolitan

**TABLE 6** Dissimilarity index for different occupational structures of immigrant groups in Athens, 2011

| Occupational category (ISCO-08) | Total | Non-EU immigrants | EU immigrants |
|---|---|---|---|
| 1. Managers | 0.159 | 0.192 | 0.282 |
| 2. Professionals | 0.172 | 0.221 | 0.295 |
| 3. Technicians and associate professionals | 0.063 | 0.171 | 0.243 |
| 4. Clerical support workers | 0.046 | 0.181 | 0.251 |
| 5. Service and sales workers | 0.086 | 0.210 | 0.280 |
| 6. Skilled agricultural, forestry and fishery workers | 0.079 | 0.315 | 0.784 |
| 7. Craft and related trades workers | 0.127 | 0.240 | 0.318 |
| 8. Plant and machine operators and assemblers | 0.180 | 0.206 | 0.254 |
| 9. Elementary occupations | 0.174 | 0.364 | 0.353 |

Source: Greek Census (2001, 2011) and authors' calculations.

**TABLE 7** ACE index for different occupational structures of immigrant groups in Athens, 2011

| Occupational category (ISCO-08) | Total | Non-EU immigrants | EU immigrants |
|---|---|---|---|
| 1. Managers | 0.228 | 0.358 | 0.374 |
| 2. Professionals | 0.310 | 0.460 | 0.484 |
| 3. Technicians and associate professionals | 0.322 | 0.463 | 0.490 |
| 4. Clerical support workers | 0.354 | 0.495 | 0.527 |
| 5. Service and sales workers | 0.378 | 0.520 | 0.558 |
| 6. Skilled agricultural, forestry and fishery workers | 0.330 | 0.531 | 0.912 |
| 7. Craft and related trades workers | 0.414 | 0.559 | 0.603 |
| 8. Plant and machine operators and assemblers | 0.364 | 0.500 | 0.550 |
| 9. Elementary occupations | 0.488 | 0.635 | 0.611 |

Source: Greek Census (2001, 2011) and authors' calculations.

area of Athens, that is, one that is more closely related to labour market structural characteristics than to subethnic divisions.

## 6 | CONCLUSIONS

This article presented empirical findings that can inform theoretical debates and perspectives regarding urban segregation phenomena. The quest for paths and links between migration and socio-spatial structures should always take crucial structural turning points of economic history into consideration. First, the transition to post-industrial economic models, accompanied by globalisation processes and knowledge-based economic structures, constitute important parameters that have affected, not only the labour market structure but also the processes of immigrant assimilation, especially within the urban space. These parameters have played, and continue to play, a key role during the socio-spatial segregation processes, not only as centripetal forces for immigrant flows but also as centrifugal vectors for widening socio-economic inequalities through spatial isolation.

Taking Athens as our case study, we have attempted to shed light on the spatial residential segregation patterns that have arisen during the last decade, within its metropolitan area. As is the case in most Southern European countries, throughout this period, spatial segregation within Athens has been significantly affected by immigration, along with underlying economic restructuring processes. However, its levels have not increased to a large degree.

The findings presented in this article illustrate that there has been an increase in spatial segregation in the case of both non-EU and EU immigrants. This increase was relatively higher in the case of non-EU immigrants. Exposure to different migrant-status persons indicates a decrease, leading to higher values of the isolation index, especially in the case of EU citizens. Absolute and relative concentration indicators show that there are no important ethnic concentration trends within the metropolitan area of Athens that could potentially work as a boosting parameter for spatial segregation. However, both immigrant groups tend to reside closer to the city core, a trend that has intensified during the period under investigation. Overall, our findings suggest that no important elements exist in favour of the hypothesis of a high ethnic segregation pattern within Athens.

We have also attempted to explore any possible underlying patterns of urban segregation based on occupational characteristics. The labour market restructuring that took place in Athens between 2001 and 2011 follows the overall EU economic restructuring model. The same also happens with the two migrant-status groups that we explored. Segregation information that arises from the combination of these two parameters indicates higher dissimilarity values for both non-EU and EU immigrants, when compared to the total labour market population. Occupational structure seems to play an essential role in the case of absolute centralisation, as it is negatively related to social occupational status.

In conclusion, we have shown that during the last decade, the socio-spatial segregation phenomena within Athens have intensified, indicating a vertical nature, without approaching very high levels. Moreover, centralisation of immigrants has also been enhanced. The overall labour market structure has followed the general trend towards a more knowledge-based economy, without illustrating any evidence supporting the hypothesis of an increasing migrant-group segregation. Finally, this shifting trend towards a knowledge-based economic model has consequently led to vertical segregation patterns mostly driven by professionalisation.

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**How to cite this article:** Panori A, Psycharis Y, Ballas D. Spatial segregation and migration in the city of Athens: Investigating the evolution of urban socio-spatial immigrant structures. *Popul Space Place*. 2019;25:e2209. https://doi.org/10.1002/psp.2209