Vicious Circle of Segregation: Understanding the Connectedness of Spatial Inequality across Generations and Life Domains

Editors

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Editorial

Spatial Underpinnings of Social Inequalities: A Vicious Circles of Segregation Approach

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Abstract

A paradigm shift is taking place in spatial segregation research. At the heart of this shift is the understanding of the connectedness of spatial segregation in different life domains and the availability of new datasets that allow for more detailed studies on these connections. In this thematic issue on spatial underpinnings of social inequalities we will outline the foundations of the 'vicious circles of segregation' framework to shed new light on questions such as: What is the role of residential neighbourhoods in urban inequalities in contemporary cities? Have residential neighbourhoods lost their importance in structuring daily lives since important part of social interaction takes place elsewhere? How is residential segregation related to inequalities in other important life domains, in schools, at work and during leisure time? The vicious circles of segregation framework builds on the traditional approaches to spatial segregation, as well as on the emerging new research undertaken within the 'activity space approach' and 'longitudinal approach' to segregation. The articles in this thematic issue improve our understanding of how spatial segregation is transmitted from one life domain to another as people sort into residential neighbourhoods, schools, workplace and leisure time activity sites, and gain contextual effects by getting exposed to and interacting with other people in them.

Issue

This editorial is part of the issue "Vicious Circle of Segregation: Understanding the Connectedness of Spatial Inequality across Generations and Life Domains" edited by Tiit Tammaru (University of Tartu, Estonia), Siiri Silm (University of Tartu, Estonia), Frank Witlox (Ghent University, Belgium), Maarten van Ham (Delft University of Technology, The Netherlands) and Madli-Johanna Maidla (University of Tartu, Estonia).

1. Paradigm Shift: From Residential Segregation to a Multi-Domain Understanding of Segregation

Large cities continue to attract people and jobs despite decade-long efforts to achieve more inclusive regional development. How inclusive are large cities themselves for people clustering in them? Do large cities provide opportunities for all, or do they provide opportunities on a selective basis to selected groups of people? What is the role of residential neighbourhoods in facilitating social and spatial inclusion? Have other spatial settings, such as schools, workplaces, or free time activity places, become the main arenas that shape how unequal or inclusive contemporary cities are?

This thematic issue addresses these and many other related questions in eleven articles, and it delivers three

key messages to the ongoing discussions on the spatial underpinnings of inequalities and social inclusion in contemporary cities. First, it is short-sighted to downplay the importance of residential neighbourhoods for understanding how spatial inequalities are produced and reproduced. Second, a vicious circle of segregation framework helps to shed new light on how spatial inequalities in different life domains are connected to each other, encompassing the whole activity space of people—residential neighbourhoods, schools, workplaces and leisure time activity sites. Third, bringing together research from longitudinal studies on individual life courses and across generations with research from daily activity spaces anchored around homes provides the key for understanding how urban social and spatial inequalities form, how to break the vicious circles of inequality and segregation, and what might be the roadmap towards more socially and spatially inclusive cities.

Research on spatial inequalities and exclusion has mainly focused on residential segregation (Booth, 1888; E. W. Burgess, 1925; Krysan & Crowder, 2017; Maloutas & Fujita, 2012; Musterd, 2005; Musterd & Ostendorf, 1998; Peach, 1996; Schelling, 1971; Tammaru, van Ham, Marcińczak, & Musterd, 2016; van Ham, Tammaru, Ubarevičienė, & Janssen, 2021). Residential segregation, defined as an uneven distribution of population groups across urban neighbourhoods, is generally understood as a function of income inequality, preferences and discrimination. Although income inequality is often seen as the prime cause for the spatial inequality between population groups, for residential segregation to occur, housing preferences matter as well. Segregation levels rise if high-income households seek housing in attractive parts of the city, such as regenerated inner-city neighbourhoods, pushing house prices in those neighbourhoods beyond the reach of lower-income households (Pastak, 2021). Some forms of discrimination tend to operate in housing markets as well, even when explicit discrimination is outlawed, stemming from subtle mechanisms that range from the selection of renters by landlords through to which neighbourhoods are included in the consideration set by renters (Krysan & Crowder, 2017).

Residential sorting is a household-level process (Rossi, 1955) and, since people tend to find partners similar to themselves (Kalmijn, 1991), residential segregation by income or social status is reinforced by demographic processes of family formation. Dual-earner households with two higher incomes drive urban spatial inequalities through their behaviour in the housing market, as they have the purchasing power to buy in the most attractive neighbourhoods. Lower-income households have much less choice and less financial credibility with banks and, as a result, they rent or buy in low-cost neighbourhoods (Gonalons-Pons & Schwartz, 2017). Since there is some overlap between social groups and ethnic groups in terms of incomes, a triple inequality—social, ethnic and spatial—or 'eth-class' segregation tends to emerge in multi-ethnic cities (R. Andersson & Kährik, 2016). In his

pioneering study, Peach (1980) took an explicit interest in the links between family formation and residential segregation. He showed that ethnic minorities living in a co-ethnic union live in more segregated neighbourhoods compared to ethnic minorities living in a mixed ethnic union with members of the native majority population.

The considerations of households that produce and reproduce spatial inequalities go beyond financial resources at hand. The search for a home also relates to other important decisions facing families, including where to school children and how to obtain easy access to jobs and other urban amenities. In other words, the choice of where to live relates to the linked lives of family members and to the needs related to the daily activity space of all family members (Coulter, van Ham, & Findlay, 2015; Järv, Müürisepp, Ahas, Derudder, & Witlox, 2015; Silm et al., 2021; Silm & Ahas, 2014). In addition, the choice of housing options is influenced by social network ties and their locations (Krysan & Crowder, 2017). Hence, the long-term residential decisions are tightly related to the expectations families have towards schools and other important daily activity sites. Different neighbourhood characteristics tend to be considered jointly; the overall reputation of neighbourhoods as places to live and raise children is especially important in the home search of families (Bernelius, Huilla, & Lobato, 2021; Nieuwenhuis & Xu, 2021).

The study by Rivkin (1994) was the first to measure whether segregation in residential neighbourhoods and schools are related. Based on the analysis of US census data from 1968, 1980 and 1988, he found that schools are highly segregated primarily because of high levels of residential segregation. School segregation is largely driven by the fact that children generally attend nearby schools and, as neighbourhoods are relatively homogeneous in composition, schools are too (Bernelius & Vilkama, 2019; Oberti & Savina, 2019; Rich, Candipan, & Owens, 2021). Ellis, Wright, and Parks (2004) established that there is also a strong connection between levels of residential and workplace segregation. Based on census data from 1990 in Los Angeles, they found that residential segregation accounts for about half of workplace segregation. In short, research on residential segregation has gradually established strong links with segregation in other important domains of daily life: schools and workplaces. Neighbourhood reputation is important in residential sorting, and homes are an important anchor point for other daily activities, shaping access both to schools (Nieuwenhuis & Xu, 2021), jobs (Delmelle, Nilsson, & Adu, 2021) and leisure time activities (Kukk, van Ham, & Tammaru, 2019; Mooses, Silm, & Ahas, 2016; Silm & Ahas, 2014).

2. Conceptual Foundations of the Vicious Circle of Segregation

The pioneering studies on the connectedness of residential segregation with family formation (Peach, 1980),

school segregation (Rivkin, 1994) and workplace segregation (Ellis et al., 2004), paved the way for a paradigm shift in research on the spatial underpinnings of inequality and inclusion in cities, from residential segregation to a multi-domain understanding of segregation. This paradigm shift was further supported by the availability of individual-level, longitudinal, relational and geocoded register data covering full populations. While early pioneering studies provided "photo-like" snapshots on levels of and changes in segregation, longitudinal studies (e.g., Manley, van Ham, & Hedman, 2020; Musterd, Ostendorf, & de Vos, 2003; Strömgren et al., 2014; Tammaru, Strömgren, Stjernström, & Lindgren, 2010; Torpan, Sinitsyna, Kährik, Kauppinen, & Tammaru, 2020; Vogiazides & Chihaya, 2020) allow for a "video-like" following of people across time and space, connecting their behaviour in school, residential and work environments, and connecting family members, neighbours, schoolmates and co-workers with each other.

These longitudinal empirical studies led to the first attempts to conceptualize the connectedness of segregation in different spatial settings. Tammaru et al. (2010) introduced the term 'domains' for studying the contextual effects of residential neighbourhoods and workplaces on migrant incomes. Silm and Ahas (2014) proposed an 'activity space approach' for analysing links between different 'activity sites' by focusing on segregation in residential neighbourhoods and other out-of-home daily activities. Van Ham and Tammaru (2016) elaborated the 'domains approach' for investigating the linkages and interactions between different domains over time. Boterman and Musterd (2017) used the notion of 'cocooning' to explain segregation at places of work and residence, and in transport. Park and Kwan (2017) proposed the term 'multi-contextual segregation' for understanding how immigrants and members of the host population sort into various daily activity sites, anchored around home and work. Tammaru, Kallas, and Eamets (2017) introduced the term 'vicious circle of segregation' to show how spatial inequalities and segregation are systematically produced and reproduced in different life domains, in residential neighbourhoods, workplaces and schools. Finally, van Ham, Tammaru, and Janssen (2018) developed the 'vicious circles of segregation' framework by explaining that feedback loops connect segregation in different life domains over the life course and across generations.

Within a vicious circles of segregation framework, a city could be understood as a set of different life domains where spatial inequalities are produced and reproduced, including the residential domain, school domain and work domain (Figure 1). Domains are the sum of activity sites; all residential neighbourhoods in the city form the residential domain, all schools form the school domain, and all workplaces form the work domain. If high-income households sort into certain residential neighbourhoods (i.e., activity sites), they drive up segregation in the residential domain. When kids from affluent families attend certain schools, they drive up segregation in the school domain. When people with certain skills are sorted into certain workplaces, they drive up segregation in the work domain. Indices of segregation can be computed for each domain to compare levels of segregation between them (Silm, Ahas, & Mooses, 2018; Toomet, Silm, Saluveer, Ahas, & Tammaru, 2015).

The aim of this thematic issue is to contribute to the ongoing paradigm shift in research on spatial inequalities in the city by shedding new light on segregation as a multi-domain process, its drivers and consequences, and how segregation may be passed from generation
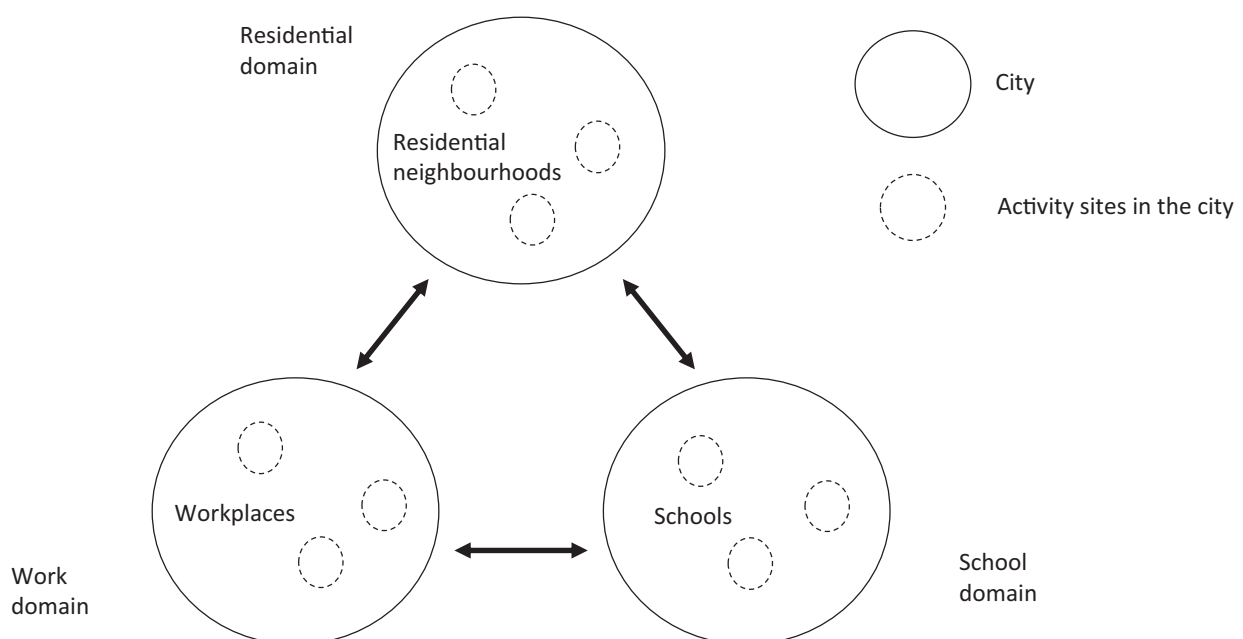

Figure 1. The connections between spatial inequalities in different life domains.

to generation as people sort into concrete activity sites. By following the 'domains approach' by van Ham and Tammaru (2016) and the 'activity space approach' by Silm and Ahas (2014), we develop further the 'vicious circles of segregation' framework (Tammaru et al., 2017; van Ham et al., 2018). The production and reproduction of inequalities and segregation in different life domains emerges as a result of (1) the sorting of people into concrete activity sites by buying or renting a home in a certain neighbourhood in the city, starting studies in a particular school and by getting a job in a certain work-place, and (2) the contextual effects people experience at these activity sites by being exposed to and interacting with others—with neighbours, schoolmates and co-workers. Both sorting and contextual effects are further shaped by the institutional set-up and spatial distribution of opportunities in different cities. For example, the way in which social housing is distributed across the urban neighbourhoods—being spatially clustered into certain neighbourhoods or spread evenly across the city—affects the residential sorting of less affluent households and, as a consequence, levels of segregation (Friesenecker & Kazepov, 2021; Torpan et al., 2020).

The vicious circles of segregation framework thus argue that segregation experienced in one life domain tends to be reproduced in other life domains, and that segregation experienced early in life is often reproduced later in life and transmitted from parents to children because of the interconnected lives of the family members. Hence, when adding the time dimension, the vicious circles of segregation framework could be understood as a sequence of feedback loops both in space and time as people proceed over their life course, live their daily lives and navigate between home, school and workplaces, as well as leisure time activity sites and temporary mobility and activities abroad (Mooses,

Silm, Tammaru, & Saluveer, 2020). Figure 2 illustrates how these sequences and feedback loops evolve over a person's life course and across generations, running from the lower-left corner to the upper-right corner. For adults, sorting in the labour and housing markets are connected. One the one hand, money buys choice on the housing market (Hulchanski, 2010), implying that the inequalities generated in the labour market drive inequalities in the housing market. On the other, the places where people live shape their labour market opportunities and access to jobs (Kain, 1968). The effects are not immediate, and there is often a time-lag before differences in the labour market become visible in the housing market (Tammaru, Marcińczak, Aunap, van Ham, & Janssen, 2020).

The main global urban labour market trend is the professionalization of workforce as people living in large cities move up the occupational ladder because of significant improvements in education and skills (Hamnett, 2021; van Ham, Uesugi, Tammaru, Manley, & Janssen, 2021). However, the spatial effects of professionalization are uneven as we can observe both professionalization, polarization and proletarianization taking place in residential neighbourhoods (Maloutas & Botton, 2021). Professionalization of the urban workforce, and the residential preferences of higher-income households, has brought along three spatial "megatrends" related to residential segregation (Hochstenbach & Musterd, 2018; see also Hess, Tammaru, & van Ham, 2018; Tammaru et al., 2016; van Ham, Tammaru, et al., 2021):

1. The upgrade of the social composition of many neighbourhoods as the share of professionals increases in the city, often as a result of in situ changes as younger and better-educated people replace the less-educated previous generation;
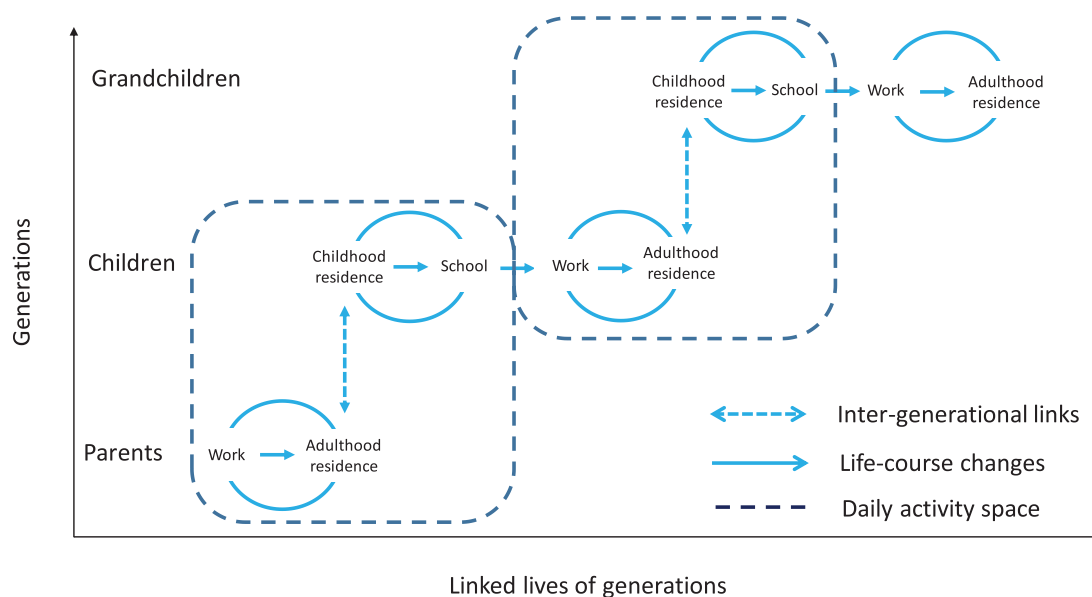

Figure 2. The conceptual framework of vicious circles of segregation.

2. Gentrification driven by the residential mobility of higher-income households moving into former working-class neighbourhoods, driving up housing prices in inner-city neighbourhoods;

3. The displacement of lower-income households to less-attractive suburban settings such as modernist high-rise housing estates.

It has been argued that residential neighbourhoods have lost their importance in producing and reproducing inequalities and segregation, since they are simply places where people sleep with very little social interaction occurring between neighbours (Boal, 1987). However, residential location has a wider meaning in peoples' lives beyond interacting with neighbours. The reputation of neighbourhoods itself is very important in residential decision-making (Bernelius et al., 2021). Housing is the key element that structures social and spatial inequalities in cities (Sorando, Uceda, & Domínguez, 2021) and housing inequalities may be transmitted over several generations (Galster & Wessel, 2019; Hedman & van Ham, 2021). The location of homes shapes access to schools and jobs. As higher-income households have moved to inner cities and low-income households have moved the suburbs (Hochstenbach & Musterd, 2018), a greater symmetry in the geography of where low-income and high-income households live and where high-wage and low-wage jobs are located has emerged (Delmelle et al., 2021). This implies that the geography of disadvantage is increasingly clustering on the peripheries of large cities (Hess et al., 2018).

The growing body of research using an activity space approach shows that the homes where people live are the main anchor points in daily activities and shape access, not only to schools and workplaces, but also a rich set of various leisure time activity sites (Järv, Ahas, & Witlox, 2014; Silm & Ahas, 2014). The importance of residential neighbourhoods as places of social interaction varies too between population groups. Neighbourhoods are central spatial settings for children, the elderly and members of the ethnic minority population (Wissink, Schwanen, & van Kempen, 2016). For example, Hedman and van Ham (2021) show that, for 60% of people living in ethnic neighbourhoods, the neighbourhood is also the main daily activity site. Silm et al. (2018) show that segregation in the activity places (including leisure time sites) tends to be passed on to following generations.

Residential sorting of households with different incomes is thus directly related to a wider consideration set in terms of local amenities and public goods (Tiebout, 1956). Because of the linked lives of the family members, these considerations lead to the inter-generational transmission of segregation (Tammaru et al., 2017; van Ham et al., 2018). Children frequently attend a nearby school and, consequently, residential segregation of parents results in the school segregation of their children (Bernelius & Vilkama, 2019; Oberti & Savina, 2019). School segregation not only reflects existing patterns of residential segregation, but also plays a crucial role in maintaining and reinforcing social and spatial inequalities in cities (Boterman, Musterd, Pacchi, & Ranci, 2019). Comparative studies of residential segregation and school segregation have shown that levels of school segregation tend to be higher than levels of residential segregation (S. Burgess, Wilson, & Lupton, 2005). For example, having the opportunity to choose a school contributes to school segregation when affluent parents living in lower-income neighbourhoods send their kids to schools outside the home neighbourhood (E. Andersson, Malmberg, & Östh, 2012; Maloutas & Fujita, 2012; Maloutas & Lobato, 2015). When school choice is not available or heavily restricted, parents may also start to 'shop' for schools by renting or buying homes in the catchment areas of desired schools (Rich et al., 2021).

In other words, school choice leads to school segregation through many and often highly localized mechanisms (Wilson & Bridge, 2019), for example when affluent families prioritize the academic quality (Nieuwenhuis & Xu, 2021) and reputation (Bernelius et al., 2021) of the schools where their children study. School reputation, in turn, reinforces residential segregation, meaning that there is a circular relationship between residential segregation and school segregation (Rich et al., 2021; see Figure 2). This circularity emerges since differences in school quality affect residential segregation through prices in the housing market: Neighbourhoods in which schools are perceived as being of a higher quality attract higher-educated and affluent households, leading to higher property prices, which excludes low-income families (Nieuwenhuis & Xu, 2021). In short, the interconnectedness of residential segregation and school segregation results from a joint residential-school choice, in parallel with the clustering of low-wage jobs and low-income households in certain parts of cities. Residential clustering of high-income households into certain neighbourhoods contributes not only to school segregation, but also to broader inequalities in education. For many reasons, learning outcomes tend to be better in those neighbourhoods where more affluent families reside (Nieuwenhuis & Hooimeijer, 2016; Owens & Candipan, 2019; Rich et al., 2021).

3. Policy Implications: A Roadmap to More Spatially Inclusive Cities

Vicious circles of segregation are a result of the connectedness of social and spatial inequalities in different life domains. Advantage breeds advantage and disadvantage breeds disadvantage. Hence, policy interventions in one domain could potentially transmit into the other domains (Figure 1). Dealing with overall levels of income inequality is important for achieving more spatially inclusive cities. During times of growing income inequality, social and spatial mobility increase as well, leading to higher levels of segregation as higher income groups

sort into more attractive neighbourhoods (Nieuwenhuis, Tammaru, van Ham, Hedman, & Manley, 2020). When income inequality stays high, social and spatial inequalities remain high and intergenerational transmission of advantage and disadvantage becomes more frequent. While the growth of income inequalities leads to higher levels of spatial inequalities, the opposite is true as well: reduced income inequality contributes to lowering the levels of residential segregation (Tammaru et al., 2020).

Tackling the overlap between residential segregation and school segregation within the linked lives of family members is especially important for reducing spatial exclusion. Since children usually attend neighbourhood schools, urban policies that aim for diverse housing in residential neighbourhoods help to maintain socially diverse schools as well. The even distribution of social housing across urban neighbourhoods or allocation of social housing to different social groups helps to address residential segregation (Friesenecker & Kazepov, 2021). If social housing is concentrated in certain neighbourhoods, as exemplified by modernist high-rise suburban housing estates (Hess et al., 2018), and residualized for lower-income groups (Ogrodowczyk & Marcińczak, 2021), levels of segregation increase as well. Hence, lowering levels of residential segregation would be the first important measure that would help to reduce school segregation and differences in learning outcomes (Nieuwenhuis & Xu, 2021). The second measure would relate to school choice; when parents have relatively unrestrained choice in which schools their kids learn, levels of school segregation rise as well as affluent parents compensate residential social mix with sending their kids to more attractive schools (E. Andersson et al., 2012; Maloutas & Fujita, 2012; Maloutas & Lobato, 2015; Maloutas, Spyrellis, Hadjiyanni, Capella, & Valassi, & 2019). Bonding ties form at schools between the peers and lowering levels of school segregation would facilitate bridging social ties between different ethnic and social groups. For example, Lubbers, Van Der Werf, Kuyper, and Offringa (2006) find that peer acceptance in schools is not related to the socioeconomic characteristics of parents. Both skills and social networks are, in turn, important in the labour market (Muringani, Fitjar, & Rodríguez-Pose, 2021).

The social interaction between neighbours is often less intense than the social interaction with peers at school and colleagues at work, giving rise to questions on the importance of neighbourhoods in shaping social interaction (Boal, 1987). However, Silm et al. (2021) demonstrate that the social networks are more diverse for people living in mixed neighbourhoods. Rahnu, Puur, Kleinepier, and Tammaru (2020) show that living in mixed neighbourhoods contributes to the formation of mixed-ethnic unions. Residential neighbourhoods shape social interactions directly and indirectly. First, sharing a neighbourhood may bring together neighbours with different backgrounds. For example, families living in the same neighbourhood may start to interact with each

other if they have same-age children through meeting each other in the neighbourhood playground or when their children attend the same kindergarten or school (Špačková & Ouředníček, 2012). The effect may also be indirect. Living in mixed neighbourhoods may make people more comfortable in diverse environments, leading to more social interactions with members of different social or ethnic groups in other life domains or even the formation of mixed-ethnic unions (Rahnu et al., 2020).

Policies aiming at residential mixing also need to go hand-in-hand with policies that address overall levels of income inequality, i.e., housing and labour market policies should reinforce each other in achieving higher levels of spatial inclusion. Otherwise, eliminating the transmission of disadvantage from one domain to another would be much harder. For example, Nieuwenhuis et al. (2017) find that adolescents whose parents move to a more affluent neighbourhood experience increased levels of depression, social phobia, aggression and conflict with parents. It is stressful for children if peers in the neighbourhood and school can afford significantly more. In short, city-level policies in residential mixing should go together with country-level policies on tackling overall levels of income inequalities in breaking vicious circles of segregation (cf. Tammaru et al., 2020; van Ham, Tammaru, et al., 2021). Likewise, a combination of residential mixing with parental choice in school allocation may not help to break the vicious circles of segregation, since higher-income households living in socially mixed neighbourhoods can opt for non-neighbourhood schools, increasing school segregation (cf. E. Andersson et al., 2012).

4. Empirical Contribution: Main Findings from the Thematic Issue

The most effective way of addressing the spatial underpinnings of social inequalities and segregation is to focus on residential neighbourhoods as related to other important life domains, as families live their linked lives and navigate from homes to schools and workplaces, as well as to leisure time activity sites. The rest of this thematic issue provides more detailed insights into the mechanisms of how segregation evolves in daily activity spaces, over the life course and between generations.

The first four articles deal with residential inequalities and housing. Friesenecker and Kazepov (2021) show that the unitary housing system in Vienna helps to keep levels of residential segregation low. Social housing is distributed relatively evenly in Vienna and the tenure structure in social housing is very mixed, preventing a rise in levels of residential segregation. Contrary to Vienna, social housing has contracted in Łódź, and is mainly occupied by lower-income households, a process called residualization of social housing (Ogrodowczyk & Marcińczak, 2021). Since social housing is over-represented in certain parts of the city, its residualization contributes to increasing levels of residential segregation as well.

Sorando et al. (2021) argue that housing is the key element of social inequality in Spain. Their study shows that gentrification has contributed to the disappearance of the last socially mixed residential settings in the inner city in Madrid. Immigrants are over-represented among lower-income households, and they are increasingly clustering in comparatively more affordable housing in the suburbs. Maloutas and Botton (2021) take a different angle by focussing on the role of changes in the occupational structure on residential geographies in Athens. Professionalization in the workforce is the main driving force at the level of the metropolitan area. However, they observe a more detailed geography of neighbourhood social trajectories characterized either by professionalization, proletarianization or polarization driven by both poles. Hedman and van Ham (2021) extend the analysis of residential change across three generations. They find that for Swedish women the probability of residential disadvantage or living in a low-income neighbourhood is correlated with the residential disadvantage of their mothers and, to some extent, their grandmothers.

The following two articles are about school domain. Nieuwenhuis and Xu (2021) demonstrate that there is a strong link between children from higher-income households attending wealthier schools in larger cities in Taiwan while no such link exists in smaller urban areas. Hence, wealthier and higher educated parents make use of opportunities when it comes to residential and school choice in the most urbanized areas to secure a better education for their children. Bernelius et al. (2021) find that school segregation and reputation are strongly linked to neighbourhood reputation in Helsinki. Schools with excellent institutional quality and high learning outcomes suffer from being in disadvantaged neighbourhoods with poor reputations. This implies that investments into quality education alone are not enough to break the vicious circle of segregation if parents' perceptions remain unchanged. However, successful ways in improving school reputation may lead to positive outcomes for the school and neighbourhood.

The following two articles focus on the work domain. Delmelle et al. (2021) focus on accessibility to jobs for people living in disadvantaged neighbourhoods in the suburbs of the Charlotte metropolitan area. They find that the suburbanization of both low-income households and low-wage jobs reinforce each other. Hence, improved access to jobs would not improve levels of employment among low-income households. However, improved accessibility to higher-wage jobs would increase incomes of people living in low-income neighbourhoods. Sorting in the labour market has, however, both a spatial (sorting into workplaces) and aspatial (sorting into industries) dimension. Sinitsyna, Torpan, Eamets, and Tammaru (2021) find that immigrants in Helsinki's labour market cluster both to certain workplaces, referred to as 'workplace segregation,' and certain industries, referred to as 'industrial niching.' Immigration policies favouring migrants with certain skill thus tend to increase inequalities in the labour market. Also, women are more likely than men to be employed simultaneously in segregated workplaces and niched industries.

The last two articles take an activity space approach to studying segregation in different life domains based on mobile phone data. Hedman, Kadarik, Andersson, and Östh (2021) analyse the daily mobility patterns of people living in two medium-sized cities in Sweden. Results reveal that daily mobility patterns are strongly segregated. People living in immigrant-dense neighbourhoods tend to spend most of their day in their home neighbourhood or, when they travel elsewhere to the city, the destination neighbourhoods tend to be immigrant-dense too. People living in non-immigrant neighbourhood are more mobile, and their destination neighbourhoods tend to be less immigrant-dense. The findings from Silm et al. (2021) in Estonia are similar and the authors further elaborate that there is a relationship between spatial mobility and the ethnic composition of social networks. Neighbourhoods with a higher proportion of residents from another ethnic group tend to favour interethnic social networks. The activity-space is most constrained for ethnic minorities whose social networks contain mainly ethnic minorities, while the activity space is the largest for members of the ethnic majority population with mainly ethnic-majority-population social networks.

5. The Way Forward: Five Questions Stemming from the Thematic Issue

There is a paradigm shift taking place in research in spatial inequality and exclusion, from residential segregation to multi-domain understandings of segregation. This thematic issue outlines the conceptual foundations of the vicious circles of segregation to better understand the connectedness of segregation in different life domains and provide empirical insights to the various elements of the concept. It provides the basis for future research since many questions remain unanswered. We will highlight five questions that warrant future research.

First, what is the impact of improved education and the greater professionalization of workforces on social and spatial inequalities? There has been much interest in the role of income inequality on segregation. In parallel, there has been a heated debate on occupational composition change in cities by considering whether it is shifting towards higher levels of social polarization or professionalization. Recent empirical evidence indicates that professionalization has been a trend across the globe. Hence, although cities are more unequal on the one hand, the share of professionals earning high incomes is growing on the other. Furthermore, people worldwide increasingly concentrate in large cities. The expansion of people living and professionals working in large cities drives up house prices and pushes low-income households to urban peripheries. In this thematic issue, we learn that the professionalization of the workforce

contributes to the socioeconomic upgrading of many urban neighbourhoods. However, more needs to be done when it comes to understanding the other effects of increased income inequality and professionalization of the workforce on cities. For example, does the socioeconomic upgrading of neighbourhoods also improve the reputation of the neighbourhoods, and what is its effect on breaking the vicious circles of segregation?

What are trajectories of segregation across neighbourhoods and individual life courses? In this thematic issue, we learn about segregation in daily activity spaces, the connectedness of segregation in different life domains and the transmission of segregation over multiple generations. However, we still know little about (1) neighbourhood trajectories and (2) individual life trajectories in different life domains, as well as how they are connected. Research in this thematic issue indicates that advantage and disadvantage tend to cluster increasingly to the broad macro regions in cities. Many inner-city neighbourhoods gain high-income households, provide high-wage jobs and attractive schools. In many cities, inner cities that were the most socially mixed have become more homogenous as the number of high-income households increases. In contrast, many suburban locations have witnessed increased concentrations of low-wage jobs, low-income households and schools with poorer reputations. What such a spatial "scaling-up" of segregation into broader macro regions in the city means for individuals needs further research. In a nutshell, more longitudinal research is needed on neighbourhood and individual life trajectories. For example, research could address how family or residential contexts are related to the educational trajectories of people through their whole school life from kindergarten to graduating from university, and how these educational trajectories with their various episodes and twists, in turn, shape different aspects of labour market success for individuals.

In this thematic issue, we learn that the residential outcomes of daughters, mothers and grandmothers are related. However, we lack nuance of exactly how the lives of family members are related to each other regarding the intergenerational transmission of spatial inequalities. This begs the question: What is the role of linked lives of family members in the transmission of spatial inequality? For example, how do the high and increasing levels of wealth inequality contribute the intergenerational transmission of various resources and capital? And from a different but equally important note: Do different family arrangements matter in segregation? Families in contemporary cities take different forms and shapes and are in constant flux; families form and dissolve, and kids grow up in very diverse family arrangements. What is the role of increased transnationalisation in everyday lives? Although research in this thematic issue shows that many people live very localized and neighbourhood-based lives, there is also a growing number of families where one of the partners works abroad or under-

takes long-distance commutes within the home country. Likewise, many people living in large cities have second homes which they visit in summertime. Kids spend more time outdoors in summertime and may develop friendships with kids in very different social and spatial environments in second-home neighbourhoods compared to their first-home neighbourhoods.

What is the role of social networks and digital spaces in shaping inequality and inclusion in physical spaces? Although research in this thematic issue demonstrates the continued importance of neighbourhoods in structuring the lives of families, it also shows that spatial mobility and social networks are mutually related to each other. Also, an important part of social relations takes place in the digital space, where people make friends and find partners. Many digital environments and services are location-based, though. For example, people search for partners on digital platforms that allow filtering according to proximity. It is, therefore, important to learn more about whether the social homophily in digital spaces helps to reduce the tyranny of space, by bringing together people with similar interests irrespective of their social background, or reinforces segregation in the physical space as well.

Finally, how do the aims of smart and sustainable cities shape segregation and inclusion? The leading paradigms in urban research relate to smart, sustainable and inclusive cities. Future cities aim to be green and sustainable and, for this end, reducing the ecological footprint of mobility is a key target. It implies promoting green and active forms of mobility, including public transit, walking and cycling. Research is needed on the implications of increased active mobility on the sizes of people's activity spaces and whether shorter travel distances contribute to the spatial isolation of social groups who reside in different neighbourhoods of the city.

Acknowledgments

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Article

Housing Vienna: The Socio-Spatial Effects of Inclusionary and Exclusionary Mechanisms of Housing Provision

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Abstract
The provision of housing plays a decisive role in segregation processes. In a European context increasingly influenced by variegated neo-liberal housing policies, Vienna's approach is characterised by generous access to social housing. This inclusive strategy aims at actively preventing segregation and the isolation of certain groups. Over the last 30 years, however, reconfigured multi-level arrangements and wider contextual changes have transformed Vienna's housing governance. This article explores how. In particular, it aims at disentangling the relationship between housing policy reforms at multiple policy levels and the changes of the mechanisms shaping the access to tenure segments and residential segregation in Vienna. Through the use of process tracing, we identify critical junctures of housing governance and relate them to housing segmentation and segregation measures over a period of approximately 30 years. Our findings show that reforms on multiple levels produce an increasingly deregulated private rental market and an increasingly fragmented access to a diversified provision of social housing. From a spatial point of view, persistent patterns of segregation blend with new ones, leading to decreasing segregation characterised by a more even spatial distribution of low and high-status groups. At the same time, both groups show very low, but slightly increased levels of isolation. Tenant profiles in social housing are, however, generally still very mixed. Balancing the trade-off between a social mix and social targeting without excluding residents in need will remain the main challenge for Vienna's social housing model.

Issue
This article is part of the issue "Vicious Circle of Segregation: Understanding the Connectedness of Spatial Inequality across Generations and Life Domains" edited by Tiit Tammaru (University of Tartu, Estonia), Siiri Silm (University of Tartu, Estonia), Frank Witlox (Ghent University, Belgium), Maarten van Ham (Delft University of Technology, The Netherlands) and Madli-Johanna Maidla (University of Tartu, Estonia).

1. Introduction

In the context of globalisation, neoliberalisation and welfare state retrenchments, increasing social inequalities and segregation levels are well documented in urban areas worldwide but to varying degrees (Musterd, 2020, p. 415). For Europe, recent research has shown that the process of residential segregation differs across countries and cities because of an interplay of various factors. According to Tammaru, Marcińczak, van Ham, and

Musterd (2016), at least four factors interact in shaping segregation: (1) globalisation and economic restructuring, (2) social inequalities, (3) welfare regimes and (4) housing regimes. Yet these factors are not fully accountable in explaining the differences in segregation that led Musterd, Marcińczak, van Ham, and Tammaru (2017) to conclude that local contexts and path-dependent urbanisation patterns may (partially) override the structural factors.

In that regard, the role of (local) housing policies, modes of housing provision and tenure structure shape

the spatial distribution of tenure segments and the socio-spatial outcomes of economic restructuring and social inequality in urban settings (Andersen, Andersson, Wessel, & Vilkama, 2016; Arbaci, 2019; Maloutas, 2012). Maloutas (2012, p. 10) emphasised that the "shifting and sorting of housing allocation processes" are central filters in translating the household's unequal financial resources into socio-spatial inequalities. This financial capacity shapes "preferences, opportunities and restrictions," whereas opportunities and restrictions also depend on housing stock availability and (institutional) allocation mechanisms (van Ham & Manley, 2014, p. 253). From this perspective, housing segmentation based on different qualities and allocation mechanisms, as well as the size and balance of different housing tenures, are considered important in channelling the uneven/even distribution of social groups across housing tenures and space (Andersen et al., 2016; Arbaci, 2019; Giffinger, 1998; Murie & Musterd, 1996).

However, neoliberal housing policy ideas in which housing became increasingly perceived as a commodity rather than a public responsibility emerged (Wetzstein, 2017). The promotion of owner-occupation, re-commodification, privatisation and, residualisation of social housing, reduction of brick-and-mortar subsidies in favour of person-oriented subsidies and the de-regulation of rent controls are some examples (Arbaci, 2019; Kadi & Musterd, 2014; Scanlon, Whitehead, & Fernández Arrigoitia, 2014). Nevertheless, the State continues to play a key role in regulating housing, mediating the pace, impact and form of these policies producing "diversified responses at the national and local level" (Maloutas, Siatitsa, & Balampanidis, 2020, p. 6).

In Amsterdam, for instance, the promotion of the owner-occupation sector has weakened the function of a large and high-quality public rental sector, but its significant size enables the public sector to house the middle classes leading to less marked social separation in space (Musterd, 2014). Another example with different outcomes is Stockholm. The national government and later the City of Stockholm enabled the conversion of public housing units to market-based cooperatives, which led to substantial gentrification of inner-city areas and higher levels of segregation (Andersson & Turner, 2014). Other countries such as France and Austria preserved and even enhanced the social housing sector, yet the 'social' orientation among those countries became increasingly fragmented (Lévy-Vroelant, Reinprecht, Robertson, & Wassenberg, 2014). Reports from Southern European cities show that low levels of segregation have increased since the 1990s, as the familistic model of homeownership, characterised by self-production and informal access to land, was increasingly replaced by a credit financed access to homeownership (Arbaci, 2019; Maloutas, 2012). Social rental sectors in Central and Eastern European cities are highly fragmented as national social housing stocks have been largely privatised and the existing stock became residualised and often decen-

tralised to municipalities (Hegedüs, Lux, Sunega, & Teller, 2014). In some cities, this initially led to decreasing segregation levels through emerging suburbanisation and gentrification processes, which was interpreted as a paradox of (post)socialist segregation (Marcińczak, Gentile, & Stępniak, 2013). However, recent evidence suggests that this trend is temporary and is followed by increasing segregation tendencies in the second decade after the fall of state socialism (cf. Kovács, 2020).

Against this background, this article focuses on the housing policy trajectory of Vienna and traces policy reforms since the 1980s concerning housing segmentation and residential segregation. In the European context, Vienna is portrayed as a unitary housing regime characterised by a large social housing stock, which roots in nearly a century-long political hegemony of the social democratic party. Vienna's housing policy followed and still aims to follow an egalitarian 'housing for all' approach, which provides social housing to a broad section of society to actively reduce social segregation and the isolation of certain groups. Yet, changing multi-level configurations and housing reforms at different levels altered housing provision as well as the access to different housing segments. The aim of this article is, therefore, to explore the relationship between housing policies at multiple policy levels, and local changes in housing segmentation and residential segregation in Vienna since the 1980s. More specifically, we seek to understand the relation between changing housing segmentation, accessibility and levels and patterns of socio-economic segregation. In particular, the extent to which Vienna was able to retain its inclusive and socially mixed approach to housing.

Research on Vienna has largely focused on ethnic segregation and housing market barriers for immigrant groups (Giffinger, 1998; Kohlbacher & Reeger, 2020), but also on the socio-economic dimension (Hatz, 2009; Hatz, Kohlbacher, & Reeger, 2016). Although these studies take into account the housing dimension, there has been no systematic analysis of housing reforms at multiple levels and its relation to tenure segmentation and segregation in the last 30 years. Furthermore, these studies focus mainly on 'evenness' and pay less attention to 'exposure,' which in our understanding captures the Viennese housing approach more precisely. We, therefore, follow a definition of residential segregation that emphasises the changing isolation or separation of one group from the rest of the population (cf. Johnston, Poulsen, & Forrest, 2014, p. 16). A prime focus of segregation studies has been on 'evenness' (Massey & Denton, 1988; Reardon & O'Sullivan, 2004), a dimension usually operationalised as the over- and underrepresentation of certain groups across the neighbourhoods relative to their overall proportions of a city. However, as uneven patterns of over- and underrepresentation do not necessarily translate into stronger isolation of groups (Johnston et al., 2014), we additionally consider 'exposure.' This dimension refers to the likelihood that members of

one group will encounter residents of a different background in their respective neighbourhoods (Reardon & O'Sullivan, 2004).

To address these issues, the article proceeds as follows: In the next section (2) we lay out our analytical framework which emphasises the relationship between housing-welfare regimes, tenure segments and residential segregation in multi-level arrangements. This is followed by a methods section (3) describing the quantitative and qualitative approaches and data used. The next section (4) presents the most important critical junctures and housing reforms at multiple policy levels impacting Vienna's housing provision. Section five (5) will focus on changes in accessibility to housing segments concerning socio-economic trends, followed by (6) the analysis of changing levels and patterns of segregation. Finally, the conclusion (7) will discuss what we can learn from Vienna's housing trajectory on processes of housing segmentation and segregation.

2. Housing Regimes between Path Dependency, Reforms and Multilevel Arrangements

The relation between housing policy, housing tenure and segregation from a comparative perspective has mostly relied on the concepts of dualist and unitary housing regimes (Kemeny, 1995). Recently, this approach has been further developed into "housing-welfare regimes" to emphasise the close connection of housing and broader welfare regimes (cf. Stephens, 2020, p. 523). The most comprehensive account between housing regimes and segregation is, to our knowledge, the work of Arbaci (2019). Beyond the redistributive effects of housing tenure compositions, she demonstrated that forms of housing production and promotion, ownership and regulation of land supply and the profit regime shape the segregation patterns. She found that in relation to segregation, liberal welfare cities tend to be associated with higher levels of segregation because of their large-scale, market-oriented housing context that produces a dualised tenure structure dominated by owner-occupation, as opposed to a residualised social housing sector (Arbaci, 2019, pp. 78–90). The least segregated cities are associated with corporatist regimes, because of their mixed-scale housing provision characterised by a balanced (unitary) tenure structure with a predominance of the private rental sector. Between these two extremes, the familistic welfare cluster (of Southern Europe), dominated by small-scale, owner-occupied housing provision, produces less segregated cities, whereas social-democratic welfare regimes and their associated large-scale and dominant social housing production is characterised by higher levels of segregation (Arbaci, 2019, p. 88).

As housing-welfare regimes are changing in light of recent policy reforms (Stephens, 2020), tenure restructurings and changes in housing segmentation are important analytical elements in understanding the chang-

ing redistributive role of housing, also concerning segregation. Housing segmentation can be understood as a process in which housing provision is segmented into different forms of tenure characterised by "different qualities and conditions for access" (Andersen et al., 2016, p. 3). These qualities and conditions are highly dependent on the type of housing provision and the allocation mechanisms of the operating market-state nexus. As processes, they crucially shape uneven or even 'socio-tenurial differentiation' (Arbaci, 2019) or 'socio-tenurial polarisation' (Murie & Musterd, 1996). On the one hand, housing inequality is thus shaped by mainly market-based inclusionary and exclusionary mechanisms that enable or restrict opportunities on the housing market based on the household's financial resources (Maloutas, 2012; van Ham & Manley, 2014). On the other hand, these market-based inclusionary and exclusionary mechanisms may be reinforced—or mitigated—by housing policies.

Housing policies might regulate the 'price' of housing through rent regulation. Rent regulation may be applied to certain segments only (e.g., according to the age of the building) or the whole rental market (Kadi, 2015; Kadi & Musterd, 2014). With regard to the deregulation of rent, no clear-cut picture across Europe can be depicted. However, what the study of Kettunen and Ruonavaara (2020) shows is that it makes an important difference if the initial rent and rent increases are controlled or if only rent increases are controlled. Nevertheless, de-regulation of rent-control most likely impacts the inclusionary/exclusionary mechanisms to housing segments, for instance, by raising (financial) access barriers to low-income residents on the private rental market (Kadi, 2015; Kadi & Musterd, 2014). Housing segmentation might be also channelled through additional (non-monetary) access and eligibility criteria or discriminatory housing allocation practices (Maloutas, 2012). Knijn and Akkan (2020, p. 225) consider decisions on the deservingness of vulnerable groups, which are grounded in criteria of equity and needs, as central mechanisms of inclusion and exclusion. In relation to social housing in the UK, van Ham and Manley (2014) argue that needs-based systems were designed to bring objectivity into housing allocation processes. However, it must be assumed that the interplay of inclusionary and exclusionary mechanisms based on eligibility criteria and the diminishing social housing stock leads to limited redistributive options for those in need. Yet, much depends on the demand as well as the availability and size of the (social) housing stock.

Another important analytical element in translating socio-tenurial differences into residential segregation is the spatial distribution of the housing segments. The diminishing relevance of social housing and its concentration in certain parts of the city clearly leads to increased levels of segregation and the residualisation of low-status residents in social housing (Tammaru et al., 2016). The point here is that the socio-spatial

impacts of (changing) housing regimes might still be mediated by urbanisation patterns of cities, differences in the structure of the economy, cultural differences, and more nuanced and complex institutional arrangements (van Kempen & Murie, 2009). In relation to institutional arrangements, for instance, Bengtsson and Ruonavaara (2011) have shown that crucial differences within the seemingly uniform Nordic Housing Regime exist and that they are shaped by path-dependent actors' arrangements.

For these reasons, it becomes increasingly important to focus on multi-level institutional arrangements to allow for a more thorough understanding of the changing distributive effects of housing-welfare systems and changing levels and patterns of segregation (Arbaci, 2019). Stephens (2020) argues that the theory on housing regimes needs to engage more in-depth with the role of institutions, both at the very local level and upper-tier levels. From this perspective, research should focus on how the access to housing segments is regulated and how local policy choices unfold concerning supra-national and global financial mechanisms, such as the European Union's financial policy. Such a multilevel focus enables us to attune our attention to the trajectories of city-specific political choices, forms of governance and planning practices in housing both shaped by path-dependencies and impacts of higher-tier policies. In general, according to Maloutas et al. (2020, p. 6) such "genealogies and path-dependencies of national and local housing systems" allow not only a deeper understanding of the effects but also to identify institutional changes and new housing policies that deepen housing exclusion. Following this, we conceptualise cities as embedded in wider (multi-level) institutional relations and contexts (Kazepov, 2005) to analyse the city's redistributive capacities (Fainstein, 2010).

3. Research Approach, Methods and Data

We started our investigation by analysing policy reforms that led to a reconfiguration of housing provision. In doing so, we used the method of process tracing, which allows identifying the policy shifts that (1) influenced the mode of housing provision and (2) affected the housing segmentation and accessibility of housing segments, hence how inclusionary and exclusionary mechanisms changed over the last three decades. This allowed us not only to detect critical junctures or path-changing events but also to trace them back to changing contextual factors and policy reforms at different levels. Following Bengtsson and Ruonavaara (2011), our analysis focused on important political decisions regarding tenure legislation, access to different housing segments and the specific contextual factors that led to policy choices. As contextual factors, we considered important events which changed the political frame for action (e.g., EU membership). The process-tracing method draws on evidence from the analysis of regulatory and policy documents and grey literature. In a second step, expert interviews with local and national policy-makers and officials responsible for housing policy were held to validate the identified critical junctures and the impacts of multi-level arrangements and contextual factors.

We then analysed the relation between housing policy reforms and housing segmentation as well as residential segregation. In doing so, we analysed changing tenure profiles based on educational attainment and unemployment for different housing segments in order to relate shifts in accessibility. Due to the paucity of historic individual microdata, this analysis is limited to 2005 and 2018. To analyse the relation to segregation we calculated a) the well-known dissimilarity index representing 'evenness' and b) the modified index of isolation representing 'exposure.' Both indices allow for international comparison (Tammaru et al., 2016) and allow for longitudinal comparison as they account for changes in group size, which is most likely when considering longer study periods (Johnston et al., 2014). We calculated these indicators for the years 1991, 2001, 2011 and 2017 based on around 1.350 statistical areas, which are the smallest available statistical units for Vienna. To reveal changing patterns of segregation in terms of an even or clustered distribution of social groups in space (Reardon & O'Sullivan, 2004), we also deployed a spatial clustering method using the Local Moran's I (see Anselin, 1995). In doing so, we used a low-status composite indicator which considered: (1) the share of the low-educated population, (2) the unemployment rate and (3) the share of the working class including unqualified manual workers and routine service and sales workers. To take into account the overall changes of social groups in the city, the mean value of the standardised locational quotients was first calculated for each year, followed by a Moran's I analysis using the mean of the locational quotients. The spatial dependence was modelled using a spatial weight matrix taking into account the thirty nearest statistical areas. The suitability of the weight matrix was approved by a robustness check of the spatial weight matrix. This check largely confirmed that, with both low and high numbers of nearest neighbours, persistent spatial patterns and levels of clustering exist.

4. Vienna's Housing Policy between Persistence and Change

Vienna's long history of promoting socially inclusive forms of housing provision can be traced back to the era of 'Red Vienna' when around 60,000 municipal housing estates were built from 1920 to 1934 (cf. Kadi & Suitner, 2019). Already from this early phase, most municipal housing was built in the form of 'superblocks' (Blau, 2014). Access to this early form of municipal housing privileged skilled workers, municipal servants and low-skilled employees but was also oriented along social needs criteria, which not necessarily focused on the poor (Lévy-Vroelant et al., 2014). In the 1950s, Vienna's

municipal housing provision continued its communal housing program following the logic of a universalist or 'housing for all' approach mostly financed via reconstruction funds. As the Social Democratic Party has been in charge of the most influential administrative units managing housing since the end of World War II, the underlying orientation of the City's social-democratic housing model to achieve social equity and prevent social segregation has remained in place until today.

In the 1950s, however, Vienna's housing provision also got more embedded into the national housing system which forms the basis of today's multi-level framework in housing policy (Matznetter, 2002). This period was marked by the introduction of the housing subsidy legislation in 1954, which became an important cornerstone of Austria's housing policy. In 1989, housing subsidies have been increasingly decentralised to the *Bundesländer*, such as Vienna, which is both a *Bundesland* and a municipality of the Federal Republic of Austria. This decentralisation gave the City of Vienna more power in subsidising housing provision and urban renewal through which the City can overrule two important federal laws temporarily: the Tenancy Law and the Limited-Profit Housing Act.

The applicability of different types of rent regulation of the federal Tenancy Law depends mainly on the buildings' year of construction and the date of the rental contract. As a rule of thumb, buildings built before 1945 are rent-level controlled, albeit in different ways according to the date of contract (see details below), while for the other rental stock, regulations regarding contract termination and duration are in place. The resurrection of the German Non-Profit Law, which became the Limited-Profit Housing Act in 1978, paved the way for limited-profit housing associations (LPHAs) as additional key providers of social housing. Regulated at the national level, these actors of the third sector are considered as social housing providers as they are allowed to charge cost-covering rents only. Additionally, in exchange for tax exemptions, their economic field of action is limited to housing reinvestments. *Bundesländer* only have the power to permit LPHAs as housing providers in their regions.

Before presenting the first critical juncture of Vienna's recent housing policy trajectory, we want to highlight the City's context of the 1980s. The City saw the main urban challenges in overcrowded inner-city housing and an increasing spatial concentration of immigrants in the substandard housing stock built before World War I. As a reaction to population decline through increased suburbanisation, the city focused on the qualitative upgrading of this housing stock. In doing so, it introduced the 'soft urban renewal' program in the mid-1980s and established a 'renewal and land fund' that is today known as the *wohnfonds_wien* (see Figure 1). Focusing on the pre-war, mainly private rental housing stock in central locations, the 'soft urban renewal' model is realised through public-private partnerships. This approach aims at subsidised renovations that raise the quality of private rental apartments while preserving the historic housing stock without displacing people, by freezing the rent levels for 10 years (Hatz et al., 2016; Kadi, 2015).

A first important critical juncture was the Fall of the Soviet Union in 1989, which brought about increased immigration in the early 1990s. Political parties aimed at countering the resulting housing shortage, which became a pressing issue in Vienna. Initially—with an amendment to the tenant law at the federal level—they introduced time-limited contracts in 1991. The Social Democrats accepted the introduction of time-limited contracts as a temporal solution to raise housing supply since the law foresaw a 20% discount on the rent level. More substantial was the amendment to the tenant law of 1994, which introduced a quasi-market mechanism to buildings constructed before 1944 and rental contracts signed after 1994 more significantly. Old contracts remain well protected and their rent control is based on housing quality categories (reference value rent). For new rental contracts, landlords could raise rents according to specific premiums, for example, location premiums in specific areas (Kadi, 2015). In general, these reforms undermined the redistributive capacities of Vienna's socially oriented housing policy as the housing allocation mechanism in the regulated private rental market became increasingly market-based. Additionally, the conservative/right-wing government pursued its neo-liberal housing policy at the federal level and excluded tenancy in detached and semi-detached houses and attic conversions in 2001. This led to a somewhat paradoxical situation that attic conversions on rent-controlled buildings in inner-city neighbourhoods become free-market rent, while the rest of the buildings are still rent-controlled. In general, the latter deregulations undermined the City's housing approach which increasingly aimed at providing additional, affordable housing in the inner-city districts by attic conversions.

A second critical juncture was Austria's accession to the European Union, which influenced the social housing provision of Vienna in various ways. Although construction levels were already low in the 1990s, the withdrawal of municipal housing construction in 2004 must be seen from this perspective. In fact, the Social-Democrats—Vienna's ruling party—justified this decision by arguing that they had to comply to the budgetary constraints implied by the Maastricht criteria and state aid regulations of the European Union's competition law. Despite this development, the City kept its municipal housing stock characterised by the lowest rents across all tenures. The public housing stock was neither converted nor privatised, as some other European cities did to varying degrees, for example, Stockholm or London. Furthermore, as the construction of subsidised social housing by LPHAs already outweighed the construction of municipal housing in the 1990s, the administration argued that rent levels in newly built subsidised social
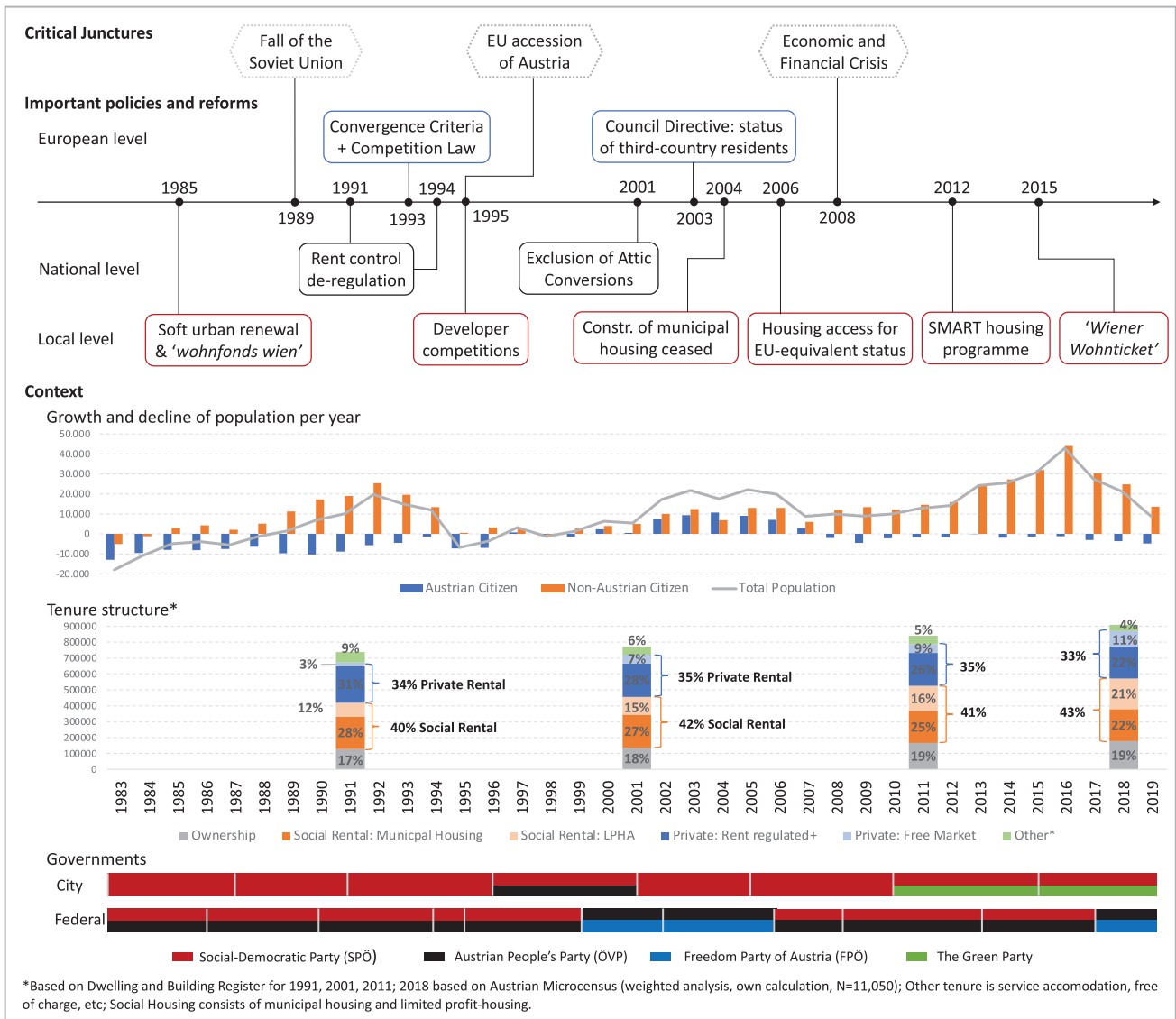
Figure 1. Important critical junctures, housing policies and contextual data. Source: Authors' own calculations based on data from STATcube–Statistische Datenbank von Statistik Austria, Statistik Austria and the Microcensus 2018.

housing provided by LPHAs were similar. Hence, as of 2004, Vienna solely relied on subsidised social housing provision, built via subsidising mainly LPHAs. This approach builds on two path-dependent elements of Austria's housing policies. First, on the federal Limited-Profit Housing Act and its reliance on cost-based rents and, second, on the decentralisation of housing subsidies to the federal states in 1989. By linking housing subsidies with land allocation policies and developer competitions, the City continued its universalistic housing approach mainly by steering housing provision. The city-owned land fund established in 1985 (*wohnfonds_wien*) which started to buy up land in close relationship to urban development zones at the outskirts since the mid-1980s, additionally became the main responsible body to organise social housing provision via developer competitions during the 1990s. The City, however, retained its power to set the (social) criteria for developer competi-

tions since the head of the fund is the City Counsellor for Housing.

The adaption of Vienna's social housing policy approach enabled the City to provide new social housing. Although the City grew dramatically by 380,000 residents between 1991 and 2018, this approach was able to stabilise the tenure structure. Social rental housing maintained its dominant position in Vienna's unitary housing regime followed by private rental and a less important home-ownership sector (see Figure 1). However, beyond these main tenure segments, a rather uneven tenure restructuring occurred. While LPHAs nearly doubled in relative terms and clearly compensated for the stagnation of municipal housing, the rent-regulated private rental sector became less important. This led to a higher amount of insecure rental contracts and free-market rents, especially in inner-city areas characterised by the pre-war housing stock. As a consequence of this

uneven restructuring in sub-segments, the inclusionary and exclusionary mechanism of Vienna's housing system was reconfigured along access, housing security and housing price developments in line with changing socio-economic contexts.

5. Accessibility of Housing Segments: Reconfiguring Inclusionary and Exclusionary Mechanisms

The context for shifts in inclusionary and exclusionary mechanisms of Vienna's housing regime is mainly related to a steep population and educational expansion as well as rising vulnerability. According to Verwiebe, Haindorfer, Dorner, Liedl, and Riederer (2020), the at-risk-of-poverty rate increased since 1995 by 7 percentage points, whereas unemployment has almost doubled since the 1990s (10% in 2018) and nearly two-thirds of people at risk of poverty were unemployed in 2018. Furthermore, their study revealed that the most pronounced difference in unemployment emerges between natives and people with first- and second-generation migratory backgrounds. Barriers to labour market integration and increased vulnerabilities are very much tied to the uneven growth patterns of educational levels as well as economic restructuring. Between 1991 and 2017, Vienna witnessed a massive increase of residents with tertiary education (+220,000), whereas residents with compulsory education declined (−50,000). Both groups account for about 23% in 2017.

In interplay with this changing socio-economic context, the approach characterising access to social housing (e.g., targeted at middle-income groups) began to change with the ceasing of municipal housing construction. In general, income thresholds to access social housing are relatively high (47,740€ annual net-income for one person, 71,130€ for two persons in 2021), around two times higher than those in Berlin for instance, so that about eighty percent of Viennese are 'theoretically' eligible (Marquardt & Glaser, 2020, p. 8). A Viennese peculiarity in social housing provision is tenant contributions for land and construction costs of social housing production (Lévy-Vroelant et al., 2014). These contributions were used to co-finance the construction costs for the historical municipal housing from the 1960s onwards, wheras the current provision of new subsidised social housing mainly built by limited-profit housing makes use of tenant contributions for construction and land costs. As housing subsidies do not cover all construction and land costs, tenants need to pay contributions in the form of one-time payments when moving into social housing. These tenant contributions are capped at 500€/m^2 and work as a quasi-loan that will be paid back to the tenants when moving out, with one percent depreciation per year from the original sum (cf. Marquardt & Glaser, 2020, p. 7).

Against this peculliarity, the shift from constructing municipal housing to subsidising social housing had two important effects in terms of access to the social housing sector. First, to access municipal housing, tenants do not need to pay tenant contributions anymore, which contributed to the inclusiveness of low-income and vulnerable groups. Second, the tenants' contributions for new subsidised social housing mainly built by LPHAs became a problematic barrier to low-skilled and vulnerable groups. This shift in accessibility is confirmed by the development of tenant profiles for the most important rental segments compared to all main residencies between 2005 and 2018 (see Figure 2). The tenants' composition in municipal housing saw an increase of low-skilled as well as unemployed residents while retaining a wide social mix. On the contrary, the tenants' profile for LPHAs remains persistently exclusionary for low-skilled and vulnerable groups.

This exclusionary mechanism became further intensified as affordable land for new social housing became scarce because of increased construction activities by the private sector, which led to increased tenant contributions during the 2000s (Kadi, 2015). However, becoming increasingly aware of this access barrier, the City started to introduce caps on tenant contributions in developer competitions, which were later mainstreamed into the SMART housing program (see Figure 1). Since 2012, it has become a common practice that one-third of all apartments in new subsidised social housing need to be planned as SMART apartments. These apartments are intentionally smaller in size but receive higher subsidies and caps on tenant contributions apply. Additionally, the capped tenant contributions may be financed by means-tested loans from the City (Marquardt & Glaser, 2020, p. 7). This clearly enhanced the inclusion of lower-income residents into subsidised limited profit housing and shows the power of the City of Vienna in shaping the social orientation of social housing.

An equally important housing reform that is rooted in Austria's accession to the EU was the council's 2003 directive concerning the long-term residency of third-country nationals. From 1993 to 2006, eligibility to municipal housing was granted to legally-aged Austrian citizens with a one-year residence in Vienna and an income below the above-mentioned threshold. Additionally, needs-based criteria such as overcrowding or health are applied. The EU-directive opened access to social housing for EU/EEA citizens and third-country citizens of equal status in 2006. To achieve equal status, a residence permit can be granted both to third-country citizens after five years of permanent main residency or to recognised refugees. Furthermore, the reform of the centralised allocation system to social housing saw the introduction of the *Wiener Wohnticket* in 2015, which fragmented eligibility to the increasingly differentiated social housing stock. While the main eligibility criteria were maintained, the city extended exclusionary barriers for (foreign) newcomers to municipal housing providing a bonus in the ranking to long-term Viennese residents. Second, needs-based criteria for municipal housing and SMART apartments were further diversified:
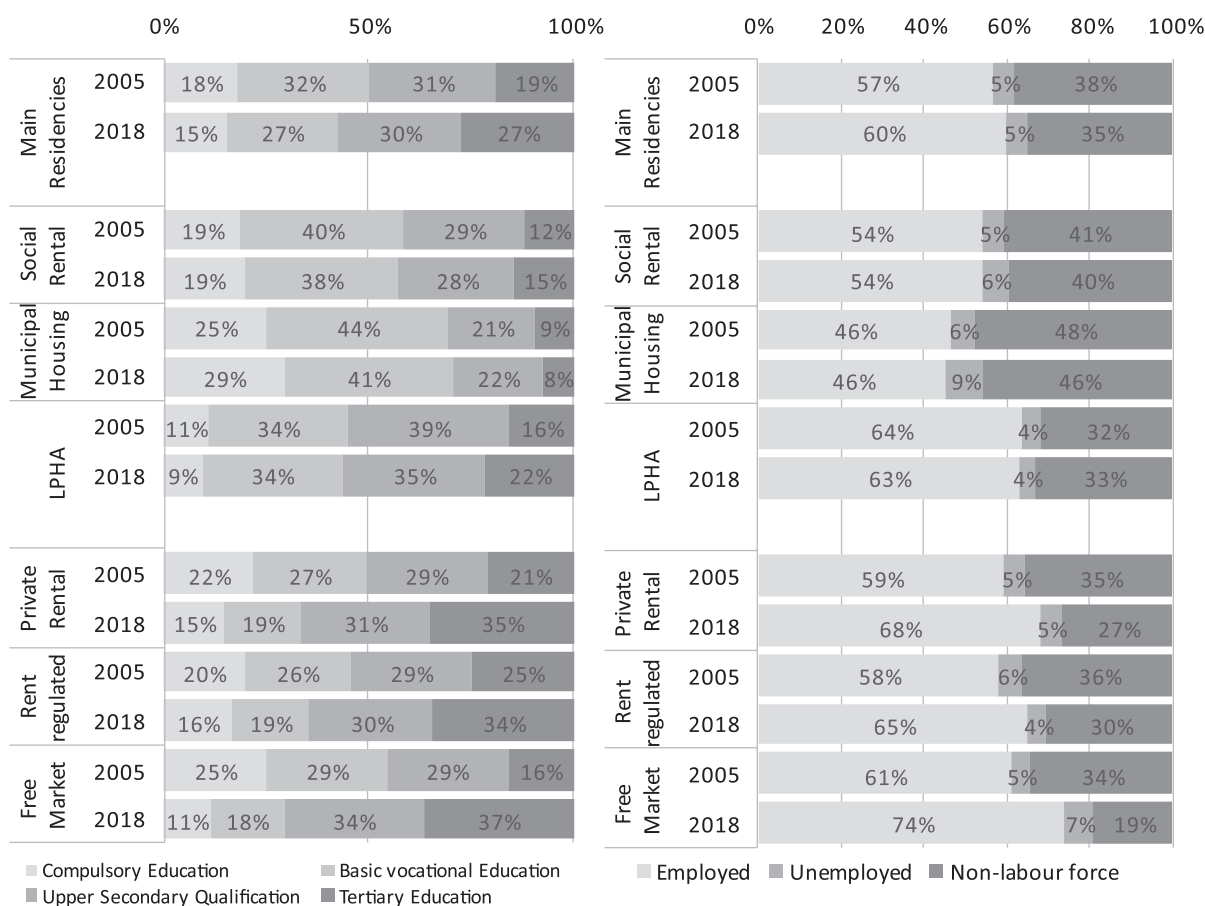
Educational attainment and employment status of household reference person.

Figure 2. Tenant profiles for housing segments, Vienna 2005—2018. Source: Authors' own calculations based on Statistik Austria and the Microcensus 2005, 2011, 2018.

Besides overcrowding, people in need of barrier-free apartments, specific needs of elderly and younger residents were acknowledged. Third, the allocation process for subsidised social housing became rather complex as two-thirds of regularly subsidised apartments and half of the SMART apartments can be allocated directly by LPHAs without additional needs-based criteria, whereas the rest of the regularly subsidised apartments are allocated by the City of Vienna.

In sum, the interplay of financial, eligibility-based and needs-based criteria shows that Vienna used its 'historic' municipal housing stock for an increasing shift towards the inclusion of low-skilled and vulnerable groups for municipal housing (see Figure 2). Yet, their recent reforms have also produced exclusions, especially for low-income newcomers in need or homeless persons that cannot fulfil the criteria of the main residency (cf. Kadi, 2015). However, quotas for emergency apartments for social hardship cases exist, as well as specific programmes and social services for housing homeless and refugees (Reinprecht, 2014). Although this led to a drop in ethnic segregation (Kohlbacher & Reeger, 2020), our tenant profile analysis shows that municipal housing witnessed an increase of Non-Austrian citizens, even though most non-Austrian citizens are dependent on

the private rental market. There, especially low-income and low-skilled newcomers increasingly face affordability issues. On the contrary, the newly subsidised housing retained its middle-class orientation, mainly because of tenant contributions.

As for the private rental segment, market-based mechanisms became more important after increasing renewal activities and the deregulation of rent control: time-limited contracts and locational premiums. These apartments are concentrated in the central districts (see Figure 4) and especially newcomers to Vienna face increasing rental prices in these locations. Kadi's (2015) study revealed that locational premiums remained rather stable until the Global Economic and Financial Crisis and increased dramatically thereafter. This third critical juncture (see Figure 1) shows that after the crisis, financialisation of housing took a stronger halt in Vienna and—in interplay with the deregulation of rent control—contributed to steep increases in (private) rents, housing and land prices (Aigner, 2020). Bearing that in mind, tenants' profiles for private rental and its submarkets in Figure 2 reveal that low-skilled groups are increasingly excluded from these segments. This is supported by other evidence on increasing housing cost burdens for low-income newcomers (Kadi, 2015).

6. Trends of Levels and Patterns of Segregation

Having outlined the relationship between changing multilevel arrangements and changes in Vienna's housing landscape, we now turn to analyse these changes concerning levels and patterns of segregation vis-á-vis the spatial distribution of housing segments. With regard to 'evenness,' our analysis confirms that the rather uneven distribution of high-status and low-status groups across the city has decreased. Compared to London, segregation is slightly lower in Vienna but slightly higher than in Amsterdam, where segregation decreased during the 2000s, and similar to Stockholm, where segregation has increased dramatically because of cutbacks on housing subsidies and public housing privatisation (Tammaru et al., 2016). The drop of the dissimilarity index from 42 to 38 (Figure 3) is mirrored by trends towards a more dispersed distribution of high-status and low-status groups across the city.

In the 1990s, Vienna's segregation pattern was dominated by an overrepresentation of high-status groups in the Western outskirts characterised by single-family houses and cottages and in the city centre dominated by a small-scaled, pre-war multi-storey housing stock of higher quality (Figure 4, left, green coloured clusters), while low-status groups are overrepresented following a doughnut shape around the northern, western and southern *Gürtel* (Figure 4, brown clusters). These areas are characterised by a mix of low-quality, pre-war housing on small building lots to large social housing estates. Until 2017, segregation—in the form of (un)even distribution of group clusters around the city—decreased as clusters of high-status and low-status groups became more dispersed throughout the city. Additional clusters of high-status groups were identified in the eastern outskirts and the cluster in the city centre started to expand in 1991 throughout almost all inner-city districts between the *Ring* and the *Gürtel*. Clusters of low-status groups expanded towards north-eastern and southern parts of the outer districts between 2001 and 2011.

The most significant drop of the dissimilarity index was measured between 1991 and 2001. This most likely relates back to the effects of the urban renewal efforts from the 1980s onwards, when the pre-war housing stock of inner-city areas was renovated. In interplay with the immigration of a high-skilled workforce and associated lifestyle changes, an increasing social upgrading of inner-city areas took place (cf. Hatz, 2009). However, the expansion of clusters of high-status residents in the inner-city areas in subsequent periods tends to be closer related to rising rent costs triggered by the deregulations of rent control at the national level and increased financialisation of housing (cf. Kadi, 2015). Inner-city areas, therefore, became increasingly
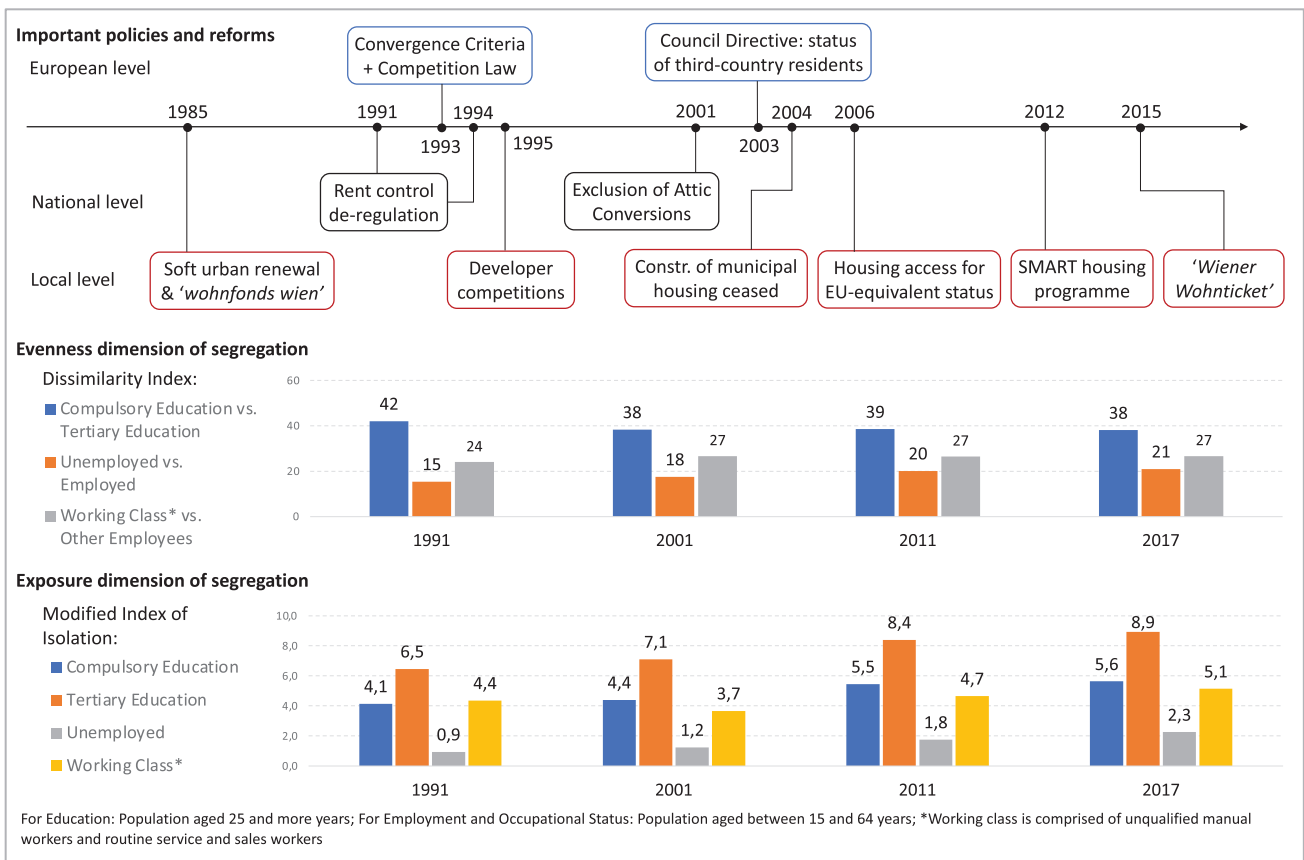
Figure 3. Important housing policies and segregation. Source: Authors' own calculations based on MA23—Wirtschaft, Arbeit und Statistik.

inaccessible for low-status and economically marginal-ised groups, fuelling gentrification tendencies (Hatz et al., 2016). However, one would expect a further increase in segregation levels due to the introduction of market-based mechanisms, but the expansion of low-status groups from 2001 onwards towards the north-eastern

and southern parts of the city seem to work against this trend. As a consequence, segregation, measured as the dissimilarity index between high- and low-status groups, remained stable.

Expanding concentrations of low-status groups are related to the distribution of large municipal housing

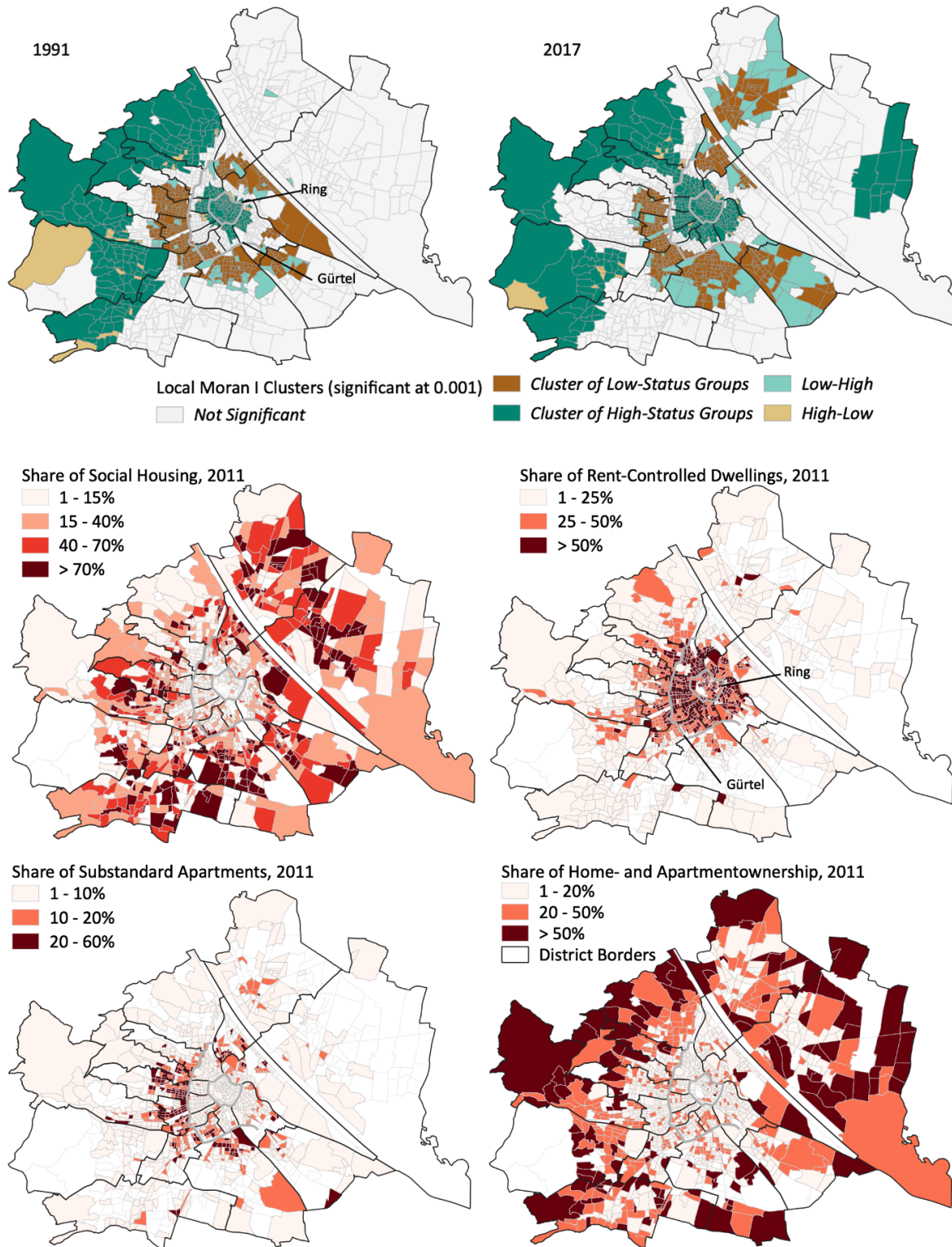**Figure 4.** Cluster map of low status composite indicator from 1991 and 2017 (top) and the spatial distribution of housing segments in 2011 (bottom). Source: Authors' own calculations based on MA23–Wirtschaft, Arbeit und Statistik.

estates from the post-war era (1950–1980) and can be interpreted as the spatial effect of shifts in tenant profiles shown in the previous section. Although the introduction of needs-based criteria and a stronger social targeting of municipal housing brought greater inclusion of low-skilled and vulnerable groups but decreases the social mix. At least, for the clusters in the northern and south-eastern parts presented in Figure 4, a residualisation is rather likely. The overrepresentation of low-status groups around the western and southern parts of the *Gürtel* with its low-quality private rental has remained since 1991. As found in other studies (Hatz et al., 2016), this persistence confirms the importance of substandard private rental as arrival spaces for low-skilled newcomers and can be read as the spatial effects of the (increasingly tight) access criteria to social housing. In fact, although barriers to social housing based on citizenship have been removed, low turnover rates and growing demand for social housing explain long waiting lists and the spatial consequences.

The two spatial trends described above are coherent with the paradoxical effects reported in other cities. First, segregation patterns between high and low-status groups can decrease when gentrification processes are still at work (Musterd, 2020, p. 418). Our results confirm the argumentation by Musterd et al. (2017) that both Vienna and Amsterdam are characterised by similar processes—such as ongoing gentrification processes. Second, the "paradoxical effect of welfarism" (Andersen, 2012, p. 195), in which marginalised groups are supported but also segregated through the provision of large, modernist social housing estates, became more articulated in Vienna. The path-dependent egalitarian approach of Vienna's social housing policies that aimed at a social mix seems to be at a turning point since the mid-2000s. Concerning the 'exposure' dimension of segregation, the very low levels of isolation shown in Figure 3 underline that Vienna is still a socially mixed city. There is indeed a high probability of encountering groups with a different socio-economic background at the neighbourhood level. Nevertheless, the increase of the indices suggests the slightly stronger isolation of low-skilled, unemployed and working-class from higher-status groups (Figure 3). An important finding, however, is that the increase in isolation of lower-status groups is less marked than for those of higher-status. The aim of the egalitarian 'housing for all' approach to limit social segregation mitigates the outcomes of the City's housing market restructuring. Especially, the large number of municipal housing stock and the newly subsidised social housing slow down the changing levels of isolation for lower-status groups, even though in some areas, in which social housing plays a dominant role, this is likely to be the case.

7. Conclusion

This article has set out to analyse the relation between trends and patterns of segregation in Vienna and the reconfiguration of inclusionary and exclusionary mechanisms emerging from recent multi-level housing policy reforms since the 1990s. In analysing the recent genealogy of Vienna's housing regime, we aimed at understanding to which degree Vienna is challenged to maintain its inclusive and socially mixed housing approach. In doing so, we analysed the policy developments at multiple levels using a process-tracing method focusing on changing modes of housing provision and regulation. In particular, we considered the changing access criteria and the resulting housing distribution for different tenure segments. These mechanisms were then analysed with regard to changing tenant profiles as well as changing patterns and levels of segregation.

The results of our study resonate with the increasing literature on context-bounded paradoxes of segregation processes (Arbaci, 2019; Marcińczak et al., 2013; Musterd et al., 2017). In particular, our findings suggest that the decreasing levels of segregation between high-status and low-status groups relate to two processes. On the one hand to the expanding gentrification tendencies in central districts (Marcińczak et al., 2013; Musterd et al., 2017). On the other hand, to emerging patterns of residualisation in some parts of the City characterized by large municipal housing estates. The latter process relates to the paradox of welfarism, in which increasing support produces segregated outcomes in contexts characterised by large social housing estates (Andersen, 2012, p. 195). Hence, our analysis provides evidence that decreasing levels of segregation in terms of even and uneven distribution of social groups across space are driven by two mechanisms that work against each other. This relatively mild polarisation trend is underpinned by the fact that levels of isolation are still very low, even though they have slightly increased for both higher-status and lower-status groups.

Our analysis has also provided evidence that the above-mentioned segregation paradoxes relate to recent shifts in housing policies at multiple policy levels along three contextual junctures: (1) the fall of the Soviet Union, (2) Austria's accession to the EU and (3) the global economic and financial crisis of 2008. While the fall of the Soviet Union and its associated population growth set the path for the deregulation of rent control at the national level, increased investments in housing after the economic and financial crisis have deepened marketisation efforts and exclusionary tendencies on the private rental market, especially in central locations marked by high-quality housing. Neoliberal policy reforms mainly imposed from upper-tier levels, therefore, paved the way for greater marketisation on Vienna's private rental and ownership segments.

Moreover, Vienna's social housing provision, and especially the access to social housing, became increasingly fragmented because of financial, eligibility-based and needs-based criteria. This changing role relates to Austria's accession to the EU. On the one hand, EU policies have contributed to pushing Vienna's social housing

approach towards the path of a more targeted municipal housing sector. The still particularly large stock of municipal housing has become more inclusionary for low-status and vulnerable groups, and upon pressures from the EU was also opened to third-country citizens of EU equivalent status. However, emerging residualisation trends are observable. Yet, the residualisation of the social housing sector appears to be limited in comparison to highly dualised housing regimes. While clusters of low-status groups in large municipal housing estates exist, tenant profiles for the whole sector suggest that the social mix is still largely in place. Pockets of greater residualisation and isolation most likely exist concerning scale and conditions of the municipal housing premises. However, concerning that, our study is limited and calls for micro-scale studies to explore potential trade-offs between inclusiveness, residualisation and emerging stigmatisation.

Nevertheless, the turn towards subsidising social housing—provided mostly through limited profit housing—allowed Vienna to 'actively' maintain its social-democratic, unitary housing regime. In particular, it sustained redistributive capacities to offer permanent rental contracts at below-market rents, opposing neo-liberal tendencies in the private rental market for a broad section of the society. In 2019 about 780,000 out of 1.86 million inhabitants lived in municipal and limited-profit housing (Statistik Austria, 2020). Yet, this comes with trade-offs as subsidised social housing rather caters to mid-income classes. While this contributes to a well-balanced social mix, it does so at the expense of excluding low-income households. Balancing the trade-off between a social mix and social targeting without excluding residents in need will remain the main challenge for Vienna's social housing context (see also Marquardt & Glaser, 2020). Recent efforts to raise the inclusiveness for lower-income residents in subsidised social housing and the resumption of municipal housing construction (Kohlbacher & Reeger, 2020, p. 111) are promising and much-needed signals to mitigate ongoing neoliberal pressures in the private rental market.

Acknowledgments

Conflict of Interests

The authors declare no conflict of interests.

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Article

Market-Based Housing Reforms and the Residualization of Public Housing: The Experience of Lodz, Poland

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Abstract

Housing inequality is one of the central topics in urban studies, and in the social sciences more broadly. It is also one of the most significant and visible aspects of socioeconomic inequality. Over the last three decades, the process of housing commodification has accelerated across western societies and, consequently, the public housing sector has contracted and become more closely associated with the poorest sections of societies in many cities. Over the same period, the political changes in Central and Eastern Europe have contributed to the dismantling and monetizing of state housing sectors at the forefront of broader social and economic transformations. Unfortunately, most recent studies on housing commodification and inequalities in Europe are confined to the national scale. The aim of this article is to detail the linkages between the position and functioning of public housing in Lodz (Poland) and the evolving socioeconomic profile of individuals and households that rely on public housing. This study relies on microdata (statistical information on individuals and households) from two national Polish censuses (1978 and 2002) and from household budget surveys (2003–2013). The main finding of our study is that 'residualization' is present in the public housing stock in Lodz and that the process gained momentum in the first decade of the 2000s.

Issue

This article is part of the issue "Vicious Circle of Segregation: Understanding the Connectedness of Spatial Inequality across Generations and Life Domains" edited by Tiit Tammaru (University of Tartu, Estonia), Siiri Silm (University of Tartu, Estonia), Frank Witlox (Ghent University, Belgium), Maarten van Ham (Delft University of Technology, The Netherlands) and Madli-Johanna Maidla (University of Tartu, Estonia).

1. Introduction

Housing inequality is one of the central topics in urban studies and in the social sciences more broadly. It is also one of the most significant and visible aspects of social (socioeconomic) inequality. Welfare and housing regimes play an important role in mediating the effects of social inequalities and the changing urban landscape in Europe. While state interventions in Europe have long countered socioeconomic disparities, (neo) liberal transformations in welfare states and housing systems, under the influence of globalization, changed this trend. Accordingly, for the last thirty years income inequalities in Europe have been on the rise, especially in Eastern Europe (Blanchet, Chancel, & Gethin, 2019), and cities in Europe have become more socially unequal and spatially divided (Marcińczak, Musterd, van Ham, & Tammaru, 2016). Regarding the nexus between the proliferation of neo-liberal policies and practices and the housing sector, scholarly attention has centered on

the process of accelerated marketization of housing provision and consumption across western societies, and on how housing commodification contributes to increasing disparities along racial or socioeconomic lines (Kadi & Ronald, 2014; Madden & Marcuse, 2016). In a similar vein, there are arguments that the roll-back of the welfare state together with the marketization of public services triggered the process of 'residualization' of the public housing sector (Musterd, 2014). This form of housing generally relates to those types of housing provision which involve elements of decommodification and not-for profit, some bureaucratic process of allocation, and where access is not determined by ability to pay a market price or rent. The process of residualization implies that public housing sectors have contracted and become more closely associated with the poorest sections of societies—areas where public housing dominates are often spatially marginalized and more socially stigmatized (Forrest, 2014). Importantly, although the current understanding of the term residualization highlights the more recent effects of marketization and neo-liberal reforms to the welfare system on the declining shares of public housing, the decreasing social status of this tenure form appears to pre-date the era of extensive privatization. The results from the UK suggest that the increase in unemployed and lower social class households in public sector housing was already evident when public housing was still expanding (Forrest & Murie, 1983; Williams, Sewel, & Twine, 1988). The large-scale privatization that started in the 1980s simply gave momentum to the process, and residualization was sensitive to differentiation within the public housing stock (Murie, 1997). Put differently, there are grounds to assume that residualization, the declining social status of public housing in particular, could be selective and not solely related to privatization.

In Western Europe, direct state housing provision is often represented as a failed social intervention and symptomatic of the malaise of welfare dependency (Forrest, 2014). At the same time, housing studies have convincingly demonstrated that the transformation of public housing follows different trajectories in different countries and is crucially affected by the 'housing systems' it refers to (for an overview see Kemeny, 1995; Stephens, Lux, & Sunega, 2015). Then, while market-based transformations of the housing sector have become a fairly ubiquitous process, they are embedded in, and premised upon, pre-existing institutional structures, making reforms and their social and spatial effects highly contingent on local economic, political and demographic contexts (Brenner, Peck, & Theodore, 2010).

With some delay compared to Western Europe, the political changes in Central and Eastern Europe (CEE) and the region's re-emergence into the world economy have seen the dismantling and monetizing of state housing sectors at the forefront of broader social and economic transformations (Lux & Sunega, 2014). As space precludes a comprehensive review of literature on housing transition after socialism—for recent reviews and explanations see Hegedus, Lux, and Teller (2013), Soaita and Dewilde (2020) and Stephens et al. (2015)—suffice it to say that, characterized by the decommodified housing system before 1990, the CEE countries implemented a large-scale give-away privatization of public stock after the collapse of the ancient regime. Essentially, state-owned housing was privatized to sitting tenants at prices substantially below market value. Treating housing privatization as a policy to mitigate the hardship faced by the population during the early economic transition (Hegedus & Tosics, 1998; Struyk, 1996), the former socialist states eventually moved towards a hyper-ownership model. The differences in skills and education levels gave rise to a rapid increase in income inequality after socialism. Assuming that housing is a key component of household wealth (Benjamin, Chinloy, & Jud, 2004), the privatization of public housing directly and significantly contributed to the ensuing increase in wealth inequality in the region after 1990. Accordingly, those stuck in public housing have arguably accumulated less wealth than those that benefited from give-away privatization. The effect of housing privatization may also linger to influence the housing opportunities of younger generations, as financial (or in-kind) support from families is among the important factors paving the way to home ownership in the former socialist countries (Criman, 2008).

The scale of housing privatization was not uniform across CEE. Irrespective of the general trend, the housing privatization process has been path-dependent (co-determined by a variety of socialist legacies) and hinged on specific policies adopted and implemented in different national contexts after 1990 (Stephens et al., 2015). There are also grounds to assume that the pace and scale of public housing residualization could differ from city to city. As the history, institutional milieu, structure of the housing stock, functional specialization, and location in a national urban hierarchy are important factors shaping the changes in the socio-spatial structure of the post-socialist city (Marcińczak, Musterd, & Stępniak, 2012), one can reasonably assume that those characteristics of urban areas should also set the stage for the development of housing stratification after socialism. Such reasoning finds support in the notions of the 'privatization trap' and the 'paradox of decentralization' advanced by Lux and Sunega (2014) to explain the process of residualization of public housing in the former socialist countries. The notion of the privatization trap means that the main tendency in the CEE is to sell existing public housing and that the development of new public housing often assumes privatization in the future (Lux & Sunega, 2014). Even if the process of give-away privatization was a common trend across CEE and the resultant privatization trap precluded chances for a sustainable development of public housing after socialism, some countries preserved more of the socialist era public housing—notably the Czech Republic and Poland, where the decision to privatize was shifted down to local

municipalities (Hegedus et al., 2013). While the privatization trap undeniably triggered the process of public housing residualization, the decentralization paradox gave it a local flavor. In fact, the municipalities that often did not have sufficient resources were faced with the problem of maintaining significant housing stock after 1990. Accordingly, the pace and scale of public housing commodification most likely hinged on the economic condition of municipalities and the residents' interest in the privatization process.

Even though there is wide agreement among urban researchers on both sides of the former Iron Curtain that housing inequalities are on the rise and that the public housing sector is contracting in Europe, existing empirical studies on the relationship between housing commodification and income stratification are limited in two ways. First, the available studies mostly revolve around cross country comparisons of evolving housing policies or focus on the relationship between housing inequalities and income stratification at the national level, thus leaving the local context unexplored—a good example being the recent cross-sectional or longitudinal analyses by Lux, Sunega, and Katrňák (2011), Norris and Winston (2012), and Soaita and Dewilde (2019, 2020). Second, those studies that attempt to link the evolution of the welfare state and housing regime with housing stratification in a specific urban context often adopt a short timeframe for concrete empirical analysis (e.g., Musterd, 2014). Concerning the former socialist countries, it seems that the issue of housing change remains outside the mainstream scholarly debate on post-socialist cities (Stephens et al., 2015), and that most empirical studies on public housing residualization and housing stratification more broadly in specific urban contexts are confined to the first decade of post-socialist transition (Gentile & Marcińczak, 2014; Hess, Tammaru, & Leetmaa, 2012). Finally, it is often assumed that the residualization of public housing in the former socialist countries started no sooner than in the 1990s, along with the post-socialist transition.

With this in mind, and based on the assumption that the effects of housing commodification are conditioned by diverse regulatory frameworks and policies, the aim of this article is to explore how the process of residualization manifests itself and what effects it causes in a former socialist city. It thus combines an empirical study of public housing residualization at the city-scale with an analysis of housing reforms adopted and implemented in the multi-scalar environment (national and local). We draw empirical evidence from Lodz, Poland. Importantly, Poland has the highest rate of income inequality in Europe (Blanchet et al., 2019), and it is also tempting to explore how the substantial increase in income disparities relates to the process of public housing commodification after socialism. The study relies on the microdata from national censuses (1978, 2002) and household budget surveys (HBSs) from 2003 to 2013. We ask the following research questions:

1. What are the effects of market-based transformations on the position and wider functioning of public housing in Lodz?
2. What are the local housing outcomes of the residualization process—for whom (at the household level) is the public rented sector currently functioning, and has this changed over the last three decades?

The article is structured as follows: The next section presents the evolution of the public housing sector in Poland and in Lodz after socialism in the wider context of housing transitions in CEE. Data and methods are presented in the following section, followed by the empirical findings. Finally, we summarize our conclusions and make some suggestions for future research on housing inequalities in CEE.

2. Public Housing in Transition: Poland and Lodz

Far-reaching transformation of the housing sector occurred in CEE in the early 1990s: The transfer of the ownership of properties to individuals or non-state sector organizations has been seen as pivotal to more fundamental processes of social and economic change (Turner, Hegedus, & Tosics, 1992). In this context, one of the basic problems confronting the transitional economies of CEE has been the lack of a functioning housing market (Forrest & Williams, 2001). At the beginning of political and economic transformation in Poland, in 1989–1990, housing policy was based on the principle that the purchase or construction of a flat as a property would be the main route to obtaining it.

The housing reforms implemented in the 1990s involved the withdrawal of the State from the financing of housing construction, the communalization of flats belonging to the State and state-owned companies, the abolition of the monopoly of cooperatives in housing construction, the creation of Housing Associations, the introduction of housing allowances for low income households, and the creation of new forms of financing of housing construction (Milewska & Ogrodowczyk, 2006; Uchman & Adamski, 2003). Currently, the central government does not participate directly in the housing development process; according to the *Local Government Act* of 1990 reinstating local government in Poland, housing development is a responsibility of local government (Republic of Poland, 1990). That means that that municipal-led housing development depends on the type of commune, its population size, and its own revenues (e.g., its share of state budget tax revenues or local taxes and fees). The responsibilities of local government in the housing domain (in satisfying the housing needs of the population living on its territory, especially those who are worse-off) include the provision of social and replacement housing and the payment of housing allowances. Municipalities also have some instruments to conduct housing policy. It should be mentioned that

like in the other CEE countries the acquisition of housing resources (often in poor physical condition) by municipalities in 1990 proved to be a large financial burden for them. This is reflected in the small scale of activities aimed at improving the physical condition of municipal housing stock. Unlike in most other post-socialist countries, and in a similar manner to the Czech Republic (Stephens et al., 2015), municipalities in Poland conduct their own privatization policy with regard to municipal properties. The main motive to privatize public housing was to solve the problem of the maintenance and renovation of municipal buildings. Many experts also believed that the right to buy occupied apartments with a significant discount, give-away privatization, would be a kind of compensation for years spent in an undemocratic and non-market system. Table 1 presents the key policies and regulations implemented in Poland and in Lodz to deal with the issue of public housing.

There were nearly two million flats in the municipal housing stock in Poland in 1990, which constituted 16.7% of the entire housing stock; the number of dwellings dropped to 868.5 thousand (6.1% of the total stock) in 2016. The reasons for this were: privatization of flats, shutdowns due to the poor physical condition of the housing and the slow pace of construction of new public housing. The last factor was common to virtually all the former socialist countries (Lux & Sunega, 2014). For instance, the public housing built in 2016 was only 1.3% of total housing built in Poland that year; the queue of

people waiting to rent a flat from the municipal housing stock swelled to nearly 160 000 people in 2016. But there was also a setback in the construction of cooperative housing, a sector that was strongly supported by the state in the socialist period. Eventually, private developers have become the main providers of new housing, especially in larger cities.

The contemporary housing structure in Lodz is primarily the result of many complex economic and social processes, which, operating for several centuries (especially in the 19th and 20th centuries), significantly transformed its constituent parts. After the Second World War, inefficient housing policy resulted in an inadequate development of municipal housing in Lodz and led to a significant degradation of the pre-socialist housing stock. In fact, the authorities deliberately did not renovate or modernize the fabric of the historical core, leaving it to dilapidate for nearly fifty years. New public housing developments were mainly carried out to provide substitute accommodation to persons evicted from buildings intended for demolition and only satisfied the housing needs of society to a small extent (Ogrodowczyk, 2015). As was the case elsewhere in Poland in the 1970s and 1980s (Ciechocińska, 1987), the housing needs of the socialist 'middle class' were primarily satisfied by state-controlled housing cooperatives.

Following the collapse of socialism, the city suffered from the main economic depression that lasted throughout the 1990s, which in turn contributed to huge

Table 1. Public housing related policies and regulations adopted in Poland and Lodz after 1990.

Years	Poland	Lodz
1990–1994 Early political and socio-economic transition	The *Local Government Act* (*Ustawa o samorządzie gminnym*) from 1990. Formerly state-owned housing stock was transferred to municipalities. Municipalities are responsible for the provision of social housing and for meeting the housing needs of low-income households.	First attempts to privatize extensive public housing stock, including the "Own Apartment" program (*własne mieszkanie*) from 1991 to 1997. Housing was privatized to sitting tenants with discount.
1995–2003 Late transition	An Act from 1997 on the management of real estate regulates the process of privatization. Municipalities set the details of privatization, including the rate of discount that ranges from 1% to 99% of the actual property value.	According to the *Municipal Council Act* from 1998, sitting tenants were offered the following discount rates: • 80% for housing constructed from 1986 to 1996 • 90% for housing constructed before 1986
Since 2004 Poland in the European Union		The 2012 *Lodz Housing Policy 2020+* (*Polityka mieszkaniowa Łodzi 2020+*) reformed the issue of privatization. Since 2015, the municipality of Lodz has stopped the sale of apartments in buildings that are completely owned by local authorities. On the other hand, privatization has been promoted in those buildings where the share of public stock is less than 25%. The following discount rates have been adopted: • 70% for housing constructed before 1946 • 40% for housing constructed from 1946 to 1989 • 30% for housing constructed after 1990

unemployment, growing social problems, and massive population shrinkage; all factors which brought about the devastation of the historical core. Moreover, along with the reform of the country's economic system, Lodz had already taken over 133,000 dwellings from the State Treasury in 1990, and thus became the largest owner of tenement housing among Polish cities. In consequence, the municipality became an owner of housing stock that quite often had (and still has) unresolved issues with property rights. This in turn has brought about substantial difficulties in establishing the legal status of many buildings and plots after 1990, and thus precluded a swift privatization process. Due to the large size of the municipal housing stock and long-term negligence in maintaining its physical condition under socialism, the state-owned buildings, especially those located in the inner city, deteriorated significantly. Unfortunately, the spatial and housing policy after the downfall of socialism did not contribute to the improvement of the physical condition of the tenements in the city centre. Regarding Lodz, almost 70% of the buildings owned by the municipality in the inner-city are in a bad or very bad physical condition, which does not improve the image of the city-center (Ogrodowczyk, 2014). Housing policy was often carried out on the basis of old documents, updated only in terms of the rental policy and the sale of public housing. This

has resulted in an accumulation of the following problems (City Hall of Lodz, 2012): excessive municipal housing stock and its misuse; a lack of social and temporary housing; poor physical condition of the municipal housing stock and its progressive deterioration; low rents in the municipal stock, which limits the possibility of doing repairs or improving quality; rent arrears and the lack of an effective system of debt recovery; an inefficient model for privatization of the housing stock; and lack of land-use plans for a large part of the city, including areas with a high proportion of municipal housing stock, which prevents effective management.

According to the data available from the Central Statistical Office and the Town Hall, from 1999 to 2013 the municipality of Lodz sold almost 33,000 apartments to tenants. It should be emphasized that Lodz is currently pursuing the most active policy of privatization of housing resources among Polish cities. Consequently, the share of municipal housing stock was already declining in the 1990s: from 38.0% in 1990 to 28.6% in 1995. The process continued in the next decade and public housing constituted only 9.63% of total stock in 2013. The location of public housing in Lodz is presented in Figure 1. However, the position of the public sector in housing provision in Lodz was greater than in other major cities such as Warsaw, Kraków, or Poznań, where the share of this
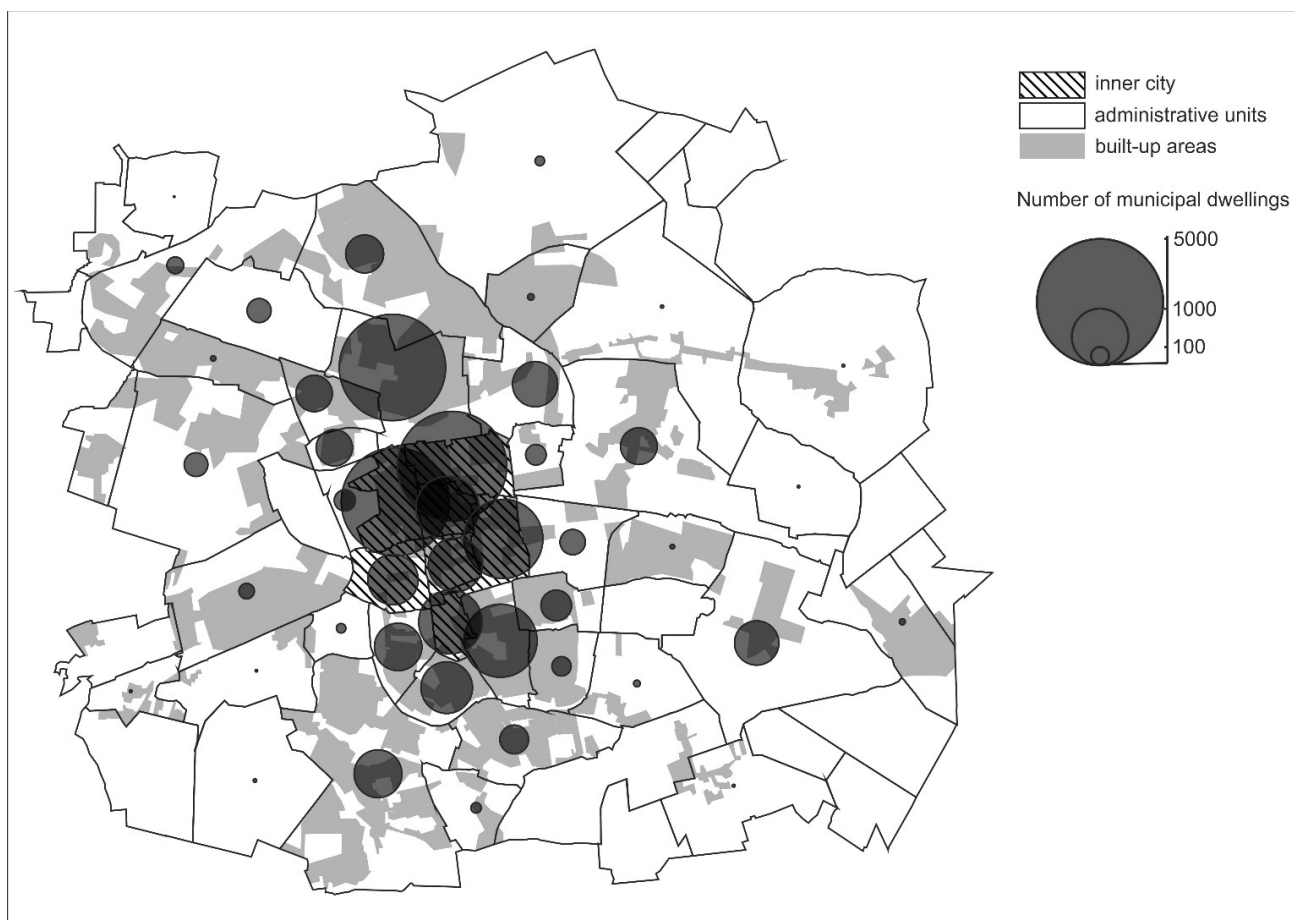

Figure 1. Location of public housing stock in Lodz in 2002. Source: Authors.

form of tenure was 5.15%, 2.68%, 3.35%, respectively. To sum up, even if municipalities have been responsible for the process of privatization of public stock in Poland, the main result in Lodz has been the massive transfer of wealth to sitting tenants. However, the process has been spatially selective and determined by differences in the quality of state-owned housing. The process has also had an unequal effect on the distribution of wealth. Those who occupied better quality public housing under socialism benefited the most from the process; paying a fraction of market price, they became the owners of housing that could either be transferred to a family member or commodified with substantial profit.

3. Data and Methods

This article relies on microdata (anonymized statistical information on individuals and households) from two main sources: national Polish censuses and HBSs. Regarding the former, we use the 10% samples from the 1978 and 2002 national censuses that are publicly available from IPUMS (Minnesota Population Center, 2020); these are two large datasets (with more than 20,000 households each) that provide detailed information on the demographic, social, and economic characteristics of individuals and households and on the quality and structure of housing stock in Lodz in 1978 and in 2002. The data enables us to investigate and directly compare the demographic and socioeconomic profiles of residents in public housing at two specific time points. The 10% sample of census data is fully representative for the population of Lodz. The statistical information for 1978 generally illustrates the socialist system in Poland at the peak of its economic development, especially in terms of housing production. The post-socialist systemic transition was virtually finished in 2002, and the process of housing privatization was advanced. Unfortunately, the publicly available microdata from the 2011 National Census does not include information on housing. Moreover, Polish national censuses do not provide any information on income other than the income source. Consequently, we turn to the data from the HBSs to examine for whom the public housing sector in Lodz functioned in the second decade after the demise of socialism.

The HBS is conducted by the Central Statistical Office of Poland and collects information on household incomes, expenditure, and on their demographic and socioeconomic characteristics and housing conditions. Approximately 37,000 households in Poland are examined every year. Whereas each round of the survey is representative for Poland, obtaining reliable and representative information for Lodz requires pooling samples from at least two rounds. We then employ the microdata from the following rounds of the HBS: 2003, 2004, 2005, 2011, 2012, and 2013. Eventually, we pooled the first three HBSs into one data set of 1864 households in total; accordingly, the 2011–2013 surveys were

pooled into the other data set of 2001 households in total. The microdata from the HBSs was prepared and provided by the Central Statistical Office. Even though the samples from the HBS are much smaller than the ones from national censuses, they are still representative for Lodz, but the sampling error is approximately 3%. Unlike national censuses, the data contain information on household incomes, and thus allow the process of public housing residualization to be more firmly linked to income stratification in the post-socialist context. Most importantly, the information provided by the HBSs and national censuses allows us to identify the public housing segment that can be directly compared across selected time points (1978, 2002, 2003–2005, and 2011–2013). We then operationalize the notion of public housing stock as the apartments that belong to and are rented from the municipality (*gmina*) or the state (the State Treasury). Equally important is the fact that the datasets contain information on small territorial units equivalent to census tracts or groups of neighboring tracts in which households reside (the *strata* variable in the IPUMS data sets or the *statistical unit* in the HBSs). While it is not possible to locate those tracts in space, the units allow one to control for the spatial residential heterogeneity of Lodz in regression models.

We specify a binominal logistic regression with clustered standard errors to explore who (which social groups) relied on public housing in Lodz under socialism and after. Clustering standard errors allows for correlation between households in the same local neighborhood (or other unit; Cameron & Miller, 2015). Put differently, if the potential similarity between households in the same tract is not taken into account, estimated results could be biased, as observations are not independent. Then clustering by strata units or statistical units ensures robust estimates of the socio-demographic profile of public housing residents. To avoid extra clustering by households, the analysis is limited to household heads. In each regression model, the dependent variable denotes that a household rents an apartment from the public housing stock; the reference category is all other housing. We separately estimate models for each time point. Importantly, as the set of explanatory variables depends on the data source, only the results of models relying on the data from the same source (national censuses or HBSs) can be directly compared. Despite this limitation, we believe that some general trends in the evolving socio-demographic composition of public housing residents can be distinguished. In trying to select a set of explanatory variables, we isolate the demographic, economic and social characteristics that appear to be significant predictors of housing segmentation and/or housing inequalities under socialism (Kulu, 2003; Szelenyi, 1983), under the post-socialist transition (and after; see Gentile, 2015; Gentile & Marcińczak, 2014; Hess et al., 2012; Soaita & Dewilde, 2020; Lux et al., 2011), and in Western Europe (Musterd, 2014; Norris & Winston, 2012). Accordingly, we select the following

characteristics of household heads and their households from the national censuses: age, household type, level of educational attainment, and socio-professional category (for 2002 only). Concerning the characteristics available from the HBSs, in addition to the above-mentioned socio-demographic factors, we selected two additional variables: the information on households' monthly incomes (income quintile groups) and on their residential mobility statuses. The latter variable indicates how long a household has resided in the present apartment/house—we consider those that have moved into the present apartment within the last ten years as movers.

4. Findings

4.1. Regression Results

Table 2, model 1, illustrates the relationship between socio-demographic factors and reliance on public housing in Lodz in 1978. The model is significant and the Nagelkerke pseudo R^2 (pseudo R^2 hereafter) is 0.089. The age of household heads increases the probability of living in public housing. The effect of educational attainment is especially revealing in terms of the link between

this segment of housing and social stratification under mature socialism. In fact, public stock housed noticeably lower social categories than the other segments (private and cooperative)—the probability of being a resident in public housing decreases, virtually linearly, along with level of education. Also being employed decreased the probability of residing in this type of housing. Families with children were the least likely, especially if compared with single person households, to reside in public housing. Thus, the effects of selected determinants generally reflect the logic of housing allocation under socialism. Apart from a number of other factors (cf. Gentile & Sjöberg, 2013), younger families with children and the better educated enjoyed better access to new and higher quality housing (Węcławowicz, 1998; Szelenyi, 1983). From the 1960s until the collapse of the socialist system, the higher quality housing in Poland was offered by state-controlled housing cooperatives, and access to this kind of dwelling required down-payments (Ciechocińska, 1987). Put differently, even if the state owned nationalized and new-build dwellings housed higher social groups in CEE in the first decades of socialism (Chelcea, 2012; Szelenyi, 1983), our results suggest that this segment was already overrepresented

Table 2. Binominal logistic regression models on reliance on public housing, Lodz, 1978 and 2002.

Covariate	1978	2002	
	Model 1	Model 2	Model 3
Constant	0.967*	0.245***	0.486***
Age	1.014***	0.887***	0,987***
Education (ref: primary or without education)			
Vocational	0.829***	0.973	0.935'
Secondary	0.652***	0.405***	0.447***
Higher	0.529***	0.205***	0.256***
Household type (ref: married couple with children)			
Single	3.405***	1.046'	1.067'
Married couple without children	1.156***	0.668***	0.682***
Single parent	1.435***	1.534***	1.520***
Extended family	1.187***	1.431***	1.499***
Other	1.662***	1.210	1.414'
Employment status (ref: not working)			
Working	0.739***	0.747***	
Socioeconomic status (ref: managers, higher clerks)			
Professionals			1.352***
Technicians			1.517***
Clerks			1.773***
Service workers			1.933***
Production workers			1.803***
Machine operators			1.813***
Unskilled workers			2.728***
Pensioners and retired			2.216***
Living on social assistance			3.850***
Other sources of income			2.647***
Nagelkerke R²	*0.089*	*0.146*	*0.214*
N	*23078*	*33567*	*33552*

Note: '0.1, *0.05, **0.01 and ***0.001.

by lower social categories by the late 1970s. Interestingly, the study by Marcińczak and Sagan (2011) suggests that concentrations of public housing were a significant indicator of low social status areas in Lodz in 1988, which means that the position of public housing stock did not improve over the last decade of socialism.

The effect of the selected demographic and socioeconomic predictors on reliance on public housing appears to be stronger in 2002 than in 1978 (Table 2, model 2); as showed by the pseudo R^2, the model's explanatory power raises to 0.146. While the effect of age changed direction after the first decade of transition (the elderly were more likely to rely on the other tenure types than public housing), some differences can also be noticed in the effect of household type on housing segmentation. In fact, only the more socially vulnerable (single parents) and extended families were more likely to concentrate in public housing. More importantly, the relationship between educational attainment of household heads and the likelihood of living in public housing points to further social downgrading of this tenure segment—for the highly educated, the probability of being a resident in public stock dropped from 0.529 in 1978 to 0.205 in 2002. The results of model 3 (Table 2) provide further insights into the relationship between housing segmentation and socioeconomic stratification ten years after the demise of socialism, and illustrate the process of social decline even more clearly. The adoption of a more detailed classification of socioeconomic groups also raises the explanatory power of the model to 0.214.

All other factors being constant, socioeconomic status is inversely related to the likelihood of living in public housing in Lodz in 2002; while unskilled workers have an almost three times higher probability of residing in public housing than the highest socio-professional category, for those living on social benefits the probability is nearly four times higher.

The regression analysis on housing segmentation in the 2000s based on the data from the 2003–2005 HBSs generally delivers congruent results with those for 2002. What is particularly interesting is the effect of household income on residence in public stock (Table 3, model 4). Essentially, even if the lower social categories were overrepresented in public housing, the public sector did not necessarily serve the poorest residents in Lodz in the mid-2000s. There is no significant difference in access to public housing between the first and the second income quintile; however, the population belonging to the third income quintile has nearly two times lower probability of living in public housing. Whereas the effects of education and household structure virtually did not change in the second decade after the fall of socialism, the link between income stratification and housing segmentation became even more clear-cut than in the mid-2000s (Table 3, model 5). More to the point, all income categories have a lower likelihood of residing in public housing than the bottom (lowest) quintile; even the less affluent population, those belonging to the second quintile, are actually half as likely to rely on the public housing sector as those in the lowest income category. For the

Table 3. Binominal logistic regression models on reliance on public housing, Lodz 2003–2005 and 2011–2013.

Covariate	2003–2005	2011–2013
	Model 4	Model 5
Constant	2.662*	3.625***
Age	0.985**	0.979***
Education (ref: primary or without education)		
Vocational	0.794	1.125
Secondary	0.488***	0.424***
Higher	0.144***	0.134***
Household type (ref: married couple with children)		
Single	0.605	0.584*
Married couple without children	0.662*	0.756
Single parent	1.844**	1.714
Extended family	1.665**	2.950***
Other	1.134	1.531*
Income quintiles (ref: 1st—bottom)		
Second	0.687	0.531**
Third	0.529**	0.270***
Fourth	0.311***	0.264***
Fifth (top)	0.294***	0.259***
Residential mobility (ref: stayer)		
Mover	1.427	0.646**
Nagelkerke R²	*0.202*	*0.220*
N	*1864*	*2001*

Note: ʼ0.1, *0.05, **0.01 and ***0.001.

medium and high-income groups, the probabilities of residing in public housing are very similar and they are consistently below 0.3. Put differently, what we observe in the first decade after transition is a firmer relationship between reliance on public housing and income stratification, one that reflects the massive increase in income (and wealth) inequalities in Poland after 1990. Finally, the effect of residential mobility on housing segmentation is statistically significant and points to the fact that the public stock was home to the less residentially mobile population in 2011–2013. The relative residential immobility of those relying on public housing in the early 2010s can be related to the fact that extended families have the highest probability of residing in public housing. Put differently, due to low incomes, it seems that younger generations remain much longer with their families living in public housing than their peers living elsewhere.

4.2. Changing Quality of Public Housing

To gain further insights into the process of public housing residualization we also conducted a simple descriptive analysis of the evolving quality of Lodz's public housing stock. Table 4 illustrates the changing levels of housing consumption and sewage provision (the existence of a flush toilet in the dwelling), which are common indicators of housing stratification (Soaita & Dewilde, 2020). The level of housing consumption was identical in the public and in other housing sectors in Lodz in 1978. This could be the effect of strict housing norms regarding housing consumption under socialism (French, 1995). However, the public housing stock was more disadvantaged than the other segments. This implies that a noticeably lower social status of residents in public housing already coincided with the somewhat lower quality of this housing segment in the late 1970s. Whereas housing consumption increased significantly over the

three decades, the process was less advanced in the public housing segment. A gap of approximately six square meters had already emerged between public housing and the other forms of tenure in the early 2000s. More importantly, contrary to the other housing segments, the issue of sewage provision in the public sector did not improve, or even worsened slightly after 1978. Consequently, one in four public dwellings could be labelled as substandard in 2011–2013.

The unique information from the 2011–2013 HBSs additionally offers the opportunity to explore how the residents of public housing evaluate the quality of their dwellings and neighborhoods. The differences in perceived living conditions between the residents of public housing and those relying on other tenure are actually substantial (Table 5). One in three residents in public housing considers the dwelling they occupy to be in poor physical condition and/or cramped. Those who rely on public stock also seem to live in 'bad' areas more often: One-third of them reported living in neighborhoods with a high rate of crime and social problems, and nearly one-fourth of them consider their local environment to be polluted. For the population living in the other housing sectors, the share of those who reported living in an unfavorable location is roughly three times smaller. To sum up, the results show that the public housing sector in Lodz is not only more likely to be located in 'problematic' neighborhoods, but also tends to be of low quality.

5. Conclusion

The aim of this article was to investigate the pace and effects of public housing residualization in a former socialist city. As elsewhere in West Europe (Kadi & Ronald, 2014) and in CEE (Lux & Sunega, 2014), the decline of the public housing sector in Poland is an undeniable fact. However, our findings from Lodz suggest that

Table 4. Housing consumption and housing disadvantage in Lodz, 1978–2013.

	1978		2002		2003–2005		2011–2013	
Housing tenure	Other	Public	Other	Public	Other	Public	Other	Public
Living area per capita in m^2	17.75	17.78	26.26	19.17	26.12	20.45	30.79	24.73
Flush toilet in dwelling (in %)	82.2	77.3	94.9	76.4	93.3	70.3	98.0	73.4

Table 5. Self-evaluation of living conditions, Lodz, 2011–2013.

Housing tenure	Public	Other
	Positive answers (in %)	
Has your dwelling leaky roof, damp walls, floors, foundations, rotting windows and floors?	33.7	7.1
Is your dwelling cramped and/or does it not have enough sunlight?	29.3	8.2
Is your dwelling located in a polluted environment (dust, smoke, other sources of pollution)?	24.5	9.2
Is your dwelling located in a dangerous neighborhood (high crime rate, vandalism, social problems)	33.7	11.3

some context-specific characteristics of the process can be distinguished. The process of public housing residualization in Lodz, apart from the steady shrinkage of this form of tenure, manifests itself in two ways.

First, our results show that the process of give-away privatization is selective and sensitive to differences within public housing stock, and involves increasing housing disadvantage rates in the public sector. Put differently, there is less and less public housing, and what is left is in very poor physical condition. The relatively high rate of housing disadvantage in the public sector could be explained by the development path and specific urban structure of Lodz. The parts of the city constructed before 1945 are very densely built-up with predominantly low-quality tenements, and pre-socialist housing was nationalized under socialism thus becoming the backbone of the public stock. As the efforts of the socialist state concentrated on new housing developments, pre-socialist dwellings were not renovated. The good quality public housing in the blocks of flats on housing estates was privatized first. Due to unresolved issues with property rights, give-away privatization has been less smooth in the historical core. While the high-quality tenements inhabited by higher social categories under socialism (Marcińczak & Sagan, 2011) were equally likely to be privatized or returned to former owners or their heirs, a relatively large housing stock of (very) low quality dwellings remained in public hands. The poor economic condition of the city in the first decade after 1990 and the lack of subsidies from central government for housing maintenance (the decentralization paradox (Lux & Sunega, 2014)) did not improve the position of the public housing sector in the city. The residents of low-quality public dwellings were often recruited from the lower social categories and usually preferred keeping low rents rather than becoming poor owners.

Second, the evolving socioeconomic composition of public housing residents unequivocally points towards declining social status. However, contrary to what is often assumed (Hegedus et al., 2013), public housing was not already primarily serving the socialist 'middle class' in the late 1970s. It then appears that the first signs of residualization can already be identified back then, and there is convincing empirical material suggesting that the process continued in the late socialist era (Marcińczak, Gentile, & Stępniak, 2013). This was the result of constant shortages under socialism (Kornai, 1992) and the development of cooperative housing for those who could participate in the construction costs (Ciechocińska, 1987). Interestingly, the results from Lodz imply that public housing residualization in the socialist regime began pretty much at the same time as in the more liberal welfare regimes in Europe, the UK in particular (Williams et al., 1988). Put differently, contrary to what is often assumed (Kadi & Ronald, 2014; Lux & Sunega, 2014) our findings support the argument that the process of residualization is not necessarily linked with privatization. Even if the process of public housing

residualization was already advanced in the early 2000s, it gained momentum in the second decade after transition. Then, after 20 years of systemic social and economic changes, the patterns of housing segmentation are firmly related to the patterns of income stratification, and public housing is generally the stronghold of the worse-off. Accordingly, it is tempting to propose that, similar to the development of social segregation patterns after socialism (Marcińczak et al., 2016), the pace of the residualization process lagged the increase in income inequality, which had already sky-rocketed in the 1990s (Blanchet et al., 2019).

Housing stratification is among the most visible aspects of income and wealth inequality. Regarding the relationship between housing change and the development of economic inequality after socialism, give-away privatization brought about an unprecedented transfer of wealth that generally fossilized socialist-era socioeconomic inequality (Bodnar, 1996; Lux & Sunega, 2014). Assuming that the lower social categories were already overrepresented in public housing under socialism, it seems that the residents who stayed in public housing after 1990 are doubly disadvantaged. They did not benefit from the post-socialist transition of wealth and, due to their education and skills, often belong to the low-income categories. This in turn implies that they simply lack resources (both incomes and housing that could be commodified) to improve housing conditions and have become trapped in the low-quality public housing sector. The fact that the remaining public housing in Lodz is relatively often located in impoverished and dangerous neighborhoods further adds to the disadvantaged position of those who rely on this housing sector. Importantly, the residual public housing in the inner-city was a good indicator of the enclaves of poverty in Lodz in the 1990s (Warzywoda-Kruszyńska & Grotowska-Leder, 1996). The lack of opportunities to leave those clusters of public housing has had a profound impact on residents' life trajectories. There are concrete results illustrating that children from the poverty enclaves have much lower educational outcomes compared to those from other neighborhoods, and are more prone to delinquency; in fact, poverty and reliance on social welfare (including housing) have often been 'inherited' in families that are stuck in those tracts (Warzywoda-Kruszyńska & Jankowski, 2013).

This study clearly shows that public housing residualization is a path-dependent process, and its effects are context-specific. But our analysis, like many previous studies (Gentile, 2015; Gentile & Marcińczak, 2014; Hess et al., 2012), is limited to only one case. Consequently, assuming that cities differ not only in morphology, functional specialization, and exposure to globalization, but also in housing policies adopted and approaches to public housing, we suggest that future studies should investigate the process of public housing residualization in the comparative perspective encompassing a larger number of cities, preferably from different housing systems

(Stephens et al., 2015). We believe that comparative studies should allow a better understanding of how public housing residualization unfolds in different spatial and institutional settings and is co-determined by the local context. This in turn can be helpful in identifying those conditions that can potentially reduce the most negative effects of residualization. Regarding potential policy implications for Lodz, the city should continue with the more selective privatization that was introduced in the early 2010s. More precisely, the municipality should concentrate on the improvement of the technical condition of those buildings in the inner-city where all apartments belong to the public sector; by the same token, the municipality should privatize the apartments in buildings where only a small share of apartments is public housing. Finally, to reduce the concentration of poverty in residualized public housing, especially old tenements, along with the regeneration of housing stock, some forms of social mixing should be considered when distributing renovated public housing.

Acknowledgments

Conflict of Interests

The authors declare no conflict of interests.

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Article

Inequality on the Increase: Trajectories of Privilege and Inequality in Madrid

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Abstract

In Spain, housing is one of the main axes of social inequality. Its position within Spain's economic model and welfare system is key to understanding why its financialization at the beginning of the 21st century had such different consequences among residents as well as territorially. In this context, from 2001 to 2011, Madrid became one of the most segregated metropolitan areas in Europe. This article delves into how both housing and its location organise inequality in different social spheres and reproduce it over time. To this end, the geography of this inequality is analysed in different social residential trajectories, along with how segregation produces its own dynamics of inequality. The analysis is based on census data and applies a combination of factor and cluster analyses. The results reveal important processes of social residential marginalisation articulated by the interaction between high international immigration and the spatial manifestation of the housing bubble. The main socio-spatial result of this process is the disappearance of mixed social spaces in Madrid, previously located in the centre of the city. This dynamic produces opposite territories in terms of advantage and disadvantage in different spheres linked to social inequality such as education, health, leisure, care and even prejudice. In the process, impoverished immigrants disperse towards the neighbourhoods that concentrate the greatest disadvantages in each of these spheres.

1. Introduction

In major European metropolitan areas, residential segregation between socio-economic groups grew from 2001 to 2011 (Tammaru, Marcińczak, van Ham, & Musterd, 2016). This dynamic goes hand in hand with an increase in economic inequality (Piketty, 2013). In the case of the metropolitan area of Madrid, this parallel increase was particularly outstanding. According to the comparison that Tammaru et al. (2016) made between the inten-

sity of residential segregation between socio-economic groups in twelve European capitals, Madrid was situated at intermediate values at the beginning of the 21st century. However, ten years later, it was the most segregated metropolitan area. One of the consequences of the increase of segregation is the erosion of contact among unequal social groups. Even though the lines that define the structure of segregation among groups (socioeconomic position, ethnic origin, household cycle) have not changed in contemporary cities,

the form of residential segregation has become increasingly more rigid (Marcuse & van Kempen, 2002). In this process, socio-spatial processes progressively differentiate between dynamic and declining territories, thus questioning the existence of mixed social areas (Castells, 2003). Therefore, the territories of privilege and vulnerability are consolidated and disconnected socially and geographically. In this context, previous trajectories of socio-spatial mobility and mixing fade and urban space fragments into positions without interaction (Kesteloot, 2005). This socio-spatial division gives rise to unequal socio-economic contexts in different social domains which, in turn, condition the individual outcomes of its inhabitants (van Ham, Tammaru, & Janssen, 2018). By this, we do not refer to the effects of the segregation of ethnic and social *per se*, whose relationship with social integration remains contested (Musterd, 2003; van Kempen & Bolt, 2012), but to the material advantages and disadvantages that unequal urban contexts pose.

The case of Spanish cities during the first decade of the century, characterised by heavy suburbanisation facilitated by the intense financialization of housing, has been analysed in several studies (Antolín-Iria & Fernández-Sobrado, 2020; Porcel & Antón, 2020; Rubiales, 2020; Sorando & Leal, 2019). However, the specific processes of socio-spatial change that sparked the increase in residential segregation during the first decade of the century have not yet been addressed in-depth, especially regarding these dynamics with a direct impact on its remaining socially mixed territories. Likewise, there is a gap in the empirical study of the effects of these dynamics on the reproduction of inequality in and through other spheres such as education, health, leisure, care and even prejudice (van Ham et al., 2018; Wacquant, 2008). These are to be the main contributions made by the present article, tracing the shifts in the relation between the social and spatial dimensions of inequality over a decade of significant increases in the financialization of housing. To this end, the article begins with a review of the relevant literature on the processes of segregation and inequality in urban societies in Southern Europe. The research strategy employed is then specified in the methodology section. Next, our results reveal the trajectories of privilege and vulnerability through which segregation and inequality have expanded and reproduced across Madrid's society and territory. Finally, the conclusions address the scenario that the analysis poses in the context of the subsequent decade.

2. Processes of Segregation and Inequality in Southern Europe

The literature on the relationships between social inequality and residential segregation has traditionally been dominated by concepts such as the ghetto or the neighbourhood effect, which are sometimes insuffi-

cient to understand these relationships in all their complexity. Residential segregation in Southern European cities specifically gave rise to socio-spatial paradoxes that cannot always be understood through such concepts (Arbaci, 2019). Noteworthy among these paradoxes is the unstable relationship between inequality and segregation, a disparity that has also been observed in other contexts (Frey, 2014; Fujita & Hill, 2012). In the case of Southern European cities at the turn of the century, several authors pointed to high levels of residential marginalisation in contexts with low intensity of residential segregation and an important social mix in their neighbourhoods, from both racial and socio-economic perspectives (Domínguez, Leal, & Martínez, 2012; Malheiros & Fonseca, 2011). Recent research has demonstrated that this relationship underwent a transformation whereby both social inequality and residential segregation increased together once again in the first decade of the millennium (Sorando & Leal, 2019). Therefore, finding residential segregation does not presuppose the discovery of its consequences on social inequality. Whether the two phenomena change together or not, what is revealed is the need to contextualise the relationships between the two concepts. In short, "rather than being an inevitable outcome or an organic phenomenon, segregation is the product of, and part of broader mechanisms and structures that (re)produce, social inequalities and (un)equal production of space in capitalist societies" (Arbaci, 2019, p. 42).

In the case of Spain, as a variant of the Mediterranean model, the familistic welfare regime gave housing a key role in the reproduction of its main structures. In this sense, promoting homeownership has been an instrument to promote the economy, rather than to reduce social inequalities. Specifically, tax relief for mortgage repayments on primary and secondary homes (which significantly benefits middle and high-income households) was the traditional instrument of housing policy in Southern European countries. Public spending on this policy has been applied to the detriment of public support for the working classes regardless of their tenancy classification (Allen, Barlow, Leal, Maloutas, & Padovani, 2004). In societies with pronounced dualism in the labour market where the informal economy occupies an important position, owning a residence is imperative for household social security (Castles & Ferrera, 1996). In this setting, solidarity strategies within the family are organised around the transmission of property assets across generations, legitimising the abandonment of social housing policy. In this regard, it is important to point out that two types of social housing have coexisted in Spain. The first type of social housing is the so-called *viviendas de protección oficial*, which is destined almost entirely to homeownership and is publicly subsidised through low-interest loans to private developers. More importantly, low-income households were systematically excluded from the distribution of *viviendas de protección oficial*, for which around 80%

of households were eligible during the period considered in this article. The second type of social housing corresponds to its common use in the rest of Europe: rental social housing (Alberdi, 2014). In 2011, the distribution of tenure in Spain showed the consequences of this model: 79.6% of households lived in their own home compared to 12.1% who did so in rental housing at market price, and 2.8% in social rental housing (according to data from the Life Conditions Survey; see INE, 2011). In this context, Spain is the fourth country in the EU with the lowest percentage of social rental housing, only above Greece, Luxembourg, and Estonia (Pittini, 2019).

From the end of the 1990s, the financialization of this model expanded to the whole of Spanish society (Fernandez & Aalbers, 2016; García-Lamarca & Kaika, 2016). The deregulation of the mortgage markets during the 1980s and 1990s, in conjunction with the reduction in interest rates, allowed the expansion of the mortgage supply to sectors with less economic solvency, mainly migrants and young people: "Spanish 'subprimes' consisted in granting at least a million mortgages to vulnerable segments of society between 2003 and 2007" (López & Rodríguez, 2011, p. 20). This promoted residential mobility until the outbreak of the great financial crisis in 2008 (Bayona & Pujadas, 2014). Since then, the consequences of this model have made access to housing (both owned and rented) unimaginably difficult for some sections of society. Difficulties in accessing adequate and safe housing are, together with the low quality of employment, the main paths towards social exclusion in Spain. Therefore, social inequality is strongly linked to the Spanish residential model, due to the overburden that housing costs have on the economies of the most vulnerable households (FOESSA, 2019). This problem is serious for the two groups without access to family assets that were recipients of the subprime mortgages: most migrants (Arbaci, 2019) and many young households affected by economic precariousness (Bayrakdar, Coulter, Lersch, & Vidal, 2019). In many cases, these households have been evicted from their mortgaged home or have been at risk (Cano, Etxezarreta, Dol, & Hoekstra, 2013). In this context, a crucial savings strategy for them is the search for the cheapest housing in their metropolitan areas, which often involves a process of urban dispersion (Arbaci, 2019).

The territorial articulation of this welfare regime, in the current context of housing financialization, is based on the traditional patterns of residential segregation in Spanish cities. These trends can be interpreted as a variation of the quartered city model proposed by Marcuse and van Kempen (2000) according to the analysis of this phenomenon in the case of Madrid carried out by Sorando and Uceda (2018). Spanish cities' main distinguishing characteristic is the absence of widespread abandonment of urban centres, except in working-class areas in the process of gentrification. This characteristic is crucial because it had given rise to socially mixed urban centres at the beginning of the century. The peripheries

of Spanish cities are segmented into three of the characteristic forms taken by the quartered city model: the suburban city, the tenement city of the post-war period and the tenement city of the late 20th century. The first is characterised by new middle classes, the second by both impoverished migrant populations and traditional working classes, and the third by autochthonous and ageing households. Lastly, two of the categories from the divided city model do not entirely coincide with the social geography of the Community of Madrid. They are the ethnic enclave, which appears only partially, and the abandoned city, which is even more divergent here, as the presence of the state is common even in the urban areas of increased social and residential vulnerability.

This scenario is, however, subject to the dynamics of socio-spatial change. According to van Ham, Manley, Bailey, Simpson, and Maclennan (2012), the main causes of social change in neighbourhoods are: (1) the behaviour of households that change neighbourhoods according to their preferences, resources and restrictions, (2) in-situ changes in the remaining population (in demographic and socio-economic terms) and (3) external impacts on neighbourhoods (such as structural socio-economic change and/or urban regeneration operations). In the case of Spanish metropolitan areas, the first two factors are related to the underlying characteristics of their segregation patterns, whereas the main external impacts involve two interconnected processes: the great international migratory flow beginning at the turn of the century and the different mutations of the financialization of housing in Spain, together with their unequal effect across the territory (Méndez, 2017; Rubiales, 2020).

All these dynamics reconfigure the geography of residential inequality, which has substantial effects on social inequity, as a result of the unequal position of different urban groups in property market dynamics. However, the manners in which different segregation trajectories reproduce social inequality are much broader. Following van Ham et al. (2018), segregation implies exposure to differential socio-spatial contexts that have specific effects on individual achievements and which, in turn, condition subsequent residential strategies. These contexts include housing and the neighbourhood of residence, but also places of work, leisure, education, and transport. In particular, the concentration of poor housing in certain neighbourhoods exposes its inhabitants to risks prevalent in other spheres such as health and education. In this respect, it makes sense to highlight three mechanisms for reproducing inequality through the social residential context. Firstly, the lack of available space in overcrowded dwellings is linked to psychological and school problems among children, as a result of the lack of space for study, the impact of high noise levels on concentration and sleeping difficulties (Solari & Mare, 2012). Similarly, residence in buildings without a lift implies the social and physical isolation of many elderly and disabled people. Such isolation has significant effects

on physical and mental health, well-being, and participation in social life (Holt-Lunstad, Smith, & Layton, 2010). Finally, conditions for daily mobility are unevenly distributed across different territories and social groups as a result of the segregation of economic activities and the unequal ability of households to select their neighbourhood of residence, giving rise to inequalities in many areas including welfare, social inclusion and time availability (Church, Frost, & Sullivan, 2000; Delbosc & Currie, 2011; Kaufmann, Bergman, & Joye, 2004).

3. Methodology

The analysis of the processes of socio-spatial change in the Community of Madrid from 2001 to 2011 and their effects on inequality was based on the Population and Housing censuses of 2001 and 2011 (INE, 2004, 2013). Since the 2011 census was not carried out as a thorough census (unlike the 2001 census), but rather by means of a sample, this census section cannot be used as a territorial unit of analysis. For this reason, the territory analysed has been divided into the largest number of territorial units possible while maintaining sufficient sample sizes to obtain statistically representative information for 2011. The procedure for drawing up these territorial units followed two criteria: The number of grouped census sections was established as eight, given that the resulting population size (an average of 13,063 residents) is the smallest that allows sociodemographic data to be obtained without high sampling errors, while the grouping of census sections was carried out following urban planning criteria so that each grouping includes sections mainly corresponding to the same urban planning category. To sum up, the 4,271 census sections of the Community of Madrid in 2011 were grouped into 488 aggregated territorial units (ATU), which were subsequently used as a reference to construct the census section groupings for 2001.

Taking this information as a starting point, a three-stage research strategy was adopted. First, a multidimensional index of social residential inequality was developed which categorises each territory for both dates. To this end, factor analysis was used to synthesise the different dimensions tracing the structure of territorial resource distribution and the risks associated with social residential inequality. Each factor, therefore, measures a specific latent dimension of inequality at each ATU. The aim is to obtain stable factors for 2001 and 2011 so that each factor can be assumed to measure the same dimension in both years. For this investigation, we chose to include more variables than those of the classic three-factor model (social class, household life cycle and ethnic composition) used in the analysis of residential segregation in Western cities (Hartschorn, 1992). Along with the variables that make up these factors, this study incorporated other components that structure settlement patterns amid increasing uncertainties and precariousness (Standing, 2011) such as residential condi-

tions, economic activity, type of contract and proximity to the place of work.

Secondly, the group of territories was classified into seven social residential types (SRT) for each year so that the most frequent trajectories between types could then be determined. To this end, a cluster analysis was applied to classify each ATU into an SRT according to its score on each of the factors in the social residential inequality index. In this way, the trajectories of each area can be observed from 2001 to 2011 through the classification of each ATU into a social residential trajectory according to its SRT of origin (in 2001) and the SRT it ends up in (in 2011). Of the 29 existing trajectories, the patterns of the trajectories accounting for over 3% of the total cases were analysed. This involved observing their transformation in the social residential inequality index dimensions.

Lastly, the average for a series of indicators of the specific processes involved in the reproduction of inequality linked to residential segregation was obtained in each of these trajectories. These indicators are space available (average surface area per person), the lack of time (percentage of workers who spend more than one hour commuting from their homes to their places of work) and potential physical isolation (percentage of people living in buildings of more than three floors without a lift). Although these variables were used in the social residential inequality index, the objective was to observe how their impact varies across different trajectories of social residential inequality.

4. Results

The empirical analysis of resident group settlement in the Community of Madrid in 2001 and 2011 confirms that their spatially differentiated locations are based on social and residential characteristics.

4.1. Dimensions of Social Residential Inequality

The social residential differentiation between residents in the Community of Madrid is a social process characterised by three dimensions that substantiate the classic model of western cities (Hartschorn, 1992) (see Table 1). Respectively, these factors explain 73.5% and 68.7% of the total variance of the set of variables included in 2001 and 2011. Also, the adjustment of both models is satisfactory on both dates (with KMO indices of 0.82 in 2001 and 0.85 in 2011 that confirm the suitability of the data for factor analysis, given the sufficient intercorrelation between the variables). The first dimension synthesises the socio–economic position of the residents of each ATU according to their occupation, their professional situation, and their level of education. This component, to be discussed in more depth below, is connected to some of the specific processes of inequality reproduction linked to residential segregation: lack of space and time availability, as well as physical isolation. Moreover, this dimension is bipolar, as it is made up of exclusionary

Table 1. Composition of social residential differentiation factors in 2001 and 2011.

Variable	F1		F2		F3	
	2001	2011	2001	2011	2001	2011
University studies (25–64)	−1.0	−1.0				
Professionals	−0.9	−0.9				
No Secondary Education (20–64)	0.9	0.9				
Temporary contract	0.9	0.7				
Craft and related trades workers	0.9	0.9				
Service and sales workers	0.9	0.8				
Plant and machine operators and assemblers	0.8	0.8				
Inactive persons (45–64)	0.8	0.5				
Unemployed persons	0.7	0.8				
Average area per occupant	−0.7	−0.6				
Elementary occupations	0.7	0.8				
More than one hour (commuting)	0.6	0.8				
No lift (more than 3 floors)	0.5	0.6				
Children (0–14)			−0.9	−0.9		
Home with mortgage			−0.9	−0.9		
Aged 64 to 74			0.8	0.9		
Aged over 75			0.8	0.7		
Single mother households			0.8	0.6		
Housing paid for			0.7	0.8	−0.5	
Rental housing					0.7	0.8
Born abroad (non-OECD)					0.7	0.8
Buildings in poor condition					0.7	0.5
Empty housing					0.6	0.6

Source: Drawn up by the authors based on the 2001 and 2011 Population and Housing censuses (INE, 2004, 2013).

characteristics, in other words, the presence of features of privilege excludes those of vulnerability and vice versa. Thus, socio-economic privilege involves more time availability, less difficulty in accessing housing, and more space in the home for each inhabitant whereas the opposite is linked to socio-economic vulnerability.

The second dimension (household life cycle) refers to the type of household that inhabits each ATU. Specifically, it distinguishes (and mutually excludes, as it is also a bipolar component) spaces including ageing and single-mother households, on the one hand, and spaces where children live in homes that are pending payment (through mortgage credit), on the other. The third component points to those territories with a high percentage of populations born in economically impoverished countries, which are also characterised by precarious residential conditions. This association is linked to the fact that the main access to housing is through private rental, due to the conditions imposed by the migratory path of these residents and the dynamics of the Spanish housing market in the first decade of the 21st century (Leal & Alguacil, 2012).

The stability of these factors from 2001 to 2011 is significant here. In this respect, the 23 variables introduced in the model remain grouped in the same factor in both years. Also, the factorial structure and saturation of each variable in this dimension are similar in both years

(the positive/negative orientation remains unchanged). Thus, we can assume that each of the three dimensions of the index measures the same latent concept on both dates and that, therefore this measuring instrument can be used to explain the processes of change across time and space.

4.2. Trajectories of Social Residential Change (2001–2011)

For 2001, the areas of the Community of Madrid were divided into three working-class types and three privileged-class types (according to the origin and age structure of its population, in each type), together with a socially mixed type (in each of the components of the social residential inequality index), as shown in Table 2. This division is based on the average value of each socio-residential type in the first dimension (the socio-economic position) extracted by factor analysis. In this regard, a value close to zero in this component indicates a socio-economic position similar to that of the metropolitan area of Madrid as a whole. On the other hand, values far from zero in this component indicate an impoverished socio-economic profile (if it adopts positive values) or privileged (if they are negative).

In the case of 2011, the SRT differentiate the Madrid region into two variants (according to the diversity of

Table 2. Centre of each SRT in each social residential inequality factor.

Social Residential Type	F1	F2	F3	Total
SRT1 Diverse ageing working classes	0.8	0.5	0.6	85
SRT2. Young native working classes	0.7	−1.0	−0.3	84
SRT3. Ageing native working classes	0.6	0.6	−0.8	109
SRT4. Socially and ethnically mixed spaces	0.2	0.4	2.7	25
SRT5. Young upper-middle classes	−0.9	−1.5	0.2	71
SRT6. Ageing privileged classes with immigration	−1.1	1.0	0.7	53
SRT7. Native privileged classes	−1.2	0.5	−0.8	61

Source: Drawn up by the authors based on the 2001 and 2011 Population and Housing censuses (INE, 2004, 2013).

origin of the population, in each case) of the young working classes, the ageing lower-middle classes and the upper-middle classes, alongside an axis of privilege (Table 3). The disappearance of the socially and ethnically mixed spaces that were identified in 2001 is crucial in terms of segregation.

Overall, a transformation was identified in the social residential division of Madrid's metropolitan space, through which the consolidation of an axis of privilege can be observed, along with two types of particularly disadvantaged space. Certain processes of social change can be observed in four intermediate spaces. Both stability and change are articulated through the main social residential trajectories in the territory of Madrid from 2001 to 2011. In concrete, eleven transformation patterns are identified, each of which represents over 3%

of the total trajectories: all together constituting 83.0% of that total (Table 4).

These transformation patterns, or trajectories of social-residential inequality, can be classified into three main types (Table 5), each one characterised by a particular housing dynamic (Table 6).

These trajectories can be further expanded on as follows:

1. Trajectories of impoverishment:

• The precarization of extremely impoverished young natives [SRT2 to SRT1: 10.5%]: These metropolitan and working-class areas are the territories where the socio-economic position of their inhabitants is most precarious. These territories

Table 3. Centre of each SRT for each social residential inequality factor (2011).

Social Residential Type	F1	F2	F3	Total
SRT1. Young, native, highly precarious classes	1.1	−0.5	−0.5	80
SRT2. Diverse highly precarious classes	1.0	−0.3	2.0	23
SRT3. Diverse working classes	0.6	0.5	0.6	82
SRT4. Ageing native lower-middle classes	0.4	1.1	−1.0	78
SRT5. Young native upper-middle classes	−0.5	−1.5	−0.4	88
SRT6. Diverse upper-middle classes	−0.6	0.3	1.6	45
SRT7. Ageing privileged classes	−1.3	0.5	−0.1	93

Source: Drawn up by the authors based on the 2001 and 2011 Population and Housing censuses (INE, 2004, 2013).

Table 4. Percentage of ATUs according to their SRT in 2001 and 2011.

		2011							
		SRT1	SRT2	SRT3	SRT4	SRT5	SRT6	SRT7	Total
2001	SRT1	2.5%	3.7%	9.0%		0.8%	1.4%		17.4%
	SRT2	10.5%	0.2%	0.2%	0.8%	5.5%			17.2%
	SRT3	2.7%		7.2%	12.1%		0.2%	0.2%	22.3%
	SRT4		0.8%	0.2%		0.2%	3.9%		5.1%
	SRT5	0.8%			0.2%	11.1%		2.5%	14.5%
	SRT6						3.7%	7.2%	10.9%
	SRT7			0.2%	2.9%	0.2%		9.2%	12.5%
Total		16.4%	4.7%	16.8%	16.0%	17.8%	9.2%	19.1%	100.0%

Source: Drawn up by the authors based on the 2001 and 2011 Population and Housing censuses (INE, 2004, 2013).

Table 5. Social residential inequality index according to the type of social residential trajectory.

	F1		F2		F3	
Trajectory	2001	2011	2001	2011	2001	2011
Precarization of extremely impoverished young natives	0.9	1.1	−0.9	−0.7	−0.4	−0.6
Ethnic enclaves	1.1	1.0	0.6	−0.2	1.1	2.0
Consolidation of early immigration	0.8	0.7	0.5	0.4	0.4	0.7
Incorporation of migrants into working-class areas	0.6	0.6	0.8	0.7	−0.5	0.5
Impenetrable native working-class areas	0.5	0.6	0.5	1.1	−1.0	−0.9
Incipient metropolitan gentrification	0.5	0.2	−1.2	−1.6	0.0	−0.4
Socio-economic improvement in the urban centre	0.0	−0.5	0.6	0.1	2.7	1.9
Expansion of native affluent peripheries	−0.9	−0.8	−1.7	−1.5	0.3	−0.4
Permeability to ethnic minorities in affluent areas	−0.8	−0.9	1.0	0.5	1.0	1.4
Persistent privilege for relatively mixed groups	−1.3	−1.3	0.9	0.7	0.5	0.4
Persistent native privilege	−1.4	−1.3	0.5	0.6	−0.6	−0.5
Total	0.0	0.0	0.0	0.0	0.0	0.0

Source: Drawn up by the authors based on the 2001 and 2011 Population and Housing censuses (INE, 2004, 2013).

are, to a large extent, made up of housing built between 2001 and 2011. As a result, in 2011, people living in homes with a mortgage accounted for 43.1% of the total. Given the social composition of these spaces, residential growth during the said decade was based on the expansion of the mortgage supply to young native households in a precarious economic situation. This configuration has posed a considerable risk of eviction and impoverishment since the bursting of the housing bubble.

- The formation of ethnic enclaves [SRT1 to SRT2: 3.7%]: These are working-class areas where people of the same ethnic minority come together in search of social networks, shared services, and a sense of security (Feijten & van Ham, 2009). This process was already happening in 2001 and became consolidated with an intensity that led to

a rejuvenation of the age structure and a shift in the socio-economic structure towards increased precariousness. A high percentage of the population residing in these ethnic enclaves lived in rental housing in 2011. This pattern is common to the following two types of trajectories (with a significant presence of migrants). In this regard, the percentage of people living in rental housing is directly proportional to the intensity of the settlement of the migrant population.

- The consolidation of early immigration in working-class areas [SRT1 to SRT3: 9.0%]: This involves a similar process to those described above but at a lower intensity.
- The incorporation of migrants into working-class areas [SRT3 to SRT3: 7.2%]: These are working-class areas where there was an intense settlement of impoverished migrants whose presence

Table 6. Relative increase of main dwellings (2001–2011) and tenure structure (2011) according to the type of social residential trajectory.

		Tenure Structure		
Trajectory	Increase in Housing	Housing paid for	Home with Mortgage	Rental Housing
Precarization of extremely impoverished young natives	49.2	35,8	43,1	15,2
Ethnic enclaves	14.9	31,5	30,0	29,9
Consolidation of early immigration	9.6	39,5	28,8	22,6
Incorporation of migrants into working-class areas	9.4	44,2	25,4	21,9
Impenetrable native working-class areas	6.2	53,7	25,0	14,5
Incipient metropolitan gentrification	173.9	20,3	59,4	14,8
Socio-economic improvement in the urban centre	25.3	27,6	23,8	37,1
Expansion of native affluent peripheries	153.0	25,0	56,1	14,0
Permeability to ethnic minorities in affluent areas	16.1	33,8	21,8	31,8
Persistent privilege for relatively mixed groups	12.8	37,5	22,8	23,5
Persistent native privilege	18.6	45,2	28,9	15,1
Total	49.1	36,1	37,9	18,2

Source: Drawn up by the authors based on the 2001 and 2011 Population and Housing censuses (INE, 2004, 2013).

was not significant in 2001. These last three trajectories reflect processes involving the substitution of the Spanish population of lower-middle classes by impoverished foreign migrants as a result of the opportunities provided by the housing bubble to the former and the lack of options of the latter (Módenes, 2007). The substitution process is deduced from the important population change in the context of low residential growth.

- Impenetrable native working-class areas [SRT3 to SRT4: 12.1%]: These are spaces where the autochthonous working classes, whose socio-economic position is slightly deteriorating, age in houses in relatively adequate condition, which leads to their anchorage to the territory and explains the absence of substitution dynamics (Uceda, Sorando, & Leal, 2018). This configuration makes these the territories with the highest percentage of people who reside in properties already paid for, as well as the spaces with the lowest residential growth between 2001 and 2011.

2. Trajectories of gentrification:

- Incipient metropolitan gentrification [SRT2 to SRT5: 5.5%]: These are previously precarious metropolitan areas that are being transformed through rejuvenation and a significant improvement in the socio-economic conditions of their populations, as a result of processes of new construction (with an increase of 173.9% in the number of main dwellings from 2001 to 2011, which imply a proliferation of mortgages, placing these territories as those with the highest percentage of people in dwellings with a mortgage in 2011). These processes exploit the land regulations promoted by the real estate bubble to capitalise on new potential income gaps through new-build gentrification processes (Davidson & Lees, 2010).
- Socio-economic improvement in the urban centre [SRT4 to SRT6 3.9%]: These are the areas with the greatest increase in socio-economic position, a transformation that brought an end to social and ethnic mixing in 2001. This dynamic is facilitated by major urban regeneration and marketing processes in this territory, as well as by the importance of rental housing among its residents. Different case studies on transformations to these territories point to the gentrification processes as the cause of this change (García-Pérez, 2014).

3. Trajectories of privilege:

- Expansion of native affluent peripheries [SRT5 to SRT5 11.1%]: These are affluent spaces where the main shift relates to the notable decrease in the proportion of migrants in rented housing as a result of the proliferation of new owner-occupied

residences (main dwellings increased by 153.0% in the period studied, while the percentage of residents in homes with a mortgage in 2011 is the second-highest among the analysed trajectories).
- Permeability to ethnic minorities in affluent areas [SRT6 to SRT6: 3.7%]: The continuation of the process of arrival of impoverished migrants to upper-middle-class affluent territories where a certain degree of mixing is possible and thus, a process of rejuvenation also occurs. Such permeability to migrants finds its conditions of possibility in the significant presence of rental housing in these territories.
- Persistent privilege for relatively mixed groups [SRT6 to SRT7: 7.2%]: The rejuvenation of the privileged population, in social residential terms, in spaces with a certain degree of ethnic diversity, also facilitated by a notable stock of rental housing.
- Persistent native privilege: [SRT7 to SRT7: 9.2%]: Ageing of the privileged population in socio–residential terms and homogeneity in its autochthonous origin. These are territories with little residential growth and significant weight of already paid-for owned homes.

The geography of these trajectories confirms the traditional (privileged) northwest–southeast (impoverished) axes of the Community of Madrid, and yet it also introduces variants that confirm the dynamic nature of unequal socio-spatial configurations (Figure 1). Among these variants, the disappearance of the socially mixed spaces in the city centre stands out. The combination of the improvement in the socio-economic position of its inhabitants with its central location feeds the hypothesis of the gentrification of these spaces (Figure 2).

4.3. Interlinked Inequalities

Residential segregation processes tend to distribute households with disadvantaged socioeconomic status to residential settings with an unfavourable mix of advantages and disadvantages. The analysis of the dimensions of social residential inequality has revealed that the spaces which concentrate populations in a weaker socio-economic position are those whose housing (due to its surface area and conditions of physical access) and location (in relation to the main centres of employment) constitute a greater disadvantage. Thus, residential segregation, which to a large extent is the result of social inequality, contributes additional specific mechanisms towards its own reproduction, in a chain of inequality processes that takes the form of a vicious circle (van Ham et al., 2018).

In this respect, the high percentage of residents who have to spend more than one hour commuting from their homes to work means that in neighbourhoods with the highest concentration of impoverished households, the time available for activities with the potential to

Figure 1. Main trajectories of social residential change (2001–2011) in the Region of Madrid. Source: Drawn up by the authors based on the 2001 and 2011 Population and Housing censuses (INE, 2004, 2013).
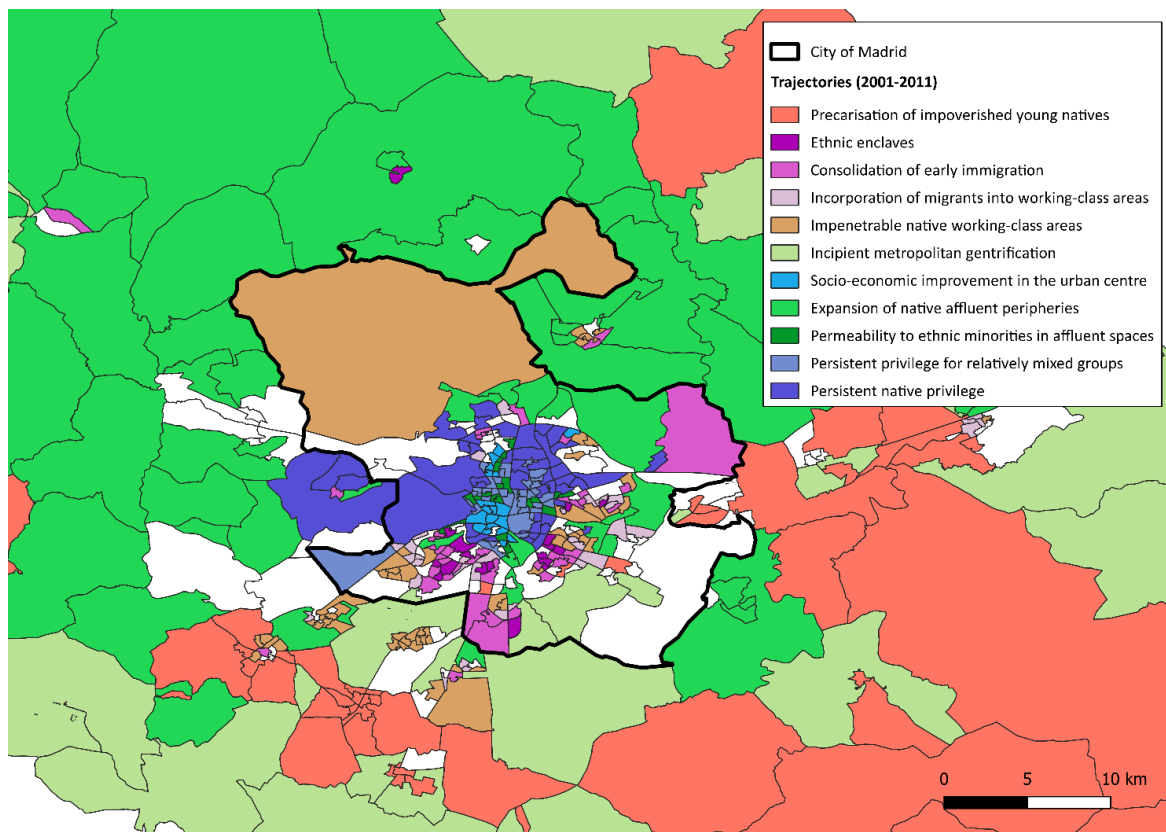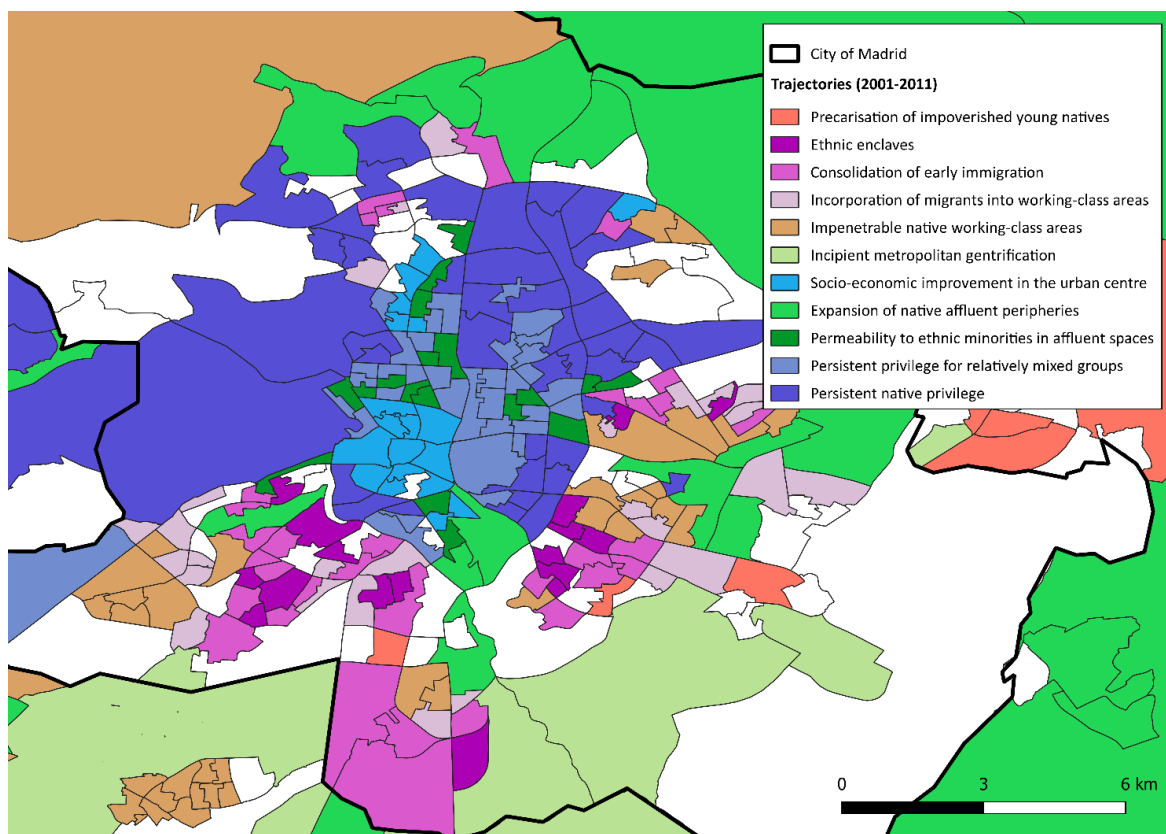

Figure 2. Main trajectories of social residential change (2001–2011) in the city of Madrid. Source: Drawn up by the authors based on the 2001 and 2011 Population and Housing censuses (INE, 2004, 2013).

correct socio-economic inequality (such as education or family support) as well as the access to key services and social inclusion mechanisms are reduced (Church et al., 2000). Similarly, the lack of space for activities that require privacy, especially for those related to education and employment, constitutes a barrier to success for populations living in neighbourhoods in these areas. Overcrowded houses involve a lack of space for study, as well as high noise levels with significant impacts on concentration and sleeping that are related to psychological and school problems among children (Solari & Mare, 2012). This is particularly relevant in the current context of the global COVID-19 pandemic, as well as in the social changes and inequalities it projects into the future concerning teleworking and online education (Beaunoyer, Dupéré, & Guitton, 2020). In line with the uneven challenges posed by the COVID-19 pandemic, it is significant that the partial confinement of the population of the Community of Madrid during the autumn of 2020 was concentrated in the neighbourhoods in the southeast of the region, where the main trajectories of impoverishment are to be found. Lastly, physical isolation poses a threat to people with reduced mobility in the most impoverished neighbourhoods and has significant effects on their physical and mental health.

As per the associations observed in the social residential inequality dimension analysis, trajectories leading to concentrations of residents in weaker socio-economic positions are those in which these specific mechanisms of inequality reproduction are concentrated (Table 7). The distribution of these mechanisms in impoverishment trajectories, however, is not homogeneous. Here the accumulation of difficulties in impoverishment trajectories permeable to the settlement of precarious migrants stands out, with particularly high values of physical isolation which confirm their social residential marginalisation. In contrast, in the rest of the impoverished trajectories, characterised by the protagonism of the autochthonous population, physical isolation and lack of space are less intense. Gentrification trajectories, on the other hand, combine advantages with specific disadvantages (relating to location in the peripheries, and physical isolation in the urban centre). Meanwhile, privileged trajectories enjoy above-average advantages in terms of each of these mechanisms.

5. Conclusion

From 2001 to 2011, residential segregation grew in parallel with social inequality in the Madrid metropolitan area. The results of this article reveal eleven significant trajectories within which different processes of socio-spatial change have operated, according to the classification of van Ham et al. (2012). Overall, during this period, two external shocks increased residential mobility in the region and explained many of the social residential changes: the real estate bubble and the arrival of significant numbers of international migrants (Bayona & Pujadas, 2014).

Of all the trajectories of impoverishment, the processes of residential mobility in the southeast of the region stand out: those of young natives towards the newly built peripheries and, to an even greater extent, those of migrants towards houses abandoned by autochthonous residents in search of higher quality residential environments. The social residential trajectory of the latter involves a process of centrifugal expulsion from the city centre into the successive rings of the metropolitan areas (Arbaci, 2019). In this context, the only exception to the residential mobility among the trajectories of impoverishment is the ageing in-situ of native working classes in those neighbourhoods where residential conditions were acceptable. Regarding the trajectories of gentrification, residential mobility is stimulated by external impacts on processes of socio-economic improvement in the urban centre (which remove the only remaining spaces of social mixing left in the region) and new-build gentrification in the periphery.

Table 7. Average percentage of the variables of lack of time, available space and physical isolation, according to the trajectory of social residential inequality (2011).

Trajectory	Lack of time	Space Available	Physical Isolation
Precarization of extremely impoverished young natives	15.1	32.5	23.2
Ethnic enclaves	12.4	25.4	72.1
Consolidation of early immigration	14.2	28.6	57.3
Incorporation of migrants into working-class areas	14.7	28.4	51.8
Impenetrable native working-class areas	14.9	30.3	35.3
Incipient metropolitan gentrification	14.7	36.9	11.1
Socio-economic improvement in the urban centre	5.2	34.3	37.4
Consolidation of native affluent peripheries	10.5	40.8	8.0
Permeability to ethnic minorities in affluent areas	8.2	36.4	16.1
Persistent privilege for relatively mixed groups	4.1	40.7	9.0
Persistent native privilege	9.0	41.1	8.7
Total	12.0	35.1	27.2

Source: Drawn up by the authors based on the 2001 and 2011 Population and Housing censuses (INE, 2004, 2013).

Finally, trajectories of privilege are characterised by the persistence of privilege, based on processes of ageing in-situ and residential mobility segmented by socio-economic position. In short, the disappearance of spaces of social mixing is complemented, on the one hand, by the expansion of spaces of persistent privilege and, on the other hand, by the division of the trajectories of impoverishment according to the residential quality of each area in the southeast of the region. For the latter, this division leads migrant households to the most disadvantaged environments, where they join the autochthonous population hardest hit by this social residential model to share in the specific mechanisms of inequality reproduction linked to segregation. In this article, we have investigated some of these mechanisms, such as time poverty, overcrowding and physical isolation. Together with these, it is important to point out the symbolic mechanisms with the potential to reproduce inequality in the spaces of advanced marginality. In this regard, the concentration of this regime of poverty in clearly known and recognised territories produces discourses of defamation about these spaces. The consequence is the superposition of the neighbourhood taint to the rest of the stigmas assigned on the poverty and ethnic diversity of its inhabitants (Wacquant, 2008). Marcuse and van Kempen (2002) argue that spatial divisions not only reflect the divisions in society, but also help to create them, given that the decline in social mixing fosters prejudices based on the lack of significant daily interactions.

According to the results obtained, it is open to new research to investigate whether some of the spaces that host the most precarious socio-residential trajectories, with an important role of migrants, such as ethnic enclaves, could suffer from territorial stigmatisation, redoubling the disadvantages that its inhabitants carry in their daily lives. If we add to this the unequal effects of the great recession which began in 2008, the scenario of the following decade entails dynamics of deepening inequality, given the concentration of the brunt of the recession's impact in the southeast of Madrid, which included the largest drops in employment (Rubiales, 2016) and property value (Sorando & Leal, 2019), as well as the evictions (Méndez, 2017). In a context of abandonment of social housing in the region and a strategic commitment by financial actors to renting, future research should explore the unequal burden this implies and how it underlines or mitigates the different trajectories of social residential inequality.

Acknowledgments

Conflict of Interests

The authors declare no conflict of interests.

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Article

Trends of Social Polarisation and Segregation in Athens (1991–2011)

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Abstract

This article investigates social and spatial changes in the Athens metropolitan area between 1991 and 2011. The main question is whether social polarisation—and the contraction of intermediate occupational categories—unevenly developed across the city is related to the changing of segregation patterns during the examined period. We established that the working-class moved towards the middle and the middle-class moved towards the top, but the relative position of both parts did not change in the overall socio-spatial hierarchy. The broad types of socio-spatial change in Athens (driven by professionalisation, proletarianisation or polarisation) were eventually related to different spatial imprints in the city's social geography. Broad trends identified in other cities, like the centralisation of higher occupations and the peripheralisation of poverty, were not at all present here. In Athens, changes between 1991 and 2011 can be summarised by (1) the relative stability and upward social movement of the traditional working-class and their surrounding areas, accounting for almost half of the city, (2) the expansion of traditional bourgeois strongholds to neighbouring formerly socially mixed areas—25% of the city—and their conversion to more homogeneous middle-class neighbourhoods through professionalisation, (3) the proletarianisation of 10% of the city following a course of perpetual decline in parts of the central municipality and (4) the polarisation and increased social mix of the traditional bourgeois strongholds related to the considerable inflow of poor migrants working for upper-middle-class households.

Issue

This article is part of the issue "Vicious Circle of Segregation: Understanding the Connectedness of Spatial Inequality across Generations and Life Domains" edited by Tiit Tammaru (University of Tartu, Estonia), Siiri Silm (University of Tartu, Estonia), Frank Witlox (Ghent University, Belgium), Maarten van Ham (Delft University of Technology, The Netherlands) and Madli-Johanna Maidla (University of Tartu, Estonia).

1. Introduction

Deindustrialisation and globalisation have produced changes in the social structure of large metropolitan areas in advanced capitalist societies. There were two opposite approaches in the early 1970s claiming, on the one hand, the growth of the upper pole of the social hierarchy—professionalisation (Bell, 1973)—and, on the other, the growth of the lower pole—proletarianisation (Braverman, 1974). In the 1980s and early 1990s, a third approach—polarisation—was developed by Friedmann

and Wolff (1982), Friedmann (1986) and Sassen (1991), defending that both poles of the social hierarchy were growing at the expense of intermediate positions. The 'polarisation thesis' focused on world or global cities, i.e., on the metropolitan areas that had substantially increased their role in the management of the globalising economy by providing a network of high-end producer services to transnational corporations.

Hamnett (2020) provides an overview of the discussions about these approaches with a focus on the polarisation thesis. He also provides empirical evidence

to support or disprove these three theses for several large cities across the world over the last 50 years. He concludes that in most cases there is professionalisation combined sometimes with polarisation, which, however, does not appear as an unavoidable universal effect of globalisation. Polarisation appears to be an outcome related to contextual factors like welfare regimes, varieties of capitalism, urbanisation paths, immigration flows and their regulatory policies. This conclusion matches his previous claims about the polarisation thesis (Hamnett, 1994, 1996).

Hamnett's discussion about social polarisation usually evaluates its validity in terms of changes in the occupational or broader social structure and deals much less with its spatial dimension (Buttler & Hamnett, 2012). Sassen (1991), however, claimed that social polarisation in global cities leads to more segregation due to the gentrification of centrally located working-class spaces by the incoming and growing corporate elite and the appropriation of prime spaces by corporate activities. The dividing spatial impact of globalisation on world cities has been discussed by several authors (e.g., Marcuse & van Kempen, 2000; Mollenkopf & Castells, 1992). Recently, van Ham, Uesugi, Tammaru, Manley, and Janssen (2020) have revisited the cities discussed by Sassen (New York, London and Tokyo) and, apart from eventually agreeing with Hamnett's claim about professionalisation, deal with the changing levels and patterns of segregation observed between 1980 and 2010. Their analysis shows that although the levels of segregation have not changed much over these 30 years, the social geography of these cities was considerably reshaped. In New York and London, the main trends were the growing concentration of higher-income occupations in central locations through gentrification and the peripheralisation of poverty. In Tokyo, changes were less manifest, involving mainly the intrusion of higher-income categories in some neighbourhoods of the disadvantaged eastern part of the city.

The main purpose of this article is to discuss the spatial imprint of social changes in Athens between 1991 and 2011, taking polarisation as the reference process. Our primary hypothesis is that residential areas where polar occupational categories increased their weight during these 20 years have moved towards the top or the bottom of the city's hierarchy of residential spaces, while those where intermediate categories increased moved towards the middle. This hypothesis is accompanied by the assumption that polarisation is a process strongly diversified in space, as exemplified by the comparative analysis of five East European capital cities where polarised areas were very unequally distributed both within and among cities (Marcińczak et al., 2015). The analysis of changes within different types of residential spaces in Athens is used to illustrate this diversity and to discuss the causality of observed changes related to parameters beyond those which induce social polarisation. Sorando (2021, in this issue) used a similar methodology to investigate the trajectories of different social spaces in Madrid in this issue.

2. Persistent Questions about Social Polarisation and Methodological Issues

Since the 1970s, empirical data have corroborated professionalisation much more than proletarianisation in the advanced capitalist world. Managers and professionals were expanding categories while the working class was shrinking. However, relying on the simple growth or decrease in these categories should not be enough. Braverman's (1974) position was not that the working class was growing stricto sensu, but that many other occupational categories—mainly in the services— were moving towards the occupational bottom through increased deskilling, precariousness and low wages. Today's proletarians are not the same as those of industrial societies. Many jobs at the lower end of services do not require skills, are poorly paid, provide minimal job security and those who perform these jobs are easily replaced. These jobs are regulated as labour contracts rather than service relationships which are reserved for those occupying secure positions in the labour market (Erikson & Goldthorpe, 1992). Women of working-class origin and immigrants are mainly providing the human capital to expand proletarian positions in today's occupational structures. Considering only the traditional working class to assess the lower part of the social hierarchy is, therefore, negating that positions in social hierarchies are relative and that the shrinking of the working class is mainly indicating that the changing economy introduces new, deletes old and alters the content and the placement order of all occupational positions.

Professionalisation is not unambiguous either. Managers and professionals may be expanding, but their relative social position is not the same as that of the 1970s. These occupations are now much less homogeneous. On the one hand, a substantial fragment—e.g., professors and researchers, professionals and managers in the public sector, self-employed professionals without employees—is no longer part of the higher occupational positions in terms of income or job security. The limits between higher and intermediate occupational positions are increasingly placed within rather than beyond managers and professionals. Moreover, a large part of the expanding categories of managers and professionals in advanced capitalist societies are the ones that have experienced the lowest income increase compared to other parts of the social hierarchy in recent decades— mainly the supermanagers characterised by higher earnings, particularly in the Anglo-Saxon context since the end of the 1980s (Piketty, 2013, pp. 500–505) and the 'enablers' who are very highly remunerated for facilitating the exclusive consumption needs of the super-rich in top-tier global cities (Atkinson, 2020)—as well as to the expanding and upwards moving middle-classes of China and India (Milanovic, 2016).

These reservations about rejecting proletarianisation and accepting professionalisation at face value also affect how polarisation should be investigated. The upper pole should not comprise all managers and professionals, but only those partaking in the corporate elite of the global economy and, secondly, the high-rank officers of the public administration and the local large employers. This limitation would be more compatible with the mechanism behind the growth of the upper pole proposed by Sassen (1991), leading to the attraction of a corporate elite operating the network of vital production services for transnational corporations in global cities. Likewise, the lower pole should comprise the workforce attracted by such cities to service personal needs and to perform the menial jobs within the workplaces of the corporate elite. Both poles should, therefore, comprise a large share of migrants, either as highly qualified professionals and managers attracted by competitive job offers or as poor migrants willing to perform routine jobs for low wages to escape from worse conditions in their places of origin. The combination with the loss of intermediate positions in the occupational hierarchy—due to the declining industry—depicts the hypothetical landscape of polarisation in global cities. Three questions arise:

The first is practical. The limits of the upper and lower poles of the occupational hierarchy according to the previous paragraph are very difficult to identify within occupational datasets originating from censuses or standard surveys. In very few cases, mainly in France, occupational data can allow more detailed investigations (e.g., Préteceille, 2018). In most cases, however, analyses—including, e.g., Maloutas (2007)—are restricted by the available data sets and the upper (managers and professionals) and lower categories (working-class occupations) are used as broad proxies, often without acknowledging their limitations. Moreover, there is no clear distinction between segments of the occupational hierarchy that are affected by globalisation and those that are not. In most cases, occupational positions are neither completely affected nor completely unaffected by globalisation and, consequently, the limits of the poles that should be investigated become even more blurred. Several solutions can be considered, like the combination of occupational and income groups undertaken by van Ham et al. (2020), but precision remains a challenge, even more so when a comparison among different contexts is involved.

The second question is more fundamental. Should we limit our investigation to the part of the social structure mostly affected by globalisation or should we expand our focus? In cities at the top, like New York City, the two options may not be very different, but as we get closer to 'ordinary' cities (Robinson, 2006), the part not clearly affected by globalisation becomes more and more sizeable. Athens is ranked as a 'beta' global city for 2020 (GaWC, 2020), meaning that changes in its social and spatial structures should be expected to be less affected by global forces than those in cities at the top of the list.

The third question is methodological. When we talk about professionalisation or polarisation, we assume that their limits are rather clear and that they are mutually exclusive. In reality, however, this may not be the case: 30% growth of the upper pole and a 5% decline of the lower one may be a clear case of professionalisation, and a 20% growth of both poles may be a clear case of polarisation. But a 30% growth of the upper pole and a 10% growth of the lower one is both professionalisation (dominant trend) and polarisation (both poles are growing). Moreover, professionalisation and proletarianisation can materialise within conditions of growing or shrinking intermediate social categories. We assume that a growing or shrinking social middle is also changing the content of professionalisation or proletarianisation. In this article, our attention is mainly turned to the parts of the city where intermediate categories are shrinking and where changes in polar categories—in principle more closely related to global forces—are more clearly reshaping the city's social profile. This induced us to initially divide our terrain into areas with a growing or shrinking social middle and then to subdivide the latter according to the main trend of social change (e.g., professionalisation).

3. Social Polarisation in Athens?

Athens is a Mediterranean metropolis in the Southeast of Europe with comparatively reduced connections to regional and global economic networks. This is partly due to the difficult relations for over a century with Turkey, Greece's major neighbour, and to the shutting of all the country's other land borders from the Cold War to the 1990s. The expansive Greek corporate activities since the 1990s in banking and telecommunications with takeovers in neighbouring Balkan countries, in Turkey and Cyprus, was short-lived and literally disappeared in the early 2010s with the sovereign debt crisis. Moreover, the Greek economy never invested in highly innovative industrial activities or in high-end producer services that would be attractive for global markets. Greek exports comprised a large share of unprocessed agricultural products, while industry and services were mainly oriented to the national market. Tourism and merchant marine have been the most extroverted activities, but the management of the former could be located in tourist areas outside Athens and shipping companies have usually settled their headquarters outside Greece, usually in London.

As a result, the appeal of Athens for members of the corporate elite has been weak. However, the data on changes in broad occupational categories between 1991 and 2011 show an impressive increase in the percentage of higher occupational categories and a decrease of blue-collar workers. Table 1 shows that Athens experienced professionalisation, with the sum of the two polar occupational groups climbing from 55.1% to 65.4% between

Table 1. Share of managers and professionals and blue-collar workers in the active population and distribution by nationality group in the Athens metropolitan area (1991–2011).

	Managers & professionals		Blue-collar workers	
	1991	2011	1991	2011
% in active population	23.7	37.7	31.4	27.7
% by nationality group				
Greeks	97.2	96.6	97.4	69.2
Developed economy countries	2.1	1.3	0.7	1.3
Developing countries	0.7	2.1	1.9	29.4
Total	100	100	100	100
% within nationality groups				
Greeks	23.6	41.8	31.1	22.1
Developed economy countries	43.4	43.1	19.8	30.8
Developing countries	12.9	6.5	44.3	68.7

Note: This table and all subsequent calculations refer to the 25–54 age group of the economically active population living in the Athens metropolitan area. The exclusion of older age groups is induced by our focus on the economically active and on those who are more residentially mobile and, therefore, more partaking in the reshaping of segregation patterns. In 1991, 97.2% of the managers and professionals were Greek and 23.6% of the Greeks were managers or professionals at that period. Table 1 overestimates managers and professionals since technicians and professionals' assistants are also included because they could not be separated from professionals in 1991. Without technicians and professionals' assistants, the percentage of managers and professionals in 2011 would be 26%. Source: EKKE-ELSTAT (2015).

1991 and 2011, mainly due to the increase in managers and professionals.

The sharp increase of managers and professionals between 1991 and 2011 mainly comprises professionals rather than managers (242,000 new professionals' positions against 48,000 for managers). Moreover, 50.4% of managers and 23.1% of professionals were self-employed in 2011 (EKKE-ELSTAT, 2015)—therefore not part of the salaried corporate elite—while a large part of salaried professionals was employed in the public sector. Also, the attraction of a foreign highly qualified workforce has been very small: 2,000 new positions for nationals from developed economy countries and 9,000 from developing ones between 1991 and 2011 (EKKE-ELSTAT, 2015), while Greek nationals continued to represent about 97% of this higher occupational category (Table 1). The occupational structure of Athens is therefore professionalised, but not like in global cities at the top of the list. Only the native Greek component in the labour market was professionalised, and the positions filled usually did not belong to the corporate elite.

On the other hand, the composition of the lower pole of blue-collar workers changed significantly despite their aggregate share in the active population remaining quite stable relative to the dramatic increase in the share of the upper pole between 1991 and 2011. Migrants from developing countries formed about 30% of this category in 2011, rising from a mere 2% in 1991. Only 22% of Greeks were blue-collar workers in 2011, compared to 69% of migrants from developing countries (Table 1). In this case, globalisation has affected the occupational structure of Athens through the collapse of socialist regimes in the Balkans, and mainly in Albania, which provided more than 50% of immigrants in Greece in the

1990s and the 2000s. Once again, it was not the function of Athens as a nexus or as a hub that attracted new migrants but push factors in their places of origin with accompanying effects at the receiving end. It is also the case with the recent migrant crisis in 2015, though at a smaller scale.

These changes in the occupational structure are not contradicted by the rather stable level of income inequalities in Greece, and presumably in Athens. The s80/s20 index (i.e., the ratio of the upper to the lower quintile of the income distribution) has oscillated around 6 between 1995 and 2011—6.1 in 1995 and 6.4 in 2011—according to Katsikas, Karakitsios, Filinis, and Petralias (2015), based on microdata of the Hellenic Statistical Authority (ELSTAT) on poverty.

Another important change between 1991 and 2011 is the gender ratio in different occupations. The participation of women in the labour market has constantly increased, but not in the same way for different occupational categories. The share of women increased in the upper pole (from 41.7% in 1991 to 51% in 2011) mainly among professionals, but much less in the higher managing positions. It also increased among blue-collar workers (from 15.3% in 1991 to 26.1% in 2011), especially at the lower end of unskilled positions (EKKE-ELSTAT, 2015). In both categories, the participation of women increased mainly at the bottom. At the top, it is mainly young, socially mobile native Greek women from intermediate social categories whose trajectories are often curtailed by glass ceilings. At the bottom, even younger women, mostly migrants from developing countries, have been relegated to routine jobs despite frequently possessing much higher qualifications which are not acknowledged by the city's labour market. Migrant women accounted

for 1.2% of professionals and 0.3% of blue-collar workers in 1991. These percentages changed to 1.5% and 28.9% respectively in 2011 (EKKE-ELSTAT, 2015). Feminisation has, therefore, mitigated professionalisation in the sense that the latter has not been developed on the model of growth of the corporate elite; the feminisation of the lower pole, on the other hand, is closer to the global city model as it mostly refers to the growing share of the female migrant workforce employed in personal services for upper-middle-class households.

4. The spatial Patterns of Changes in the Occupational Structure

4.1. Data and Method

All data used in the subsequent analysis are part of the micro datasets of the 1991 and 2011 censuses concerning the metropolitan area of Athens. They have been accessed through the "Panorama of Greeks Census data 1991–2011" application (EKKE-ELSTAT, 2015). Our analysis uses polarisation as a starting point in the broad sense of initially dividing the city's residential areas into polarised and depolarised areas (i.e., where the social middle is shrinking or growing respectively). Then, we focus mainly on the part of the city where intermediate categories are shrinking and explore the different types of trends, i.e., professionalisation, proletarianisation or polarisation. The measures we used to distinguish the different types of spaces are simple. They are based on the average percentage change of occupational categories in the metropolitan area, and the difference—in terms of standard deviation from average—of this percentage change in the small neighbourhoods of the city (ad hoc aggregates of ELSTAT's 3,000 URANUs [Urban Analysis Units] that provided 455 units with an average population between 3,000 and 4,000 inhabitants).

4.2. Results and Discussion

We have examined the changes of the spatial imprint of the three broad occupational categories (managers and professionals; intermediate occupations; blue-collar workers) during the 1991–2011 period, linking them with the social profile of residential areas. In fact, we have divided the city's residential space in accordance with the changes in the mix of the three broad occupational categories and explored thereafter whether the change observed is related to the social composition and the location of the areas it corresponded to. We start by distinguishing between residential areas where the sum of the two occupational poles increased or decreased regardless of their positive or negative contribution. This option allows distinguishing spaces that are moving towards the social middle from spaces that move towards the edges (Figure 1).

We initially ordered neighbourhoods of the Athens metropolitan area in three categories according to their share of blue-collar workers: (1) the workers' areas, which correspond to 30% of inhabitants living in neighbourhoods with the highest share of blue-collar workers, (2) the higher occupation areas, which also comprise 30% of individuals living in the neighbourhoods with the smallest share of blue-collar workers and (3) the intermediate areas that correspond to the remaining 40% of the population. Table 2 shows that changes in the occupational composition of residential areas are related to their social profile. In fact, in the residential spaces where the share of workers is the lowest (deciles 1, 2 and 3) the sum of the two poles increased by 17.6pp, while the increase was very small (1.8pp) in the three deciles with the highest share of workers. Moreover, polarisation stricto sensu–i.e., when the shares of both poles increase—is observed only in the first three deciles. In the other two groups of deciles, there is an important
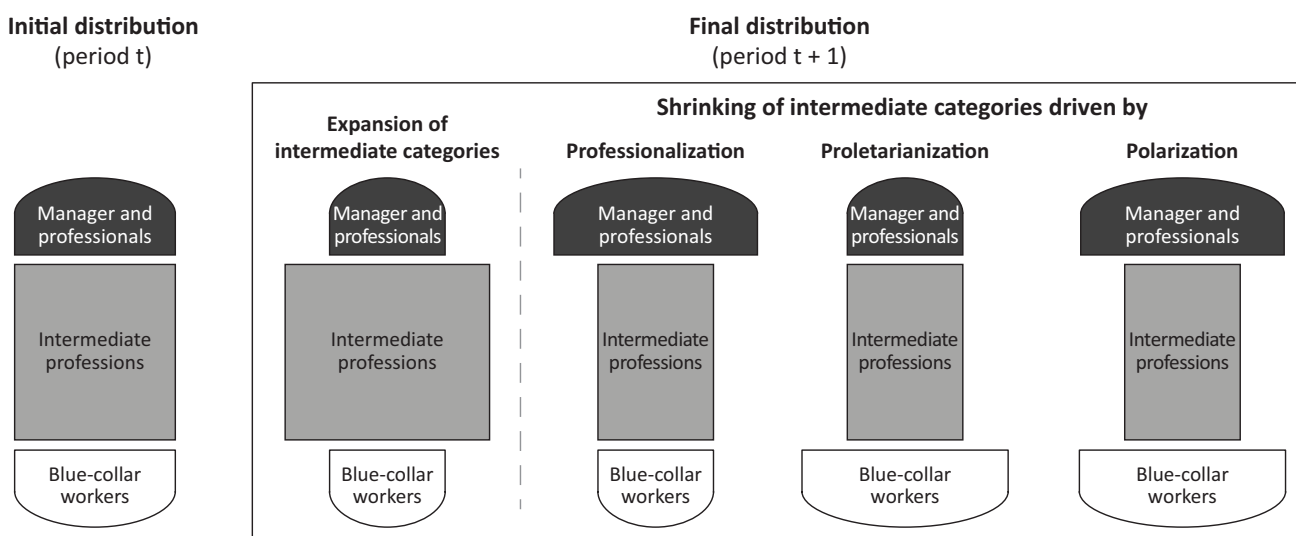

Figure 1. Major types of social change in terms of polarisation/depolarisation.

Table 2. Percentage of managers and professions (M&P) and blue-collar workers (BCW) in the active population aged 25–54 in the Athens metropolitan area, according to the percentage of blue-collar workers at the URANU level.

Area/Decile	1991			2011		
	% M&P	% BCW	Sum	% M&P	% BCW	Sum
Higher occupations areas/Deciles 1–3	36.4	16.2	52.6	50.7	19.5	70.2
Intermediates areas/Deciles 4–7	21.1	32.0	53.1	36.7	27.4	64.1
Workers areas/Deciles 8–10	12.3	48.9	61.2	27.7	35.3	63.0
All areas	23.7	31.4	54.8	37.7	27.7	65.3

Source: EKKE-ELSTAT (2015).

growth of the share of managers and professionals and a sharp decrease in the proportion of workers, especially in the deciles where workers had the highest shares. It looks, therefore, as if there is professionalisation all over the city—even if the distribution of this category remains very unequally distributed among deciles—and polarisation only in the most bourgeois neighbourhoods of the city.

Table 2 shows that polarisation is observed at the higher socio-spatial pole, where a big increase in higher categories is combined with a slight increase in the lower categories. In the other two groups of areas, there is a trend towards more social mix, not due to the growth of intermediate categories, but to the equilibration of the two poles. These patterns may not make much sense at this very broad level of analysis, but they invite the exploration of causal mechanisms in more spatial detail where these mechanisms operate.

As noticed in previous work on segregation in Athens (Maloutas, 2007; Maloutas, Arapoglou, Kandylis, & Sayas, 2012; Maloutas & Spyrellis, 2019), segregation levels did not increase during the examined period. The index of dissimilarity (ID) has decreased between 1991 and 2011, from 24.1% to 21.5% for managers and professionals and from 26.7% to 20.2% for blue-collar workers. It would be expected for managers and professionals who increased in numbers and expanded in areas where their share was small. It was less expected for blue-collar workers because shrinking categories are usually also confined in space.

The declining levels of segregation are not necessarily related to reduced changes in the city's social geography. Van Ham et al. (2020) show that stable or decreasing IDs for London and New York for the period 1980–2010 developed in parallel with the concentration of higher occupational groups in central areas and with the peripheralisation of poverty. The social geography of Athens has also changed substantially but has not followed a similar path.

For a detailed examination of changes in the city's social geography, we initially distinguished between spaces of growth or shrinkage of the social middle. Figure 2 distinguishes spaces where the share of intermediate occupational categories has increased and those where their share has decreased more than 1 standard

deviation below their average decrease between 1991 and 2011. Spaces with a lower decrease of intermediate occupations are not marked with a symbol on this map.

Figure 2 shows that there is a clear dichotomy between the eastern and the western part of Athens according to changes in the share of intermediate categories. This dichotomy coincides with the broad partition of the city into working-class (West) and middle-class areas (East). Figure 3 shows the forms of the different types of the city's residential space in terms of dominant trends. In the West, intermediate categories increased their share in most spaces, remained stable or mildly decreased between 1991 and 2011, while in the East their share decreased noticeably.

The growth or stability of intermediate categories in the West is due to the shrinking of the working-class and the spatial entrapment of the endogenous social mobility in the traditional working-class strongholds of Athens (Maloutas, 2004). The latter entails that the socially mobile new generation of working-class children usually does not abandon their parental neighbourhoods due to the importance of family self-help networks in a context of reduced availability of social services, a phenomenon observed in other metropolises of Southern Europe as well (Leal, 2004).

The areas with the highest growth of intermediate categories are clearly situated in the western working-class suburbs (Figure 3, type 1.a). These are the lowest-rise areas—55% live in apartment blocks compared to the average of 70% for the whole city—where the housing stock is relatively recent (EKKE-ELSTAT, 2015). They are surrounded by a broader group of lower-middle-class and working-class neighbourhoods (Figure 3, type 1.b), which also comprise pockets in the eastern part of the city and the outer periphery, where the trend in 1991–2011 was stability or mild decrease of intermediate categories. The upward social mobility trend in these areas involves mainly native Greeks with a working-class background who have accessed intermediate occupational positions. An important part of this mobility is female (Arapoglou & Sayas, 2009), related to the much more important progress of women in education and especially of young women of working-class origin. These women have been massively partaking to the active population—compared to their mothers and
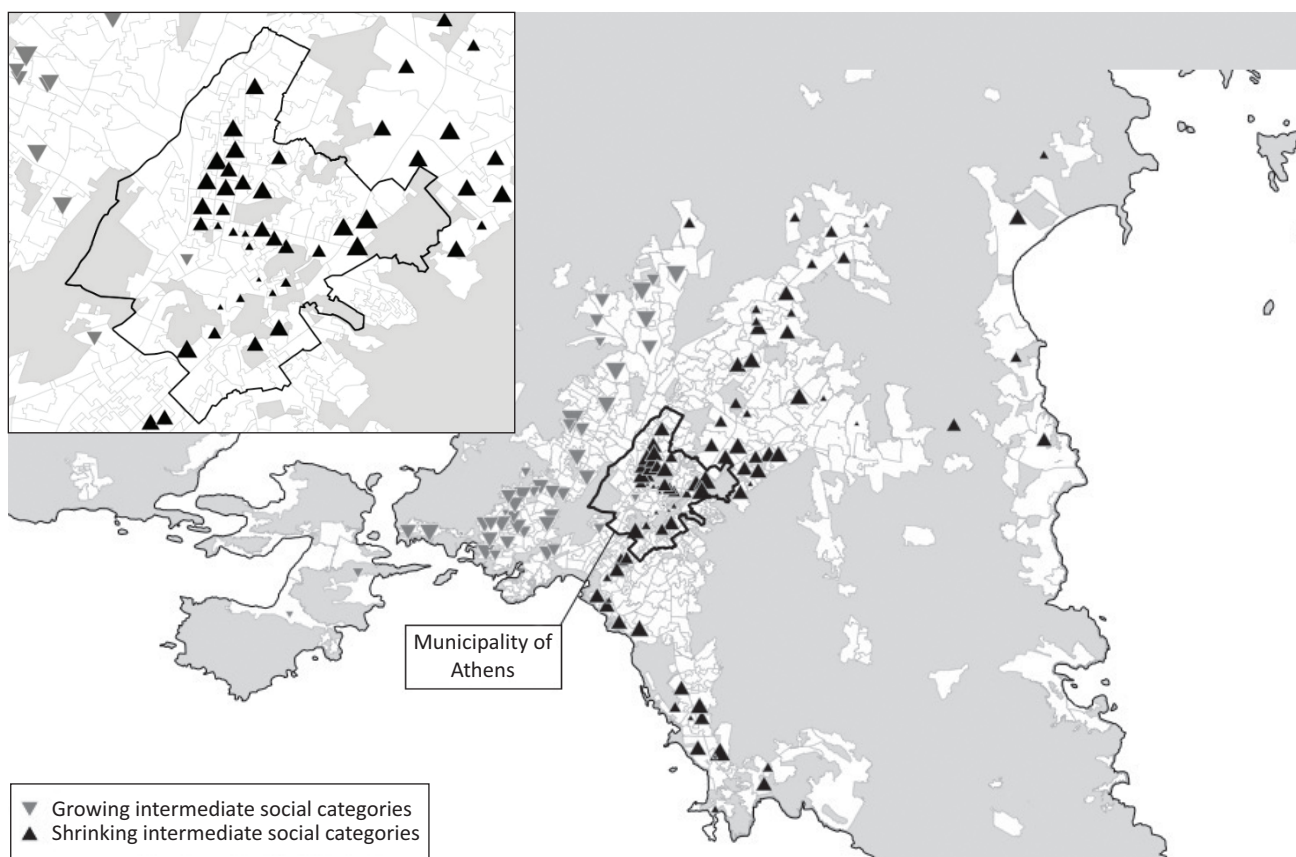
Figure 2. Residential spaces in Athens metropolitan area with a growing or shrinking share of intermediate social categories between 1991 and 2011. Notes: Black triangles depict areas where the share of intermediate occupations decreased at least by −17.5pp, i.e., 1 standard deviation (−7.8pp) more than their average decrease in 1991–2011 (−9.7pp); grey triangles represent areas where the share of intermediate occupations increased; areas without symbols correspond to areas with a mild decrease of intermediate occupations (up to −17.5pp). The size of the symbols is proportional to the resident population aged 25–54.

grandmothers—and mainly accessed lower positions in services since working-class jobs are still dominated by males. However, this process of moving towards the social middle is not to be taken at face value since the relative position of these residential spaces and of the occupational categories that populate them remain at the bottom of the city's socio-spatial hierarchies. The type 1 of residential space hosts a very large part of the city's active population aged 25–54, 44% in 1991 and 48% in 2011. It had the highest share of working-class occupations in 1991 (Table 3) and lost a substantial part of it in the next 20 years, while it gained important numbers of managers and professionals—in fact, their shares doubled—becoming socially much more mixed. Type 1 has been less accessed than average by immigrants, but it continues to lag in terms of housing surface per capita and of the education level of its population (Table 3).

The maps in Figure 3 should be further described and explained as follows:

- **Type 1**: Areas of growth or stability of intermediate categories (12.1%):

  - **Type 1.a**: The share of Intermediate occupations increased (> 0pp)
  - **Type 1.b**: Areas of stability or mild decrease of intermediate categories (36%): The share of intermediate occupations decreased slightly [−10pp; 0pp]

- **Type 2**: Areas of professionalisation (25.6%):

  - The share of intermediate occupations decreased dramatically (< −10pp)
  - The share of blue collar-workers decreased (< 0pp)
  - The share of managers and professionals increased more than the average (> +15pp)

- **Type 3**: Areas of proletarianisation (9.3%):

  - The share of intermediate occupations decreased dramatically (< −10pp)
  - Blue-collar workers compensate at least half of the drop in the share of intermediate professions in each neighbourhood
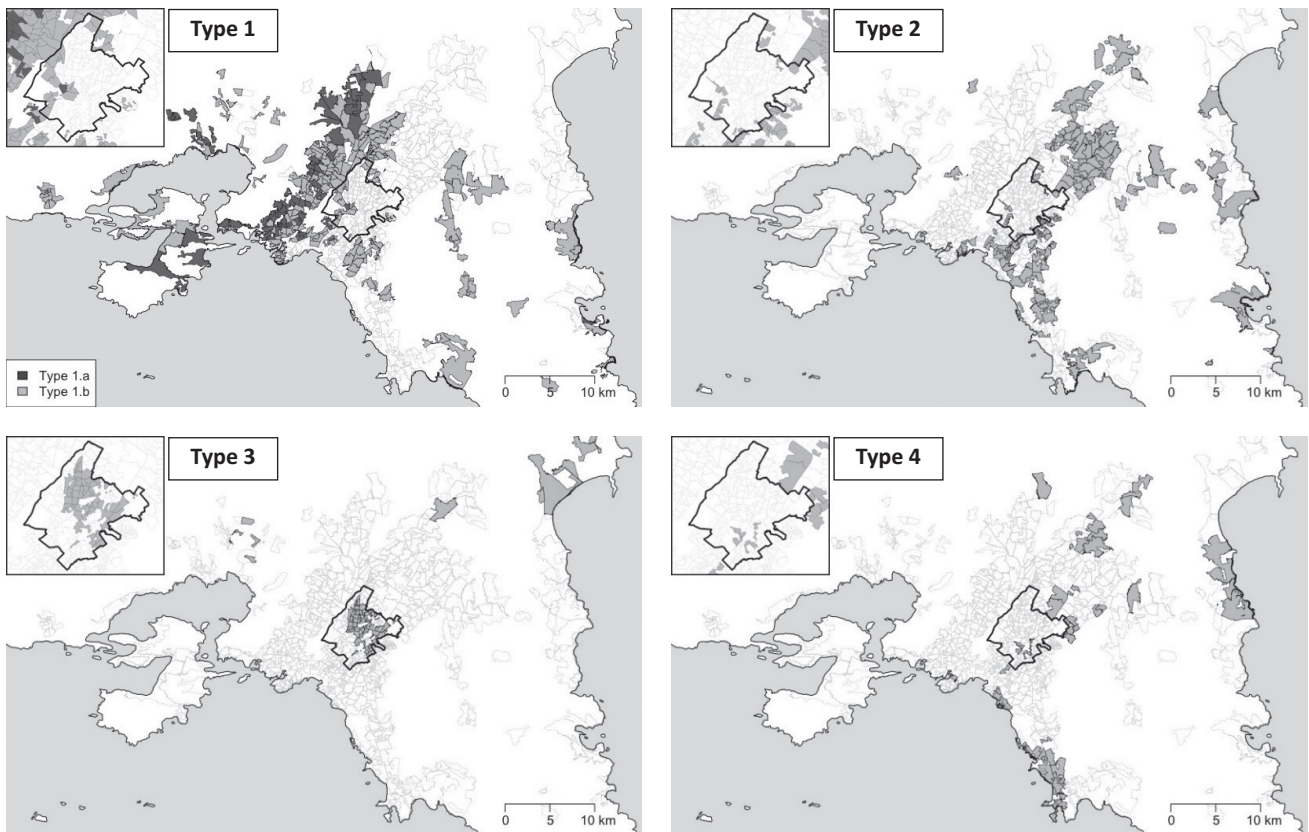
Figure 3. Location patterns of residential areas according to changing social profile trends in Athens metropolitan area (1991–2011). Notes: Spatial units represented on theses maps correspond to aggregates of URANUs of the metropolitan area of Athens. Percentages in brackets represent the share of individuals aged 25–54 living in this type of area in 2011.

- **Type 4**: Areas of polarisation (5.9%):

  – The share of intermediate occupations decreased dramatically (< -10pp)
  – Either the share of managers and professionals increased more than the average ($> +15$pp) and the share of blue-collar workers increased less than the average (< -6pp)
  – Or the share of blue-collar workers increased more than the average (> -6pp) and the share of managers and professionals increased less than the average ($< +15$pp)

Type 2 neighbourhoods contain residential spaces, where the increase in managers and professionals was the driving force of change and the share of blue-collar workers remained stable or decreased moderately (Figure 3, Table 3). This type of spaces covers most of the middle-class neighbourhoods of the city and about 25% of the active population aged 25–54. They have an average share of residents in apartment blocks and their housing stock is more recent than in all other types—60% of housing built after 1980 compared to the average of 50% for the whole city (EKKE-ELSTAT, 2015). They are not the traditional bourgeois strongholds, but close to them and along the main communication axes that link them to the city centre. These spaces, rapidly appropri-

ated by higher occupational groups, are not at all located in the city centre, contrary to the outcome of gentrification processes observed in other cities, especially in the Anglophone world. They complement the settlement pattern of the middle-classes in the north-eastern suburbs, the south—where they filled spaces along the axes leading from the centre to the coastal communities—as well as isolated spaces within the western—working-class—part of the city and in the distant periphery. A small part of these areas is located at the periphery of the central municipality, without any particular link with gentrification processes. The dominant change pattern for type 2 spaces is the *embourgeoisement* of the surrounding areas of upper-middle-class strongholds. They are spaces of expansion for middle-class categories, where the shares of managers and professionals (slightly less than 30%) and blue-collar workers (around 25%) were quite close in 1991. The distance between these shares increased significantly by 2011 (around 50% of managers and professionals and less than 20% of blue-collar workers). The percentage of immigrants remained below the average at the level of the metropolitan area, while housing conditions and the education level of the active population remained above the city's average (Table 3).

The following types of neighbourhoods (type 3) comprise fewer people—about 10% of the active population

Table 3. Selected characteristics of types 1–4 of residential areas in Athens metropolitan area in 1991 and 2011 (%).

	Relative size		Occupation				Nationality		Housing		Education	
	% Active population		% M&P		% BCW		% Immigrants		% 50sm, pp or more		% Higher education	
Types	1991	2011	1991	2011	1991	2011	1991	2011	1991	2011	1991	2011
1	43.8	48.1	15.3	30.3	43.8	32.4	0.8	10.6	3.3	10.8	7.8	16.5
1a	*10.7*	*12.1*	*12*	*25.2*	*51.4*	*36.7*	*0.8*	*9.2*	*2.8*	*9.4*	*4.9*	*11.5*
1b	*33.1*	*36*	*16.3*	*32*	*41.4*	*30.9*	*0.8*	*11.1*	*3.5*	*11.3*	*8.8*	*18.2*
2	24.5	25.6	28.6	48.5	24	18.8	0.9	7.3	6.6	19.5	19.9	34.8
3	11.5	9.3	31.6	31.9	19.5	37.6	3.7	37.5	10.8	18.1	22.5	25.6
4	6.4	5.9	40.4	58.7	11.8	14.8	2.4	8.7	17.1	35.6	32.4	47.8
All			23.7	37.7	31.4	27.7	1.3	12.8	6.4	15.8	15.5	25.1

Source: EKKE-ELSTAT (2015).

of the Athens metropolitan area aged 25–54—but is significant for the changes in the city's social geography since social change has been driven mainly by the increase of blue-collar workers. Type 3 neighbourhoods (Figure 3, Table 3) experienced an increase of blue-collar workers +18pp whereas the aggregate share of blue collars decreased by −4pp in the entire metropolitan area. At the same time, managers and professionals was stable whereas their aggregate share increased by +14pp. Most type 3 neighbourhoods are located within the central municipality and occupy spaces extending around the bourgeois strongholds of the city centre and cover a large part of the densely built neighbourhoods that experienced extensive filtering down since the 1980s. They are the areas with the highest share of apartment blocks among the high-rise areas—89% of residents live in apartment blocks compared to the average of 70% for the whole city—and most of the housing stock (80%) was built before 1981 against an average of 50% for the whole city (EKKE-ELSTAT, 2015). These are the areas of the centre that were increasingly abandoned by the middle-class since the late 1970s due to the declining living conditions brought up by very dense building and increased air pollution. Former inhabitants were partly replaced by immigrants who found affordable housing in the less attractive housing stock of small apartments of lower floors in the apartment blocks of the centre, and particularly in the areas where abandonment increased the housing supply. Migrant presence increased spectacularly (+34pp) and the education level declined in relative terms, from +7pp above the average of the metropolitan area in 1991 to +0.5pp in 2011. Housing conditions remained above the average, reflecting the housing stock that corresponded to more affluent residents in previous times (Table 3). Type 3 areas are socially contested spaces, where the lower part of the occupational hierarchy has increased its presence much more than the upper part between 1991 and 2011. Similar social changes are observed in Madrid with the formation of ethnic enclaves (Sorando, Uceda, & Domínguez, 2021).

Finally, type 4 comprises the city's polarised neighbourhoods where both the shares of managers and professionals and blue-collar workers increased between 1991 and 2011. These neighbourhoods are close to the average both in terms of low/high rise and age of the building stock. They comprise most of the bourgeois traditional strongholds in the northern suburbs, along the coast and the city centre, with by far the highest percentage of managers and professionals in 1991 (40%). This percentage increased by 2011 (59%), but by then other areas had notably converged (the share of managers and professionals in type 2 areas increased from 28.6% in 1991 to 48.5% in 2011; see Table 3). The share of blue-collar workers also increased (+3pp) during the same period, remaining however the lowest among the types of neighbourhoods presented in Table 3. Type 4 preserved the highest indices for housing conditions and the education level for its active population. The important change between 1991 and 2011 was the increase of the share of blue-collar workers—unlike all other types where it decreased—as well as the substantial increase of immigrants (Table 3) who are almost exclusively female and from countries with a reputation of providing the highest quality of domestic workers (e.g., the Philippines). Type 4 areas continued to be at the top of the city's socio-spatial hierarchy. The change is related to the large number of immigrant workers who were employed as domestic live-in personnel in a period when the abundant supply for this type of work made it much easier for middle-class households to massively employ immigrants for domestic work and caretaking, with the more affluent being able to employ live-in personnel.

5. Conclusion

The research presented in this article showed that in an 'ordinary' metropolis like Athens, socio-spatial change over two recent decades (1991–2011) in terms of the trends of professionalisation, proletarianisation and polarisation can be summarised as follows:

- The increase, relative stability or mild decrease of intermediate social categories in most of the traditional working-class areas of the city (type 1) which moved towards the social middle by losing shares of blue-collar workers that were much higher than in all other social types of residential areas at the beginning of the 1990s and by gaining substantial shares of managers and professionals as well as of intermediate occupational positions. The professionalisation of these traditional working-class areas, however, should not be related to the corporate elite and/or to an invasion of gentrifiers, but mainly considered as the outcome of the spatial entrapment of endogenous social mobility in traditionally working-class neighbourhoods. These areas account for almost half of the city's active population aged 25–54 in 2011.
- The professionalisation of a slightly smaller part of the city (25%), where the share of managers and professionals was already above the average in 1991 and eventually approached that of neighbourhoods at the top of the occupational hierarchy by 2011 (type 2). Contrary to working-class neighbourhoods, these areas around the traditional bourgeois strongholds, especially outside the city centre, became less socially mixed through a process of *embourgeoisement*.
- The proletarianisation of a large part of the central municipality, comprising approximately 10% of the whole city's population (type 3). The change in the occupational composition is due to the long-lasting abandonment of these neighbourhoods by native Greek middle-class households following the deteriorating living conditions produced by dense building which put these areas in a course of perpetual decline. Poor migrants, usually employed as unskilled workers, partly replaced the exiting middle-class population.
- The polarisation which increased social mix in the traditional bourgeois strongholds following the increase of the shares of the two occupational poles. At a closer look, however, an increased mix is due, on the one hand, to the inflow of poor immigrants working for the personal service of upper-middle-class households and, on the other, to the significant increase of the share of managers and professionals (type 4).

In a nutshell, the working-class part of the city moved towards the middle, but this big move is changing the content of the social middle both in social and spatial terms and brings it closer to the bottom. Respectively, the middle-class part of the city moved towards the top, but the professionalisation process refers mainly to positions that are at the bottom of higher occupations or at the top of intermediate ones. As a result, this professionalisation process raises new questions about the limits between upper and intermediate occu-

pational categories as well as between upper and intermediate residential areas. Bourgeois strongholds remain at the top, but other spaces are converging in terms of social composition and also implicate these areas in the aforementioned question of limits. Moreover, their space is socially diversified by proletarian newcomers who, nevertheless, occupy specific positions at the service of the dominant group. Finally, the centre is reshuffled, but not gentrified. A process of proletarianisation through filtering-down is the main trend in many of the city centre neighbourhoods during the examined period (1991–2011).

The modest development of gentrification in Athens, at least until 2011, seems to be a paradox. Developments in other cities of the region, from Istanbul to Lisbon, point otherwise. Moreover, there were important factors favouring gentrification in Athens, like the huge investment in the city centre related to the 2004 Olympic games. The argument about modest gentrification is supported by the type of change in the social profile of neighbourhoods mostly affected and discussed in terms of this process. Evidence from census data does not corroborate the inflow of gentrifiers or the displacement of former residents. The main barrier to gentrification has been the typical Athenian apartment block which provided housing to a broad range of social strata. This diversity was not threatened by gentrification because no investment could make the most affordable parts of these blocks appealing to gentrifiers' tastes (Maloutas, 2018). Things have considerably changed since the mid-2010s due to the rapid development of tourism and of short-term rentals (STR) that made a large part of the 'ungentrifiable' stock appealing for the occasional tourist-gentrifier (Balampanidis, Maloutas, Papanzani, & Pettas, 2019). The impact of these changes, temporarily stopped by the pandemic, will be recorded in detail by the next census. For the time being, we hypothesise that gentrification has been developing more than in the past, as witnessed by the sharp rise of rents in the city centre between 2016 and 2018 and the proliferation of Airbnb and other similar platform listings in the low-status neighbourhoods of the centre. The outcome, however, is still uncertain since it depends on many different factors, like tourist development, policies to regulate STR, the participation of foreign investors, the resistance of actual tenants, etc.

The social polarisation debate helped us to synthetically formulate the investigation of trends for social change in terms of a broad social hierarchy that can be used across advanced capitalist societies. The advantage is that this framework can be used comparatively, although it is imperative to consider the changing content of the different concepts used across contexts.

Polarisation was ambiguously useful. If taken stricto sensu, only a rather small part of the city would be eligible where both poles increased (type 4). This would have limited our attention to around 6% of the metropolitan area, in terms of population share, without a valid

justification of such a focus. Moreover, polarisation in Athens is not similar to that of global cities at the top of the list since the rise of the upper pole, for example, is not driven by the corporate elite.

It was useful, on the contrary, to consider polarisation in the broad sense of spaces losing or gaining intermediate occupations. Eventually, we believe that polarisation-related research concerning social change in today's metropolitan areas are much more productive if polarisation, professionalisation and proletarianisation are not considered as mutually exclusive, but as potentially combining elements (e.g., professionalisation within a polarised context).

This particularised broad matrix of polarisation in Athens was eventually useful to depict the spatial imprint of different social/occupational change trends in the city's residential space. It could be insightful to apply the matrix we used to refine the analysis of the polarisation debate on other cities and distinguish processes driven by proletarianisation and professionalisation. Some broad trends identified in other cities, like the centralisation of higher occupations and the peripheralisation of poverty, were not at all present here. Gentrification, for example, was very weak, at least up to 2011. Identifying the main trends and processes of social change and locating differences among diverse types of residential areas facilitates to elaborate on the causal relations behind these trends and processes, enabling informed comparisons of processes of change in different cities and not simply of outcomes, making it possible to assess the significance of contextual diversity. Eventually, social change in the neighbourhoods of Athens displays differences not only in terms of patterns but also in terms of the content of categories (e.g., the characteristics of managers and professionals) and processes (e.g., professionalisation) used in the analysis. Our analysis raises questions concerning the differences observed. These differences may be partly attributed to disparities between top tier global cities and middle tier in terms of social structure, and in particular regarding the content of the upper social pole. On the other hand, differences and particularities of urban social changes are due to factors beyond our analysis. Global forces may be exercising pressure towards some outcomes, but eventual outcomes are always subject to a lot of other parameters, like welfare regimes, urban policies, urbanisation paths, form of and property rights in the housing stock, immigration trends and regimes, etc.

Acknowledgments

Conflict of Interests

The authors declare no conflict of interests.

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Article

Three Generations of Intergenerational Transmission of Neighbourhood Context

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Abstract
The literature on intergenerational contextual mobility has shown that neighbourhood status is partly 'inherited' from parents by children. Children who spend their childhood in deprived neighbourhoods are more likely to live in such neighbourhoods as adults. It has been suggested that such transmission of neighbourhood status is also relevant from a multiple generation perspective. To our knowledge, however, this has only been confirmed by simulations and not by empirical research. This study uses actual empirical data covering the entire Swedish population over a 25-year period, to investigate intergenerational similarities in neighbourhood status for three generations of Swedish women. The findings suggest that the neighbourhood environments of Swedish women are correlated with the neighbourhood statuses of their mothers and, to some extent, grandmothers. These results are robust over two different analytical strategies—comparing the neighbourhood status of the three generations at roughly similar ages and at the same point in time—and two different spatial scales. We argue that the finding of such effects in (relatively egalitarian) Sweden implies that similar, and possibly stronger, patterns are likely to exist in other countries as well.

Keywords
intergenerational transmission; low-income neighbours; neighbourhood; register data; Sweden

Issue
This article is part of the issue "Vicious Circle of Segregation: Understanding the Connectedness of Spatial Inequality across Generations and Life Domains" edited by Tiit Tammaru (University of Tartu, Estonia), Siiri Silm (University of Tartu, Estonia), Frank Witlox (Ghent University, Belgium), Maarten van Ham (Delft University of Technology, The Netherlands) and Madli-Johanna Maidla (University of Tartu, Estonia).

1. Introduction

The literature on intergenerational transmission suggests that the socio-economic status of children is linked to that of their parents. A vast bulk of this literature has focused on issues such as class, occupation, education and earnings (for overviews see Black & Devereux, 2011; D'Addio, 2007). Geography, or the quality of the residential environment, is another aspect of socio-economic status that may affect individual life chances in terms

of occupation, education and earnings. For children, the spatial environment—a function of opportunities and decisions made by their parents—affect their future life chances and consequently their opportunities in terms of where to live. In a 2016 *The Guardian* newspaper article, the argument is brought home starkly:

> [If] you are born poor in Britain, in a poor area, the chances are that you will remain poor for the rest of your life. If you are born rich, in a rich area, the

likelihood is that you will find a way—or will have ways come to you—to stay wealthy and privileged throughout your life, and your children will do the same. (Hanley, 2016)

There is a small but growing literature on the intergenerational transmission of neighbourhood status. Several studies have been able to link the neighbourhood status of children to that of their parents. For example, based on data from the US, Vartanian, Buck, and Gleason (2007) show that childhood neighbourhood disadvantage is correlated with adult neighbourhood quality for those living in the lowest quality neighbourhoods. Sharkey (2008, 2013) and Pais (2017) come to similar conclusions, adding that intergenerational transmission of neighbourhood composition is especially prevalent among poor African-American families. In two separate studies, both using data from Sweden, Gustafson, Katz, and Österberg (2017) and van Ham, Hedman, Manley, Coulter, and Östh (2014) find that the neighbourhood status of children is correlated to that of parents and that immigrants are more likely than natives to remain in disadvantaged areas over two generations. Manley, van Ham, and Hedman (2020) add a family dimension to the analysis: children from the same family live more similar lives than unrelated individuals but the neighbourhood of origin has an independent effect on future residential careers. Using data from the Netherlands, de Vuijst, van Ham, and Kleinhans (2017) add that higher education can reduce intergenerational transmission but that this is less prevalent among the immigrant population. Nordvik and Hedman (2019), however, argue that in the Norwegian setting, higher education may function as a means of social mobility for people with an immigrant background in particular.

These studies all support the idea that neighbourhood outcomes are influenced by the residential histories of previous generations and hence that individual life opportunities are correlated not only with one's own neighbourhood experiences but also with the experiences of previous generations.

The intergenerational argument can be extended further in time so that the same family experiences similar neighbourhood environments for multiple generations. Sharkey (2013) argues that this might indeed be the case among poor African-American families in the US:

> The problem of urban poverty…is not only that concentrated poverty has intensified and racial segregation has persisted *but that the same families have experienced the consequences of life in the most disadvantaged environments for multiple generations*. (Sharkey, 2013, p. 26, italics in original)

Sharkey provides compelling theoretical arguments to support his claim and he uses two-generation data from the US to simulate how many generations it would take a family from a poor neighbourhood to reach a more affluent environment (a full century, or five generations). However, the study is based on simulations and does not actually use data for more than two generations.

This is the first article, as far as we know, that empirically tests the hypothesis of multiple-generational transmission of neighbourhood status. Using detailed Swedish register data, we investigate the extent to which the neighbourhood statuses of young women are related to the neighbourhood environments of their mothers and grandmothers. Sweden is internationally known for its low level of income inequality, including relatively small differences between neighbourhoods (although socio-economic residential segregation levels have rapidly increased; see Andersson & Kährik, 2016). The country is also characterised by a welfare system which is set up to help people 'move up,' for example, by providing free education for all. This implies that social mobility (including mobility to more affluent neighbourhoods) is easier and more common in Sweden compared to other countries (see Nieuwenhuis, Tammaru, van Ham, Hedman, & Manley, 2020). Hence, any patterns of multigenerational transmission of neighbourhood status in Sweden are likely to be generalisable to other countries with fewer opportunities for social mobility.

2. Neighbourhood Deprivation and Affluence as Multigenerational Phenomena

The literature on neighbourhood effects increasingly stresses the importance of timed effects, longer time frames and intergenerational transmission. Empirical analyses demonstrate that effects linger and that childhood neighbourhood exposure affects life chances of individuals well into adulthood (Chetty, Hendren, & Katz, 2016; Galster & Santiago, 2017; Hedman, Manley, & van Ham, 2019; Hedman, Manley, van Ham, & Östh, 2015; Sampson, Sharkey, & Raudenbush, 2008; Sharkey, 2008). Sharkey and Elwert (2011) take the analysis one step further and show that cognitive abilities of children are substantially reduced (by more than half a standard deviation) if their families have been exposed to poverty for two consecutive generations. That is, children suffer negative effects from a residential environment they have not experienced themselves. Sharkey and Elwert's (2011) findings stress the importance to better incorporate multigenerational mechanisms into understanding the residential deprivation context which people live in. This need is further highlighted by the increasing empirical evidence of intergenerational transmission of living in impoverished neighbourhoods over two consecutive generations. More than 70% of the African-American children who grow up in the most deprived areas live in similar types of neighbourhoods also as adults (Sharkey, 2008, 2013). As mentioned in the introduction, the inheritance of living in poverty neighbourhoods is not restricted to the US but is also prevalent in countries with a very different welfare state arrangement, such as Sweden, Norway and the Netherlands (de Vuijst et al.,

2017; Gustafson et al., 2017; Manley et al., 2020; Nordvik & Hedman, 2019; van Ham et al., 2014).

Whereas for a long time the multi-generational perspective was more or less missing in the segregation and neighbourhood effect literature, it is somewhat better represented in the broader literature on intergenerational transmission of socioeconomic status. In this literature, several theoretical and empirical papers have illustrated and empirically tested whether and how multigenerational transmission occurs (although the two-generational perspectives dominate). A critical debate in the literature revolves around the question of to what extent grandparents influence their grandchildren directly, over and above parental influence. Much of the 'early' research argued that high social fluidity would result in null (Piketty, 2000; for empirical studies see Cherlin & Furstenberg, 1992; Warren & Hauser, 1997) or even negative (Becker & Tomes, 1986) associations between grandparents and grandchildren once parental characteristics are controlled for. Although supported by some later studies (Bol & Kalmijn, 2016), there are also several examples of work that have found evidence of direct grandparental influence, such as Hällsten's (2015) analysis of grades, length of education and cognitive abilities, using Swedish 1st and 2nd cousins (see also, e.g., Chan & Boliver, 2013; Lindahl, Palme, Sandgren Massih, & Sjögren, 2015; Modin, Erikson, & Vagero, 2013). Mare (2011) suggests that multigenerational influence might be context-dependent (most of the early research focused on mid-19th century US) and adds that even if the main path of transmission is from one generation to the next (which is generally confirmed by empirical studies), a multigenerational approach is useful since the second generation will influence their children. Hence, regardless of whether grandparents' influence is direct or only indirect, the result will be multigenerational inequality.

The literature on multigenerational socio-economic transmission discusses several mechanisms through which parents and grandparents may exert an influence on their (grand)children's future outcomes (for lengthier discussions see Mare, 2011; Piketty, 2000). Many of these mechanisms should apply to the housing and neighbourhood fields. Among the most important mechanisms for the transmission of socioeconomic status and housing are economic transfers, either through inter-vivo transfers or as after-life inheritances (D'Addio, 2007; Hochstenbach, 2018; Mare, 2011). Such transfers may consist of (larger sums of) money passing between generations or direct investments in (grand)children's housing. Economic transfers are especially important for explaining entrance into the homeownership sector for those whose ancestors are owners themselves (Helderman & Mulder, 2007). Transfers and investments provide the opportunity for older generations to directly influence the quality of the home and its surroundings, the timing of the purchase and the mortgage setup (Engelhardt & Mayer, 1994). (Grand)children of renters

and low-income earners, or of owners in more deprived neighbourhoods characterised by a smaller housing prize increase, naturally lack these advantages and are consequently less able to buy a home in more affluent neighbourhoods when first entering the housing market (Hochstenbach, 2018; Hochstenbach & Boterman, 2015; Jenkins & Maynard, 1983; Mulder & Smits, 1999).

Besides direct economic transfers, (grand)parents also have an indirect influence on their (grand)children's socioeconomic status (and hence housing market resources). They transfer knowledge, abilities and 'cultural resources' (including, among other things, reading habits, engagement in 'high cultural activities' and language habits; see Bol & Kalmijn, 2016), and function as role models, all of which may affect the (grand)child's socio-economic choices and performance. In their study of Danish grandchildren's education success, Møllegaard and Meier Jæger (2015) found effects of grandparents' cultural capital, but not economic or social capital, and argue that their results are expected in the Scandinavian context characterised by high levels of income redistribution and free education. Their results may however be less relevant for the costly housing sector. (Grand)parents also share some of their genetic setups with their (biological) (grand)children and may hence share genetic advantages or disadvantages concerning socio-economic status. According to findings by Rowe, Vesterdal, and Rodgers (1998), a substantial part of the variation in IQ, education level and income can be explained by heritability, i.e., genetic variance.

(Grand)parents are also likely to affect housing-related norms, attitudes and behaviours of their (grand)children. It has been argued that children 'learn' what appropriate housing is and strive to reach the social housing status of their parents (and potentially also previous generations; see Helderman & Mulder, 2007; Henretta, 1984). Socialisation is not only related to housing type but also the larger residential environment. It has been shown that parents and children tend to live in similar types of environments, such as the inner city, suburbs or the countryside (Blaauboer, 2011; Feijten, Hooimeijer, & Mulder, 2008). By growing up in, or pay regular visits to, a certain type of environment, children internalise the characteristics of that kind of environment and imbed them into their own housing aspirations.

To sum up, we know from the literature that there is a strong link between the neighbourhood trajectories of parents and their children. Therefore, it is likely that the neighbourhood trajectories of grandparents influence the trajectories of their children, and subsequently of their grandchildren (either directly or indirectly, via the mid-generation). This could be due to aspects that are directly related to housing (such as direct investments in children's housing) or to the transmission of norms or resources that eventually affect housing and neighbourhood decisions. Mare (2011) also points to the importance of acknowledging demographic aspects. In the

multigenerational context, issues of timing of birth and longevity become especially important. Physical distance and the degree of interaction are also likely to affect the (grand)parent-(grand)child relation, interactions and level of transmission. Figure 1 illustrates these different forms of transmission as well as the partly overlapping neighbourhood trajectories of grandparents, parents and (grand)children. The figure also shows how the influence of the parental neighbourhood lingers on from childhood into adulthood, which (potentially) results in the multigenerational transmission of neighbourhood status.

3. Data and Methods

The data we use for this study is derived from the GeoSweden database, which is owned by the Institute for Housing and Urban Research, Uppsala University and bought from Statistics Sweden. The database consists of a compilation of datasets covering demographic, geographic and socio-economic characteristics of all individuals registered in Sweden. It contains consecutive data starting in 1990, up to 2014 (at the point of investigation).

The population selected for the study includes all females who in 2002 were at least 20 years old, had left the parental home, and whose mother and maternal grandmother were alive in 2002 and no more than 75 years of age. The age restrictions of daughter and grandmother ensure that we only compare adult individuals whose living situation is independent of that of their parents, and who are not 'too old' to reduce the likelihood of having moved into elderly care centres. Also, the (young) women had to live in municipalities with more than 100,000 inhabitants to obtain a more geographically robust estimate of the neighbourhood environment. We restrict the population to the female line

for reasons of simplicity and because females on average live longer than males. In addition to being alive and younger than 76, the mother and grandmother must also live in Sweden in both 1990 and 2002 for the family to be in the research population. Unfortunately, this requirement excludes most of the immigrant population. The remaining immigrants in the research data mainly consist of people born in the neighbouring countries of Finland and Denmark. This is unfortunate given that previous research has found that non-western immigrants, or people with an immigrant background, are more likely than natives to remain in poverty areas over two generations (van Ham et al., 2014; for a US Black–White comparison see also Sharkey, 2008, 2013).

We employ two different analytical strategies for comparing the three generations. Strategy 1 is to compare the three generations at as similar ages as possible. Demographic features (age and related features such as partnership status and child-bearing) are among the most powerful predictors of both intra-urban mobility and neighbourhood sorting. Using the full range of data, we compare the neighbourhood status of the youngest generation (daughters) in 2014 to the mid-generation (mothers) in 2002 and the oldest generation (grandmothers) in 1990. However, even though we reduce the age gap as much as possible, given the data at hand, the three generations are still of very different ages, which may influence neighbourhood sorting processes: The daughters are in their late 30s (in 2014) whereas the grandmothers are in their early 60s (in 1990; see Table 1). However, we capture all three generations at working ages and at a point in life when mobility rates are low and hence argue that the comparison still has merit.

A downside of strategy 1 is that it is sensitive to structural changes. During the 24 years that have passed between 1990 and 2014, Sweden has gone through economic boom and bust periods and experienced
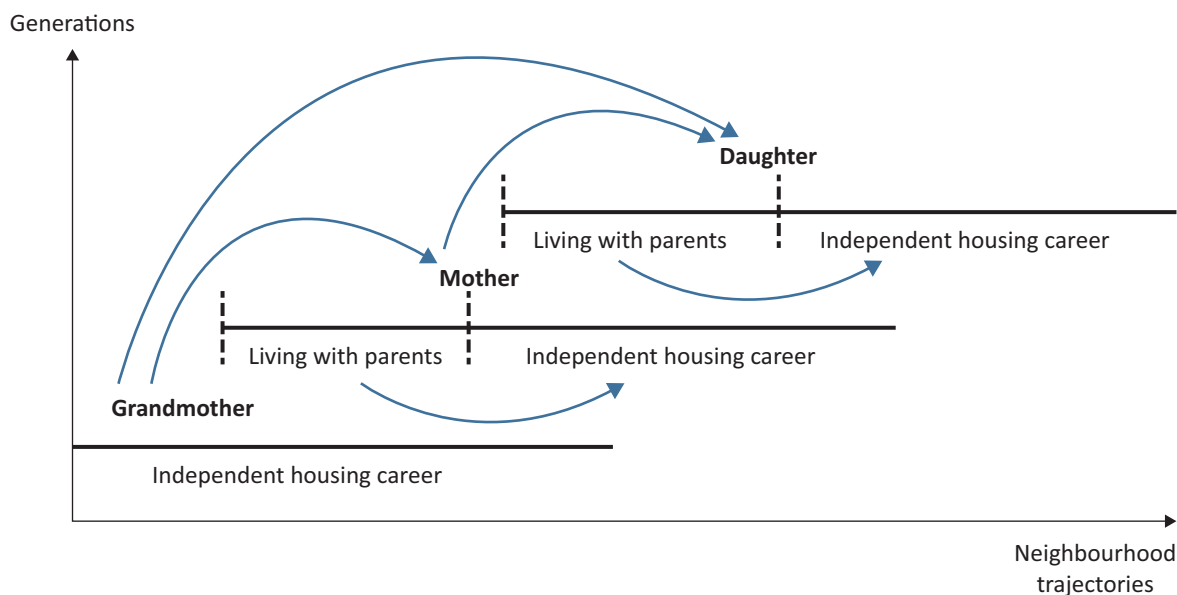

Figure 1. The linked lives across three generations.

fundamental changes in welfare policies and life standards. In 1990, Sweden had almost full employment, with unemployment levels of about 1.5%. During the crisis of 1992–1994, unemployment levels rose rapidly and have never fully recovered to their old level. High female participation in the labour force is a fundamental feature of the Swedish welfare state. Female employment levels are close to male employment levels and have been so through the entire period of study. However, the mother and in particular the grandmother generations are more likely than the younger women to have experienced spells of non-working and/or part-time working periods throughout their work-age career (housewives were a common feature of the 1950s and 1960s; Statistics Sweden, 2020) which obviously affects both their labour market status and their overall income situation.

Since the early 1990s, Sweden has witnessed a decline in welfare state arrangements, increasing inequality and increasing levels of privatisation. Between 1991 and 2013, the Gini Index has increased from 0.209 to 0.281 (OECD, 2021) due to increased capital gains and cuts in both tax levels and welfare redistributive systems. Residential segregation by income has increased accordingly, as a result of the increasing income gap and housing policy deregulations (Andersson, Magnusson Turner, & Holmqvist, 2010). In short, tax reforms and changing political priorities have favoured owner-occupation over renting a home, resulting in a smaller rental sector (Grundström & Molina, 2016). The housing surplus of the early 1990s changed into a housing shortage in most large cities in the early 2000s and prices have risen dramatically since the 1990s. Another important trend in Sweden as well as elsewhere is urbanisation. The total population has increased by almost 2 million people (21%) since 1990, and the population increase has concentrated in urban areas. Cities are expanding spatially but the countryside, in general, has not experienced any particular population decline (with many variations across and between regions and places).

These and other changes on the macro level that may affect both the characteristics of neighbourhoods of different categories and the likelihood of different groups residing in them are controlled for in the second analytical strategy (strategy 2), which is to compare the three generations at the same point in time, in 2002. Obviously, the three generations are of very different ages (see Table 1) and they have furthermore had very different experiences up to this point but at least the macro-level situation at the point of comparison is the same. Each methodological strategy suffers from serious drawbacks but by combining both strategies, more robust conclusions can be drawn. Our data set encompasses 82,811 family lines using strategy 1. With strategy 2, the data set is slightly larger (due to more daughters living in large municipalities), encompassing 88,943 family lines.

To make neighbourhoods as comparable as possible, both over space and time, we make use of a k-nearest neighbour approach to define bespoke neighbourhoods.

Using the software EquiPop, we created bespoke neighbourhoods based on k-nearest neighbours. The neighbourhood computation is based on geographical coordinates, 100x100m. For each coordinate pair, the software calculates the share of people of a certain characteristic among the k-nearest neighbours, by adding the population of surrounding coordinate pairs. In this study, we use the share of low-income people among the working-age population (20–64) as our neighbourhood variable. This share is based on income from work, including work-related benefits. We argue that income from work, or the share with a low income from work, provides a good reflection of education and employment levels in the neighbourhood which are important signals of the neighbourhood's social status or deprivation level. This is especially true in countries (like Sweden) with high female labour participation rates. A low-income person is defined as someone whose income from work belongs to the three lowest deciles of the national distribution. This distribution is calculated separately for each year (1990, 2002 and 2014). We work with two different neighbourhood definitions, based on the 500 and 3,000 nearest neighbours, to control how transmission of neighbourhood status is related to geographic scale. The 500 nearest neighbours represent the immediate surrounding where the individual might know or recognise a substantial share of the neighbours. The 3,000 nearest neighbours scale aims to capture larger districts of shared local resources.

Descriptive statistics of the neighbourhood environments of daughters, mothers and grandmothers, using the two analytical strategies and the two geographical scales, are shown in Table 1. The share of low-income people in the neighbourhood of the mother is equal using strategy 1 and 2: tautologically since the mother's neighbourhood environment is measured in the year 2002 using both research strategies. The grandmothers' neighbourhood status is also fairly similar over the two strategies, despite using strategy 1 in 1990 and strategy 2 in 2002. The daughters do, however, live in neighbourhoods with a lower share of low-income people using strategy 1 than strategy 2, on average. This is expected, given that the daughters are older using strategy 1 (measuring their neighbourhood status in 2014), about 37 years on average, compared to 25 using strategy 2.

Table 1 also presents descriptive statistics for the control variables used in the linear regression model that will complement a set of descriptive tables and graphs. Using the share of low-income people in the neighbourhood of the daughter as the dependent variable, we model the effects of the share low-income neighbours of the mother and grandmother, controlling for the distance between daughter and mother/grandmother, the size of the municipality and several demographic and socio-economic variables, all measured as characteristics of the daughter. Distance is measured as Euclidean distance. Table 1 reveals that daughters and mothers live on average about 85 km from each other,

Table 1. Descriptive statistics.

	500 nearest neighbours				3000 nearest neighbours			
	Strategy 1		Strategy 2		Strategy 1		Strategy 2	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Age, daughter	37.56	3.31	25.56	3.31	37.56	3.31	25.56	3.31
Age, mother	51.13	4.71	51.13	4.71	51.13	4.71	51.13	4.71
Age, grandmother	64.68	6.21	76.68	6.21	64.68	6.21	76.68	6.21
% Low-income neighbours, daughters	25.27	10.00	34.52	14.55	27.01	8.91	33.88	11.62
% Low-income neighbours, mothers	27.36	9.02	27.36	9.02	28.71	7.88	28.71	7.88
% Low-income neighbours, grandmothers	30.00	6.69	31.26	9.49	29.95	5.30	31.03	7.99
Distance daughter/mother (km)	106.88	169.25	110.76	174.38	106.88	169.25	110.76	174.38
Distance daughter/grandmother (km)	143.16	193.68	144.74	196.75	143.16	193.68	144.74	196.75
Family disposable income (10,000 SEK)	5.90	4.62	1.84	2.19	5.90	4.62	1.84	2.19
Education status, daughter (1 = lowest, 4 = highest)	3.01	1.11	2.56	1.04	3.01	1.11	2.56	1.04
Family status, daughter								
single	18.92%		72.09%		18.92%		72.09%	
single w/ children	11.77%		4.99%		11.77%		4.99%	
couple	3.12%		4.24%		3.12%		4.24%	
couple w/ children	66.20%		18.68%		66.20%		18.68%	

while grandmothers live on average slightly further away from their granddaughters (about 120 km). Distances are slightly longer using strategy 2. The demographic and socio-economic control variables are age, disposable family income, education level and family type. Education level is categorised into four types: less than 12 years of schooling, 12 years (equivalent to a high school degree), 13–14 years (some post-schooling) and 15+ years (university degree). Family type is categorised into single, single with children, couple and couple with children.

4. Results

The main variables of interest in this study are the share low-income neighbours of daughter, mother and grandmother respectively. Table 2 displays the correlation coefficients of these respective variables, using strat-

egy 1 and 2, and the two geographical levels. The table reveals, not surprisingly, that there is a stronger correlation between two consecutive generations—mother and daughter (0.12 to 0.21) and mother and grandmother—than between grandmother and (grand)daughter (0.06 to 0.09). This is to be expected, partly because intergenerational transmission is assumed to be stronger between two consecutive generations, partly because of the data setup. The data better captures similar life stages for two consecutive generations, and/or more similar times. Comparing grandmothers to their granddaughters inevitably means either capturing them at very different ages (strategy 2; see Table 1) or at different times and still at rather different life stages (strategy 1). There are also differences depending on scale.

Correlations are generally stronger on the 3,000 nearest neighbour scale, indicating that whereas the immediate surroundings differ, the characteristics of the larger

Table 2. Correlation coefficients.

	500 nearest neighbours		3000 nearest neighbours	
	Strategy 1	Strategy 2	Strategy 1	Strategy 2
Daughters – Mothers	.1937	.1194	.2062	.1714
Daughters – Grandmothers	.0679	.0590	.0859	.0916
Mothers – Grandmothers	.1610	.2082	.1951	.2674

area are more similar. A possible interpretation is that the three generations' larger neighbourhoods have a similar place in the urban hierarchy, even though they may reside in different types of dwellings.

The share low-income neighbours of the daughter is the dependent variable in our regression models. Table 3 presents results on the 500 nearest neighbours scale using strategy 1. Models I and II test how the share low-income neighbours of the daughter is correlated with that of the mother and the grandmother, respectively. Both correlations are positive, but with a larger coefficient for the mother in line with previous results. In model III, the share of low-income neighbours of both the mother and the grandmother are included. We find that the coefficients related to the mother are very similar to those of model I whereas those related to the grandmother are reduced compared to model II. The explanatory power of the model is also basically the same as for model I (0.137 in model III, compared to 0.135 for model I) whereas model II, including only the grandmother, was slightly weaker (0.114). This suggests that the neighbourhood of the mother is the most important to explain the outcome of the daughter whereas adding neighbourhood information of the grandmother only changes the outcome marginally.

The distance to the mother and the grandmother has little effect on the dependent variable. The other control variables work as expected. The likelihood of residing among a high share of low—income neighbours is negatively correlated with age, income and a higher level of education, whereas being single, with or without children, has a positive effect on the share of low-income neighbours. Not including controls leads to somewhat higher coefficients for the share low-income neighbours of both the mother and, to some extent, the grandmother, but (not surprisingly) to a much weaker model (model V).

The finding that the socioeconomic features of the daughter are the most important predictors of her neighbourhood composition is not surprising. It is similarly possible that the effect of the mother/grandmother neighbourhood composition is, in fact, a reflection of their socioeconomic situation. An intergenerational transmission of income would result in similar neighbourhood environments, through restricting housing market options of grandmothers, mothers and daughters. We test this by also adding the income of the mother and the grandmother to our model (model IV). However, the effect of these income variables is not significant, and the results do not change when removing the share of low-income neighbours of mother/grandmother to avoid collinearity issues (results not shown). These results suggest, in line with previous results of Sharkey (2008) and Nordvik and Hedman (2019), that intergenerational transmission of neighbourhood status is driven by neighbourhood context rather than income.

The relatively weak results for the grandmothers' influence are not very surprising keeping in mind that their residential environments are measured 24 years before those of their granddaughters. In fact, many of the grandmothers had already passed away when estimating the neighbourhood environments of the daughters. For this reason, we repeat the model III analysis using strategy 2, comparing the three generations at the same point in time (see model VI). The general pattern using strategy 2 is similar to strategy 1: We find a clear positive correlation between the share of low-income neighbours of daughters and mothers, and of daughters and grandmothers, although the former relationship is substantially stronger. The size of the coefficients is however larger using strategy 2 for mothers and grandmothers alike. The explanatory power of the model is also substantially stronger (0.169). A possible explanation is that transmission is facilitated by time and timing. Strategy 2 measures direct transmission. Strategy 1, however, requires that the effects on norms (including housing norms) and available resources last over long periods of time (12 years for mother/daughter, 24 years for grandmother/granddaughter). Another possible explanation is that daughters are more easily influenced at a younger age when they have a weaker social status (and may be more financially dependent on older generations) and have a less stable life position.

Models III and VI are repeated for the 3,000 nearest neighbours scale (see Supplementary File). The overall pattern is the same using the larger scale, but coefficients are bigger. Hence, the regression confirms the results of table 2 with stronger coefficients on the large geographical scale.

To better understand how the share low-income neighbours of the daughter is correlated with the share low-income neighbours of the mother and grandmother respectively, we have filled in the equation of model III (strategy 1, 500 nearest neighbours) using varying levels of the mothers' (Figure 2) or grandmothers' (Figure 3) low-income neighbours. We set the control variables to their mean levels, or modes for education (university degree) and family status (couple with children), and use two different estimates of the neighbourhood environment of the individual (mother or grandmother) whose neighbourhood environment is not shown on the x-axis. A high share of low-income neighbours (in the graph defined as a 'low-income neighbourhood') is equivalent to two standard deviations above the mean whereas a 'high-income neighbourhood' is a neighbourhood where the share low-income neighbours is set to two standard deviations below the mean. Figure 2 shows how the share low-income neighbours of the daughter is correlated with that of the mother, using the high- and low-income (grey and black lines respectively) neighbourhood scenarios of the grandmother, and the two different geographical scales (solid lines represent 500 nearest neighbours, dashed lines 3,000 nearest neighbours). The lines of Figure 2 are bundled very closely together, suggesting a very limited effect of geographical scale and, interestingly, whether

Table 3. Linear regression model using strategy 1.

	Strategy 1										Strategy 2	
	Model I		Model II		Model III		Model IV		Model V		Model VI	
	Coeff	Std. Err.	Coeff	Std. Err.	Coeff	Std. Err.	Coeff	Std. Err.	Coeff	Std. Err.	Coeff	Std. Err.
% Low-income neighbours of *mother*	.1777	.004			.1714	.004	.1709	.004	.2053	.005	.1767	.005
% Low-income neighbours of *grandmother*			.0905	.005	.0551	.005	.0558	.005	.0594	.005	.0749	.005
Distance to mother (km)	.0005	.000			.0003	.000	.0003	.000	−.0003	.000	.0095	.000
Distance to grandmother (km)			.0005	.000	.0001	.000	.0002	.000	−.0001	.000	.0007	.000
Age of daughter	−.1824	.010	−.2009	.010	−.1847	.010	−.1828	.010	−.2447	.010	−1.0581	.030
Family disposable income of daughter (100 000 SEK)	−.1889	.014	−.1977	.105	−.1866	.014	−.1855	.014			−.4917	.335
Education level of daughter (ref = LT12yrs)												
12 yrs	−2.4753	.126	−2.7609	.129	−2.4658	.126	2.4620	.126			−1.3888	.129
13–14 yrs	−2.5461	.139	−2.8843	.141	−2.5274	.138	2.5182	.138			4.7398	.151
15+ yrs	−2.6619	.119	−3.1180	.121	−2.6498	.119	2.6386	.199			2.4016	.160
Family type daughter (ref = couple w/ children)												
couple	3.6311	.202	3.7274	.206	3.6409	.202	3.6426	.202			1.2015	.238
single w/ children	4.3526	.126	4.5509	.129	4.3629	.126	4.3635	.126			3.9374	.591
single	5.3953	.110	5.5156	.113	5.409	.110	5.4126	.110			3.3654	.610
Family disposable income of mother (100 000 SEK)							−.0126	.007				
Family disposable income of grandmother (100 000 SEK)							18.0097	13.051				
Constant	28.9338	.420	32.1067	.433	27.5177	.439	27.3810	.462	27.0962	.430	50.3118	.619
R2	.135		.114		.137		.137		.046		.169	
N	82,811		82,811		82,811		82,811		82,811		88,943	

Notes: Dependent variable = share low-income neighbours of daughter. All control variables relate to the daughter; 500 nearest neighbours.
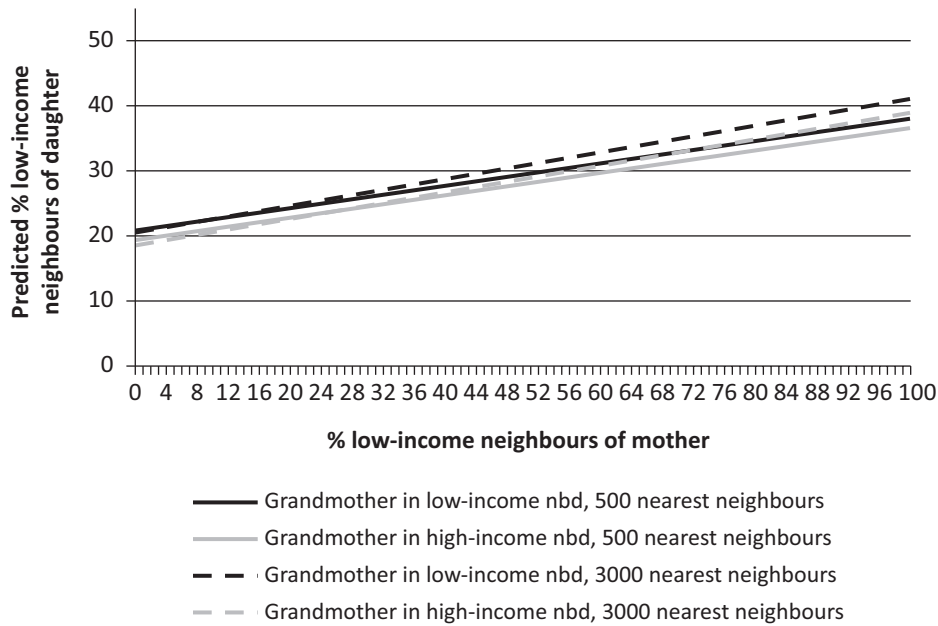
Figure 2. Predicted share low-income neighbours of the daughter by share low-income neighbours of the mother, for an individual of mean age, income and distance to mother/grandmother, mode education level and family status. Notes: Grandmother in high- or low-income neighbourhood, varying scale; strategy 1.

the grandmother lives in a high- or low-poverty neighbourhood, given the mother's neighbourhood composition. However, the grandmothers' neighbourhood environment is marginally correlated with that of their granddaughters: Daughters whose grandmothers live in high-income neighbourhoods live in areas with lower percentages low-income neighbours. The effect of the residential context of the mother is, however, relatively strong; as the share low-income neighbours of

the mother increases from 0% to 100%, the share low-income neighbours of the daughter doubles (from about 20% to about 40%). Figure 3 is equivalent to Figure 2 but shows the correlation between daughters and grandmothers, using two different neighbourhood scenarios of the mother. The graph confirms the limited extent of the grandmother's influence, given the neighbourhood environment of the mother. Changing the share low-income people in the grandmother's neighbourhood
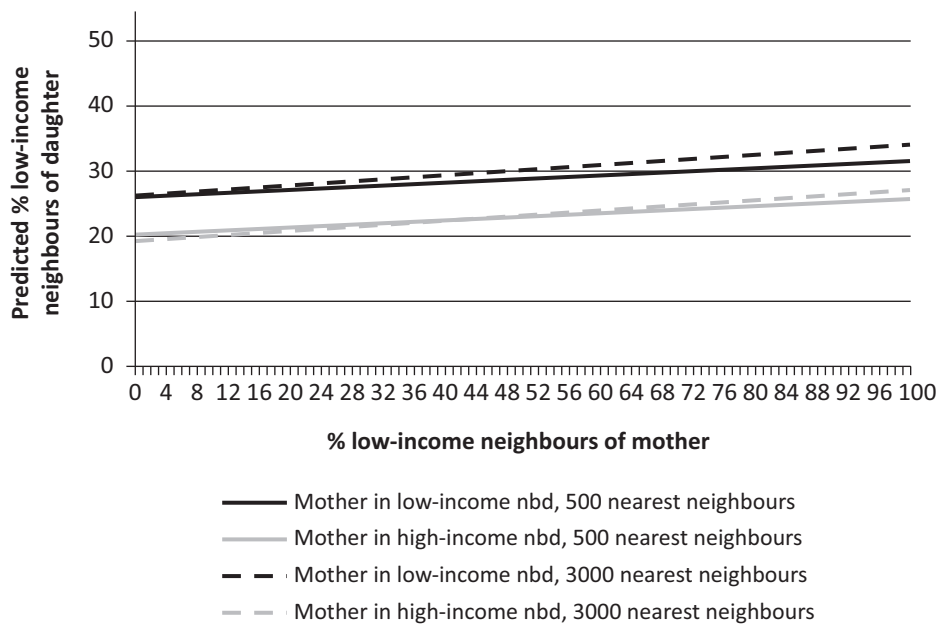

Figure 3. Predicted share low-income neighbours of daughter by share low-income neighbours of grandmother, for an individual of mean age, income and distance to mother/grandmother, mode education level and family status. Notes: Mother in high- or low-income neighbourhood, varying scale; strategy 1.

from 0% to 100% will only result in a 5% increase in the share low-income neighbours of the (grand)daughter.

Repeating the same exercise but with the results of strategy 2 (model VI), and an average strategy 2 individual, produces predicted shares of low-income neighbours that are higher—naturally since coefficients are larger and an average daughter in strategy 2 is younger, has a lower family income, a lower education level and is single (for means and modes using the two strategies, see Table 1). Whereas strategy 1 predicts that a daughter whose mother has 0% low-income neighbours and a grandmother in a high-income neighbourhood will have 19% low-income neighbours (see Figure 2), the equivalent number using strategy 2 is 27%. Yet, despite differences in levels, strategy 2 yields a similar pattern (to Figure 2) when comparing mothers and daughters. The predicted share of low-income neighbours of the daughter increases by about 18 percentage points as the mother's share of low-income neighbours increases from 0% to 100% (compared to about 17 percentage points using strategy 1). Predictions are also very similar regardless of the grandmother's neighbourhood environment and geographical scale. The 3,000 nearest neighbour scale produces steeper lines, suggesting a stronger correlation with the mother/grandmother neighbourhood environment. The most probable explanation is scale effects. Segregation decreases on larger geographical scales, making areas more similar. It is also possible that a larger area better captures the neighbourhood surroundings. In densely populated areas, the 500 nearest neighbours may reside within a few building blocks, whose population composition does not necessarily capture the composition of the immediate area.

5. Conclusion

In this article, we set out to test the hypothesis that intergenerational transmission of neighbourhood status not only occurs from parents to children but is extended to multiple generations. Our findings suggest that transmission between two consecutive generations is substantially stronger than between grandmother and granddaughter, which is in line with previous literature on transmission of socio-economic status. Controlling for the neighbourhood environment of the mother, there is only a limited effect of the grandmother's residential environment on her granddaughter's location. However, rather than emphasising the marginal effect of the grandmother, it could be stressed that we *do* find empirical evidence for multigenerational transmission of neighbourhood status. Also, as argued by Mare (2011; see also Figure 1), multigenerational transmission could also be seen as multiple events of two-generational transmission where the elder generation influence their children, who in turn transmit their status to their children. Hence, the grandmother may have an additional indirect influence over the neighbourhood environment of her granddaughter. It should be stressed that our results do not

measure causality. More research is needed to work out the causal transmission patterns and mechanisms over multiple generations. The findings of multigenerational correlations are however robust. They hold over different geographical scales and comparison strategies also when controlling for some of the most common predictors of where people live.

We find that comparing the three generations at the same point in time (i.e., at different points during the life course) yields stronger estimates than when comparing at as similar ages as possible but at different points in time. This is likely due to both timing and opportunities for the transfer of neighbourhood context. When estimating neighbourhood outcomes at the same time point, the youngest generation (daughters) is still very young—in their mid-20s—and hence more likely to be under parental influences. In their mid- to late 30s (the age when we compare them at similar ages; strategy 1), most people have entered the labour market, started a family and moved into a more permanent home. The influence from older generations could be assumed to be smaller at that stage in life. Also, when comparing neighbourhood contexts at similar ages, the situation of the daughters is compared to that of their mothers' (12 years prior), and of their grandmothers' (24 years prior). Obviously, the (grand)parental influence diminishes with time, especially since many grandmothers are no longer alive at the time when we measure the (grand)daughters' neighbourhood environments. Rather than thinking in terms of small effects, one could argue that it is striking that we find even small correlations between the neighbourhood deprivation levels of adult women and their mothers and grandmothers, given the time that has passed. A third explanation for the smaller estimates of strategy 1 is that the structural situation has changed. The grandmothers' neighbourhood contexts are measured in 1990, at a time when Sweden experienced full employment, a strong welfare state, higher levels of equality and when housing policy was based on tenure neutrality. In 2014, there were higher levels of unemployment, segregation, income inequality and tenure inequality, with an increasing share of homeownership. Of course, the structural situation affects both the likelihood and the meaning of living among low-income neighbours. Hence, the incentives for daughters to avoid certain areas/neighbours may be different from those of their mothers and grandmothers.

The context also explains why the tentative multigenerational transmission of neighbourhood status is much lower in our study compared to the simulation by Sharkey for the US. Sweden has substantially lower levels of segregation, polarisation and poverty compared to the US. Also, most of our 'low-income neighbourhoods' (i.e., neighbourhoods with a share of low-income people among the nearest 500 or 3,000 neighbours) are most likely well-functioning areas inhabited by low-income workers. We might have found stronger patterns had the analysis been restricted to the poorest segments

on the housing market. Another caveat is that for data reasons, our analysis is almost exclusively restricted to native Swedes and immigrant families from neighbouring Nordic countries. Non-western immigrants, a population group that is increasingly associated with poverty and residence in low-income areas and for whom two-generational transmission of neighbourhood status is strongest (van Ham et al., 2014), are absent in the analysis.

However, in a sense, these caveats only strengthen our results. We have found (weak) evidence of three-generational transmission of neighbourhood status in a context where 'low-income neighbourhoods' are not characterised by extreme poverty and where a population group that is highly overrepresented in the most deprived areas is not included. We could thus expect patterns of transmission to become stronger in the future, in the context of both increasing levels of income segregation in Sweden and more multigenerational immigrant families.

Another caveat is that our analysis is restricted to females only and results may differ for males. It is also possible that results change if both the maternal and paternal lines are included. Maternal and paternal grandparents may live in a similar environment, which might strengthen multigenerational effects, or live in a very different environment, and hence 'compensate' for each other (the same is true for divorced parents). To look into all these complexities is a task for future research.

Conflict of Interests

The authors declare no conflict of interests.

Supplementary Material

Supplementary material for this article is available online in the format provided by the author (unedited).

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Article

Residential Segregation and Unequal Access to Schools

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Abstract

Socio-spatial inequality and school inequality are strongly related. Where people live affects the opportunities individuals have in life, such as the opportunity to send your children to a good school. The level of urbanisation is related to the number of options people have to choose good schools, so more urbanised areas likely offer more options for good schools. However, the families that can choose good schools are likely families with high income or education levels. Data for this study come from two waves of the Taiwan Youth Project (N = 2,893), which consists of two cohorts of students from 162 classrooms in 40 junior high schools in northern Taiwan. When school quality is proxied by socioeconomic status (SES), the results show that, in general, students from the most urbanised areas, wealthier parents, and higher-educated parents, are more likely to go to higher SES schools. However, the strongest effects are for higher income and higher-educated parents in the most urbanised areas. This suggests that in the most urbanised areas, families have the most options regarding school choice, and richer and more educated families are better able to circumvent school catchment areas, either because they can afford an address in a better catchment area or because they understand the importance of school choice.

Keywords

catchment areas; parental socio-economic status; school quality; segregation; urbanisation

1. Introduction

School quality plays a crucial role in chances for a good education. Good schools provide students with higher learning outcomes and nonmaterial resources, such as social and cultural capital to succeed in a work environment (Bourdieu, 1977; Lareau, 1987). Education is known as the most effective path to upward social mobility for disadvantaged children by creating an equitable distribution of learning outcomes (Downey & Condron, 2016). However, educational inequality has persisted over time in many countries and been widely discussed again since the neoliberal education reforms (Alon, 2009; Tam & Jiang, 2014; Yang, Huang, & Liu, 2014). In this study, we focus on the case of Taiwan, where educational inequality is also emphasised as a concern by several studies (L.-J. Chen, 1993; L.-J. Chen & Chen, 2009; Y. G. Chen, 2001; Mao, 2015), but is understudied when it comes to spatial processes (Nieuwenhuis, 2020; Nieuwenhuis & Hooimeijer, 2016).

School quality can be operationalised in different ways, all with their own limitations. We suggest that the idea of school quality is partly socially constructed through parental perceptions. Certain schools are perceived to be of higher quality than others and parents use their resources to ensure their child's admission to those schools. This will ultimately lead to a sorting of children from different socioeconomic backgrounds into

different schools, with schools that are perceived as high-quality having a, on average, higher socioeconomic status (SES) population than schools that are not perceived as high quality. Therefore, school quality is proxied with average school income. Schools' quality has more often been linked to the SES of its population (Condron & Roscigno, 2003; Perry & McConney, 2010), and higher-SES schools have been shown to positively impact students' educational achievement (Nieuwenhuis, 2018; Portes & MacLeod, 1996). Schools with a higher SES population provide more social and cultural capital, which can further benefit students' achievement (Cheadle & Amato, 2011; Lareau, 1987). When higher parental SES is reflected in school expenditure, higher-SES schools can afford better teachers, activities, and facilities (Elliott, 1998; Greenwald, Hedges, & Laine, 1996; Hochschild & Scovronick, 2003), as well as enhance the teacher-student ratio (Wenglinsky, 1997). Although most public primary and secondary schools in many areas receive equal government funding (Butler & van Zanten, 2007), good schools are unequally spatially distributed (Oberti, 2007; Wilson & Bridge, 2019). Generally, more developed urban areas have more higher-SES families and more educational resources, so schools in urbanised areas have higher-SES populations and are often of better quality than in less urbanised areas (L.-J. Chen & Chen, 2009; Owens & Candipan, 2019; Parsons, Chalkley, & Jones, 2000). Thus, urban children are likely to have better access to good schools.

Also within urban areas, the distribution and access opportunities of good schools are unequal because of school segregation, which is strongly connected to residential segregation (Bernelius & Vaattovaara, 2016; Oberti, 2007; Taylor & Gorard, 2001). Many countries set school catchment areas that link the place of residence to a selection of nearby schools available to children in that area (e.g.: in the UK, see Mayet, 1996; Parsons et al., 2000; in Germany, see Noreisch, 2007; in France, see Oberti & Savina, 2019; in Australia, see Rowe & Lubienski, 2017; in China, see Wen, Xiao, & Zhang, 2017; Wu, 2012). Because of residential segregation by SES (Nieuwenhuis, Tammaru, van Ham, Hedman, & Manley, 2020), some school catchment areas are wealthier than others and consequently have schools with higher average income levels. When, as described above, perceived school quality is what attracts high-income families to certain catchment areas, a correlation between school quality and the school population's income is suggested. For example, in the US, the quality of public schools was found to be shaped by the amount of wealth in a school district (Kozol, 1991; Slavin, 1999).

Family background is considered a strong predictor of educational differentiation (Marjoribanks, 1979; Nieuwenhuis, Hooimeijer, van Dorsselaer, & Vollebergh, 2013). Studies show that parental income and education influence children's ability to do well in education (Cheadle & Amato, 2011; Lareau, 1987). Some argue that working-class parents with low income and edu-

cational levels pay less attention to school choice and long term educational strategies (Ball, 2002). Others believe that although parents of each class have the same educational expectations for children, they have vastly different abilities and economic resources to attain them (Chin & Phillips, 2004; Votruba-Drzal, 2003). High-income parents can afford houses in urban areas with better schools, and higher-educated parents may be better equipped with knowledge about good schools (Webber & Butler, 2007). Therefore, to understand the relation between parents' income and education and school quality in areas with different levels of urbanisation, we examine the interaction between urbanisation and parental SES in Taiwan. This will shed light on whether high-SES parents are better able to exploit the opportunities of urbanised areas than low-SES parents. In sum, our research question is: How are urbanisation and the interrelation between urbanisation and parental socioeconomic background related to students' differential access to schools? By studying the Taiwanese case, we include an East Asian perspective to the mostly Western-based body of literature.

2. Factors Shaping Access Opportunities to Good Schools

Both urbanisation (Parsons et al., 2000) and family SES (Cheadle & Amato, 2011; Marjoribanks, 1979) make differences to children's chances for good schooling, and the two factors are intertwined as family SES tends to be related to spatial residential choice (Nieuwenhuis & Hooimeijer, 2016). High-SES families tend to aggregate in urban areas where dense population and developed economies give rise to more well-paid, high-skilled jobs (Hacker, Klaesson, Pettersson, & Sjölander, 2013). Besides, due to residential sorting based on income, not only between areas of different levels of urbanisation but also within areas, the spatial distribution of households with different SES is uneven (Nieuwenhuis et al., 2020; Oberti & Savina, 2019). Much of the existing literature investigates access opportunities to good schools in terms of urbanisation and family SES separately, but their combined impact lacks sufficient exploration. We will, therefore, review the existing research from each of these two perspectives first and then propose our hypotheses.

2.1. Urbanisation and Residential Segregation Causing Educational Inequality

Education is socio-geographically unequal because economically developed urban areas tend to have more resources for infrastructure like schools (Logan, Minca, & Adar, 2012; Roscigno, Tomaskovic-Devey, & Crowley, 2006). Take the US as an example, poorly performing schools are located in the most disadvantaged rural areas that suffer high poverty rates (Lichter & Brown, 2011; Lichter, Cornwell, & Eggebeen, 1993). Noreisch (2007)

reported that in Germany, there are far more school options in urban areas than in rural areas. In some places (e.g., in Taiwan), the central government provides disadvantaged public schools with subsidies according to a uniform national standard, but studies show that educational funds are still unequal (L.-J. Chen, 1993; L.-J. Chen & Chen, 2013). Also, many countries allow private schools to encourage competition for quality development in public schools (Broccolichi & van Zanten, 2000; Lubienski, 2005; Rowe & Lubienski, 2017). These private schools reinforce the educationally advantaged position of urbanised areas. For example, in Chile, private schools located closer to the city centre have better teachers, student-teacher ratio, and educational test results than more peripherally located schools (De la Fuente, Rojas, Salado, Carrasco, & Neutens, 2013). In sum, urbanised areas have a greater variety of schools both in quality and quantity than less urbanised areas, suggesting between-area inequality in opportunities for good schooling.

Schools are also unequally distributed within urbanised areas. Generally, the best performing and most attractive schools are concentrated in the most advantaged urban neighbourhoods, while the less developed schools are located in mostly working-class neighbourhoods (Oberti, 2007). This is partly because high- and low-income families cluster in separate neighbourhoods within the city, which appears as economic residential segregation (Nieuwenhuis et al., 2020). Residential segregation and school segregation are thought to be mutually reinforcing factors (Bernelius & Vaattovaara, 2016; Frankenberg, 2013; Taylor & Gorard, 2001; Waslander & Thrupp, 1995). High-performing schools are likely to be located in affluent neighbourhoods (Oberti & Savina, 2019), where there are school catchment areas with higher levels of income (Rowe & Lubienski, 2017). The amount of wealth in a school catchment area shapes its school's quality (Kozol, 1991; Slavin, 1999). Consequently, the housing market around popular schools will be hot and thus hard for low-income parents to afford, further restraining their school choices. The more wealthy parents try to move into areas with desirable schools, the more expensive popular areas become (Butler & van Zanten, 2007; Wen et al., 2017), resulting in expensive gentrified areas only available to a wealthy few (Butler, Hamnett, & Ramsden, 2013; Wilson & Bridge, 2019). So this actually forms a vicious circle where wealthy parents cluster in wealthy catchment areas of popular schools and make these schools and areas even more attractive and expensive (Bernelius & Vilkama, 2019).

2.2. Parental SES and School Choice Causing Educational Inequality

High-SES parents can evade school catchment area restrictions by moving into other catchment areas with better schools or by some illicit means like using false addresses (Boterman, 2019; McGinn & Ben-Porath, 2014). Considering parents' school choosing needs, many countries adopt school choice policies that allow choosing schools across catchment areas, with the hope to promote school quality through competition (Hadderman, 2002; McGinn & Ben-Porath, 2014). However, such policies have been controversially debated since their implementation. Some argue that they can improve the quality and equity of education, especially by allowing disadvantaged parents to choose schools across districts (Manno, Finn, Chester, Bierlein, & Gregg, 1998; Viteritti, 2003), but more studies show that school choice policy exacerbates educational inequality because parents of different classes do not have the same ability to choose schools (Cheng, 2002). Parents who have the ability of school choice are highly educated with occupational prestige, compared to lower SES families forced to accept the school catchment assignment (Echols & Willms, 1992; Willms & Echols, 1993). Thus, students from high-SES families may benefit more from this education market of school choice (Robert, 2010).

Attitudes towards education also matter towards school choice, albeit restricted by available resources. Middle-class parents are found to regard education as a negotiable system while working-class parents just accept the school arrangement (Webber & Butler, 2007; Willis, 1977). Lower-class parents may not be aware of the benefits of education, as they have not benefitted much from education themselves. However, Chin and Phillips (2004) argue that parents of different SES all have high educational expectations for children and apply similar parenting strategies, but disadvantaged families are restricted by a lack of resources, which means it is not attitudes but rather attitudes in the context of the range of available options that matters (Boterman, 2019). In summary, different attitudes and abilities between parents of different SES affect children's chances of good schooling.

2.3. School Access in the Taiwanese Context

The education system of Taiwan provides a crucial case to explore how urbanisation and parental SES act together predicting unequal school access opportunities. Taiwan has implemented a nine-year, centrally controlled education since 1968. With compulsory education until middle school, the government aims to ensure equal opportunities (Ministry of Education, 2020b). Although from the late 1980s to the early 1990s, Taiwan relaxed central government control and enhanced the local autonomy of education under the influence of neo-liberal ideology (Mao, 2015). Public middle schools still dominate, with recent statistics showing that 98.2% of middle schools are public (Ministry of Education, 2020a). Public schools are mainly financed by local governments (L.-J. Chen, 2006). The central government only provides financial subsidies if local educational funds are not up to the national standards, to ensure equal conditions for public

middle schools in all regions. Such a system would theoretically ensure similar funding and qualities among public schools. Nevertheless, studies show that the disparity in economic development across Taiwan leads to a large financial inequality in education (L.-J. Chen, 2006). Local educational spending in urbanised areas is much higher than in less urbanised areas (L.-J. Chen & Chen, 2013).

In Taiwan, public middle schools that students attend are determined by the system of catchment areas set up by administrative education authorities (Mao, 2015). Students generally go to the nearest middle school according to their family's residence in the catchment area. But under the pressure of the high school entrance exam, some parents believe that only the informally ranked "superstar schools"—junior high schools with a high percentage of graduates gaining admission to prestigious public senior high schools (Mao, 2015)—will better prepare their children for the entrance exams of elite high schools. Contrasting with some Western cases, these prestigious public schools are generally perceived as higher status schools than private schools (Chu & Yeh, 1995), which is comparable to the situation in Japan (Aizawa, 2016). So, if there are no such "superstar schools" in a given school catchment area, some may gain access to schools across the catchment boundary by changing their home address (Mao, 2015). As a result, the access opportunity to middle schools of various qualities is unequal in reality. The differences in school popularity lead to fierce competition to gain access to perceived high-quality schools. Such competition requires that parents spend a great deal of energy and resources on choosing schools and deciding where to live, which means middle-class parents with more available resources are more likely to win. This inequality of access to schools is more severe in densely populated areas than in less populated areas (Chang, 2000), from which we can infer that more urbanised areas with large populations have more access to good schools but also more severe competition for entrance.

The unequal access to schooling is reflected in the distribution of SES in our study area (i.e., northern Taiwan): Figure 1 shows that more urbanised centres such as Taipei City contain higher shares of highly educated individuals and shows a variation with urbanised areas as well. Much of this image can be explained by urban areas being the areas where higher-paying jobs cluster, requiring highly educated people, but the image also aligns with the idea that in terms of schooling, some areas are more attractive than others, potentially causing the spatial variation of high-SES individuals. When comparing educational and occupational segregation in our study area with other areas in Taiwan (Table 1), it shows that segregation is on the lower end compared to the rest of Taiwan. In the case of Taiwan, most of the variation in SES is within, rather than between districts. Taipei is comparable to a city like Tokyo in its low level of urban segregation (Maloutas & Fujita, 2012). The relatively low levels of segregation can be related to Taiwan's relative-

ly low income inequality compared to the region. With a disposable household income Gini index of 31.1 in 2010, income inequality is lower than in Mainland China (42.8), Hong Kong (40.7) and Singapore (39.3), and comparable to Japan (31.8) and South Korea (31.4; see Solt, 2020). We aim to examine how, in a situation of relatively low segregation and inequality, families seek educational distinction for their children.
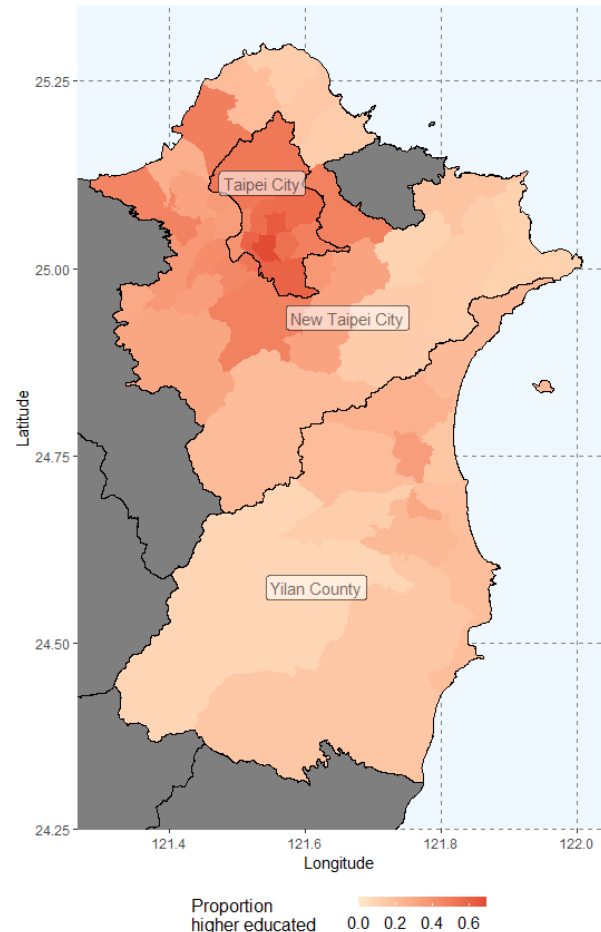
Figure 1. Proportion of higher-educated individuals in northern Taiwan, by township, city, and district. Notes: The map shows the proportions of individuals aged 15 years and over with junior college, university, or higher education in 2010. The spatial scale is townships/cities/districts, which are nested in Taipei City, New Taipei City (which roughly corresponds to Taipei County in our data, which was renamed New Taipei City in 2010), and Yilan County. Source of data: 2010 Population and Housing Census (DGBAS, 2010).

2.4. Hypotheses

Previous studies have pointed out that urbanisation and family SES both affect access opportunities to schools. Because high-income schools and high-SES families both cluster in urbanised areas, parents of higher socioeconomic backgrounds have better school

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Table 1. Residential segregation by education and occupation in counties and cities.

	H^R education	R^R education	H^R occupation	R^R occupation
Hualien County	.054	.066	.031	.038
Yunlin County	.044	.056	.028	.035
Taitung County	.044	.055	.022	.025
Chiayi City/County	.043	.053	.044	.055
Penghu County	.035	.045	.019	.025
Pingtung County	.033	.040	.034	.042
Miaoli County	.033	.040	.030	.036
Tainan City	.031	.039	.034	.042
Nantou County	.029	.035	.019	.022
Taichung City	.028	.035	.033	.041
Hsinchu City/County	.027	.036	.036	.043
Changhua County	.023	.028	.028	.035
Kaohsiung City	.022	.027	.028	.033
Yilan County*	.021	.026	.027	.033
Taipei City*	.019	.027	.020	.024
New Taipei City*	.019	.023	.017	.020
Taoyuan County	.014	.018	.017	.020
Kinmen County	.010	.012	.017	.020
Keelung City	.004	.005	.006	.007
Lienchiang County	.000	.001	.009	.012

Notes: Segregation indices H^R and R^R stand for the rank-order information theory index and the rank-order variance ratio index, respectively (for more specific descriptions of these measures see Reardon, 2011). Both can be interpreted as proportions of the variation in education and occupation that lies between rather than within townships/cities/districts. Educational segregation is based on four categories: "elementary and lower," "junior high," "senior high and vocational," and "junior college, university and higher." Occupational segregation is based on nine categories: "legislators, senior officials and managers," "professionals," "technicians and associate professionals," "clerical support workers," "service and sales workers," "skilled agricultural, forestry and fishery workers," "craft and related trades workers," "plant and machine operators, and assemblers," and "elementary labourers." The segregation measures for education and occupation use the first and sixth polynomial, respectively. The list is ordered from highest to lowest segregation based on H^R education. Source of data: 2010 Population and Housing Census (DGBAS, 2010). * Yilan County, Taipei City, and New Taipei City (Taipei County) are the sample areas.

choices. Based on the previously established connection between these two factors, we formulated the following two hypotheses:

- Hypothesis 1: Students in more urbanised areas have access to (a) higher-income schools and (b) more variation in school average income levels than students in less urbanised areas.
- Hypothesis 2: In more urbanised areas, students with higher family SES have access to higher-income schools than students with lower family SES, but not in less urbanised areas.

3. Data and Methods

3.1. Data

We used the Taiwan Youth Project, a panel dataset of students and parents from Northern Taiwan, collected since 2000. The original sample consisted of 5,541 students from a 7th and 9th-grade cohort, aged around 13 and 15, respectively. Respondents were sampled from 162 classrooms within 40 schools, within three regions (Taipei City, Taipei County, and Yilan County). We used both student-

and parent-reported information, from survey waves 1 and 4 (in wave 4, students were in the first and final year of high school for the younger and older cohort, respectively). The final sample with all relevant information was 2,893.

3.2. Measurements

Average school income was measured using parental income from survey wave 4. For the older cohort, household income was measured as a parent-reported continuous variable (0 to 155 in NT$1,000). For the younger cohort, the measure consists of a student-reported categorical variable. We used the middle of the NT$10,000 categories as our value. The average school income was measured by taking the average household income for each of the 146 schools students attended in wave 4. Descriptive statistics are available in Table 2.

The level of urbanisation of the respondents' place of residence was measured with the following categories: core city, general city, emerging town, and general and ageing township. This classification was specifically designed to best capture urbanisation in Taiwan (Hou, Tu, Liao, Yung, & Chang, 2008). The classification

Table 2. Descriptive statistics (N = 2,893).

Variable	Mean	SD	Min.	Max.
Average school income	57.48	19.01	15	125
Household income	59.66	34.31	0	155
Parental education	3.45	1.63	1	7
Years lived in the neighbourhood	8.73	7.34	0	18
	Prop.			
Urbanisation: Core city	.48			
—General city	.31			
—Emerging town	.12			
—General and ageing township	.08			
Female	.50			
9th-grade cohort	.44			
Ethnicity: Minnan	.78			
—Hakka	.07			
—Mainland	.13			
—Aboriginal/other	.02			

was calculated using Ward's minimum variance method, including six categories that capture urbanisation in Taiwan: the percentage of service industry population, the percentage of industry population, the percentage of 15 to 64 years old population, the percentage of above 65 years old, the percentage of the above population holding a college degree, and population density (Hou et al., 2008).

Household income was measured in wave 1 as a parent-reported continuous variable (0 to 155 in NT\$1,000). In the few cases parent-reported income was missing, we substituted with a categorical student-reported household income. We used the middle of the NT\$10,000 categories as our value.

Parental education was measured continuously as parents' highest level of education in the following order: elementary school, middle school, vocational high school, academic high school, junior college, university, and graduate school.

We included four control variables: sex (0 = male; 1 = female) and cohort (0 = 7th grade; 1 = 9th grade). Ethnicity has been shown to play a role in education in Taiwan, where especially Mainlanders have an advantage over other groups (Chiang & Park, 2015; Jao & McKeever, 2006). Ethnicity was measured as father's ethnic background (1 = Minnan; 2 = Hakka; 3 = Mainlander; 4 = Aboriginal/other). Finally, because the residential environment might be more important when students have lived there longer (Nieuwenhuis, Yu, Branje, Meeus, & Hooimeijer, 2016), we included the years someone lived in his/her neighbourhood in wave 4.

3.3. Analyses

To test our hypotheses, we examined the relationship between urbanisation, parental education, household income in wave 1 (age 13/15) and average

school income in wave 4 (age 16/18) using regression analysis. Because respondents who attend the same school are not independent of each other, we clustered standard errors in schools, to avoid underestimating p-values. We present three models, the first including all relevant covariates, and the second and third including an interaction between urbanisation and household income and parental education, respectively. Additionally, we calculated the marginal effects of parental education and household income for the different levels of urbanisation.

To calculate average school income, we only used schools that had 10 or more students from the sample enrolled to ensure the precision of the estimate. Additional robustness checks using only schools with 20 or more students show the same results (available on request), further indicating good precision. Because of this limit, we had to omit 880 respondents from the analyses. Further attrition between waves reduced our sample from the original 5,541 to 2,893. To test whether attrition could affect our outcomes, we performed several t-tests to examine whether the probability of data *missingness* is associated with school average income. We test how different the used sample is from the sample with missing values, on several key variables (Allison, 2002). The tests showed that parental education (t = .54, df = 5,403, p = .591) and urbanisation (t = −1.09, df = 5,539, p = .274) are missing at random. Respondents coming from households with lower household income are more likely to be missing (t = 3.24, df = 5,368, p = .001). The higher attrition from lower-income households could potentially influence our results.

4. Results

Table 3 shows the descriptive results of average income levels in schools by level of urbanisation. More urbanised

Table 3. Descriptive statistics of average school income by level of urbanisation.

	Mean	SD	Min.	Max.
Core city	63.11	12.45	43.74	87.95
General city	59.65	9.44	48.40	77.22
Emerging town	46.87	4.80	39.59	52.99
General and aging township	42.93	5.99	34.00	49.01

areas have higher average and maximum levels of school income and also a wider range of school income than less urbanised areas, in line with hypothesis 1. Next, we tested how urbanisation, family SES, and average school income are related (Table 4). Model 1 also shows that students from less urbanised areas are more likely to attend lower-income schools, which is in line with hypothesis 1a and the descriptive results from Table 3. Besides, children from higher-educated and higher-income parents are more likely to attend higher-income schools. Models 2 and 3 present the interaction between urbanisation and household income and parental education, respectively. The models show, in line with hypothesis 2, that the relationship between parental income and education and school income levels is stronger for children in the areas with high levels of urbanisation

(core and general city), and weaker in emerging towns and townships. The likelihood ratio tests show that both models are an improvement over the models without interactions. Marginal effects show that both household income and parental education only have a significant effect in the most urbanised areas (Income: core city: b = .11; s.e. = .02; p < .001; general city: b = .06, s.e. = .02, p = 002; emerging town: b = .04, s.e. = .02, p = .116; township: b = .04, s.e. = .04, p = .276; Education: core city: b = 2.90, s.e. = .48, p < .001; general city: b = 1.59, s.e. = .57, p = .006; emerging town: b = −1.19, s.e. = .50, p = .019, township: b = −.52, s.e. = .73, p = .475). The time during which respondents lived in their neighbourhood did not change the relationship between urbanisation, parental SES, and attending higher-income schools. Finally, control variables gender,

Table 4. Regression results for school income level (N = 2,893).

	Model 1			Model 2			Model 3		
	B	SE	p	B	SE	p	B	SE	p
Urbanisation (ref. Core city)									
(2) General city	−3.47	2.07	.095	−.30	2.54	.905	1.32	3.11	.672
(3) Emerging town	−9.15	2.32	<.001	−5.08	2.84	.076	−3.99	3.22	.218
(4) General and aging township	−14.52	2.71	<.001	−10.75	3.22	.001	−7.52	3.80	.049
Household income (in NT$1,000)	.08	.01	<.001	.11	.02	<.001	.08	.01	<.001
Parental education	2.17	.35	<.001	2.12	.34	<.001	2.90	.48	<.001
Interaction household income with urbanisation									
(2)				−.05	.03	.058			
(3)				−.08	.03	.015			
(4)				−.07	.04	.085			
Interaction parental education with urbanisation									
(2)							−1.31	.69	.059
(3)							−1.70	.72	.019
(4)							−2.37	.92	.011
Female	1.69	1.37	.220	1.63	1.36	.232	1.62	1.35	.232
9th grade cohort	3.18	3.68	.389	3.15	3.66	.391	2.94	3.67	.425
Ethnicity (ref. Minnan)									
—Hakka	.60	1.38	.665	.64	1.38	.643	.62	1.37	.649
—Mainland	2.44	1.20	.044	2.39	1.20	.048	2.28	1.19	.058
—Aboriginal/other	−.93	2.24	.678	−.98	2.22	.659	−.99	2.18	.652
Years lived in the neighborhood	.26	.14	.071	.26	.14	.072	.27	.14	.060
Intercept	43.53	2.72	<.001	41.91	2.81	<.001	40.99	2.96	<.001
R^2	.2276			.2305			.2317		
Likelihood ratio test with Model 1 (chi^2 (df))				10.87 (3)		.012	15.45 (3)		.002

cohort, and ethnicity did not play a role in predicting average income in schools. Only Mainlanders seemed to end up on higher-income schools, however, because the significance level hovered around p = .05, depending on the model, this evidence is very weak.

5. Conclusion

School inequality has a crucial influence on educational outcomes and life opportunities. This article aims to identify how urbanisation and family SES are related to children's access opportunities to good schools. Our results show that both factors impact access to schools and that the two are intertwined. Students with higher family SES backgrounds from more urbanised areas have more opportunities to access higher-income schools. But this relation between family SES and school inequality is only prominent in the most urbanised areas and does not appear in less urbanised areas. It suggests that in the most urbanised areas, higher income and higher educated parents enjoy more school choices, like high-income public schools or private schools. They may have more economic resources and knowledge to choose good schools despite school catchment area limitations because they can either afford addresses in an affluent catchment with high-quality schools or put more effort into children's educational planning and school choice. However, when it comes to less urbanised areas like towns or townships, schools are generally poorer and fewer, so the relation between parental SES and school income level is not present, which underlines the socio-spatial inequality of school distribution. This also adds to the understanding that school quality is a pathway through which residential segregation can reproduce educational inequality (Galster, 2011; Nieuwenhuis & Hooimeijer, 2016; Nieuwenhuis, Hooimeijer, & Meeus, 2015).

The Taiwanese case in this article verifies the relation between socio-spatial inequality and school inequality, and the relation between family SES and school inequality in previous studies. Furthermore, we extend this literature by demonstrating how urbanisation and family SES interact together when predicting children's school access opportunities. When a place is more urbanised, there will be more high-income jobs and economic resources, which will attract higher-educated parents. On the other hand, such places will be difficult to afford for low-SES parents, thus fostering residential segregation. Together with school segregation, such socio-spatial inequality exacerbates educational inequality. Because levels of residential segregation in our study areas are lower than in many other counties and cities in Taiwan, school quality may be more stratified by family SES in other areas. Placing Taiwan in the East Asian region is more difficult: Taiwan's and South Korea's educational inequality are decreasing, Japan's and culturally similar Mainland China's educational inequality are increasing (Hannum, Ishida, Park, & Tam, 2019). How the differ-

ences in residential inequality in these regions relate to changes in the educational climate still needs more rigorous and comparative study.

We identified three limitations to this study which can contribute to the development of future studies on this topic. First, it is unclear if our findings are generalisable to areas with free school choice. In many European countries, school choice policy has been implemented, but its impact on educational equity is controversial (Cheng, 2002; Viteritti, 2003; Willms & Echols, 1993). In the United States, many publicly funded but privately managed charter schools have no eligibility restrictions. While charter schools give some minority students extra school choices, these schools may draw away funding from public schools, but have uncertain educational outcomes (Bifulco & Ladd, 2006) and even increased school segregation (Rotberg, 2019). The effect of these school choice policies on educational equity also depends on the local education system and the perception of parents of public vs. private schools (the former being considered higher status in Taiwan, but not necessarily in other places), so more research is needed for accurate comparisons. It is reasonable to speculate that high-SES parents will always be able to access better schools by calling on the economic and cultural resources they have. In cases with school district restrictions, they can purchase houses in better school catchment areas to qualify for admission. With a free school choice policy, they can choose more expensive and competitive schools, because they can afford the cost of commuting long distances to other school districts. Besides, higher SES parents can afford supplementary education, even further exacerbating educational stratification. While low-SES parents, on the one hand, may be able to avoid bad schools within their catchment when there are no school district restrictions on the other hand, they may still only be able to afford the closest school regardless of its quality, as they have fewer resources for commuting. Furthermore, they may not be as aware as higher-SES parents of the importance of and diversity in school quality. Thus, whether the effects of parental SES and urbanisation are different under the two, school choice systems may await future comparative studies.

Second, we only had access to data about average parental income for schools, which we used as a proxy for school quality. With this proxy, we refer to the social constructive process describing how parental perceptions of school quality is reflected through wealthier parents being able to put more resources into getting into these perceived good schools, resulting in a clustering of a higher-income population in perceived higher-quality schools. Of course, this proxy is not perfect, and future studies may improve on this by using more comprehensive measures of school wealth and quality, which could include school funding and donations, teacher-student ratio, or measures for teacher quality.

Third, the informed assumption of a positive correlation between school wealth and quality still needs

further examination. What are the mechanisms and conditions for this relation? High-SES households can potentially bring in more donations that contribute to school quality, as well as social and cultural capital that help students' development and chances. Future research into this topic may want to study indicators of school wealth and school quality simultaneously, to understand more specifically what parents base their school decisions on.

In conclusion, even when school populations are mostly reflections of the catchment area population, it is the high-SES parents who are best able to avoid catchment areas. Taiwan's uniform public school funding and catchment area limitations still leave room for unequal school access opportunities. For educational policymakers, this article, combined with those about school choice policies, suggest that the educational outcomes of school choice policy and catchment areas are not clear-cut, and are strongly linked to geography. Where people live, both in terms of between different cities, as within cities, is associated with the opportunity structure faced by parents, with some parents being better able to deal with this structure than others.

Acknowledgments

Conflict of Interests

The authors declare no conflict of interests.

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Article

'Notorious Schools' in 'Notorious Places'? Exploring the Connectedness of Urban and Educational Segregation

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Abstract
While the statistical link between residential and school segregation is well-demonstrated, in-depth knowledge of the processes or mediating mechanisms which affect the interconnectedness of the two phenomena is still limited. By focusing on well-functioning schools in disadvantaged neighbourhoods, our article seeks to scrutinise whether reputation can be one of the key mediators of the connection between residential and school segregation. Our study combines qualitative ethnographic interviews from four (pre-)primary schools with quantitative segregation measures in four urban neighbourhoods in the Finnish capital city of Helsinki to understand the connections between lived experiences and socio-spatial segregation. The results show that there appears to be a clear link between neighbourhood and school reputation, as schools in disadvantaged neighbourhoods are strongly viewed through the perceptions attached to the place. Despite the case schools' excellent institutional quality and high overall performance in educational outcomes, there is a consistent pattern of the schools struggling with negative views about the neighbourhoods, which seep into the schools' reputation. Since school reputation is one of the central drivers of school choices and is also linked to residential choices, the close connection between neighbourhood and school reputation may feed into vicious circles of segregation operating through schools. The results highlight the need for integrated urban policies that are sensitive to issues concerning school reputation and support the confidence and identity of pupils, reaching beyond simply ensuring the institutional quality of schools.

Keywords
educational inequality; Helsinki; image; reputation; residential segregation; school segregation; stigmatisation

Issue
This article is part of the issue "Vicious Circle of Segregation: Understanding the Connectedness of Spatial Inequality across Generations and Life Domains" edited by Tiit Tammaru (University of Tartu, Estonia), Siiri Silm (University of Tartu, Estonia), Frank Witlox (Ghent University, Belgium), Maarten van Ham (Delft University of Technology, The Netherlands) and Madli-Johanna Maidla (University of Tartu, Estonia).

1. Introduction

In many European cities, residential segregation is on the rise (Andersen, 2019; Tammaru, Marcińczak, van Ham, & Musterd, 2016). At the same time, educational equality is facing a challenge as school segregation and widening gaps in educational outcomes have become marked in many contexts (Boterman, Musterd, Pacchi, & Ranci, 2019). Segregation in the residential and edu-

cational life contexts, or domains, is tightly interlinked. While increasing segregation on the neighbourhood level feeds into the growing differentiation of student composition between schools (Bernelius, 2013; Bernelius & Vaattovaara, 2016; Boterman, 2019), the residential mobility behaviour of young family households is increasingly informed by school choice considerations (Bernelius & Vilkama, 2019; Hamnett & Butler, 2013). Neighbourhoods with more popular schools attract more

middle-class residents, while some neighbourhoods are rejected partly because of concerns related to schools. However, while the statistical link between residential and school segregation is well demonstrated (Boterman et al., 2019; Frankenberg, 2013), in-depth knowledge of the underlying processes or mediating mechanisms which affect the interconnectedness of the two phenomena is still limited.

By focusing on well-functioning schools in disadvantaged neighbourhoods, our article seeks to scrutinise whether reputation can be a crucial mediator of the connection between residential and school segregation, feeding into a multi-domain vicious circle of segregation (van Ham, Tammaru, & Janssen, 2018). The main aim of our study is to explore the interconnections between urban segregation and the reputations of schools and neighbourhoods. We ask how perceptions of local schools are linked to urban segregation and problems of neighbourhood stigmatisation. To what extent do these perceptions relate to objective characteristics of schools and neighbourhoods and how are they experienced by students, parents and teachers? In short, if disadvantaged places are labelled 'notorious' (Kearns, Kearns, & Lawson, 2013), will schools also be seen as such?

The study combines qualitative ethnographic interviews from four (pre-)primary schools with quantitative segregation measures in four urban neighbourhoods in the Finnish capital Helsinki. In contrast to previous research on school reputation, the combination of quantitative and qualitative data allows us to contrast pupils', parents', and school staffs' subjective perceptions of school and neighbourhood reputations with objective, quantitative segregation measures. Through the constant dialogue between the two datasets, the everyday experiences in schools and neighbourhoods can thus be contextualised in place.

Our conceptual framework mainly draws on the concepts of reputation, image, and stigma elaborated by Kearns et al. (2013) in their study on 'notorious' places in the UK. We use these concepts to interpret how pupils, families, and school staff express their views and experiences of their neighbourhoods and schools and position themselves concerning their own communities and outsiders. Particularly, the differentiation between personal beliefs and meta-beliefs, referred to as reputation, allows for a better understanding of how values are attached to both neighbourhoods and schools and how these values are socially reproduced.

Helsinki is an ideal location to study the relationship between neighbourhood and school characteristics. As the local educational system consists mainly of local public schools with individual catchment areas, the interconnections between neighbourhood and school allocation are very strong. Public funding and a shared curriculum make institutional variation between schools low in international comparison. Based on egalitarian ideals, the municipal educational authority seeks to ensure equal academic institutional quality in all schools and

ranking lists are not published. It can therefore be argued that school reputation is less dependent on institutional variation than in more differentiated education systems which, for instance, rely more on private schools with strong school competition and varying institutional qualities. This local context thus allows revealing effects that are almost exclusively tied to the social (re)production of reputation through the composition of both schools and neighbourhoods. Since rumours and reputations play a significant role for parents' school choices even in education systems with official league tables and in which the variation between the institutional quality of schools is higher (Butler & Hamnett, 2007; Vincent, Braun, & Ball, 2010), this study provides an understanding that can likely be transferred to systems with more institutional variation.

So far, several studies have demonstrated that school segregation is to a large extent the effect of residential patterns (Boterman, 2019; Frankenberg, 2013). However, the former is not just a simple reflection of the latter; their connection is rather exacerbated by several different processes (Candipan, 2019; Oberti & Savina, 2019). Since the relationship between residential and school segregation is crucial to understand intergenerational social mobility and inequality (Boterman et al., 2019), the topic is of high educational and socio-political relevance. Based on a conceptual design combining both quantitative and qualitative empirical data, our study allows us to gain a better theoretical understanding of the mechanisms by which urban segregation affects the widening gaps in educational attainment between urban communities. Identifying these mechanisms is central to finding novel ways to support schools and communities in urban neighbourhoods throughout Europe.

2. Local Geographies of Education: The Close Relationship between Residential and School Segregation

Research across many countries illustrates that residential segregation and school segregation are tightly interlinked in a 'geography of education' (Butler & Hamnett, 2007). However, while high levels of residential segregation are usually accompanied by segregated schools, low levels of residential segregation do not necessarily result in mixed schools. In contrast, school segregation is usually higher than residential segregation, which is mainly due to parents' socially selective ways of choosing schools (Boterman et al., 2019; Ramos Lobato & Groos, 2019; Wilson & Bridge, 2019).

Access to high-quality education has become a sensitive topic for many parents (Butler & Hamnett, 2007). Especially middle-class parents, equipped with the social and cultural capital needed to take full advantage of the educational market, actively navigate the system to find the 'right' schools (Boterman et al., 2019; Kosunen, 2014). Concerned about their children's exposure to lower standards of education, to children with

inadequate language skills or the 'wrong' types of socialisation, many parents tend to define the 'right' school based on its social, racial or ethnic composition—which feeds into growing school polarisation (Boterman, 2013; Ramos Lobato & Groos, 2019; Vowden, 2012; Wilson & Bridge, 2019).

Parents' school choices are strongly influenced by their local social networks (Ramos Lobato, 2019; van Zanten, 2013; Vincent et al., 2010; Vowden, 2012). Personal impressions and the experiences of friends or relatives—so-called 'grapevine-knowledge' (Ball & Vincent, 1998)—are often used to compensate for missing or untrustworthy official information. Since parents' networks spread (middle-class) parents' personal opinions about 'good' or 'bad' schools rather than provide objective information, they do not only transfer but actively construct reputations of 'good' schools (Holme, 2002; Kosunen, 2014). As grapevine knowledge also provides a medium for social comparison (Ball & Vincent, 1998), schools' reputations play a significant role in shaping parents' choice strategies.

3. Vicious Circles of Segregation: The Relationship between Neighbourhood and School Reputation

3.1. Conceptualisation of Image, Reputation, and Stigma

Based on the conceptualisations of image, reputation, and stigma by Kearns et al. (2013), we define image as a personal belief or evaluation about schools and neighbourhoods. Reputation, in contrast, is a meta-belief; a belief about what is commonly believed about a particular object, which does not necessarily reflect the speaker's own view (Kearns et al., 2013). The way in which personal opinions are transformed into socially accepted perception or reputation is based on two mechanisms: First, through institutional actors, who can spread their views publicly—such as local newspapers (Butler, Schafran, & Carpenter, 2008; Kearns et al., 2013; Permentier, van Ham, & Bolt, 2008) and second, unintentionally, through the residents themselves (Butler et al., 2018; Pinkster & Hoekstra, 2020).

While both image and reputation can be positive or negative, stigma carries solely negative connotations. According to Goffman (1963), stigma is the classification—and the subsequent discrimination, exclusion, rejection and devaluation—of individuals as 'discredited' based on the possession of symbolic and/or physical attributes. The symbolic dimension of stigma is especially crucial since it emphasises the stigma's "structural roots in broader patterns of power and its role in legitimising social inequality in society" (Kearns et al., 2013, p. 582). As stigma is understood as an intrinsic part of the stigmatised individual—even though it is just attached to a person by others—those who have been stigmatised have less power to change the stigma but rather tend to make it a part of their own identity (Bunar, 2011; Kearns et al., 2013).

With his concept of territorial stigmatisation, Wacquant (2007) adds place as an additional and partially autonomised dimension of social discredit. Territorial stigmatisation affects not only the residents but also the level and quality of service delivery, the area's symbolic representation by journalists, and scholars, and the beliefs and decisions of state officials and their public policies (Wacquant, Slater, & Pereira, 2014).

3.2. Notorious Schools in Notorious Neighbourhoods?

In the case of a bad reputation, most residents or pupils are aware of their neighbourhood's or school's negative reputation, the stereotypes associated with it, and the position of such schools and neighbourhoods in the local hierarchy (Hollingworth & Archer, 2010; Kearns et al., 2013; Kosunen & Carrasco, 2016). A noticeable body of research shows that objective characteristics seem to be good predictors for both neighbourhood and school reputation (Boterman et al., 2019; Kearns et al., 2013; Kosunen, 2014; Permentier et al., 2008)—with schools' educational quality as one important exception to the rule. As parents tend to associate a school's educational quality with its social, racial or ethnic composition rather than its institutional quality (Boterman, 2013; Vowden, 2012), there are schools with bad reputations despite parents' positive experiences, and their good performance (Bernelius, 2013; Kosunen, 2014). To understand the source of this bad reputation, it is thus not sufficient to pay attention to objective or institutional characteristics, but rather to the schools' interrelations with the neighbourhood and their position in the social and symbolic local hierarchy (Bunar, 2011).

So far, there is only limited information about the social processes by which school and neighbourhood reputations are discursively constructed. Certain schools seem to become stigmatised via a complex interconnection of material conditions, educational outcomes (e.g., league tables) and neighbourhood reputation (Bunar, 2011), although the impact of the latter does not seem to be so straightforward (Hollingworth & Archer, 2010). Schools' reputations seem to be connected to their relative position in the local educational hierarchy (Bunar, 2011; Kosunen, 2014); however, how this hierarchy is connected to socio-spatial characteristics has not yet been studied.

In numerous cities, residential and school segregation are two strongly interrelated phenomena (Bonal, Zancajo, & Scandurra, 2019; Boterman, 2019; Frankenberg, 2013; Oberti & Savina, 2019). Regarding the underlying mechanisms of this relationship, we ask whether reputation might be one of the key elements to understanding this strong connection. So far, there are no previous studies in the Finnish and international context where school and neighbourhood reputations have been studied together, or directly connected to quantitative measures of neighbourhood segregation in a single research setting. In this article, we

thus seek to explore reputation and stigma as a potential link between urban and school segregation, feeding into vicious circles of segregation. We ask to what extent neighbourhoods' and schools' reputations are related to objective characteristics and how they are experienced by students, parents, and teachers. Our mixed-methods approach allows us to analyse both how subjective values are attached to neighbourhoods and schools and how these are connected to quantitative measures of neighbourhood segregation and thus fill the knowledge gap in research.

4. Methodology

To capture the interrelationship between neighbourhood and school segregation and reputations, we combine two sets of data in a common analytical framework: quantitative GIS-data to analyse the socio-spatial structure of the school catchment areas, and qualitative ethnographic interview data from two related research projects: "Well-Functioning Local Schools" (2014–2015) and the "Mixed Classes and Pedagogical Solutions MAPS'' (2018–2021).

The quantitative data consist of Statistics Finland Grid Database (250 m grid-cell data) on block-level socio-economic indicators for the years 1999–2019 with additional information on registered languages of residents for 2012. In the quantitative analysis, we modelled socio-spatial segregation in school catchment areas by aggregating block-level urban statistical data into the catchment area level, producing a segregation analysis of all primary school catchment areas in Helsinki. Our analysis extended over several years to check for consistency in the spatial development trajectories. The analysis software was MapInfo and QGIS, combined with SPSS for statistical analysis.

The case schools were selected based on the catchment area segregation analysis, school characteristics, and educational outcomes from 2012. The educational outcomes assessments have been carried out by the National Board of Education, and the institutional academic quality of the schools by the Helsinki City Education Council with the criteria of well-functioning school leadership, high teacher satisfaction, and low staff turnover. We selected schools, which are located in mixed or disadvantaged neighbourhoods but have been assessed to achieve good educational outcomes and to be of excellent academic quality. As previous research has demonstrated (Bernelius, 2013), the schools' educational outcomes are usually highly correlated with the socio-economic status of the catchment area in Helsinki. We searched for schools, which perform exceptionally well and exceed the outcomes which would have been statistically expected based on the catchment area's socio-economic composition. The final selection criteria were (1) a high level of local and relational socio-economic disadvantage in the school catchment area and, simultaneously, (2) educational outcomes that exceeded the level statistically associated with the quantitative measures of local disadvantage.

The qualitative data consist of ethnographic interviews that were conducted in four selected neighbourhoods and pre-/primary schools. Ethnographic interviews mean that they were conducted in projects in which the relationships between the researcher and the interviewees were established during longer observation periods within the schools. Thus, the duration and frequency of contacts with the interviewees distinguish them from interviews that are set up only for that purpose (Heyl, 2007). The overall qualitative ethnographic data were collected in the two research projects and include both field notes from observations in schools and ethnographic interviews (n = 125) with pupils, their parents, and schools' staff. For this study, we limited the analysis to the latter, in which the topic of reputation was explicitly dealt with.

In all schools, we interviewed the staff volunteering to participate (n = 47) during the observation periods. This included teachers, school leaders, and other professional personnel. The interviewed pupils (n = 51) were fifth- and sixth-graders (11–13 years of age). In Finland, children start their obligatory educational paths when they enter pre-primary school at age five or six. Pre-primary education in this study was organised on the same premises and in close co-operation with primary school. Since the interviewed pupils were about to enter lower-secondary education, which starts at age twelve or thirteen, we discussed their experiences of both primary school and the transition phase. In Helsinki, pupils are mainly allocated to their nearest lower-secondary school; however, they can apply to other lower-secondary schools. The group of parents (n = 27) included the parents of the interviewed pupils and several pre-primary school pupils, whom we contacted at parents' evenings. All interviews lasted between 30 and 90 minutes and were recorded and transcribed. All Finnish quotes in this article were translated into English.

In the interviews, we talked about the interviewees' perception and experiences of the schools and neighbourhoods. In the analysis, we first utilised coding in Atlas.ti software as a means to organise the extensive dataset and then moved on to inductive thematic content analysis (Schreier, 2012). At first, we coded talk about school(s) and neighbourhood(s) concentrating particularly on how they were described in the interviews and in relation to other schools and neighbourhoods. Next, we coded the data excerpts by using 'reputation,' 'image' and 'stigma' as codes generated deductively from our conceptual framework. Afterwards, we moved on to the inductive thematic content analysis to capture the formulations used by the interviewees themselves. To differentiate between reputation and stigma, we understand stigma as a negative reputation that has already been internalised by an individual, which points to the underlying unequal power relations and their structural roots (Bunar, 2011; Kearns et al., 2013).

The quantitative analysis was combined with the qualitative analysis in two ways: First, we used the quantitative data to analyse socio-spatial patterns in the school catchment areas to find suitable areas and schools for case studies. Secondly, we contrasted and contextualised the qualitative findings with the segregation patterns to understand the relationship between socio-spatially structured segregation and the individual interpretations of places and their images and reputations. The research findings are thus based on a mutually complementary dialogue between the structural quantitative analysis and ethnographic interview data to examine, for example, the importance of a school's or neighbourhood's relative position in the city to produce a certain reputation.

5. Geography of the Case Study Schools

Our four case schools are called here by their pseudonyms Thyme, Caraway, Pimento, and Rosemary. They have all been assessed by the education authorities to have excellent school leadership, low teacher turnover, high parental satisfaction, and good educational outcomes. Based on these institutional factors and educational performance, school reputation should not be negatively biased by any characteristics related to the institutional quality of the schools.

Caraway, Pimento, and Rosemary are all located in the larger district of East Helsinki. East Helsinki has a strong, rather stigmatised reputation as the 'notorious' part of the city, where most neighbourhoods are clearly more disadvantaged than the city average. In the national media, East Helsinki has become almost synonymous to urban disadvantage and segregation, although there is internal variance in the socio-economic status of the different neighbourhoods in the eastern parts of the city.

According to their catchment area characteristics, Caraway, Pimento, and Rosemary share a distinct disadvantage concerning the city averages in income, unemployment, and share of residents with Master's-level education (Figure 1). The catchment areas are also among the ones with the highest local share of residents with a foreign mother tongue. Other available socio-economic indicators demonstrate the same disadvantaged status: The share of adults with only basic education is distinctly higher in the selected areas than in the city in general, and cramped housing conditions are more common. According to the longitudinal observations of all catchment areas, the neighbourhoods' relative disadvantage has deep roots. While segregation has increased between the catchment areas from 1999 to 2019, the relative position of these catchment areas has remained in the lowest quartile of the city. Previous studies in Helsinki have highlighted the risk of vicious circles of segregation in these types of catchment areas, as many of them are avoided in residential decisions or they experience a migration loss of middle-class families (Bernelius, 2013; Bernelius & Vilkama, 2019).

In contrast, Thyme's catchment area is close to the city average by all its socio-economic indicators (see Figure 1). However, while the other schools are all surrounded by catchment areas that are relatively similar to each other, the Thyme catchment area is located relatively close to the city centre, between well-off areas in Helsinki. Through Thyme, it is thus possible to explore the meaning of relative local disadvantage and the effect of local hierarchies on school and neighbourhood reputation.
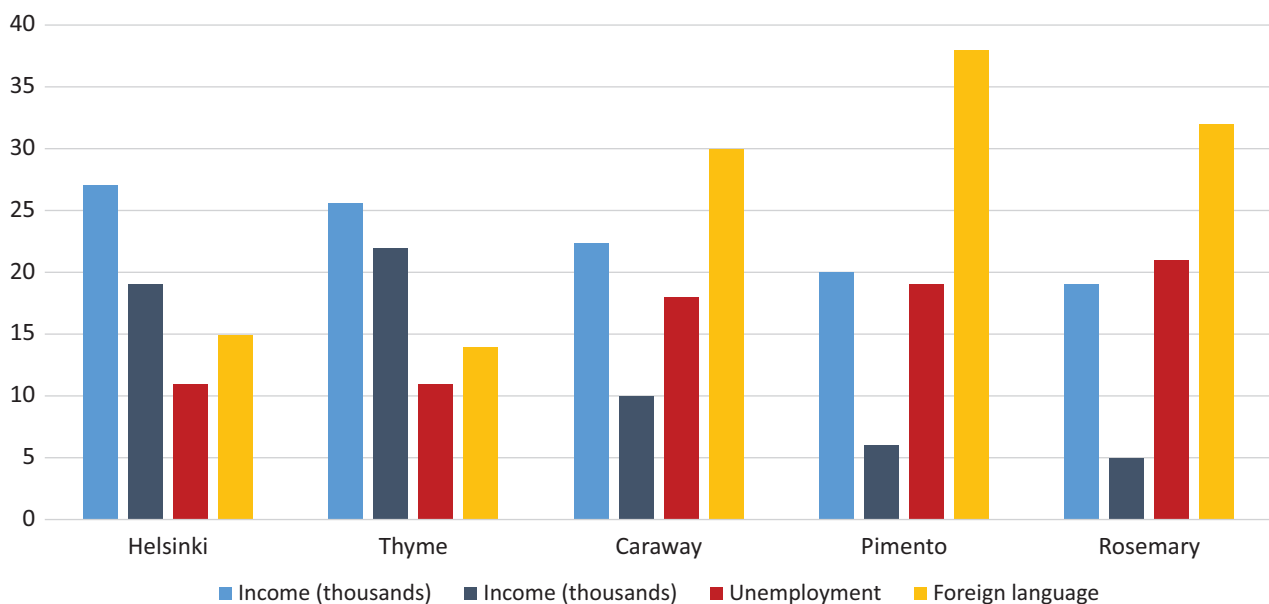

Figure 1. Socio-economic characteristics of all school catchment areas (Helsinki, average) and the case study school catchment areas: Average yearly income (thousands) and share of residents with master's-level tertiary education, share of unemployed residents and residents with a foreign mother tongue (other than Finnish, Swedish or Samí) in 2016–2018.

6. Image, Reputation, and Stigma: The Complex Relationship between Schools and Neighbourhoods

6.1. Place-Based Stigma and Real-Life Consequences

Caraway, Pimento, and Rosemary are all located in East Helsinki. While the socio-spatial characteristics of their catchment areas show quite similar patterns of socio-economic deprivation and higher-than-average shares of ethnic minorities, the interviews, in contrast, illustrate multidimensional aspects affecting images, reputations, and stigmas (Kearns et al., 2013).

Among them, Caraway differs regarding its shared positive self-image that covers both the neighbourhood and the school. School and neighbourhood images are connected strongly, and this connection is intentionally maintained. The school staff describes the school in a consistently positive way. Both staff and parents are proud of the school's place-related roots and traditions, which are used in the identity building of pupils as the following teacher's quote illustrates: "You can see Caraway in these children. It is a certain pride for many that they are from Caraway; you certainly don't have to hide it." One aspect that is important to mention is that many of the staff members live in the neighbourhood as well. Along with the parents, they applaud the diversity and social mix of the neighbourhood and the school. Pupils in Caraway describe their neighbourhood similarly positively; most of them can even imagine staying there as adults.

The other two East Helsinki schools, Rosemary and Pimento, have good images as well; however, they need to maintain them despite the neighbourhoods, which are mostly talked about in a negative way. Even though Caraway's school catchment area characteristics are like those of Rosemary's or Pimento's, the relationship between the school and the neighbourhood differs significantly. In Rosemary and Pimento, the interviewed staff, none of whom live in the neighbourhoods, describes them through social problems. This talk relates to the existence of "problematic" places in the neighbourhoods, including local public transport stations, which generally tend to gather problematic phenomena in Helsinki, such as substance abuse. Similar patterns can be found in pupils' interviews, which mention difficulties in finding positive comments about their neighbourhoods and rather describe incidents with intoxicated adults, even harassment, as one of the sixth graders illustrates:

> I'll tell you a story. When my sister was in Pimento…there was this woman she didn't know…she said to [my sister] that she will burn her hair and kill her when she sees her the next time….The woman chased her, and our dad called the police….I'm afraid to go to Pimento nowadays.

Even though these problems are not related at all to the quality of the schools, they seem to directly seep into them and consequently, to impact the schools' reputation. How strongly doubts about the quality of schools are shaped by the neighbourhoods' overall bad reputation is illustrated by the following quote. When asked about the school's reputation, one parent explicitly states: "Mostly that it is located [in Rosemary's neighbourhood], and then people already start thinking whether it's a good school." Hence, a reputation as a bad place is powerful enough to socially construct schools as notorious regardless of their actual quality (see also Bunar, 2011). In order to prove themselves to be better than outsiders' expectations, school reputations are often deliberately constructed and maintained against other schools within the area. Because of these local comparisons, it may be difficult for all schools in these neighbourhoods to be perceived as 'good', because the problems that are attached to the neighbourhoods' stigma need to be located somewhere in the local discourse. Consequently, the socially constructed relative positions of schools in the local educational hierarchies become important, which we will refer to in more detail.

While staff members talk a lot about problems, they also made clear that they believe they are doing a good job, that the schools' everyday life functions well and the atmosphere is said to be better than in some schools with an "easier" pupil composition. The staff's perception or image of the schools is an overall positive one—despite the difficulties they may experience due to the neighbourhoods, as the next quote illustrates:

> Interviewer: How would you describe this place to someone who doesn't know it?
>
> Teacher: Nice people, everything works well, not at all like, like I had the impression, of course…when I came here to Pimento school what it must be like, but the image is much more positive now.

The quote illustrates how image and reputation differ. This teacher heard about the Pimento neighbourhood's reputation before s/he first entered the school and therefore had doubts about the school's quality. Nevertheless, s/he ended up working there and now perceives the school from a different viewpoint.

The 'notoriousness' of East Helsinki creates another layer in the place-based problems of the schools. Not even Caraway, which manages to positively connect the school and the neighbourhood, can ignore the stigma attached to East Helsinki. 'East Helsinki' as a term is referred to several times in the interviews. However, 'East Helsinki' does not only or mainly refer to a certain area or place; rather, it is used as an attribute describing something challenging either in the schools or in the schools' reputations.

The stigmatised position of East Helsinki and thus the schools located in it becomes obvious in the interviews when the interviewees themselves use this stigmatisation as a self-explanatory concept when they describe

(potential) problems. This is visible in the following teacher's quote where s/he describes teaching: "And it's probably more challenging and more difficult and takes more time in an East Helsinki school than somewhere else." In the quote, East Helsinki is used as a synonym for a challenging school and potential failures. The interviewee even treats this as common sense so that the interviewer is expected to understand why something is "more difficult" in an "East Helsinki school." This self-explanatory concept is internalised as the teachers believe themselves to be in challenging circumstances due to the school's location. This stigmatised position also becomes visible in parents' frustrated comments about being tired of the talk related to East Helsinki:

> Interviewer: Were [things that outsiders find suspicious] suspicious to you?
>
> Parent: No. I think, East Helsinki is pretty peaceful, even if many say otherwise, but it's [fine].

Since all schools in this sample are doing well in terms of their educational outcomes, it might be argued that the neighbourhoods' bad reputation and stigmatised position remain on a symbolic level. However, the interviews illustrate that these symbolic meanings have real-life consequences for the schools. First, even if the principals say that their schools are popular among job applicants who are familiar with East Helsinki schools, there are, nevertheless, place-related problems concerning recruitment, as this principal puts it:

> This school has had a reputation as a good school, but geography plays a role here, because even though this school has much better social networks than many schools in the [city] centre, we have to try to sell the school when we recruit.

A second consequence becomes apparent in talks about school choice. An example shows how Rosemary pupils fear that they may end up in their nearest lower-secondary school, Dandelion. Teachers and parents recommend pupils to apply to "higher-level" schools and talk proudly about pupils who have "succeeded in getting into better schools." In the following discussion, sixth-graders talk about their choices:

> Pupil 1: [Dandelion has a] really bad [reputation].
>
> Interviewer: Do adults also talk about it somehow?
>
> Pupil 2: Some parents do, our friend said that…she won't come to Dandelion because her mother won't let her. You know that schools are given scores or something. Dandelion got six, like a really bad score, that's why she's not coming to that school. It's only because there are some foreign pupils…everyone says that Dandelion is a very bad school.

> Pupil 1: Everyone who goes to Dandelion will end up smoking and stuff.
>
> Pupil 2: And my sister's friend…said that…you can't get a proper education or [a proper] job afterwards.

The discussion shows how reputations enhance the self-perpetuating circle of neighbourhood and school segregation (Bernelius & Vilkama, 2019; Kosunen, 2014). Pupils and parents stress about the transition phase, and the reasoning for their choices appears quite random since there are no public rankings, for instance. Stigmas become visible in everyday discussions and are manifest in the choices of those who can choose. The example also shows signs of inferior educational opportunities in Helsinki. If people think that some schools are unable to offer "proper education and work," this might label pupils in those schools regardless of the actual quality of the school (Bunar, 2011).

A third example follows Hollingworth and Archer's (2010) findings showing that the pupils' location within 'pathologised' places decreases some pupils' confidence in their own abilities. We found similar patterns in our data. Since pupils seem to have internalised the stigma attached to certain places, teachers in East Helsinki schools need to build up confidence in their pupils for them to learn, as the following teacher's quote illustrates:

> Despite [others'] expectations, we need to drag these children to the level in which they themselves get to decide how they want to continue….So that they would themselves see 'I can do this.' Sometimes it's very challenging. The trust that 'I can do something' is missing completely….Raising one's self-esteem is important here.

Despite their similar socio-economic position, these consequences are more apparent in Rosemary and Pimento than in Caraway, which highlights the importance of further studying the nuances of how image and reputation affect schools and places. In Caraway, the positive connection between the neighbourhood and the school with its long roots and intentionally maintained traditions appears to soften some of the negative consequences attached to its location in the 'notorious' East Helsinki, of which Rosemary and Pimento suffer from. Also, the fact that several Caraway staff members live in the same neighbourhood, while none of the interviewed members in the case of Rosemary and Pimento do, might facilitate to identify with the neighbourhood for the former and to distance themselves for the latter.

6.2. Local Hierarchies and the Relativity of Reputation

Unlike the other schools in this study, Thyme school is mostly affected by its relative position in the local hierarchies. The school and the neighbourhood suffer

from a bad reputation or even stigma, as the socially mixed neighbourhood stands out in comparison to the prestigious, middle-class neighbourhoods that surround Thyme. The stigma appears to relate especially to racialised ethnic minorities, while the neighbouring areas are described as "white." The quantitative analysis shows that regarding its social structure, Thyme neighbourhood, in fact, follows the city average closely. Socioeconomic indicators are neither particularly low, nor does its ethnic composition differ. Thereby, Thyme provides an example of how the relative position is socially constructed (Bunar, 2011; Kosunen, 2014; Kosunen & Carrasco, 2016) and how the symbolic representation matters (Wacquant et al., 2014).

The interviews demonstrate a positive self-image in the Thyme neighbourhood. Nevertheless, the school is rejected in school choices and stigmatised in public discourse. People living in the neighbourhood and working in the school are aware of this, and comment on it in the interviews, as this parent does:

> Good connections and all, I don't see any reason why this should...have a bad reputation, but evidently, if you follow [public discourse], the reputation is very bad. Because there are so many people with immigrant backgrounds, but I don't know, I think this is a nice area.

Racialised ethnic minorities are a crucial element of both the Thyme school and the neighbourhood reputations. According to the interviewees, "immigrants" are the reason why outsiders have doubts about it. This seems to force people to comment on the subject even if they do not see it as a problem, in other words, even if it does not relate to their image of the neighbourhood. The sometimes even striking opinions that outsiders have about the Thyme neighbourhood seem to be related to their perceptions of the school, as the next quote by a teacher shows:

> I was at a [celebration] at [a nearby neighbourhood school] and behind me sat someone...who started talking...about the possibility of her child being forced to go to Thyme [instead of the other neighbourhood's school], and [she said] that Thyme [school] is "terribly bad"...and the principal horrible and [she used] extremely vulgar [language].

We interpret this as another example of how strongly school and neighbourhood reputations are connected. While Thyme neighbourhood has a good image among the people living there, those people living in the surrounding neighbourhoods rather demonise it. Interviewees give several examples of this. However, when referring to Thyme as a "bad" neighbourhood, they mainly do that in discussions that relate to the schools in Thyme. We thus argue that the 'need' for outsiders to have an opinion about Thyme emerges, or at least

increases, as soon as their children start their school paths. Thus, while we previously showed how the neighbourhoods' bad reputation seeps into schools, it seems that this relationship might also work the other way around. Schools can thus also be a crucial element in the production of a neighbourhood's reputation.

The neighbourhood's low relative position and its connection to the school seem to affect how staff encounters pupils. Some of the interviewees refer to the deficit perceptions and limited expectations some of their colleagues have about the pupils at Thyme school. These teachers believe that they cannot expect similar performances from their pupils as they could in schools in more well off areas, even though Thyme neighbourhood is not particularly low in socioeconomic terms. We interpret this as an additional sign of the school's stigmatised position since it illustrates that the staff has already internalised external beliefs about the 'problematic' school (see Kearns et al., 2013).

This internalisation has at least two types of real-life consequences. First, as the school staff has (partially) internalised that the pupil composition is too difficult to succeed with, it might play a part in maintaining the bad reputation of the school. Second, the school's stigmatised position creates anxiety in the interviewed preschool parents, whose children's school paths lead to Thyme unless they make other intentional choices. In the quote below, a parent who described herself to be highly active in the neighbourhood and said she was fighting back against the bad talk about the area, discusses the difficulties in deciding what stand to take on the negative reputation of the school:

> Parent: And since we have had the possibility to think about another school. And because of all the contradicting [opinions], some are like, 'this is a horrible school.'
>
> Interviewer: What is it related to?
>
> Parent: Bullying and, well, immigrants....I can't really tell, people's prejudices affect these things so much that they interpret things that have happened in their own way...of course, I've been thinking about whether they are right [in that the school is bad].

Among all interviewees, some actively wish to challenge the negative perceptions of the neighbourhoods or schools. Changing a bad reputation, especially a stigmatised position, is, however, difficult as it tends to become internalised and relates to larger social issues. Underlying structural issues, such as racism, are difficult to challenge by schools or neighbourhood communities.

7. Conclusion

Previous research has shown how closely the domains of neighbourhood and school segregation are connected.

Our school interviews—interpreted in dialogue with socio-spatial segregation analysis—offer additional insights into reputation as a mechanism mediating the connection between these two domains. There appears to be a strong link between neighbourhood and school reputation, as schools in disadvantaged neighbourhoods are viewed through the perceptions attached to the place. The same processes feeding into places becoming 'notorious,' as conceptualised by Kearns et al. (2013), also brand the schools as the 'notorious schools' of the 'notorious places' (Bunar, 2011). Despite the case schools' excellent institutional quality and high overall performance in educational outcomes, there is a consistent pattern of the schools struggling with negative neighbourhood reputations and prejudices. This directly seeps into the school's own negative reputation—a relationship that can be interpreted through the lens of 'territorial stigmatisation' (Wacquant, 2007). How closely school and neighbourhood reputations are interlinked becomes evident for example in an interview with a local parent, who feels that outsiders immediately assess the school as bad simply because it is located within that neighbourhood. At the same time, schools might be the trigger creating a need for families to evaluate the neighbourhood, as it appears to be in Thyme. By highlighting this territorial link, our research confirms previous studies and assumptions defending that the doubts about school quality are most often not related to the school's supposedly inadequate quality of education, but rather to social aspects of school segregation (Bunar, 2011; Kosunen, 2014).

The study also demonstrates how neighbourhood and school reputations are constructed in relation to complex local and regional hierarchies (see also Kosunen, 2014). Three of our case schools are located in a relatively homogenous part of the city, where most of the neighbouring areas face similar socio-economic challenges. Their shared negative reputation is consistent with the general stigmatisation of Eastern Helsinki and its disadvantage in terms of poverty and perceived social problems. The national and local discourse, in which East Helsinki has nearly become a synonym for disadvantage and failure, seems difficult to overcome in education. In this sense, the schools' negative reputation is constructed through the neighbourhood reputation, and in relation a city-wide hierarchy of neighbourhoods. Nevertheless, even in this rather homogenous area, relative positions of schools can be identified. The parents' and staff members' positive perspective on the neighbourhood and the Caraway school's long tradition in the neighbourhood might enable to withdraw from negative reputations and to draw counter-narratives and a more positive self-image and reputation about the school. These fine-grained and rather complex differences also highlight the need for further studies on the underlying mechanisms of local social hierarchies.

The significance of the relative position of schools and neighbourhoods becomes particularly visible in the case of our fourth case school, Thyme. In contrast to the three other schools, Thyme has a catchment area with a social status close to the city average. At the same time, it is wedged between areas with high status and a long history of social prestige. Despite the school's excellent educational outcomes and its close-to-average socio-economic composition, the subjective perception of disadvantage is constructed in relation to the neighbouring catchment areas and schools, which became evident in the way school staff and parents talked about the interlinked poor reputation of the neighbourhood and school. Thus, while the East Helsinki schools and catchment areas seem to be mostly evaluated and contrasted against the rest of the city, Thyme's reputation appears to be constructed on a smaller scale in relation to its immediate surroundings.

Like previous research showing that residents evaluate their neighbourhood significantly more positively than non-residents (Permentier et al., 2008), our interviews highlight the differences between the personal experiences with these schools and the perceived perspectives from outside. The conceptual framework of image and reputation helps to distinguish between the insider and outsider perspective and to understand why reputations easily become internalised as 'beliefs about beliefs.' In all case schools, most pupils, parents, and staff are satisfied with their school; however, at the same time, they are very strongly aware of, and sensitive to, the perceived negative views from outside, and how this reputation affects the outsiders' prejudices against the local school. Consequently, these socially constructed symbolic distinctions have real-life effects for the school communities and pupils. The stigmatisation of schools and neighbourhoods is felt by the teachers, who raise concerns about the load and fatigue caused by negative assumptions about the school and impairs the pupils' self-image and confidence. In some schools, pupils are worried about the effect that the school reputation may have on their future. In these discourses, places and schools are even used as self-explanatory phrases—"It's difficult to do that in an East Helsinki school"—creating self-fulfilling prophecies.

The results highlight, for their part, the interconnectedness of multiple domains of segregation, and the fruitfulness of studying these in a common setting to unearth some of the mediating mechanisms. The observed connection between neighbourhood and school reputation and their link to segregation provides both challenges and possibilities for educational and urban policies. On the one hand, this connection demonstrates how and why even an egalitarian, high-quality educational system is not automatically protected against vicious circles of educational segregation in disadvantaged neighbourhoods. As reputation is one of the central drivers of school choices, negative perceptions of schools and neighbourhoods likely affect their rejection as middle-class parents are especially sensitive to fears of choosing the 'wrong' kind of school for their children (Boterman,

2013; Ramos Lobato, Bernelius, & Kosunen, 2018; Ramos Lobato & Groos, 2019; Vowden, 2012). In this process, even institutionally well-functioning schools also appear to be vulnerable to the self-perpetuating growth of school segregation if they are located in a stigmatised neighbourhood. School reputation is also closely linked to residential choices. The interlinked process of stigmatisation of neighbourhoods and schools may thus feed into a multi-domain circle of segregation, where segregation in one domain feeds into the other. The risk of circles of deprivation may be even more profound in contexts where the institutional quality of schools varies more and school choice policies are more liberal. In less egalitarian and more differentiated educational systems, where inequalities between different social and ethnic or racial groups are bigger, such as the UK or US, or where schools partly rely on additional financial support by parents, or are characterised with a special pedagogical approach and gifted programmes, such as The Netherlands or Germany, schools operating in disadvantaged neighbourhoods may be even more vulnerable to rejection in school choices made by educationally motivated families.

On the other hand, as the basic dynamics appear relatively constant over diverse urban settings, the findings offer opportunities to support both schools and struggling neighbourhoods through active policies focused on improving schools and specifically targeting the way they are perceived by the general public. As cities are looking for ways to combat urban deprivation, investing in schools and strategically supporting positive school reputations has significant potential in policies aimed at breaking circles of deprivation in urban neighbourhoods across different types of cities.

Acknowledgments

Conflict of Interests

The authors declare no conflict of interests.

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Article

Poverty Suburbanization, Job Accessibility, and Employment Outcomes

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Abstract

The last decade of urbanization throughout many cities have seen a perceptible shift in the demand for centralized urban amenities while poverty has increasingly decentralized. Yet, the opportunity landscape of these shifting geographies of poverty and prosperity are not well understood. In this article, we examine how access to employment for low-income households has been impacted as a result of these changing geographies. Using a case study on the Charlotte metropolitan area we examine whether the suburbanization of poverty and reinvestment in the center city has reshaped the job opportunity landscape for low-wage residents. The objectives of this article are twofold. First, we calculate and map auto-based accessibility from all neighborhoods in the Charlotte metropolitan area to job locations, differentiated by wage categories, in 2010 and 2017 to identify potential changes in the mismatch between low-income households and access to employment. We use a point-level employment dataset for these two years and calculate accessibility originating from census block groups. Second, we estimate the extent to which access to employment has affected employment rates and household incomes at the neighborhood level using a first-difference, spatial two-stage least squares model with instrumental variables. Our findings suggest that changes in accessibility had no significant effect on changes in neighborhood employment rates. However, we find evidence that increasing accessibility for lower-income households could have a positive effect on neighborhood median household incomes. Overall, the polycentric nature of Charlotte appears to have reduced the spatial mismatch between low-income workers and low-wage jobs.

Issue

This article is part of the issue "Vicious Circle of Segregation: Understanding the Connectedness of Spatial Inequality across Generations and Life Domains" edited by Tiit Tammaru (University of Tartu, Estonia), Siiri Silm (University of Tartu, Estonia), Frank Witlox (Ghent University, Belgium), Maarten van Ham (Delft University of Technology, The Netherlands) and Madli-Johanna Maidla (University of Tartu, Estonia).

1. Introduction

In 1968, John Kain hypothesized that poor employment rates among inner-city African Americans were a result of the decentralization of employment and the inability of Blacks to relocate out of the inner-city, largely due to racial discrimination and segregation (Kain, 1968). This spatial mismatch hypothesis thus stated that unemployment was a direct result of limited physical access to employment opportunities. The hypothesis spurred

a substantial research agenda that has tested whether access is related to employment outcomes, and has identified other important factors that may explain high unemployment rates such as lack of relevant skills, racial discrimination in hiring, or social networks, among others (Houston, 2005; Ihlanfeldt & Sjoquist, 1990; Theys, Deschacht, Adriaenssens, & Verhaest, 2019). The empirical evidence has generally shown a positive relationship between access and employment, especially to low-wage and entry-level employment (Allard &

Danziger, 2002; Bastiaanssen, Johnson, & Lucas, 2020; Jin & Paulsen, 2018; Mouw, 2000), but exceptions to this relationship exist and a consensus has yet to be reached for all income segments and all types of cities.

The bulk of our understanding of how job access is related to employment outcomes in the United States has occurred in the context of an urban America characterized by concentrations of racial segregation and economic disinvestment in center cities coupled with decentralizing employment. However, urbanization throughout many US cities—and in cities throughout the world—has undergone a perceptible shift in the demand for center-city amenities while poverty has increasingly decentralized (Raphael & Stoll, 2010). Yet, the opportunity landscape for these shifting geographies of poverty and prosperity are not well understood.

The purpose of this article is to shed light on how the suburbanization of poverty and reinvestment in the center city have reshaped the job opportunity landscape for low-income residents using the rapidly growing metropolitan area of Charlotte, North Carolina, as a case study. We calculate changes in job accessibility between 2010 and 2017, differentiated by low and high-wage jobs and for low- and high-income population groups. We then estimate how changes in accessibility contribute to changes in unemployment levels and incomes at the Census block group level. Our findings suggest that changes in accessibility had no significant effect on changes in neighborhood employment rates. However, we find evidence that increasing accessibility for lower-income households could have a positive effect on neighborhood median household incomes. This may suggest that other factors such as skills gaps are relatively more important to improve opportunities for lower-income households, at least in metropolitan areas like Charlotte. Another possible explanation is that greater accessibility for lower-income households does not necessarily determine whether they are employed, but it offers a greater set of employment opportunities and hence the possibility of choosing a higher paying job.

2. Background

The spatial mismatch hypothesis was premised on the observation that employment was quickly suburbanizing as US cities decentralized alongside widespread highway and housing construction. At the same time, Blacks were largely restricted from moving to newer suburban neighborhoods due to a host of racial discriminatory practices. Thus, Black residents were increasingly physically separated from employment opportunities. Kain (1968) hypothesized that this distance was at least partially responsible for explaining high concentrations of unemployment among African American residents in central city locations. Over the past few decades, the stark poor and minority central city and white suburban dichotomy that described US cities of the 1960s has begun to change. The demand for

urban amenities and accessibility has rejuvenated many urban cores, elevating property values, and forcing those unable to keep up with rising rents, to less-accessible, amenity deserts in older suburbs (Cooke & Denton, 2015; Raphael & Stoll, 2010). These shifting dynamics are not only the case for US cities—many European cities are contending with the same gentrification and poverty suburbanization forces as well (Bailey & Minton, 2018; Hochstenbach & Musterd, 2018). Thus, this 'Great Inversion' (Ehrenhalt, 2012) of sorting by income in cities calls for a re-evaluation of our understanding of (1) the spatial distribution of the low-income population, (2) the spatial distribution of low-wage jobs, and (3) the transportation infrastructure that connects them.

Theoretically, if the physical separation between poor residents and employment has been caused by center-city poverty and the suburbanization of jobs, then the movement of the poor towards the suburbs may prove favorable in diminishing this physical separation. On the other hand, businesses may also be relocating due to these shifting residential demands and an increased desire to be in central city locations. There are of course nuances to these relationships—lower-wage manufacturing jobs have decentralized more than service sector jobs that benefit from knowledge transfer and agglomeration effects (Glaeser & Kahn, 2001). Some empirical studies have suggested that shifting urban dynamics including suburbanization are changing the job accessibility landscape (Hu, 2015) and that the suburban poor are at a disadvantage in terms of proximity to nearby jobs (Raphael & Stoll, 2010).

The literature to date is largely in accordance that a greater separation between workers and jobs is a deterrent in finding employment, and that job access therefore impacts labor market outcomes—a finding that has held true across various continents including in US cities (Gobillon, Selod, & Zenou, 2007; Ihlanfeldt & Sjoquist, 1998; Theys et al., 2019), Europe (Matas, Raymond, & Roig, 2010; Sari, 2015), and Latin America (Boisjoly, Moreno-Monroy, & El-Geneidy, 2017). Both search and commuting costs increase with distance for residents and firms alike. A further distance also restricts information on potential job opportunities and likely excludes job seekers from critical social networks in finding opportunities (Ihlanfeldt & Sjoquist, 1998). For low or minimum wage workers, commuting costs may quickly exceed pay, especially if the position is part-time (Sanchez, 1999). Given these mechanisms, the empirical evidence testing the relationship between job access and employment outcomes has largely yielded significant and positive results (Allard & Danziger, 2002; Åslund, Östh, & Zenou, 2010; Immergluck, 1998). However, some differences emerge on the magnitude and significance of this relationship when differentiating workers by income, suggesting that access may matter less for lower-income residents who tend to have worse employment outcomes despite higher levels of job access (Hu, 2017). A-spatial considerations that may deter lower-income

workers from capitalizing on their location advantage include a mismatch in skills, networks, information (Ihlanfeldt & Sjoquist, 1998; Stoll, 2005), or access to transit or an automobile (Grengs, 2010; Hu, 2017; Shen, 1998; Wang, 2003). Access to employment by transit appears to be an especially important consideration in cities outside of the United States (Matas et al., 2010; Sari, 2015).

Several more recent re-evaluations of this relationship point to the continued dichotomy in findings. Jin and Paulsen (2018) examined the effects of employment access on unemployment rates and household income, differentiated by income group and job sector for the city of Chicago. They found that increased access was associated with a decline in unemployment and an increase in median incomes among low-income households. They argue that prior studies that found contrasting results failed to account for the fact that labor market outcomes and residential location patterns are endogenous, and they correct this using an instrumental variable approach. Following that logic, Hu (2019) used a sub-sample of the Los Angeles population who had resided in their homes for a long time, and thus their residential location choices preceded employment decisions. For that polycentric city, access to jobs was insignificant in explaining employment for white and black job seekers, but it was significant for Hispanics and Asians. Clearly a consensus on the subject has yet to be reached and may vary by geographic context including urban form, employment sector composition, and residential segregation history. Chicago and Los Angeles are archetypical cities of contrasting urban form with Chicago largely following a monocentric and ordered spatial pattern to development and residential sorting, and Los Angeles the prototypical post-modern, polycentric, and auto-dominated city (Delmelle, 2019).

Our article contributes to this ongoing debate by examining the relationship between job access and labor market outcomes in a rapidly growing US Sunbelt city of Charlotte, North Carolina. We control for endogeneity following the approach outlined by Jin and Paulsen (2018) and segment between the income category of job seekers and the wage category of jobs.

3. Data and Empirical Approach

3.1. Study Area and Data

Our study area is the Charlotte-Concord-Gastonia Metropolitan Statistical Area (MSA) which consists of 10 counties in North Carolina (Mecklenburg, Union, Gaston, Cabarrus, Iredell, Rowan, and Lincoln counties) and South Carolina (York, Lancaster, and Chester counties). With a population of 2.569.213 (according to the American Community Survey [ACS] 1-year estimates in 2018) it is the largest metropolitan area in the Carolinas. The core city of Charlotte is one of the fastest growing cities in the US with a population of 872.498, represent-

ing a 18.6% increase since 2010 (United States Census Bureau, 2020). However, its outlying towns have been growing at a faster pace partly due to rising costs of housing in the urban core (Chemtob & Off, 2019). As the city has grown, it has seen an increase in the suburbanization of its poor population as well as job sprawl (Raphael & Stoll, 2010). Charlotte is also battling economic mobility issues, as assessed by the likelihood that an individual born in the lowest income quartile will move to a higher quartile later in life. The city ranked last among the 50 largest US cities in this measure of upward mobility (Chetty, Hendren, Kline, & Saez, 2014). In response to this, the Leading on Opportunity Council was formed in 2017 to address economic mobility issues in the city (Leading on Opportunity, 2020). Like many other places around the US, the Charlotte has experienced increasing poverty rates in the less dense parts of the MSA between 1990 and 2017 as seen in Figure 1.

The Charlotte MSA is not a monocentric city. Instead, employment and households are relatively spread out across the city of Charlotte and in its surrounding towns and cities (as will be further shown in Section 3.4). This is evident in Figure 2, which shows the location of spatial clusters of low-income households and low-wage sector jobs throughout the MSA in 2010 and 2017. The maps depict a Local Moran's I statistic (Anselin, 1995) on the count of low-wage jobs and low-income households. This statistic essentially compares the value jobs or households in a census block group and its adjacent block groups to the average for the entire metro. When a block group and surrounding neighborhoods are greater than the mean (and statistically significant), they are denoted as a 'high-high' cluster. When they are both statistically significantly lower than the average, they are indicated as 'low-low.' When a block group is higher than the mean, but its adjacent block groups are lower, it is denoted as 'high-low,' and the reverse is true for 'low-high' symbols.

According to the figure, high-high concentrations of low-income households are present within the Charlotte beltway in the county in the center of the map (Mecklenburg). Between 2010 and 2017, the spatial expansion of high clusters of low-income households extends in a crescent within this loop—these neighborhoods are primarily older, low-density, first and second-ring suburban neighborhoods. The concentration of housing constructed between the 1950s and 1960s in Charlotte proved to be a significant indicator of neighborhood socioeconomic decline between 2000 and 2010 (Delmelle & Thill, 2014), and the pattern in the maps in Figure 2 suggest that this trend continued through the second decade as well.

As for lower-wage jobs, a rather major cluster can be found near the border, and crossing into neighboring South Carolina counties in 2010, a pattern that becomes more pronounced in 2017. Other high-high clusters of low-wage sector jobs are found in Iredell County to the north and Union County southeast of Mecklenburg County where Charlotte is the county seat.
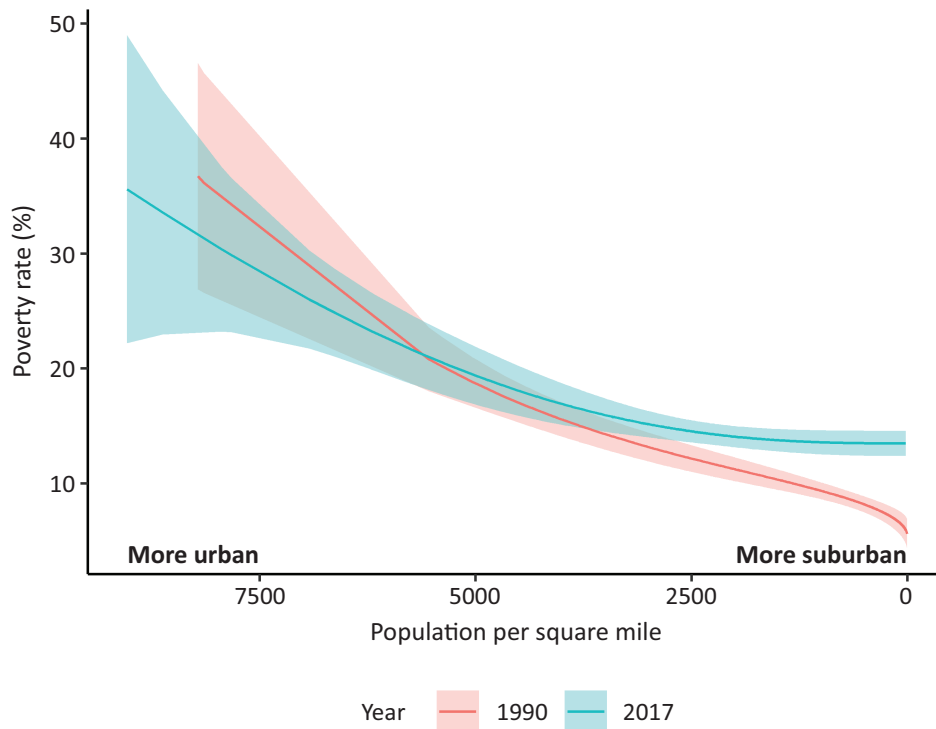
Figure 1. Average census block group poverty rates with 95% confidence bands vs. population density in 1990 and 2017.

Taken together, these maps paint a portrait of a polycentric city with low-wage and low-income households increasingly spread out away from the very center of the city's core. This dispersion away from the center does not create a visual appearance of an increased spatial mismatch between the two.

Socioeconomic and demographic data for this study comes from the ACS 5-year block group estimates which we use as point estimates for 2010 (2006–2010) and 2017 (2013–2017). Firm level job counts in 2010 and 2017 are obtained from InfoGroup's referenceUSA Historical Business database (referenceUSA, 2020). It includes the address of the business, number of employees, and its industry classification (NAICS codes). To obtain a proxy for the number of jobs at the block group level, we aggregate the number of employees in each two-digit NAICS sector by block group in 2010 and 2017, respectively. Hence, while employment rates, calculated as the number of employed over the total, non-institutionalized, civilian population 16 years old and over, and other socio-economic and demographic variables by block group comes from the ACS block group estimates, job counts (or employment) is aggregated to the block group level from firm level employment data.

3.2. Accessibility Measures

To measure job accessibility, we apply the gravity model proposed by Shen (1998) and applied by Jin and Paulsen (2018) and Hu (2013, 2015, 2017). Merlin and Hu (2017) find a higher association between employment and accessibility when using Shen's approach as compared

to accessibility metrics that do not incorporate competition. The metric is essentially a spatially weighted jobs to worker ratio as it considers the number of jobs in the numerator and job seekers in the denominator, both subject to a distance decay parameter. The model is specified as follows:

$$A_i = \sum_j \frac{E_j e^{-\gamma d_{ij}}}{D_j}, \; D_j = \sum_j P_k e^{-\gamma d_{ij}} \quad (1)$$

Where A_i is accessibility of residents living in block group i. E_j are the potential jobs in block group i which is represented by job counts aggregated from firm level employment data, γ is a distance decay parameter and d_{ij} is the network-based drive-time between the origin and destination block group centroids. For this analysis, we only consider accessibility by car since the city of Charlotte and its surrounding area are auto-centric. The city of Charlotte, which has the most built out public transit system compared to other places in the MSA, 85.1% of workers commuted to work by car and only 2.8% by public transit according to 2018 ACS 1-year estimates. D_j is the demand potential in block group j. P_k is the number of potential job seekers in location k measured by the total working age population or the number of low- and high-income households, respectively, depending on the measure.

Using this formula, we calculate three different accessibility measures. First, we calculate an overall job accessibility index (ACC) which includes job counts in all industries and the working age population (16 years and over) in the civilian labor force in each block group.
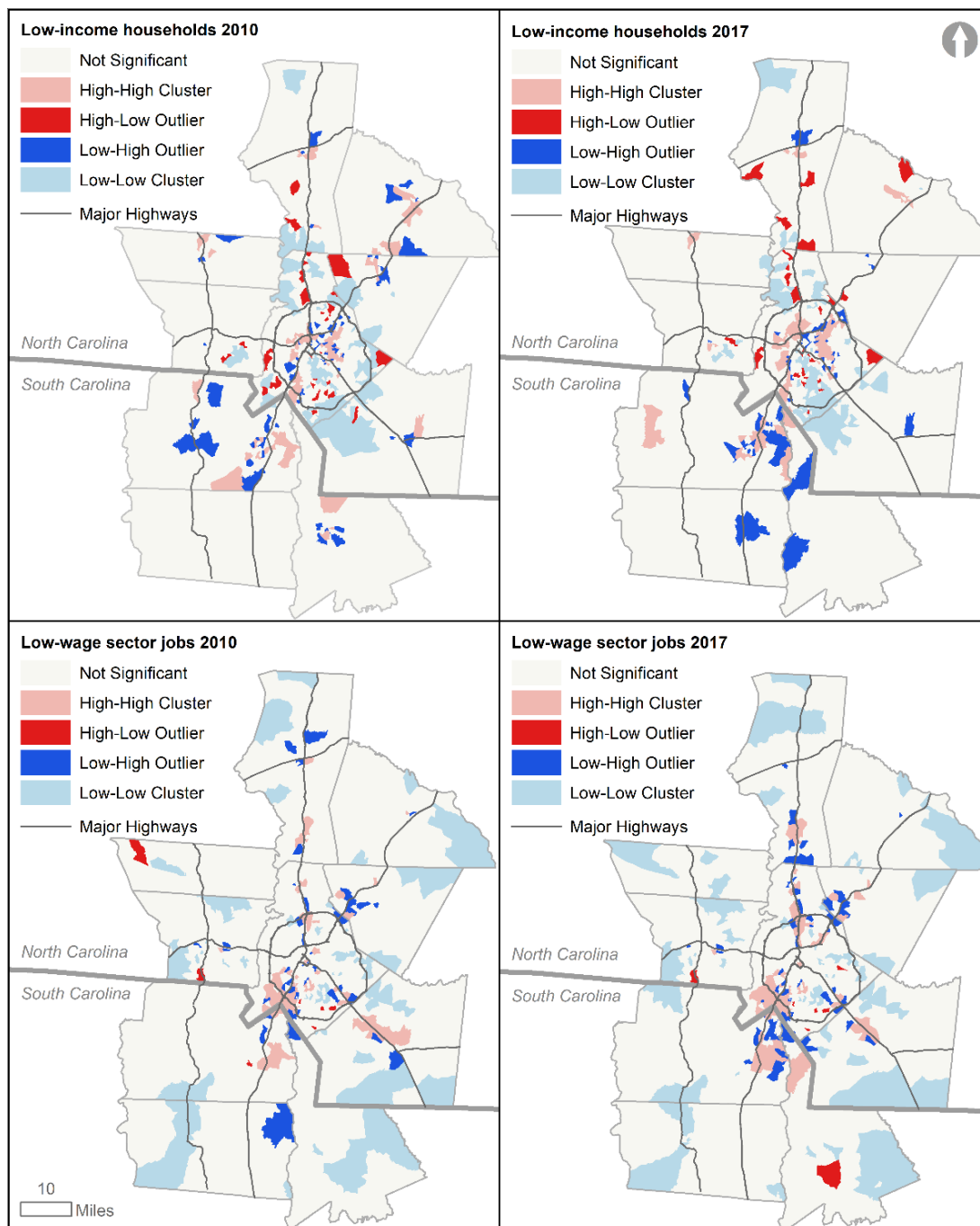
Figure 2. Local Moran's I clusters of low-income households and lower-wage jobs in 2010 and 2017, respectively.

Second, we construct an index for low-income households to jobs in sectors which are more likely to have entry-level or lower-skilled (hence lower-wage) positions available (ACC_LIH). These include Manufacturing (NAICS 31–33), Wholesale trade (42), Retail trade (44–45), and Accommodations & food services (72). Finally, we calculate accessibility for high-income households to jobs in sectors which are more likely to have higher-skilled and higher-wage positions available (ACC_HIH). These include Information (NAICS 51), Finance and Insurance (NAICS 52), Professional, Scientific and Technical Services (NAICS 54), and Management of

Companies and Enterprises (NAICS 55). To define low- and high-income households, we use the definitions set out in the Home Mortgage Disclosure Act (HMDA) and the Community Reinvestment Act (CRA; see e-CFR, 2019, section 228.12(m)). Using this classification has the advantage of making the classification time and MSA specific. Low-income households are those whose income is less than 50% of MSA median household income and high-income are those with 120% or more of MSA median household income. The ACS data on number of households by income categories has 15 categories. We chose the income categories that come closest to

matching the HMDA/CRA thresholds in each respective year.

Finally, for our distance-decay parameter, absent of empirical commuting data from which to estimate γ, we turn to other empirical estimates from the literature and test the sensitivity of our model on a range of values. Recently, Ding and Bagchi-Sen (2019) estimated commuting decay parameters by job sector for the city of Buffalo, New York. Their estimates ranged from 0.396 for low-income workers to low-wage jobs to 0.4064 for all workers to all jobs. On the lower-end, Hu and Giuliano (2014) use a value of 0.1039 based on Los Angeles commuting flows. Other studies simply do not report which parameter they use (Jin & Paulsen, 2018). We begin with the separate estimates by worker and wage category reported by Ding and Bagchi-Sen (2019), but also test the robustness of our model on values up to 1 and find no qualitative difference in our results.

3.3. Empirical Model

Since residential location is likely endogenous with other factors that influence labor market outcomes, we follow Jin and Paulsen (2018) and Mouw (2000) by estimating a first-difference, two-stage least squares model. This approach is applied to deal with various sources of potential endogeneity, including self-selection in residential location, reverse causality between labor market outcomes and job accessibility, neighborhood unobservables, and the relationship between household sorting by employment accessibility and income. In the first stage, the expected change in job accessibility of people living in neighborhood (block group) i between 2010 and 2017, $\widehat{\Delta A_i}$, is estimated on a set of instrumental variables and controls:

$$\widehat{\Delta A_i} = f(DISTMR_i, DISTSC_i, \Delta \boldsymbol{X}_i) \qquad (2)$$

where $DISTMR_i$ is the network distance from the centroid of block group i to the nearest major road and $DISTSC_i$ is the network distance to the centroid of the nearest employment subcenter, both in miles. The identification of employment subcenters are outlined in Section 3.4. $\boldsymbol{X}_i$ is a vector of neighborhood characteristics including changes in educational attainment, racial and income composition, population density, and average household size between 2010 and 2017 in block group i. While there is reason to believe that job accessibility is endogenous to labor market outcomes (Jin & Paulsen, 2018; Mouw, 2000), we need to test the exogeneity of this regressor since ordinary least-squares (OLS) is consistent and more efficient than instrumental variable estimation if the potential endogenous regressor is exogenous (or weakly endogenous). To test the exogeneity of change in accessibility we apply the Hausman LM-test. Another important assumption of the instrumental variable approach is that the instruments are valid (or exogenous). To test for the exogeneity of the instruments, we apply the Sargan test on the validity of the instruments (Heij, Boer, Franses,

Kloek, & Dijk, 2004). If change in accessibility is endogenous and its instruments valid, we regress the change in labor market outcomes (employment rates and median household income, separately) on the estimated change in job accessibility (from stage one) and neighborhood (block group) characteristics:

$$\Delta LMO_i = \beta_1 \widehat{\Delta A_i} + \boldsymbol{\beta}' \Delta \boldsymbol{X}_i + \Delta \varepsilon_i \qquad (3)$$

If change in accessibility is exogenous (or weakly endogenous) according to the tests, the model in Equation 3 is estimated using the actual change in accessibility (ΔA_i). Finally, there is reason to suspect that changes in labor market outcomes at the neighborhood level is spatially dependent given stronger interactions between nearby neighborhoods relative to more distant ones, and due to residential sorting and segregation by socioeconomic and demographic characteristics. Hence, we test the model in Equation 3 estimated using OLS for spatial autocorrelation in the residuals using Moran's I statistic. If there is evidence of spatial dependence, we estimate the model in Equation 3 as either a spatial lag model (Equation 4) or spatial error model (Equation 5), depending on the type of spatial dependence indicated by Lagrange Multiplier (LM) tests (Anselin, 1988). The spatial lag model is as follows:

$$\Delta LMO = \rho W \Delta LMO + \beta_1 \widehat{\Delta A} + \boldsymbol{\beta}' \Delta \boldsymbol{X} + u \qquad (4)$$

where W is a row-standardized, contiguity-based (Queen's case) spatial weights matrix, ρ is a spatial autoregressive coefficient accounting for spatial dependence in the data generating process, and u is a vector of residuals. The error model is specified as:

$$\Delta LMO = \beta_1 \widehat{\Delta A} + \boldsymbol{\beta}' \Delta \boldsymbol{X} + u \qquad (5)$$

$$u = \lambda W u + \varepsilon$$

where ε is an independently but not necessarily identically distributed error term.

3.4. Identification of Employment Subcenters

To identify employment subcenters in the Charlotte MSA, we use the 2010 referenceUSA business establishment data and the 95%–10K method introduced by Giuliano, Hou, Kang, and Shin (2015) and applied by Boarnet and Wang (2019). For this purpose, the Charlotte MSA is divided into 5,421 hexagons where each hexagon has an area of one square mile. Employment centers are defined as those hexagons with employment density greater than the 95th percentile of the entire MSA in year 2010, or 1.067 jobs per square mile. Subsequently, contiguous employment center hexagons are grouped together into candidate subcenters. Candidate subcenters with at least 10.000 jobs are identified as employment subcenters. This results in 12 employment subcenters in the Charlotte MSA which are shown in Figure 3. These subcenters consists of a total of 642.828 jobs, or 56.8% of the total number of jobs in the Charlotte
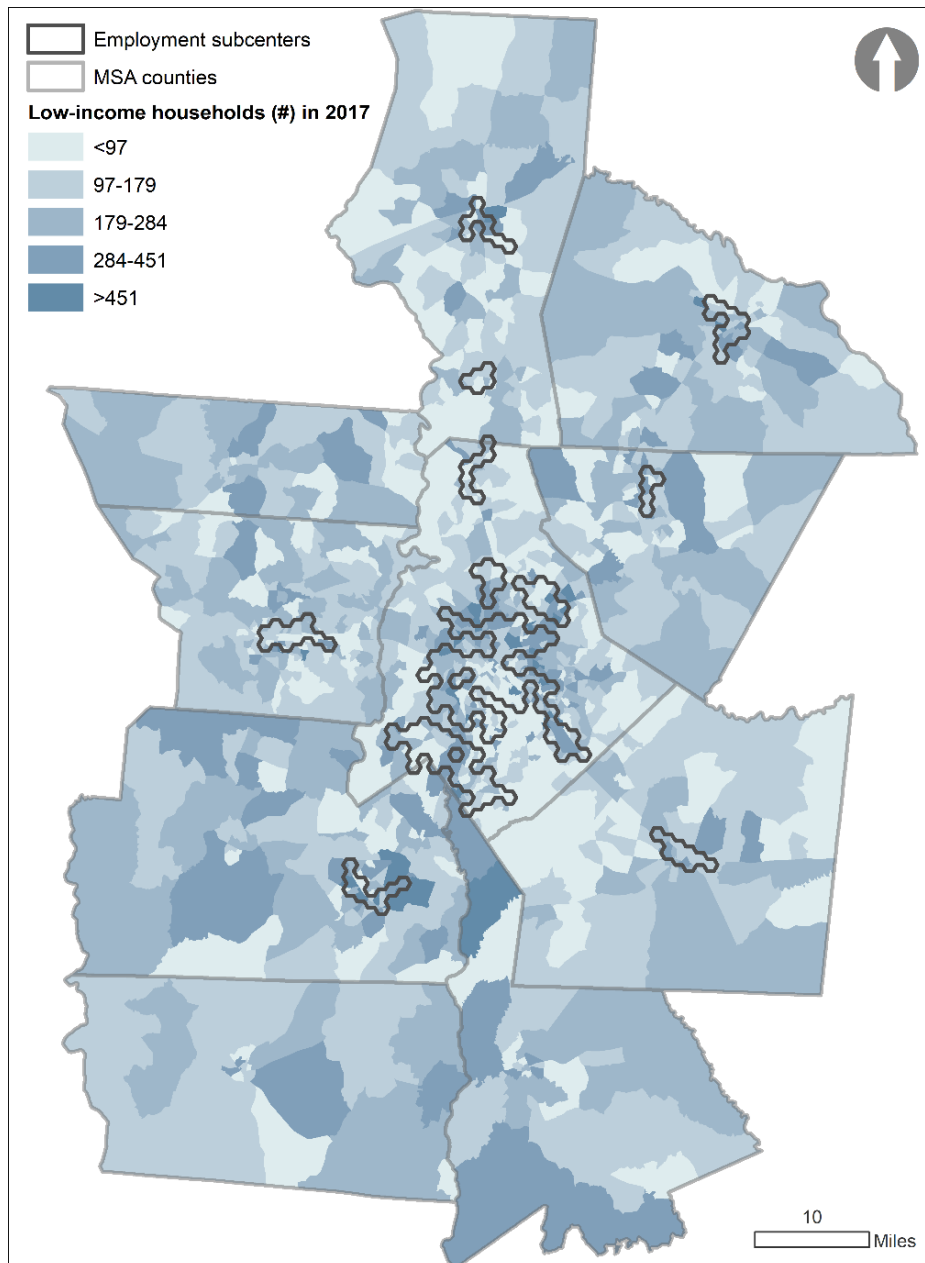
Figure 3. Employment subcenters in the Charlotte MSA.

metro region. As noted in Section 3.1, this shows the non-monocentric nature of job locations in the Charlotte MSA with employment subcenters located in the bedroom communities to the urban center of Charlotte. The job composition in the subcenters versus the remaining MSA is quite similar. In 2017, the lower- versus higher-wage job split in the subcenters was 34%/17% while this split in the remaining parts of the MSA was 35%/10%.

4. Results

Table 1 shows descriptive statistics for the variables used in the analysis. While one would expect employment rates to have increased on average between 2010 and 2017, recall that the employment rate is calcu-lated over the total (non-institutionalized civilian) popu-lation 16 years and older. In fact, unemployment rates have decreased on average by 1.88 percentage points. The explanation for this is likely that Charlotte has experi-enced a large population growth and, as noted by Graves and Kozar (2015), not at the same rate as the employ-ment opportunities in the city. Hence, this has likely led to the denominator in the employment rate calculation to increase at a relatively faster than the numerator in many neighborhoods. Median household income on the other hand has risen by approximately $6,000 on aver-age. As for accessibility, overall accessibility and acces-sibility for higher-income households has reduced while accessibility for lower-income households has increased since 2010, on average.

Table 1. Descriptive statistics for census block groups.

Variable	Meaning	Mean (sd)
ΔER	Employment rates (%)	−0.54 (10.71)
ΔMEDHHINC	Median household income ($1,000)	6.00 (16.48)
ΔACC	Accessibility for population 16 years old and over in labor force to all jobs	−0.31 (5.16)
ΔACC_HIH	Accessibility for high-income households to high-wage jobs	−0.36 (6.00)
ΔACC_LIH	Accessibility for low-income households to low-wage jobs	1.11 (5.62)
ΔBLACK	Share of African American population (%)	0.76 (11.73)
ΔHIGHINC	Share of high-income households (%)	4.71 (11.61)
ΔLOWINC	Share of low-income households (%)	−2.47 (12.82)
ΔEDUC	Share of residents with at least a bachelor's degree (%)	3.35 (10.21)
ΔHHSIZE	Average household size	0.08 (0.43)
ΔPOPDEN	Population density (population per square mile)	244.30 (847.07)
DISTMR	Distance to major road (miles)	1.77 (1.81)
DISTSC	Distance to employment subcenter (miles)	5.32 (4.77)
N		1332

Notes: All difference variables are indicted by Δ and refers to difference between year 2010 and 2017. All changes in percentage variables are calculated as percentage point changes.

4.1. Relationship between Job Access and Employment

We now turn to the regression results for our first dependent variable: changes in employment rates at the block group level, following the Equation 3 and presented in Table 2. Overall, the three models (for all household, low-income households, and high-income households) find that changes in accessibility have no significant impact on changes in employment rates.

As for model selection, the Hausman exogeneity test suggest that both the overall accessibility measure (ACC) and the accessibility measure for higher-income households (ACC_HIH) is endogenous with employment rates while the accessibility measure for lower-income households (ACC_LIL) is exogenous. The Sargan test cannot reject the null hypothesis of the instruments being exogenous (or valid) for the two models where change in accessibility was deemed endogenous. All three models show significant spatial autocorrelation in the residuals with the LM-test favoring spatial lag as best describing the spatial dependence structure. Therefore, the ACC and ACC_HIH models are estimated as two-stage least squares spatial lag models while ACC_LIL is estimated as a spatial model with the actual change in accessibility included.

While accessibility was not a significant predictor of employment, the estimated coefficients for other (statically significant) variables are as expected and robust across model specifications. For example, increases in education attainment has a positive effect on employment rates. Increases in the share of low-income or high-income households in the neighborhood is associated with a decrease or increase in employment rates. We also find that increases in the share of African American

population in the neighborhood is associated with an increase in employment rates. Finally, the significant spatial autoregressive parameter suggests that block group employment rates are positively related to neighboring employment rates.

4.2. Relationship between Job Access and Median Household Income

For the models of median household income, presented in Table 3, we do find a significant, positive relationship between accessibility and neighborhood median income in the case of low-income households (ACC_LIH). In this case, we find that increasing accessibility for lower-income households could have a positive effect on neighborhood median household incomes, but this same effect is not found for the overall model or for higher-income households.

With respect to model selection for this dependent variable, the Hausman exogeneity test suggest that the different accessibility measures are exogenous. Hence all three models are estimated with the non-instrumented change in accessibility. Moran's I and the LM-tests suggests that the ACC and ACC_HIH models should be estimated as spatial error models while the ACC_LIH model shows no significant spatial autocorrelation in the residuals and is therefore estimated using OLS. Aside from accessibility, other independent variables are similar to those of the employment rate model with increases in educational attainment and share of high-income household having a positive effect on neighborhood median household income. As expected, an increase in the share of low-income households is associated with a decrease in median household income. We find some weak evi-

Table 2. Estimation results for changes in employment rates using spatial lag.

Variable	ACC (lag, 2SLS)	ACC_LIH (lag)	ACC_HIH (lag, 2SLS)
ΔBLACK	0.061***	0.061***	0.061***
	(0.022)	(0.022)	(0.023)
ΔHIGHINC	0.126***	0.125***	0.127***
	(0.025)	(0.024)	(0.025)
ΔLOWINC	−0.269***	−0.271***	−0.270***
	(0.023)	(0.022)	(0.023)
ΔEDUC	0.088***	0.089***	0.087***
	(0.027)	(0.027)	(0.027)
ΔHHSIZE	−1.228*	−1.229*	−1.216*
	(0.654)	(0.651)	(0.654)
ΔPOPDEN	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
ΔACC	0.014		
	(0.130)		
ΔACC_LIH		−0.030	
		(0.047)	
ΔACC_HIH			0.039
			(0.118)
Constant	−1.858***	−1.868***	−1.852***
	(0.305)	(0.308)	(0.305)
ρ	0.381***	0.318***	0.382***
	(0.095)	(0.100)	(0.095)
N	1352	1352	1352
Pseudo R^2	0.180	0.182	0.181
Hausman test	12.698***	0.679	5.957**
Sargan test	0.002	11.319***	1.644
Moran's I (residuals OLS)	1.854*	2.318**	2.173**
LM (lag)	4.914**	7.662***	6.340***
LM (error)	3.066*	5.034**	4.253**

Notes: ***, **, and * denotes statistical significance at 1%, 5%, and 10%; standard errors in parentheses.

dence that increasing population density is associated with increasing median household incomes. This could be attributed to the rebirth of the Charlotte center-city and its surrounding neighborhoods.

5. Conclusion

The debate surrounding the impact of accessibility on labor market outcomes first proposed by Kain (1968) has yet to be settled—issues of measurement and model specification have yielded contrasting results—and the urban landscape initial described by Kain (1969) has undergone dramatic transformations across many cities. In this study, we re-examine this relationship in the rapidly growing, southern city of Charlotte, North Carolina, and its encompassing metropolitan area. Charlotte's dynamics have featured both strong greenfield suburbanization and center-city revitalization and gentrification, while poverty has increasingly shifted towards older, first-ring suburbs. However, job locations, especially lower-income jobs, are relatively spread out across the Charlotte MSA and clusters of low-wage jobs and lower-income households often coincide in space. Within this context, we estimated how changes in accessibility at the block group level impacted changes in employment rates and median household incomes between 2010 and 2017. We controlled for the potential endogeneity of residential location choices and labor market outcomes using the two-stage instrumental variable approach proposed by Jin and Paulson (2017) and also account for spatial dependence in our model specification where appropriate. We differentiated our models between low- and high-wage workers and low- and high-skilled jobs.

Our results suggest that changes in job accessibility had no significant impact in changes in neighborhood employment rates. This is likely explained by the relatively close distribution of lower-wage jobs and

Table 3. Estimation results for changes in median household income ($) using spatial error and OLS.

Variable	ACC (error)	ACC_LIH (OLS)	ACC_HIH (error)
ΔBLACK	1.308	−7.431	−1.516
	(34.468)	(34.333)	(34.525)
ΔHIGHINC	661.888***	668.276***	661.210***
	(38.008)	(38.068)	(38.053)
ΔLOWINC	−388.892***	−379.806***	−392.809***
	(34.652)	(34.730)	(34.601)
ΔEDUC	145.601***	158.137***	146.722***
	(41.187)	(41.208)	(41.192)
ΔHHSIZE	1757.473*	1432.462	1802.062*
	(993.291)	(993.478)	(993.943)
ΔPOPDEN	0.704	0.978**	0.787*
	(0.495)	(0.485)	(0.491)
ΔACC	−101.362		
	(81.348)		
ΔACC_LIH		240.859***	
		(71.943)	
ΔACC_HIH			−3.950
			(68.205)
Constant	−6.891	−312.354	−8.481
	(486.523)	(460.085)	(489.310)
λ	0.089**		0.096**
	(0.044)		(0.044)
N	1352	1352	1352
Pseudo R^2	0.380	0.384	0.379
Hausman test	1.172	2.152	0.457
Sargan test	1.521	1.875	3.857**
Moran's I (residuals OLS)	1.860*	1.409	1.993**
LM (lag)	2.732*	2.128	3.142*
LM (error)	3.180*	1.792	3.693**

Notes: ***, **, and * denotes statistical significance at 1%, 5%, and 10%; standard errors in parentheses.

lower-income households in the Charlotte MSA. In other words, the spatial separation between lower-wage workers and their workplaces is already relatively small. However, we found that increased accessibility for lower-income households was associated with higher median incomes. One possible explanation for these results is that accessibility does not necessarily have an influence on whether or not low-income households obtain employment, but greater accessibility does lead to a greater set of employment opportunities to choose from and hence the possibility of choosing a higher paying job.

Our results contrast those of Jin and Paulson (2017) for the city of Chicago who did find a positive relationship between access and labor market outcomes. However, they are consistent with Hu's (2019) analysis for Los Angeles. In a prior study, Hu (2015) similarly found that the dynamics of poverty suburbanization in Los Angeles served to mitigate the spatial mismatch between low-income residents and employment opportunities. Collectively these differences may be ascribed to contrasts in urban structure—Charlotte is more akin to the polycentric nature of Los Angeles as compared to the more monocentric Chicago. Together, these results suggest that a more polycentric city-structure could potentially mitigate spatial mismatch. Though more comparative analyses are needed, our analysis adds a piece of evidence to this debate.

Like Hu (2015), we do not find support for the argument that access to jobs is a barrier to employment among lower-income residents, and thus other non-spatial factors and policies are likely to be more successful in lowering unemployment rates. However, our finding on the relationship between access and income could prove beneficial in ameliorating some of the upward economic mobility problems faced by Charlotte's lowest-income residents (Chetty et al., 2014). Future research should further probe the hypothesis that access to a larger number of employment opportunities

does indeed result in increased wages among lower-income residents. This idea holds some support in the literature that has linked larger labor markets with better matching between job seekers and opportunities—or a reduction in skills mismatch (Büchel & van Ham, 2003).

This study is not without limitations and results should be viewed in lieu of these. First, estimates are based on aggregate block group data and for the low- and high-income accessibility measures, we used household-based data and not the actual working population within those categories. Second, we only consider auto-based accessibility. Although commutes to work by public transit in the Charlotte MSA is low, accounting for car availability or transit access could provide additional insight on transportation barriers to employment. Finally, as perhaps expected, our model fit for the employment-based models is relatively low suggesting that there are omitted factors that influence employment rates. As noted in the literature, there are other factors that are likely more important in explaining low employment rates such as lack of relevant skills, racial discrimination in hiring, or social networks, among others (Houston, 2005; Ihlanfeldt & Sjoquist, 1990; Theys et al., 2019).

Acknowledgments

Conflict of Interests

The authors declare no conflict of interests.

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Article

Overlap Between Industrial Niching and Workplace Segregation: Role of Immigration Policy, Culture and Country of Origin

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Abstract

This article focuses on two dimensions of labour market integration, sorting into different industries (niching) and sorting into workplace establishments (segregation) by share of migrant workers. We seek to understand to what degree these two dimensions of immigrants' lack of labour market integration—niching and segregation—overlap with each other. The study is based on Finnish individual, panel and relational registry data, and we focus on the three largest immigrant groups—Estonians, Russians and Swedes—who have arrived from countries with different wealth levels to the Helsinki metropolitan area. By applying generalised structural equation modelling, we estimate industrial niching and workplace segregation—measured as a degree of overconcentration of immigrants in particular industries and workplace establishments, respectively—jointly. Our main findings show a strong overlap between niching and segregation for all ethnic groups. Segregation and niching levels are the highest among Estonians, but very similar for Russians and Swedes. These findings do not support the cultural similarity argument in immigrant labour market integration. Rather, immigration policy and origin country wealth level may be determinant. Additionally, we found that females are more likely than males to be employed simultaneously in niched industries and segregated workplace establishments, supporting the thesis of gender-based networks.

Keywords

country of origin wealth level; immigration; labour market; niching; segregation

Issue

1. Introduction

Immigrant labour market integration is often seen as an important pathway for immigrants' better inclusion in the host society (Tesfai, 2019; Tuccio, 2020). Although many migrants fare well in the labour market, they tend to be overconcentrated in those jobs that are less attrac-tive for natives (Napierała & Wojtyńska, 2017; Ruiz & Vargas-Silva, 2018). As a consequence, a 'polarised' or 'dual' labour market may emerge with migrants being overrepresented in jobs with lower pay and lower social security, and natives being overrepresented in jobs with higher pay and higher social security (Christopher & Leslie, 2015; Halbmeier, 2019; Sassen, 1990). The poor

labour market performance of immigrants relative to natives has been related to different mechanisms of discrimination and exclusion such as ethnically segregated networks and stereotypical thinking by native employers (Arrow, 1998; Bursell & Jansson, 2018; Hensvik & Skans, 2016). Immigrant productive characteristics—e.g., education and formal qualification in the country of origin, as well as previous experiences—are often also of less value in the destination country (Fellini, Guetto, & Reyneri, 2018).

This article aims to shed new light on immigrant labour market integration by focusing on the overlap between immigrant sorting into certain industries (niching) and workplace establishments (segregation) and how it varies across ethnic groups and different skills levels. In our study, we do not seek to find causal inference as it is assumed in previous research. Instead, we draw our empirical design on the assumption of interdependency, in the further text we refer to it as overlapping, of workplace segregation and industrial niching. By overlapping we assume the degree of interdependency between the levels of workplace segregation and the levels of industrial niching. Previous research shows that both high levels of industrial niching and high levels of workplace segregation may negatively affect immigrant labour market integration associated with workplace segregation (Tomaskovic-Devey, Hällsten, & Avent-Holt, 2015) and niched employment (Gleave, 2017). Migrants who work both in segregated workplaces and in industrial niches are the most isolated in the host country's labour market and as a consequence, such isolation brings wage penalties (Catanzarite & Aguilera, 2002). Hence, the negative effect may be even stronger if the work is taking place in both an industrial niche *and* a migrant-intensive workplace. However, less is known about the extent of the overlap between industrial niching and workplace segregation. This is an important knowledge gap since various dimensions of immigrant integration tend to be related (Tammaru, van Ham, Marcińczak, & Musterd, 2015).

Building on the seminal work by Wright, Ellis, and Parks (2010), we define industrial niching as an overconcentration of immigrants in certain industries and we define workplace segregation as an overconcentration of immigrants in certain workplace establishments. We seek answers to three research questions: First, to what degree do industrial niching and workplace segregation overlap with each other? Although the study by Wright et al. (2010) theoretically discussed the importance of a joint analysis of niching and segregation, they were not able to strictly measure the overlap between these two dimensions. More specifically, we will advance their research in the following directions: (1) We measure the workplace ethnic composition at the establishment level as is common to matched employer-employee data-based studies (Hellerstein, McInerney, & Neumark, 2011; Rahnu, Puur, Kleinepier, & Tammaru, 2019) and (2) adopt a panel research design and we

apply generalised structural equation modelling on the data, which allows measuring the overlap between niching and segregation.

Second, are there differences in the overlap between industrial niching and workplace segregation by country of origin? Previous research reveals diverse patterns of labour market integration for different migrant groups (Hedberg & Tammaru, 2013; Ruiz & Vargas-Silva, 2018; Wright et al., 2010). Coming from a culturally more distant and economically less affluent country tends to contribute to a bigger disadvantage in the labour market (Tesfai, 2019). Likewise, immigration policies affect migrants from different origin countries in different ways (Söhn, 2013). The country of origin determines labour market position in the host country especially for newly-arrived migrants as the migration policies apply different entry requirements and work permits for different migrant groups.

Third, are there important differences in the overlap between industrial niching and workplace segregation by migrant gender, family status and skills? Previous research shows that niching is more common among lower-skilled migrants and, hence, immigrants tend to niche in manufacturing and the low-paid services sector (Lee, 2019). Niching is more common among men than among women, and men tend to niche into manufacturing and women tend to niche into domestic-work-related industries (Sánchez-Domínguez & Fahlén, 2018; Wright et al., 2010). As an innovation to existing studies, we extend our research by incorporating the family context into the analysis. As hiring is strongly based on social networks, marriage to a native partner is an important way to enter into a high segment of the labour market through host-country social networks (Dustmann, Glitz, Schönberg, & Brücker, 2016; Goel & Lang, 2019). More specifically, we are interested in whether migrants with a native partner differ from migrants with a migrant partner or without a partner when it comes to niching and segregation on the labour market.

Our study is based on Finnish register data for 2004–2013. The individual level, panel and relational nature of the register data allows us to provide a detailed account on the overlap of industrial niching and workplace segregation and how it varies by origin country, gender and skills. Since several country-specific barriers shape migration, we include countries with low and high migration barriers in the study. As the distance between host and home countries matters, we focus on neighbouring countries of Finland. Sweden and Estonia are culturally close to Finland and, as members of the European Union, enjoy free labour mobility. However, Sweden is more affluent while Estonia is less affluent than Finland. The third country to include in the analysis is Russia. Like Estonia, Russia is less affluent than Finland but unlike Estonia, migrants from Russia face higher obstacles to migration, as do all migrants arriving from outside the European Union. To factor out the differences between host country sub-labour markets (Ellis & Almgren, 2009;

Longhi, 2019), our research focuses on migrants living in the Helsinki metropolitan area (HMA).

The structure of the article is as follows. We begin with a literature review, starting with the debates on the 'dual labour market' (Doeringer & Piore, 1985) and how niching and segregation are related to the restructuring of the labour markets and 'social polarisation' (Sassen, 1990). We extend these debates by discussing how the country of origin context sort migrants in certain industries and workplaces (Åslund & Engdahl, 2019; Strömgren et al., 2014). Further, we discuss the role of immigrant personal characteristics and social networks (Ellis, Wright, & Parks, 2004). We proceed with the analysis by presenting descriptive data on immigrant niching and segregation first, followed by regression analysis. The article ends with a discussion of the main findings and the conclusion.

2. Literature Review

Although the research traditions on industrial niching and workplace segregation are separated, they offer many similar explanations to immigration labour market integration as related to globalisation, immigration and geographic changes in cities. Globalisation has given rise to large multinational corporations with different functions located in different parts of the world; the labour-intensive footloose jobs in manufacturing moved to low-wage countries while higher-order services, management and coordination functions stayed and expanded in high-wage countries (Sassen, 2011). Such changes have led to the dualisation (Doeringer & Piore, 1985) or polarisation (Sassen, 1990) of the labour markets.

For immigrants, it is often easier to get access to lower-paid jobs and, as immigration continues, migrants tend to cluster into certain industries and workplaces, leading to the formation of ethnic industrial niches and segregated workplaces (Ansala, Åslund, & Sarvimäki, 2020; Bygren, 2013; Liu, 2011; Waldinger, 1994). The overlap between industrial niching and workplace segregation of immigrants has several mechanisms that relate to (1) labour demand and personal characteristics of migrants such as age, gender and skills, (2) country of origin of immigrants that shapes the ease of entering the host country and its labour market and (3) social networks that link migrants and employers in countries of origin and destination as both the processes of immigration and hiring tend to hinge on information that flows in social networks.

2.1. Origin Country Context

The country of origin matters in industrial niching and workplace segregation of immigrants, e.g., because of cultural and linguistic differences (Penninx, 2005) or procedures of recognition of educational level and previous work experience of the migrants in the host country. Coming from a culturally distant country may

pose greater difficulties in skill recognition by the native employers because of the differences in country of origin and the host country's educational systems and labour market structures, sorting migrants to certain jobs and workplaces where skill mismatch is less problematic (Dustmann, Fabbri, & Preston, 2005; Hayfron, 2001). As a consequence, migrants tend to be over-educated for the jobs they are recruited for (Joona, Gupta, & Wadensjö, 2014; Visintin, Tijdens, & van Klaveren, 2015) and, hence, contribute to higher levels of industrial niching and workplace segregation.

Hiring through the ethnic network is very often considered to be a low-cost and risk-free option for the recruitment process (Hoffman, 2017). Companies seek to maximise the benefits of ethnic network hiring: decrease absenteeism at work (Hall, Iceland, & Yi, 2019; Hanson & Pratt, 1992), less friction (Liu, 2011) and better communication among ethnic workers (Ely & Thomas, 2001; Lancee, 2016). To shorten the searching process, many workplaces prefer to hire new workers through recommendations from already-employed workers (Alaverdyan & Zaharieva, 2019). Often companies use ethnic networks to hire workers from the closest residential areas and consider such living areas as labour pools (Bayer, Ross, & Topa, 2008; Ellis et al., 2004; Hellerstein et al., 2011; Manning & Petrongolo, 2017).

The hiring practices of ethnic entrepreneurs may contribute to immigrant niching and segregation as well. Ethnic enterprises often provide specific ethnic goods and services (such as restaurants) and tend to value co-ethnic co-workers not least because of trust but also because of customer demand for authentic goods. Because of those complementary forces, ethnic entrepreneurs tend to be more open to employing migrants compared to employing natives and compared to native entrepreneurs. This contributes to the niching of immigrants into certain industries as well as into certain workplace establishments (Strömgren et al., 2014). Because of the importance of ethnic networks, differences may exist not only between natives and migrants but also between migrants coming from different countries of origin.

Relative income differences between origin and destination countries may also matter concerning the sorting of migrants in the host country labour market. Migrants arriving from a less affluent country are attracted by higher incomes (Halbmeier, 2019). For them, earning higher incomes than in their country of origin may be a sufficient gain from migration. They tend to accept any job offer if relative wage will be higher in comparison with the previous wage in the country of origin. As a consequence, migrants from less affluent countries are employed in unsecure low-skilled jobs with a higher number of working hours and lower wages and cluster more in niched industries and ethnically segregated workplaces. Migrants arriving from more affluent countries often have different aspirations. They may trade lower income in a destination country for more motivating

career or business opportunities. Multinational companies staffing their branch offices tend to contribute to such moves by circulating managers between countries (Findlay & Cranston, 2015).

Origin country context also defines the selection process and requirements host countries apply for migrants. Those who emigrate from non-EU countries meet the high level of skills-selection in comparison with the European Union, which benefits from free-labour mobility. Two types of migration policies—sector- and employer-based—are directly related to the sorting into industries and workplace establishments; sector-based policies contribute to industrial niching and employer-based policies contribute to workplace segregation (Åslund & Engdahl, 2019). In Finland, our case study country, sector-based and employer-based policies co-exist, producing the overlap between industrial niching and workplace segregation.

2.2. Personal and Social Characteristics of Migrants

Although immigration policies set the broad framework for the entry of migrants, the actual migration flows are very diverse. Sorting in the labour market also relates to migrant skills and its interaction with the residential context (Liu & van Holm, 2019). Most migrants do not have a job waiting for them upon arrival in the host country (Tammaru et al., 2015), and they start looking for a job once settled. Highly-skilled migrants rely more on formal ways in finding a job, while low-skilled migrants tend to rely on ethnic networks and informal ways of finding a job. Newcomers may obtain information about job vacancies from co-ethnics that often relate to industries and workplaces that are already overrepresented by this ethnic group (Telve, 2019). When the host country language skills are poor, which is often the case with newcomers, immigrants are more likely pushed into the niched industry and in a segregated workplace (Liu, 2011).

Ethnic networks help migrants to settle but they may also reduce social inclusion of migrants into the host society and provide less motivation for local language learning (Skaptadóttir, 2019). The job-search process also hinges on the place of residence since workers tend to be disproportionally hired from the nearest residential areas (Ellis et al., 2004; Hellerstein et al., 2011). The ethnic clustering into neighbourhoods such as Chinatowns shapes sorting into industries and workplace establishments.

An important way of entering the social networks in the host country concerns getting married to a native person, which is often considered to be the ultimate form of social integration of migrants (González-Ferrer, Obućina, Cortina, & Castro-Martín, 2018; Rahnu et al., 2019). Having a native partner improves migrants' language skills, helps them learn the written and unwritten rules of the county and provides accesses to information about the labour market or even job vacancies. There

are also important differences in mixed ethnic unions by country of origin; immigrants who share similar cultural values and practices as natives are most likely to inter-marry with natives (Klein, 2001; Peach, 2005). The study by Strömgren et al. (2014) further found that migrants married to natives work in less segregated workplaces compared to other migrants.

Industrial niching and workplace segregation are also highly gendered (Ellis et al., 2004; Tammaru, Strömgren, van Ham, & Danzer, 2016). Given gender stereotypes and gendered social responsibilities, females and males tend to concentrate in different industries and workplaces. Cultural values may shape gender roles at work and at home in a way that has a direct effect both on female labour market participation as well as on their sorting into certain jobs. Because of housekeeping responsibilities and caretaking, females seek employment closer to home. The social networks of migrant women tend to be more neighbourhood-based and their social networks include more co-ethnics. Hence, living in segregated neighbourhoods tends to contribute more to female niching and workplace segregation compared to men (Light & Nandi, 2007; Tammaru et al., 2016).

3. Study Design

3.1. Research Population

We derive our empirical evidence from Finland, and our research population includes migrants from its neighbouring countries Estonia, Sweden and Russia arriving between 2004 and 2013. We form the research population based on Finnish individual-level register data. This is a high-quality data set that contains annual observations for every individual registered in Finland. However, information on the education of immigrants is limited, e.g., we are unable to define the particular education level of the person and do not observe the skills level; we use occupational status as a proxy. First, we exclude return migrants or those whose mother tongue is Finnish. Second, our analysis includes only those who live and work in the HMA in order to exclude the regional labour market differences. Third, as one of the focuses of our study is workplace segregation, we also removed self-employed persons and entrepreneurs from the research population. We began by tracking the employment history of the person from their first employment in the HMA. Finally, we included persons aged 25 to 64 for our study. As a result of those restrictions, our final research population includes 29,812 individuals (Table 1).

There are some important differences between migrants arriving from different countries of origin. The highest share of those who have a native partner is among Swedes (22%). The share of migrants employed in upper white-collar occupations is also the highest among Swedes, lowest among Estonians and in-between for migrants who arrived from Russia. Since Russia is not a

Table 1. Characteristics of the research population by country of origin.

		Estonians	Russians	Swedes
Gender	Male	42.7	45.1	67.4
	Female	57.3	54.9	32.6
	Total (%)	100	100	100
Age group	25–34	33.8	50.3	64.0
	35–44	28.9	27.3	26.8
	45–54	26.4	16.1	6.9
	55–64	10.9	6.3	2.3
	Total (%)	100	100	100
Family status	Single	62.1	30.9	47.8
	Married with native	2.2	7.9	22.7
	Married with migrant	14.9	42.6	14.0
	Married, partner unknown	7.1	6.8	6.5
	Divorced	13.0	10.9	8.7
	Widow/er	0.7	0.9	0.3
	Total (%)	100	100	100
Years of stay in HMA	0–3	71.1	52.1	65.1
	3–6	22.5	35.1	25.3
	6+	6.4	12.8	9.6
	Total (%)	100	100	100
Occupational Group				
	Higher white—collar worker	4.0	24.8	46.8
	Lower white-collar worker	16.4	27.6	30.6
	Manual worker	79.6	47.6	22.6
	Total (%)	100	100	100
$N_{observations}$		21 176	7 357	1 279

Note: Authors' own calculations based on Finnish registry data set (years 2004–2013) not publicly available.

member of the European Union, Russian migrants fall under the system of work permits—they are allowed to enter to Finland only if they have already concluded an employment contract with the employer from the host country. The migration policy limits the entry of low-skilled non-EU workers and aims to select middle and high-skilled workers for new and innovative industries. Migrants from Estonia do not face such restrictions and hence, lower-income groups seeking a way out of poverty are strongly over-represented among migrants.

As it was revealed in the literature review, migrants are sorted into niche industries due to space and informational limitations (Figure 1). However, they are placed into industries unevenly and some ethnic group members cluster in particular industries. The industrial distribution of Estonians and Russians is similar; the majority of members (42% of Estonians and 37% of Russians) of both ethnic groups are presented in health care and social work industries. Swedes are also presented in this industry (44%) but are mainly employed in educational and public activities. The second largest industry for Estonian employees is the construction sector, where 36% of Estonians are employed. Such uneven industrial distribution strongly depends on the gender structure of the sample as there are historical gender

differences and separation of the industries in terms of gender. As it is presented in the Supplementary File (Figure A1), the majority of females (67% for Estonian females, 47% for Russian females and 57% of Swedish females) for 3 ethnic groups are employed in 8th industry which includes health, social work and educational sub-industries. Based on a more detailed classification of industries, Russian and Estonian females are concentrated in social health care, whereas Swedish females are employed mostly in the educational industry. Estonian (68%) and Russian (33%) males are employed mostly in the construction industry, which is migrant-intensive especially for males, whereas Swedish males (37%) together with females are presented in education, health and social work activities. Overall, the pattern of industrial ethnic distribution of Estonians and Russians is similar—the majority of both ethnic groups are employed in industries of the secondary sector mostly, while Swedes are presented in industries of the primary sector.

The pattern of workplace segregation levels is also different across ethnic groups as well as industrial ethnic distribution. As presented in Figure 2, on average, Estonians have 48% of other migrants as co-workers. This finding is explained by the high concentration of
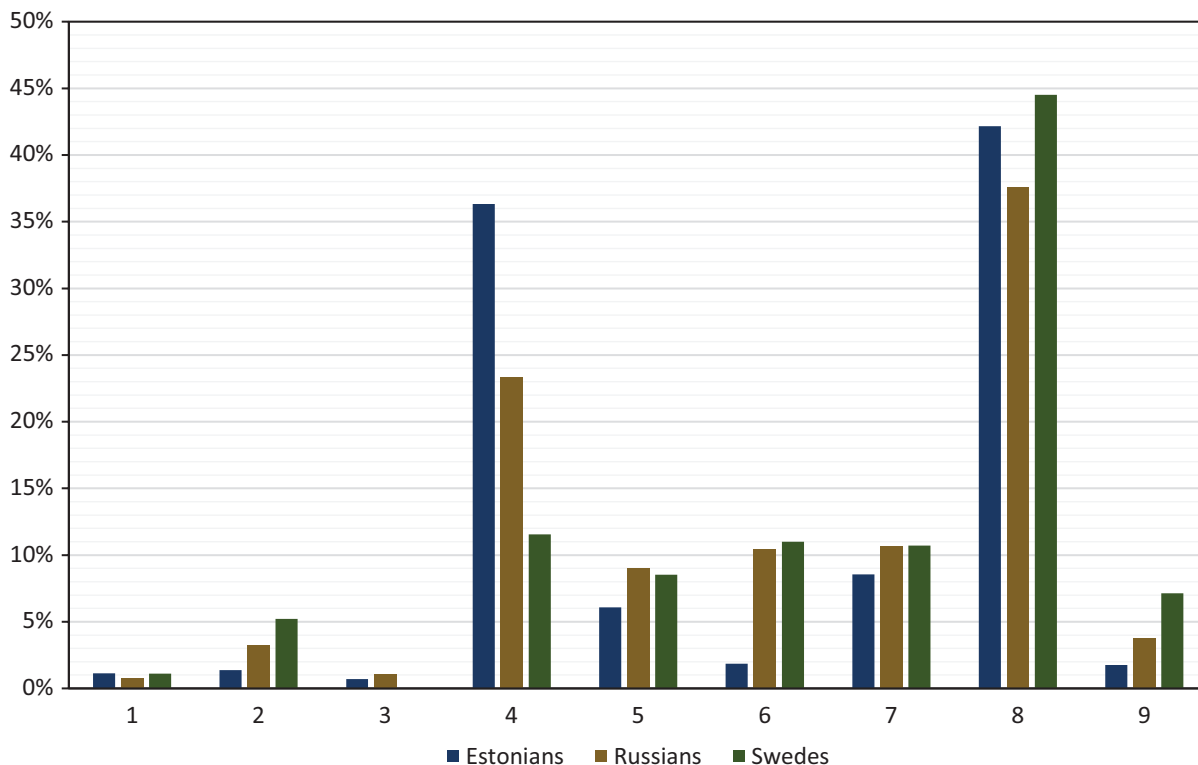
Figure 1. Distribution of ethnic groups (as a share of employed ethnic group members in a particular industry from the total number of employed ethnic group members) across industries in 2013. The aggregated industrial classification based on TOL 2008: (1) Manufacturing; (2) Mining and quarrying; (3) Electricity, gas, steam, air and water supply; (4) Construction, transportation and storage; (5) Accommodation, food and informational service; (6) Financial, insurance and real estate activities; (7) Administrative and support service activities; (8) Public administration, education, health and social work activities; (9) Other service activities (production for own use, repair of computers and household goods, activities in membership organisations). Source: Authors' own calculation based on Finnish registry data set (year 2013) not publicly available.
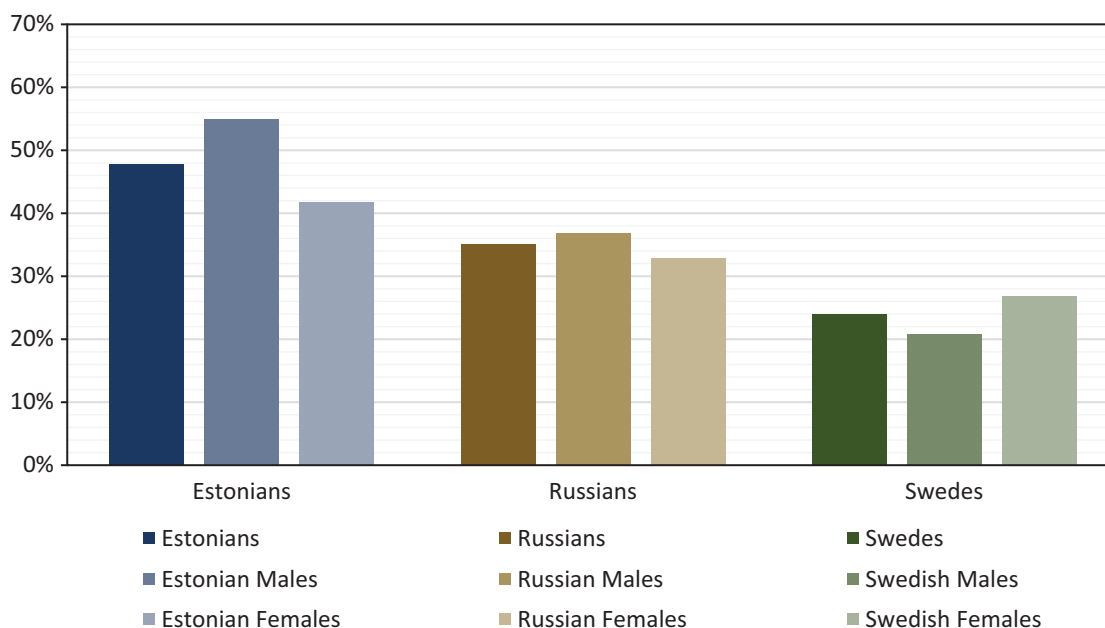

Figure 2. The average share of migrants as co-workers across ethnic groups (total, for males and females) in 2013. Source: Authors' own calculation based on Finnish registry data set (year 2013) not publicly available.

Estonians in the construction industry, hence, being employed as a construction worker means having more ethnic co-workers in the same establishment. As discussed above, Swedes are employed in the primary sector (in education and public services) and, thus, have significantly lower shares of ethnic co-workers (24% of ethnic co-workers on average). Immigrants of Russian origin are employed in the migrant-intensive construction industry as well as the health and social care industry, but they have low shares of migrants as co-workers in the workplace. On average, 35% of the total employees are ethnic co-workers for Russian migrants.

3.2. Measure of Niching and Segregation

For a simultaneous estimation of industrial niching and workplace segregation, we need a measure that is applicable for both. Following Wright et al. (2010), we use a workplace location quotient (WLQ) as the measurement of workplace segregation, calculated following Equation 1:

$$WLQ = \frac{(M_{wt} \mid T_{wt})}{(M_t \mid T_t)} \tag{1}$$

Specifications follow:

- WLQ is the workplace location quotient index; w refers to the workplace where migrant lives in year t
- M_{wt} is the number of migrant workers in workplace w in year t
- T_{wt} is the total number of workers in workplace w in year t
- M_t is the total number of migrants workers in HMA in year t
- T_t is the total number of workers in HMA in year t

The unit of measurement for workplace segregation is an establishment or a unit of a company/employer that is located at a concrete address. The offices or departments of the company that are located at different addresses are considered as different establishments. We set the minimum number of two employees for the workplace to be included in our analysis. We calculate WLQ based on Equation 1 annually for the period 2004–2013. We apply the threshold proposed by Wright et al. (2010) to define whether an establishment is overrepresented or underrepresented by migrants. If the share of migrants in the particular establishment is 50% higher than the average share of migrants in all establishments located in the HMA, we identify the establishment as migrant-intensive. Otherwise, if WLQ is less than 1, migrants are underrepresented in this establishment. All workers employed in the same establishment are assigned the same value of the WLQ index.

For industrial niching we use the niche quotient (NQ), which is calculated using Equation 2:

$$NQ = \frac{(M_{jt} \mid O_{jt})}{(M_t \mid T_t)} \tag{2}$$

Specifications follow:

- NQ is the niche quotient index; sub-index j refers to the industry and sub-index t refers to the year
- M_{jt} is the number of migrant workers in industry j in year t
- O_{jt} is the total number of workers in industry j in year t
- M_t is the total number of migrant workers in HMA in year t
- T_t is the total number of workers in year t

We follow Wang and Pandit (2007) and apply the 4-digit level of classification of industry. The calculations for industrial niching are similar to workplace segregation calculations. As with workplace segregation, we use 1.5 threshold level to define sectors where migrants are overrepresented (niched industry) or underrepresented. We assign the same value of industrial niching to migrants working in this industry, focusing on niched or non-niched industries (Wright et al., 2010).

3.3. Model for Studying the Overlap between Niching and Segregation

We estimate the system of two generalised structural equation models (GSEM) with two endogenous dummy dependent variables (working in the niched or non-niched industry and working in a segregated or non-segregated workplace) to find answers to our main research questions. The equations are fitted to the panel data with an annual clocking of time, covering the work history of migrants between 2004 and 2013. We model Equations 3 and 4 jointly, and the generalised form of the structural equation model is as follows:

$$\begin{cases} WS_{it} = \beta_{1t}X_{it} + u_1 & (3) \\ IN_{it} = \beta_{2t}X_{it} + u_2 & (4) \end{cases}$$

Specifications follow:

- WS_{it} is a dependent variable of workplace segregation defining whether the individual i is employed in a segregated workplace or not in year t
- IN_{it} is a dependent variable of industrial niching defining whether the individual i is employed in niched industry or not in year t
- X_{it} is the vector of independent variables with associated coefficients β_{1t} for workplace segregation and β_{2t} for industrial niching respectively

- u_1 and u_2 are bivariate normally distributed errors for workplace segregation and industrial niching equation respectively

Rho is the coefficient of overlap between Equations 3 and 4.

For the Equation 3, the dependent variable measures whether a given migrant works in a workplace where immigrants are either overrepresented (segregated workplace, coded as 1) or underrepresented (coded as 0). For Equation 4, the dependent variable measures whether a given migrant works in an industry where immigrants are overrepresented (niched industry, coded as 1) or underrepresented (coded as 0).

Our main interest relates to the coefficient of overlap between working in a niche industry and working in a segregated workplace. In GSEM, it is presented as a *Rho* coefficient that detects an interaction between residual covariance structures of the two equations. The *Rho* coefficient varies from −1 to 1. The *Rho* values between −1 and 0 refer to the negative residual covariance in the two equations, meaning that workplace segregation and industrial niching demonstrate reverse overlapping or interdependency—the increase in one process is associated with the decrease in the other and vice versa. The *Rho* values between 0 and 1 refer to the positive residual covariance in the two equations, meaning that workplace segregation and industrial niching are positively inter-related to each other. In other words, positive and significant values of the coefficient indicate an overlap between working in a niche sector and working in a segregated workplace.

For both GSEM equations, we include a set of relevant covariates. The first set of variables relate to the socio-demographic characteristics of migrants, including country of origin, age, gender and occupational status (higher white-collar, lower white-collar and manual workers). The following classification of occupations was used. Senior officials and upper management in research, planning, education and training and other activities were identified as the highest white-collar employees. The lower level of white-collar employment is represented by supervisors, clerical and sales workers in independent and routine work as well as in other activities. We classify workers in manufacturing and other production-related workers in agriculture, forestry and fishing, as well as

distribution and service workers as manual work. We used occupational classification as a proxy for skills level assuming that the highest level of skills is associated with high white-collar jobs and the lowest for manual workers. We propose that employees of lower white-collar jobs represent the middle-skills level.

The second set of variables relates to migrant integration, including years of stay in the HMA, type of the neighbourhood (whether it is migrant-intensive or not; if the share of migrants in the particular neighbourhood is greater by 50% than the average share of migrants in the HMA, then this neighbourhood is identified as migrant-intensive), family status (single, married or in a registered partnership with native, married or in a registered partnership with migrant, divorced, widow) and host country education (whether the individual has obtained any level of education in Finland or not). To control for reverse causality, we lag the family status and residential neighbourhood variables by 1 year compared to the two dependent variables. Finally, we split the GSEM model and run it separately for each origin country group, gender, family status and occupational groups as a proxy for skills level.

4. Main Findings

There are important differences in workplace segregation and industrial niching between migrants from different origin countries. Applying a threshold level of 1.5 implies that all migrant groups are working in niched and segregated workplaces, with levels of segregation being higher than levels of niching. 73% of migrants from Sweden are employed in segregated establishment and 42% of them are employed in the niched industry. Among Estonians, the respective figures are 87% and 68%, and for Russians 77% and 45% (Table 2). The share of migrants among co-workers is 48% for Estonians, 38% for Russians and 24% for Swedes. Estonians are highly concentrated in the construction sector, where the share of migrant workers is high. Both Estonian and Russian workers are clustered in health care and social work, where the share of migrant workers is high, too. There is a strong gender dimension in industrial niching for both Estonians and Russians, as men are clustered in the construction sector and women in health care and social work. Gender differences in workplace segregation are not particular for

Table 2. Workplace segregation and industrial niching by country of origin.

		Estonians	Russians	Swedes
Workplace type	Segregated	87.3	77.8	73.0
	Non-segregated	12.7	22.2	27.0
	Total (%)	100	100	100
Industry type	Niched	68.5	45.2	42.3
	Non-Niched	31.5	54.8	57.7
	Total (%)	100	100	100

Note: own calculations based on Finnish registry data set (years 2004–2013) not publicly available.

Russians, while Estonian men are found in more segregated workplaces compared to Estonian women. Migrants from Sweden are mainly working in education and public services where the share of migrants is low.

Next, we will explicitly address our three research questions. Our first two research questions asked what the overlap between workplace segregation and industrial niching is, and how it varies over groups originating from Estonia, Russia and Sweden. The GSEM yields a significant and positive *Rho* coefficient close to 1, referring to a strong overlap between workplace segregation and industrial niching for all migrant origin groups (Table A1 in the Supplementary File). The overlap is the strongest for Estonian migrants (0.83), and lower and very similar for migrants who originate from Russia (0.68) and Sweden (0.69).

The results by socio-demographic variables are as follows. Estonians more likely work in a segregated workplace compared to migrants from Russia and Sweden, while differences in industrial niching are smaller between origin groups. Workplace segregation increases by age while there are no age differences in industrial niching. With the exception of Russian migrants, women are less likely to work in segregated workplaces and niched industries compared to men. Manual workers are working in the most segregated workplaces and the most niched industries. All variables measuring immigrant integration—living longer in Finland, having a Finnish partner, living in a less segregated neighbourhood, and having obtained education in Finland—yield negative associations both with workplace segregation and industrial niching.

Our third research question asked what the overlap between workplace segregation and industrial niching by gender, family status and occupation is as a proxy for skills level. We find that the overlap between industrial niching and workplace segregation is stronger for women than for men (Table 3). Migrants living with a Finnish partner have a weaker overlap between industrial niching and workplace segregation both compared to singles and migrants living with a migrant partner. Finally, the overlap between industrial niching and workplace segregation weakens with rising skills level.

5. Discussion and Conclusions

Two separate strands of research deal with industrial niching and workplace segregation. In this article, a first attempt was made to connect these two dimensions of immigrant labour market outcomes by jointly estimating the overlap between workplace segregation and industrial niching.

Based on a study of Estonian, Swedish and Russian migrants in Finland, and controlling for socio-demographic characteristics of migrants and measures of integration, we find a strong and positive overlap between workplace segregation and industrial niching. This implies that there are common forces that push migrants into employment in a particular industry and/or workplace. The main explanatory idea behind positive and strong interdependence between the level of workplace segregation and industrial niching relies on social networks that operate heavily in job search and hiring processes that link migrants to certain workplaces and industrial niches (Dustmann et al., 2016; Goel & Lang, 2019; McGuinness & Byrne, 2014).

In Finland, like in most European countries, immigration policy is strongly based on labour market needs. The sorting of migrant labour in certain industries and workplaces may be, first, due to the shortage of domestic labour in some sectors such as construction. Furthermore, the free labour market of the European Union makes it easier to attract workers from lower-income member states. Hence, a high share of Estonian construction workers moves to Finland seeking higher wages (Anniste & Tammaru, 2014). Second, niched and segregated workplaces may emerge because of the mushrooming of ethnic businesses in some sectors such as ethnic restaurants (Lee, 2019) or due to a hiring process that is based on co-ethnic networks and rely on co-ethnic residential pools. Both mechanisms tend to contribute to the niching of immigrants into certain industries as well as into certain workplace establishments (Strömgren et al., 2014). In other words, industrial niching in cities is inherently spatial; immigrant workers tend to concentrate not only into certain jobs and industries but also into certain workplaces located in certain residential areas within the city (Wright et al., 2010).

We find that the level of interdependence between workplace segregation and industrial niching varies for gender and skills level as well as across ethnic groups. In earlier studies (Joassart-Marcelli, 2014; McLafferty & Preston, 2019), it was found that employment profiles for males and females are different. Following the previous explanations (Lindenlaub & Prummer, 2016) that females and males use different resources in the job

Table 3. GSEM estimates by gender, family status and occupation.

	Gender		Family status			Occupation		
	Female	Male	Single	Migrant partner	Finnish partner	Manual worker	Lower white-collar	Higher white-collar
Overlap (*Rho*)	.84***	.67***	.78***	.78***	.62***	.83***	.66***	.48***

Notes: *significant at 10%; ** significant at 5%; *** significant at 1%. Source: Authors' own calculations based on Finnish registry data set (years 2004–2013) not publicly available.

searching process, in the context of the Helsinki labour market, we revealed that females tend to funnel in segregated and simultaneously niched positions more likely than males. Gender variation in overlapping could be explained by the occupational and, hence, skills level division (Peetz & Murray, 2019; Wright & Ellis, 2000). Females may take lower positions and not take higher work responsibilities on purpose as it allows them to spend more time outside jobs. However, our findings strongly depend on the context. As Wright and Ellis (2000) suggested, gender differences are not universal and should be interpreted in the framework of cross-cultural and interethnic background as well as skills level. Hence, we suspect that gender overlapping across the same skills level and from the same ethnic group will be smaller and men and women tend to work alongside each other.

As previous research shows, low-skilled migrants tend to be employed either in segregated workplaces (Glitz, 2014) or in niched industries (Liu, 2011). Our findings show that there is a stronger overlap between niching and segregation among the low-skilled migrants compared to high-skilled migrants. Across all skills groups, manual workers have the highest likelihood to be employed in a segregated workplace or niched industry. This result holds for all ethnic groups, i.e., it is not related to coming from a less affluent or more affluent country of origin, or from within the European Union with little formal restrictions on labour mobility or from a third country with much stricter recruitment rules.

However, variations between migrant countries of origin are more important. The degree of overlap is the highest for Estonian migrants, with little difference between Sweden and Russia. Estonia and Sweden are linguistically and culturally very similar countries to Finland. Immigrants originally from Estonia and Sweden benefit from the EU free labour market movement and have many opportunities of employment in Finland. Dissimilar to Estonia, the wealth level in Sweden is comparatively higher than in Finland. Our results revealed that the overlapping coefficient is significantly larger for Estonian immigrants than for Swedes. We hypothesise that this is due to the wealth gap between home and host countries: Coming from a less affluent country, immigrants are willing to take second jobs as they often compare wages in home and host countries.

The Russian language is more distant from Finnish compared to Estonian and Swedish, and the wealth level in Russia is lower than in Finland. In this context, one could expect the strongest overlap between niching and segregation for Russians due to cultural diversity (Ely & Thomas, 2001). However, our findings are not in line with those expectations. This implies that explanations other than linguistic-cultural similarity and countries' wealth levels are needed to understand migrant sorting into industrial niches and workplace establishments, and immigration policy may be a crucial factor. The barrier for getting permission to enter Finland is high for Russian migrants, who must have a pre-signed work contract. This requirement aims to hire middle or highly-skilled workers, among which the overlap between industrial niching and workplace segregation is not so high. Hence, skills-selection produced by migration policy leads to lower levels of both industrial niching and segregation in the workplace establishments.

While skill-selection may be an important factor explaining a lower overlap between niching and segregation among Russian migrants, both cultural similarity and coming from a high-income context may explain the lower isolation of Swedes on the Finnish labour market compared to Estonians. In short, Swedes have a long and successful history of immigration to Finland that makes it easy to for Finnish employers to recognise their previous work experience and level of education and later hire them (Ansala et al., 2020). Since both Estonians and Swedes are linguistically close to Finns but experience very different outcomes in the Swedish labour market, coming from a wealthy country may also be related to different expectations and motivations. Swedish low-skilled workers are not motivated by the Finnish wage levels, unlike the low-skilled workers from Estonia. However, for high-skilled sectors, Swedish and Finnish wages could converge (Trading Economics, 2018), which makes sense for high-skilled Swedes to enter the Finnish labour market. Likewise, motives other than wage levels, such as career opportunities, may compensate the lower salary levels. Hence, the ethnic differences in the degree of overlap between workplace segregation and industrial niching stem from a complex relationship between linguistic and cultural factors, origin country context and immigration policy, with a high degree of cultural integration (Estonian migrants) not necessarily related to high levels of labour market integration.

These findings have strong policy implications. Notably, cultural differences may be of less importance than assumed. Rather, skill selection policies help to reduce migrant isolation in the labour market since the degree of overlap between industrial niching and workplaces segregation does not differ between Russian and Swedish migrants in Finland. Second, because of the overlap, labour market policies and employer hiring practices aiming at reducing one dimension of labour market inclusion (e.g., reducing workplace segregation) would also reduce the other dimension (industrial niching). However, since the overlap between industrial niching and workplace segregation is not perfect, policies and hiring practices aiming at both dimensions are most effective. Hence, a combined sector-employer-based policy may reduce the isolation of migrants in host country labour markets, as the case of Russian migrants in the Finnish labour market shows.

Acknowledgments

Research grant number PUT PRG306), the European Research Council under the European Horizon 2020 framework (UPLIFT), the Strategic Research Council at the Academy of Finland, Decision no. 303665 (URMI project, "Urbanisation, Mobilities and Immigration") and the KONE Foundation (Suomen Silta 3.0). The authors thank their colleagues from the School of Economics (Tiiu Paas) and the Department of Human Geography (Anneli Kährik) for their valuable feedback and support through this research. We are also grateful to anonymous reviewers who improved our article.

Conflict of Interests

The authors declare no conflict of interests.

Supplementary Material

Supplementary material for this article is available online in the format provided by the author (unedited).

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Article

The Relationship between Ethno-Linguistic Composition of Social Networks and Activity Space: A Study Using Mobile Phone Data

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Abstract

This study is a contribution to the discussion on the ethnic segregation cycle, through the examination of individuals' activity spaces—including residence and workplace—and from the perspective of social networks. Bridging social ties can be a key factor in higher minority inclusion and in breaking the vicious circle of segregation. We compare the spatial behaviour of two ethno-linguistic population groups living in Tallinn, Estonia's capital city (Estonian-speaking majority and Russian-speaking minority), each of which have co- and interethnic social networks, through the use of mobile positioning (call detail records) and call-graph data. Among our main findings, we show firstly that interethnic social networks are more common for the Russian-speaking minority population. The probability of having an interethnic network is related to the ethno-linguistic composition of the residential district concerned; districts with a higher proportion of residents from another ethnic group tend to favour interethnic networks more. Secondly, the activity space is related to the ethno-linguistic composition of the social networks. Spatial behaviour is most expansive for Estonian speakers with co-ethnic networks, and most constrained for Russian speakers with co-ethnic networks. At the same time, speakers of Estonian and Russian with interethnic networks show rather similar spatial behaviours: They tend to visit more districts where the proportion of people from the other ethno-linguistic group is higher. Interethnic networks are therefore related to spatial behaviour, which can indicate interethnic meeting points and locations, something that is regarded as being important in assimilation and segregation cycle theories.

Issue

This article is part of the issue "Vicious Circle of Segregation: Understanding the Connectedness of Spatial Inequality across Generations and Life Domains" edited by Tiit Tammaru (University of Tartu, Estonia), Siiri Silm (University of Tartu, Estonia), Frank Witlox (Ghent University, Belgium), Maarten van Ham (Delft University of Technology, The Netherlands) and Madli-Johanna Maidla (University of Tartu, Estonia).

1. Introduction

Spatial segregation is a complex process, which has been a source of conflict throughout human history. The lat-est advances in segregation theory serve to highlight the transmission of segregation and inequalities between different life domains, activity locations, and generations (Krysan & Crowder, 2017; van Ham, Tammaru, & Jannsen,

2018). Extensive research on the causal and explanatory mechanisms of segregation has revealed the complex and overlapping effects of factors such as discrimination, lived experiences, preferences, disadvantages, and social networks (Krysan & Crowder, 2017).

Personal social networks are generally considered an important medium for the exchange of information on residential options and job vacancies, for example, while at the same time being also a source of social support for minorities during the process of acculturation (Cachia & Jariego, 2018; van Kempen & Özüekren, 1998). Thus, social networks can either amplify or mitigate the effects of spatial isolation (DiMaggio & Garip, 2012; Wilson, 1987). Different assimilation models all suppose a growing embeddedness of minorities into the host society with respect to, for example, socio-economic status, language proficiency, and residential distribution. In terms of social networks, the classical assumption is that over time any ties to place of origin are replaced with ties to the destination (Verdery, Mouw, Edelbute, & Chavez, 2018). Empirical studies have shown that personal network structure and composition predict the outcomes of assimilation (Vacca, Solano, Lubbers, Molina, & McCarty, 2018; Verdery et al., 2018; Verdier & Zenou, 2017), although the direction of causality and the underlying explanatory factors remain unclear (Vacca et al., 2018).

In particular, rather little is known about how the ethnic composition of social networks is related to the individual's spatial behaviour and activity space, mainly due to a lack of suitable and accessible data. This study fills this gap and explores how an ethnically open (interethnic) and closed (co-ethnic) social network is related to the spatial behaviour of ethno-linguistic minority and majority groups. It is noteworthy that while many studies of social networks focus either on the minority or the majority group, in this study we consider both groups. On an approach to ethnic segregation, we take account of the whole activity space, with a full range of activity locations and the mobility between them, as previously applied in many segregation studies (Järv, Masso, Silm, & Ahas, 2020; Järv, Müürisepp, Ahas, Derudder, & Witlox, 2015; Mooses, Silm, & Ahas, 2016; Silm & Ahas, 2014a; Silm, Ahas, & Mooses, 2018; van Ham & Tammaru, 2016; Wong & Shaw, 2011). Previous research has shown that wider social networks correspond with larger activity spaces (Puura, Silm, & Ahas, 2018), and members of the ethnic majority tend to visit places with high proportions of co-ethnics (Silm & Ahas, 2014a). With this study, we go further and show how the different ethnic composition of networks (in regard to the existence of co-ethnic and interethnic ties) is related to spatial behaviour and places visited. Wider and more open social networks can be a key factor in higher minority inclusion, reducing segregation, and in breaking the vicious circle of segregation.

We use mobile positioning data (call detail records [CDR]), and call-graph data from the year 2016 to explore the relationship between social networks and activity spaces in Estonia. We focus on people living in Tallinn,

the capital of Estonia, which is an interesting case in itself because it contains almost equal numbers of Estonian and Russian speakers. Our research questions are as follows:

1. Which people have interethnic social networks? What are those social characteristics, places of residence, and workplace characteristics that are related to the existence of interethnic social networks?
2. What is the geography of the spatial behaviour of people with interethnic and co-ethnic social networks? What is the relationship between social networks and spatial behaviour?
3. How is the ethno-linguistic composition of residence and workplace related to the extent of the activity space and the ethno-linguistic composition of places that are visited by the people concerned?

2. Theoretical Background

2.1. Ethnic Segregation Based on Activity Space

The concept of activity space has been widely applied to segregation studies (Järv et al., 2015; Silm et al., 2018; Wong & Shaw, 2011). Activity space has been defined as a set of locations visited by an individual, along with their movements between and around those locations over a certain period (Golledge & Stimson, 1997). The main locations of activity space are commonly place of residence, workplace, and places of leisure activities (Schönfelder & Axhausen, 2003). Previous findings have shown that potential interactions with other social groups (including ethnic groups) occur not only in a place of residence or in the workplace, but also in a number of other locations, such as schools, leisure activity sites, or anywhere that activities can take place, in circumstances in which people have the opportunity to interact with others (van Ham & Tammaru, 2016). By considering the whole activity space it is possible to understand more completely the phenomenon of ethnic segregation and the process of integration.

Previous studies have shown that the extent of the activity space can vary across ethnic groups and the level of segregation depends on the types of places visited regularly (Järv et al., 2015; Silm et al., 2018). Segregation tends to be highest in places of residence and somewhat lower in workplaces (Ellis, Wright, & Parks, 2004; Hall, Iceland, & Yi, 2019). Estimates of segregation across all leisure activities have shown this to be lower than in places of residence and workplaces (Silm et al., 2018; Toomet, Silm, Saluveer, Ahas, & Tammaru, 2015), although the level of segregation varies depending on the activity concerned (Kamenik, Tammaru, & Toomet, 2015; Mooses et al., 2016; Shinew, Glover, & Parry, 2004).

Just as different activity locations are interconnected, so is segregation in different parts of the activity space

(van Ham et al., 2018). Several studies have shown that segregation in places of residence affects segregation in several other activity places—workplaces, schools, shops, etc. (Blasius, Friedrichs, & Galster, 2007; Peach, 2007). For example, inequalities related to residential segregation affect the opportunities available for a high-quality education, which in turn can feed into the labour market, leisure time activities, and opportunities for mobility, forming a causally related circle. Indeed, some new theories of segregation place an emphasis on this circle of segregation by explaining the inter-relational mechanisms by which different parts of the activity space are linked, and how segregation is transferred from one activity place to another (Krysan & Crowder, 2017; van Ham et al., 2018). Numerous factors have traditionally been explained as causes of segregation, including discrimination, disadvantage, lived experiences, preferences, and social networks (Krysan & Crowder, 2017). The effects of the causal mechanisms on segregation are not mutually exclusive, but rather overlapping, and segregation is then the outcome of a combination of a number of causes.

2.2. Social Networks and Segregation in the Activity Space

The segregation process is largely affected and formed by personal social networks, specifically by their structure, in terms of size, shape, density, centrality (Verdier & Zenou, 2017), and composition, meaning the proportions of those with similar and different characteristics (Bojanowski & Corten, 2014). The tendency to build relationships with others similar to ourselves (homophily) is well known (Kossinets & Watts, 2009; McPherson, Smith-Lovin, & Cook, 2001). In terms of segregation, personal social networks can be considered closed (co-ethnic, homophilous; see Portes, 1998) or open (interethnic, bridging; see DiPrete, Galman, McCormick, Teitler, & Zheng, 2011). The former are relationships formed within the same ethnic group, while the latter include relationships between different ethnic groups, the formation of which depends on conditions such as a common interests or concerns, an adequate level of trust, and language proficiency (Grossetti, 2005; Heizmann & Böhnke, 2016). Minorities with higher social status (e.g., higher levels of income and education) tend to create more interethnic relationships, which is linked to higher language proficiency and higher levels of trust among the majority population (Barwick, 2017; Martinovic, 2013).

The residential neighbourhood is an important domain, in which social networks are formed and people interact (Ratti et al., 2010; Viry, 2012). Social networks are on the one hand the medium for information that influences the choice of place of residence, but also on the other hand a source of social support. The choice to live in close proximity to co-ethnic groups can mitigate the cultural shock on arrival and help people to adapt

to the host society (van Kempen & Özüekren, 1998; Xu, Belyi, Santi, & Ratti, 2019). Alternatively, is the result of different sets of possible residential options for ethnic groups and their descendants (Krysan & Crowder, 2017). Residential segregation can create community-based and homophilous social networks in which there are disproportionate levels of information regarding opportunities, which in turn contributes to the residential mobility trap (Barwick, 2017) and reproduces vicious circles of segregation (van Ham et al., 2018). Networks that are ethnically heterogeneous are on the other hand believed to deliver information on a greater variety of opportunities (Peters, Finney, & Kapadia, 2019), which can lead to settlement in ethnically mixed residential areas.

Leisure or free-time activity locations have been considered parts of the 'long arm of home' (Kukk, van Ham, & Tammaru, 2019) because they tend to be in the vicinity of residential places. The relationship between free-time activities and social networks can relate to two different factors. Public spaces and leisure-time settings such as parks, cultural events, hobby clubs, sport facilities, etc., are generally thought to enhance inter-ethnic contact due to a lack of structural restrictions and the presence of free choice (Barwick, 2017; Shinew et al., 2004). At the same time, leisure-time activities can also be settings for ethnic separation and the strengthening of co-ethnic ties due to ethno-specific preferences (e.g., Kukk et al., 2019; Mooses et al., 2016).

In contrast to the 'voluntary' contacts seen in residential and leisure domains, workplaces (and schools) foster 'forced' contact between co-workers and students (Eisnecker, 2019). Existing social networks provide the social capital and information necessary to enter the labour market (McDonald, Gaddis, Trimble, & Hamm, 2013) after immigration or later on, which is linked to economic success, quality of life, and professional achievement (DiMaggio & Garip, 2012; Eagle, Macy, & Claxton, 2010). In this respect, interethnic networks are found to provide access to a greater variety of resources and information (Marques, 2012). Employment can also affect the spatial extent of activities: The activity spaces of the unemployed might be smaller because their central focus is on their residential neighbourhoods, which in turn affects the possibility of forming social ties (Eisnecker, 2019).

To conclude, there can be a two-way relationship between activity spaces and personal social networks (Figure 1): Overlapping activity spaces may lead to the formation of social ties between individuals, and vice versa (Galster, 2019; Grossetti, 2005; Phithakkitnukoon, Smoreda, & Olivier, 2012; Wang, Kang, Liu, & Andris, 2015). Networks that are larger and more spatially dispersed relate to greater spatial mobility of the individuals involved (Puura et al., 2018). Even in the era of rapid information and communications technology (ICT) development, people travel long distances to meet face-to-face (Calabrese, Smoreda, Blondel, & Ratti, 2011). In terms of connectivity, there is a higher proportion of interactions
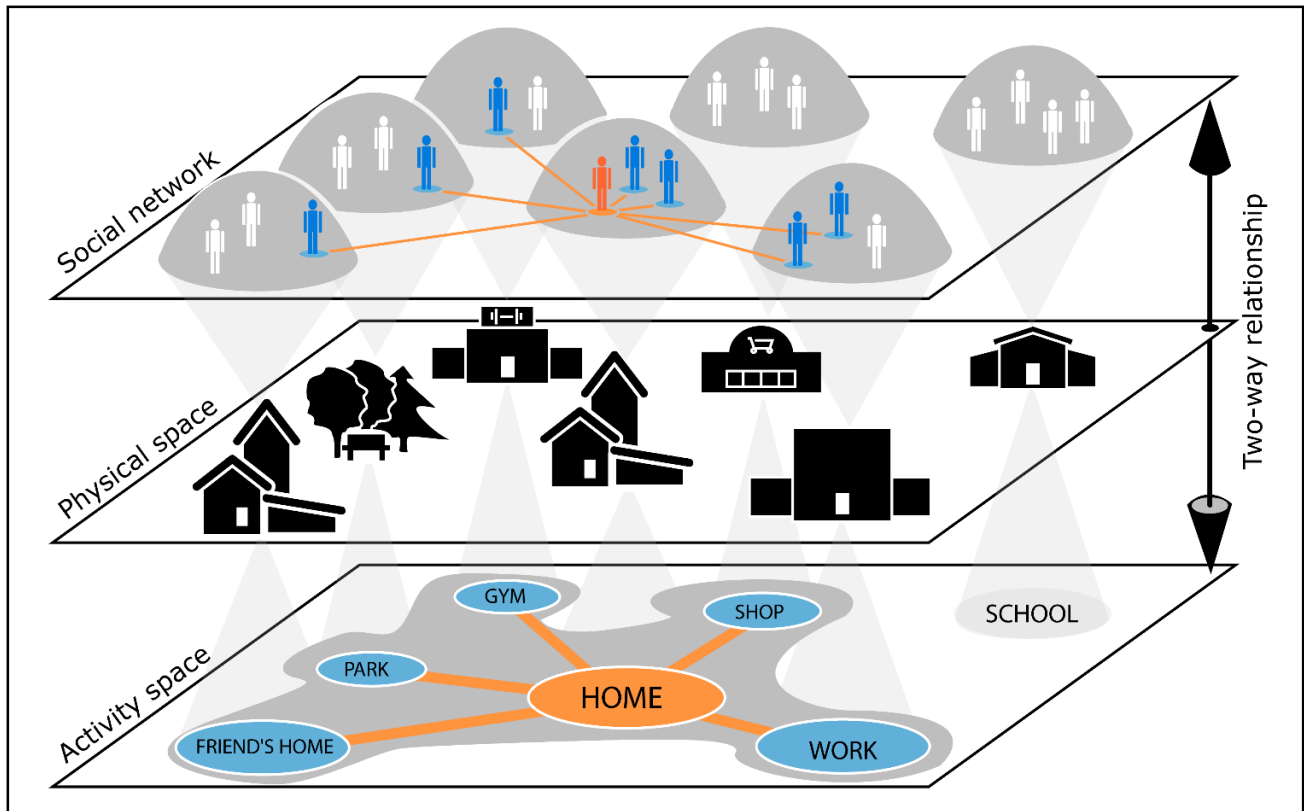
Figure 1. Two-way relationship between an individual's social network and activity space.

between areas with similar cultural and linguistic composition (Expert, Evans, Blondel, & Lambiotte, 2011; Ratti et al., 2010). Ethnic minorities tend to visit regions where the concentrations of those minorities are higher (Silm & Ahas, 2014a).

2.3. Ethnic Groups and Ethnic Differences in Estonia

The population of Estonia is divided mainly between two ethno-linguistic groups. The majority (70%) of the total population is Estonian (Statistics Estonia, 2011), while the remainder of the population (28%) consists of various nationalities from different parts of the former Soviet Union, such as Russians, Ukrainians, Belarussians, etc., who mostly speak Russian and are, therefore, termed the Russian-speaking minority (Vihalemm, 1999). Ethno-linguistic groups are commonly used as the main social category for examining ethnic differences in Estonian society (Vihalemm, Seppel, & Leppik, 2020). The proportions of the two ethno-linguistic groups are more similar in the capital, Tallinn, where 55% of residents are Estonian and 43% are Russian speakers (Statistics Estonia, 2011).

Today, the spatial distribution of Russian speakers in the capital city of Tallinn (and Estonia) is influenced greatly by the residential and labour market policies of the former Soviet Union, according to which immigrants settled mainly in larger cities and industrial areas in high-rise housing estates (Kährik & Tammaru, 2010). The spa-

tial distribution of Russian speakers and Estonians in Tallinn is therefore very uneven (Figure 2): There are more Russian speakers in the eastern part of Tallinn, and more Estonian speakers in the southern part. Majority and minority populations tend to work in different sectors of the economy, and attend different schools (Tammaru & Kulu, 2003). The Russian-speaking minority work predominantly in unskilled blue-collar jobs, while Estonians tend to work in white-collar jobs, especially in management and public administration (Tammaru & Kulu, 2003). Despite ongoing discussions on a joint educational system (Masso & Soll, 2014), both kindergarten and basic education are separated linguistically.

A linguistically separated school system further contributes to the spatial separation of the minority group, given the importance of schools for learning Estonian as well as for the formation of contacts (including inter-ethnic contacts) and social networks. Contact between Estonians and the Russian-speaking minority is more common in employment-related interaction, and through casual interaction in the service sector and on the street, but contact is rare in their private lives (Korts, 2009). Personal and family networks are highly segregated along ethnic lines (Vihalemm, 2007).

The existing literature on activity-space segregation in Estonia reveals that members of the Russian-speaking minority have significantly smaller activity spaces, whereas their activity locations are spatially more concentrated in specific geographical areas than
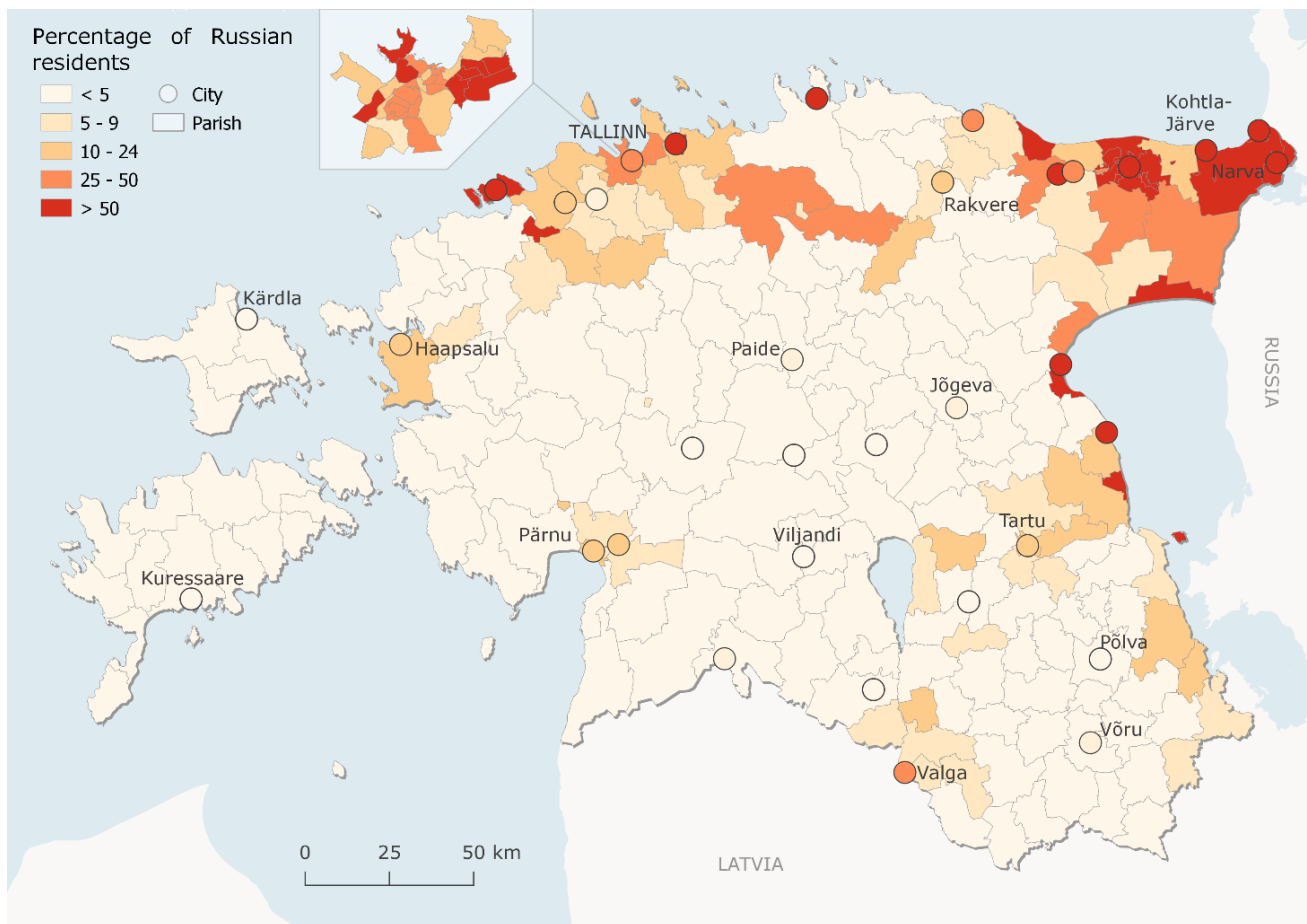
Figure 2. Distribution of the Russian-speaking minority population in Tallinn and Estonia according to the 2011 census (Statistics Estonia, 2011).

members of the majority group (Järv et al., 2015; Silm et al., 2018). Findings have also revealed variations in ethnic segregation over time (Mooses et al., 2016; Silm & Ahas, 2014b). Additionally, studies have shown the relative stability of ethnic segregation across generations (Silm et al., 2018).

3. Data and Methods

3.1. Mobile Positioning Data

The data used in this study comprise passive mobile positioning data stored automatically in the memory or log files held by a mobile network operator (MNO; see Silm, Järv, & Masso, 2020). We have used data from one Estonian MNO, whose network covers nearly 99% of the area of Estonia and whose market share is about one third. Approximately 94% of the Estonian population have access to mobile phones (European Commission, 2013).

We used two types of passive mobile positioning data:

1. Mobile call-graph data that provides information on the networks of calling partners. The data include identification codes (IDs) of a caller linked to the ID of the calling partner, provided they lie within the same MNO. The IDs are pseudonymous and generated by the MNO, which ensures anonymity and means that they cannot be associated with a specific individual or phone number (Saluveer et al., 2020).

2. CDRs that enable the evaluation of spatial mobility. We have used domestic CDRs of mobile phone users with SIM cards registered to Estonians when they were in Estonia. The CDR data include the time (to an accuracy of a second) and location (network cell/antennae) information of outgoing call activities (calls and text messages), and a non-identifiable unique pseudonymous ID. The location accuracy in densely populated areas or in areas with denser networks of roads is 100–500 m, and in more sparsely populated areas it is 500–5000 m (Ahas, Aasa, Roose, Mark, & Silm, 2008). The user IDs are the same for both types of data, which allows these databases to be linked.

In addition, the gender, year of birth, and preferred communication language of every phone user are provided for scientific purposes on those SIM cards for which

the MNO registered this information. The preferred language (Estonian, Russian, or English) is chosen by the mobile phone user when signing a contract with the MNO. The anchor point model (Ahas, Silm, Järv, Saluveer, & Tiru, 2010) was used to identify the residential and workplace locations for each mobile phone user, based on the timing and location of call activities. Each person can have only one residential and one work district.

3.2. Analytical Framework

Social networks are analysed from an egocentric perspective, with a focus on close personal social networks. We focus on calling partners' networks of people with whom an individual exchanged reciprocal call activity for at least two months. This criterion is used to reduce the effect of incidental calls (i.e., related to a service provider). We focus on two aspects: the ethno-linguistic composition and the size of the calling partners' network.

3.2.1. Characteristics of Social Networks

Ethno-linguistic composition of social networks is based on the calling partner's preferred communication language. It is either co-ethnic or interethnic. In a co-ethnic network, all calling partners use the same preferred language as the person concerned. A network is considered interethnic if the language of at least one of the calling partners differs from that of the person concerned, regardless of whether or not the calling partners use the same language.

The number of calling partners refers to the quantity of people in the network of a given user, with whom the user has had at least one reciprocal call activity within a period of at least two months (within a single year); in other words, a minimum of one call activity must be initiated by each party in order to qualify. This reflects the size of the social network.

Number of residential districts of calling partners is the number of districts that include the place of residence of the calling partners. Each district is counted non-recurrently. The districts are municipalities and 30 areas in Tallinn, 247 districts in all. This indicates the geographical extent of the social network.

Percentage of Russian residents in calling partners' residential districts is based on the average proportion of Russians in the calling partners' residential districts. The proportion of Russian residents is calculated for each district and is divided by the sum of the Estonian and Russian residents according to 2011 census data. This reflects exposure to ethno-linguistic groups.

3.2.2. Characteristics of Activity Space

Activity space indicators are calculated based on the locations of the call activities. We focus on the whole activity space of the people and estimate exposure to different ethno-linguistic groups in the place of residence and workplace in order to capture aspects of the vicious circle of ethnic segregation (van Ham et al., 2018). We use the following characteristics of activity space in the analysis:

Percentage of Russian residents in residential districts is the proportion of Russian residents in the residential district of an individual, according to 2011 census data, and indicates exposure to ethno-linguistic groups in residential districts.

Percentage of Russian residents in the workplace district is the proportion of Russian residents in the workplace district of an individual, according to 2011 census data. The proportion of Russian residents is used due to the lack of data on the distribution of employees for estimating the ethno-linguistic composition of workplaces. This indicator shows exposure to ethno-linguistic groups in workplace districts.

Number of visited districts is the number of districts in which a person made at least one call activity during the study period (2016). Each district is counted non-recurrently. This indicator shows the extent of the activity space.

The percentage of Russian residents in districts visited is calculated for each district and is divided by the sum of Estonians and Russians (according to mother tongue), according to 2011 census data, reflecting exposure to ethno-linguistic groups in these districts.

3.2.3. Social Characteristics

Some additional social characteristics were also used in the analysis, including preferred language, gender, age, and number of call activities. The number of call activities is the sum of all call activities over the whole study period. This variable is included to account for the influence of calling behaviour which could, in turn, affect the indicators for space-time behaviour.

3.3. Sample

The study covers the period from January to December 2016, and includes analysis of data from 13,021 mobile phone users corresponding to the following criteria: (1) preferred language is Estonian or Russian; (2) data on gender and age are available for the mobile phone user; (3) it is possible to determine the home anchor point (including being on the same mobile antenna for at least seven months); (4) the home anchor point of the mobile phone user is Tallinn; (5) call activities are available for at least seven months (which is important to assess annual spatial mobility); (6) a user must have at least one calling partner with whom reciprocal call activity is available in at least two months; (7) at least 50% of call activities are made to calling partners using the same MNO, which helps to guarantee that the majority of the members of the network of the calling partners are included when calculating network characteristics; (8) the language of

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at least one calling partner is Estonian or Russian; and (9) place of residence of at least one of the calling partners is known.

Because the distribution of those meeting these criteria does not correspond to the distribution of the population of Tallinn, we determined weights for the people included in the study. These weights were found based on the distribution of Tallinn residents from the 2011 census in the following characteristics: combination of the language and residential district, gender, and age groups (Table 1).

3.4. Statistical Analysis

Spearman ρ correlation analysis was performed to examine the general associations between people with interethnic networks and Russian residents in residential districts in Tallinn. Correlation analysis was performed separately for Estonian speakers and Russian speakers with interethnic networks.

In order to discover how different variables affect the odds of having an interethnic network, a set of binary logistic regression models were applied (Models 1–3). The dependent variable has values 1 (has an interethnic network) or 0 (has a co-ethnic network). Independent variables include a number of socio-demographic variables, such as: language, gender, and age; activity-space characteristics such as the percentages of Russians in residential and workplace districts; number of calling partners; and number of call activities. Separate models were then created for all people in the study (Model 1), Estonian speakers (Model 2), Russian speakers (Model 3). The exponents of the coefficients are equal to the odds ratios (OR).

To discover the relationship between social networks and spatial mobility, we applied negative binomial regression (Models 4–7) and OLS regression (8–11). Dependent variables were indicators of a person's activity space: number of districts visited (Models 4–7) and percentage of Russian residents in districts visited (Models 8–11). Because the dependent variable 'number of visited districts' is in the form of count data and is overdispersed ($\mu \neq \sigma^2$), negative binomial regression analysis is applied in Models 4–7. The exponents of the coefficients in negative binomial regression are equal to the incident rate ratios (IRRs), which represent the percentage increase or decrease in the dependent variable (counts). The main explanatory variable of interest in Models 4–11 is the ethno-linguistic composition of social networks, with other variables included. Separate models were created for all people in the study (Models 4, 5, 8, 9), Estonian speakers (Models 6, 10), and Russian speakers (Models 7, 11). These models do not refer to causality but instead help to explore the relationship between explanatory variables and activity space characteristics.

4. Results

4.1. Characteristics of Interethnic Social Networks

Co-ethnic networks dominate among both Estonian and Russian speakers. The proportion of people with an interethnic network is higher among Russian speakers (45%) than among Estonians (10%). The distribution of those with an interethnic network depends on the ethno-linguistic composition of the residential district concerned. For Estonians, there is a positive correlation ($\rho = 0.66$, p < 0.05) between the percentage of people with an interethnic network and Russian residents in residential districts (Figure 3). This means that the proportion of people with an interethnic network is higher for those districts where the percentage of Russian residents is higher. However, for Russian speakers the correlation is negative and weak: the proportion of people with an interethnic network is higher for those districts where

Table 1. Percentage distribution of characteristics of the sample compared with Tallinn residents based on 2011 census data.

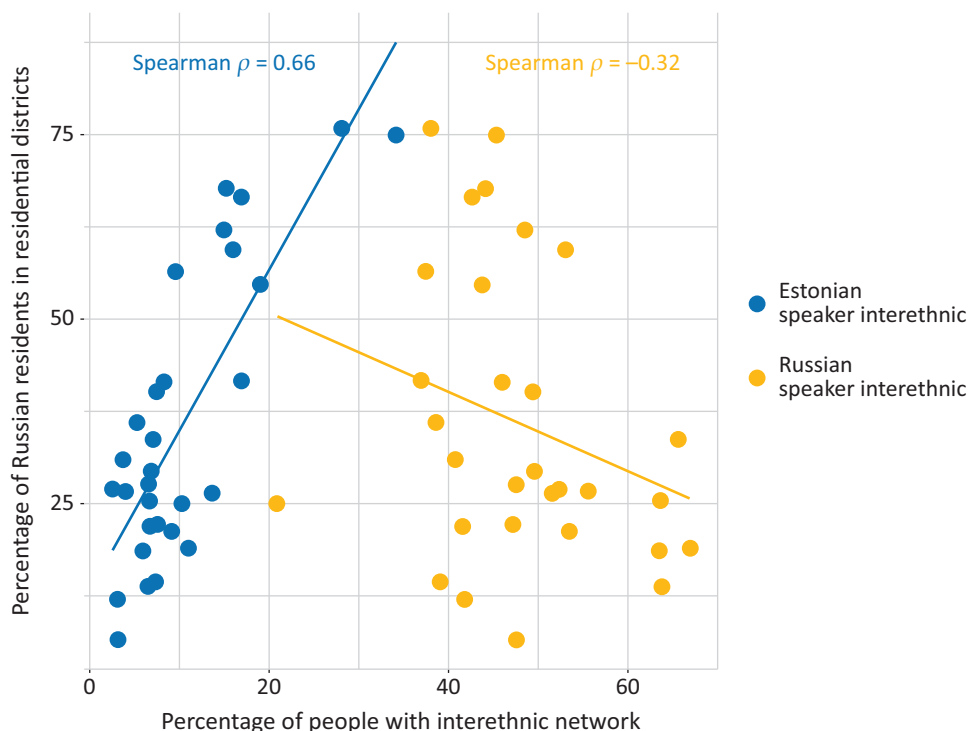|	Mobile positioning data	Tallinn residents (Census 2011)
Language		
Estonian	76.8	53.6
Russian speakers/Russians	23.2	46.4
Gender		
Male	36.5	45.0
Female	63.5	55.0
Age		
24–29	2.0	14.9
30–39	16.0	20.9
40–49	31.7	16.7
50–59	26.7	17.4
60–69	14.0	13.4
70–91	9.6	16.7

Figure 3. Correlation between proportion of interethnic networks and Russian residents in residential districts.

the percentage of Russian residents is lower, i.e., more Estonians live there ($\rho = -0.32$, p > 0.05).

The logistic regression model also confirms the dependence of the interethnic network on ethno-linguistic group (Table 2, Model 1). Russian speakers have 6.6 times higher odds than Estonian speakers (p < 0.01) of having an interethnic network. For Estonian speak-

ers, the existence of an interethnic network is most clearly related to the proportion of Russian residents in the residential district (Table 2, Model 2). Estonian speakers who live in districts dominated by Russian residents (60–76%) have 2.5 times higher odds (p < 0.01) of having an interethnic network and Estonian speakers who live in districts where Estonian residents dominate

Table 2. The personal socio-demographic characteristics, the ethno-linguistic composition of place of residence and work-place, and the size of social network relationship with the existence of an interethnic network.

Interethnic (ref.: co-ethnic)	Model 1 Est + Rus main effects	Model 2 Estonian speakers	Model 3 Russian speakers
Language: Russian speaker (ref.: Estonian speaker)	6.61***		
Gender: Female (ref.: Male)	0.91**	0.86*	0.97
Age	1.01***	1.00	1.01***
Percentage of Russian residents in residential district: 0–39 (ref.: 40–59)	0.79***	0.57***	1.23**
60–76	1.11	2.47***	0.89
Percentage of Russian residents in workplace district: 0–39 (ref.: 40–59)	0.87**	0.89	0.86*
60–76	0.99	1.42**	0.93
Number of call activities	1.00***	1.00***	1.00***
Number of calling partners	1.04***	0.95***	1.22***
N	12632.12	7267.31	5364.81
Cox and Snell	0.16	0.06	0.09
Nagelkerke	0.24	0.13	0.12
McFadden	0.16	0.10	0.07

Notes: Binary logistic regression model (Exp (B)); significance: *p < 0.1; **p < 0.05; ***p < 0.01.

(percentage of Russian residents 0–39%) have lower odds (p < 0.01; see Table 2, Model 2). Estonian speakers also have 42% higher odds (p < 0.05) for those who work in minority-rich districts. For Russian speakers, the same logic applies, 23% higher odds (p < 0.05) of having an interethnic network for those who live in majority-rich districts (percentage of Russian residents 0–39%; see Table 2, Model 3). Interestingly, the odds of having an interethnic network for Russian speakers is not significantly related to living in minority-rich (i.e., Russian dominated) districts. The proportion of Russian residents in the workplace district are not clearly related to Russian speakers. The existence of an interethnic network is also related to some social characteristics (Table 2).

4.2. Relationship between the Composition of Social Networks and Activity Space

People with co-ethnic social networks form two extremes in terms of the spatial extent of their activities. Estonian speakers with co-ethnic networks have the largest activity spaces (on average they visit 37 districts) and Russian speakers with co-ethnic networks have the smallest activity spaces (28 districts). The numbers of visited districts for Estonian speakers and Russian speakers with interethnic networks is quite similar: they visit 35 and 33 districts, respectively. The relationship between the ethno-linguistic composition of social networks and the number of districts visited is insignificant (p > 0.1) when both ethno-linguistic groups are included in the model (Model 4), but significant (p < 0.01) when included as an interaction with language (Model 5). Estonian speakers with interethnic networks visit 12% fewer districts than Estonian speakers with co-ethnic networks (Model 6, p < 0.01). For Russian speakers, the relationship is the opposite—Russian speakers with interethnic networks visit 4% more districts than Russian speakers with co-ethnic networks (Model 7, p < 0.01).

Russian speakers in general have smaller activity spaces (average 31 districts) than Estonian speakers (average 37 districts). Holding other variables constant, Russian speakers tend to visit 8% fewer districts than Estonians (p < 0.01, Model 4). People who live in minority-rich areas visit fewer districts than people who live in areas with more or less equal proportions of the two ethno-linguistic groups (Models 4–7). People who work in areas in which Estonians form the majority of the residential population visit a higher number of districts, and this applies to both ethno-linguistic groups (Models 4–7).

There is a clear relationship between the ethno-linguistic composition of a social network and the proportion of Russian residents in the districts visited. People with interethnic networks visit districts with a higher average proportion of Russian residents (32%) than people with co-ethnic networks (27%). Considering both Estonian and Russian speakers (Model 8), it is evident that there is a positive and significant relation-

ship (p < 0.01) between having an interethnic network and the proportion of Russian residents in visited districts, but this relationship depends on the particular ethno-linguistic background of the person concerned (Models 9–11). Estonian speakers who have an interethnic network visit districts with a higher average proportion of Russian residents (30%) than Estonians with co-ethnic networks (25%; Model 10: p < 0.01). In contrast, Russian speakers with interethnic networks visit districts with lower average proportions of Russian residents (32%) than Russian speakers with co-ethnic networks (34%; Model 11: p < 0.01). In summary, people with an interethnic network tend to visit such districts more in which the proportion of people from the other ethno-linguistic group is higher.

In general terms, Russian speakers tend to visit districts with higher proportions of Russian residents (on average 33%) compared with Estonian speakers (25%; Model 8: p < 0.01). The ethnic composition of everyday activity locations, such as residences and workplaces, also matters. People who live in Russian minority-rich areas tend to visit districts with higher proportions of Russian residents (Models 8, 9), and this applies both to Estonian (Model 10) and Russian speakers (Model 11). The relationship is similar between the percentage of Russians in districts visited and workplace ethno-linguistic exposure. If an individual works in a majority-rich area, he/she tends to visit districts with lower proportions of Russian residents (p < 0.01, Models 8, 9). This is statistically significant for Estonian speakers (Model 10), but not for Russian speakers (Model 11). In contrast, when a person works in an area in which the proportion of Russian residents is 60% or higher, then this person visits districts with a higher proportion of Russian residents (Model 8–9, p < 0.01). This is statistically significant for Russian speakers (Model 11), but not for Estonian speakers (Model 10).

The differences in spatial behaviour across ethno-linguistic social network groups is also evident in Figures 4 and 5. The most extensive use of space can be attributed to Estonian speakers with co-ethnic networks and the least extensive to Russian speakers with co-ethnic networks. The latter visit mostly the Northern and Eastern Estonian regions that are home to a high number of Russian speakers, and very few visit the Western and Southern parts of Estonia. Estonian speakers and Russian speakers with interethnic networks visit similar districts, but clear differences are apparent compared with people with co-ethnic networks. There are higher proportions of Russian speakers who visit districts outside Northern and Eastern Estonia among those with interethnic networks. In contrast, Estonian speakers with interethnic networks visit fewer districts than Estonian speakers with co-ethnic networks. In Tallinn, all groups apart from Estonian speakers with co-ethnic networks tend to visit the Eastern parts of Tallinn, where the proportion of Russian residents is higher, rather than the Southern parts of Tallinn, where the proportion

Table 3. The relationship between activity space and personal socio-demographic characteristics, the ethno-linguistic composition of place of residence and workplace, and social network relationship with the activity space.

	Negative binomial regression [1] Number of visited unique districts				OLS regression [2] Percentage of Russians in visited districts			
	Model 4 Est + Rus main effects	Model 5 Est + Rus	Model 6 Estonian speakers	Model 7 Russian speakers	Model 8 Est + Rus main effects	Model 9 Est + Rus interaction	Model 10 Estonian speakers	Model 11 Russian speakers
Intercept	40.03***	40.67***	43.73***	30.85***	22.80***	22.82***	21.77***	30.93***
Language: Russian speaker (ref.: Estonian speaker)	0.92***	0.88***			4.49***	6.16***		
Ethno-linguistic composition of social network: Interethnic (ref.: co-ethnic)	0.99	0.88***	0.88***	1.04***	0.91***	4.65***	3.68***	−0.98***
Language: Russian speaker (ref.: Estonian speaker) * Social network: Interethnic (ref.: co-ethnic)		1.20***				−5.58***		
Gender: Female (ref.: Male)	0.90***	0.90***	0.91***	0.88***	0.32***	0.32***	−0.04	0.83***
Age	0.99***	0.99***	0.99***	0.99***	0.04***	0.04***	0.04***	0.03***
% of Russian residents in residential district: 0–39 (ref.: 40–59)	1.00	1.00	0.99	0.99	−0.38***	−0.30**	0.02	−0.31
60–76	0.95***	0.95***	0.94***	0.96***	1.31***	1.23***	2.30***	0.79***
% of Russian residents in workplace district: 0–39 (ref.: 40–59)	1.05***	1.05***	1.07***	1.03**	−0.63***	−0.68***	−1.20***	0.02
60–76	1.00	1.00	1.04	0.99	0.62***	0.60***	0.10	1.11***
Number of call activities	1.00***	1.00***	1.00***	1.00***	−0.001***	−0.001***	−0.0003***	−0.001***
Number of calling partners	1.01***	1.01***	1.01***	1.01***	−0.18***	−0.16***	−0.17***	−0.16***
Number of residential districts of calling partners	1.03***	1.03***	1.03***	1.03***				
% of Russian residents in districts of calling partners					0.09***	0.08***	0.12***	0.05***
Adj R[2]					0.48	0.50	0.34	0.18
AIC	98,593.59	98,501.61	57,794.31	40,610.94				

Notes: [1] Numbers represent incident rate ratios and 95% confidence intervals; [2] Numbers represent B and 95% confidence intervals; significance: *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$
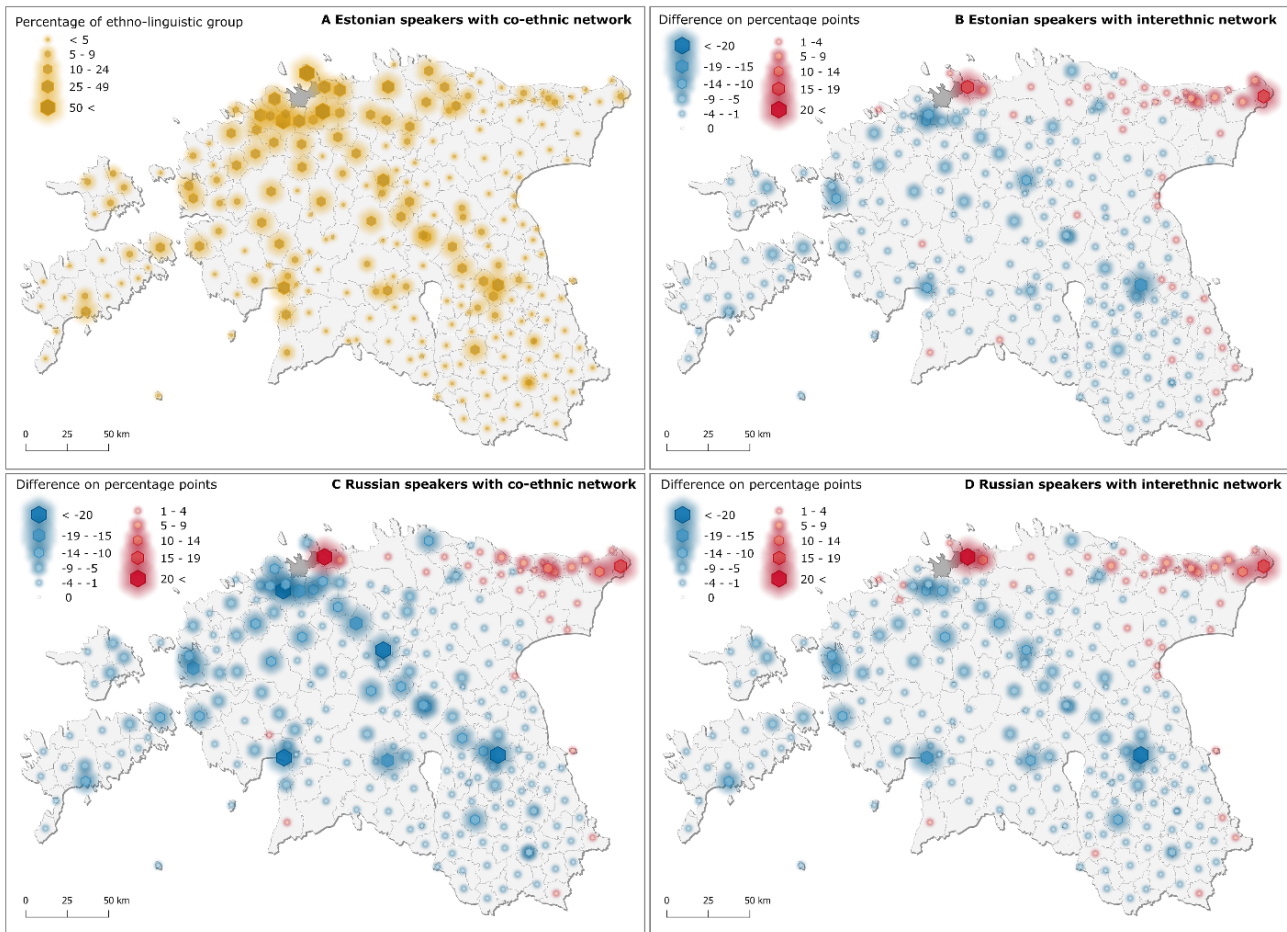
Figure 4. Comparison of visited districts in Estonia by ethno-linguistic background and network composition: (A) Estonian speakers with co-ethnic networks (reference category), (B) Estonian speakers with interethnic networks, (C) Russian speakers with co-ethnic networks, and (D) Russian speakers with interethnic networks. Differences are presented as percentage points (weighted data).

of Russian residents is lower (Figure 5). Estonian—and Russian-speaking people with interethnic networks visit central districts more than Estonian speakers with co-ethnic networks. Russian speakers with co-ethnic networks visit districts in the city centre the least.

5. Discussion and Conclusion

In this study, we have explored the relationship between the ethno-linguistic composition of social networks and activity spaces among the Estonian-speaking majority and the Russian-speaking minority residents in Tallinn. We observed the spatial behaviour of the majority and the minority with co-ethnic (closed) and interethnic (open) networks, thus taking an approach that differs from that used in previous segregation studies.

Homophily, or the tendency to build relationships with similar others, is a well-known phenomenon (Kossinets & Watts, 2009; McPherson et al., 2001). Our results show that in general there is a higher proportion of people with co-ethnic networks than people with interethnic networks among both ethno-

linguistic groups. In the literature, this phenomenon has been explained by prejudiced attitudes, preference, language proficiency, or a lack of trust (Eisnecker, 2019; Martinovic, 2013). Interethnic networks are more common for the Russian-speaking minority than for the Estonian-speaking majority. From the perspective of the minority, this can be explained by the accompanying benefits of having more diverse and open networks, which is important for success in society (Eagle et al., 2010; Verdier & Zenou, 2017). From the perspective of the majority, it could also be due to fact that Estonian speakers have more potential partners for creating co-ethnic social ties (i.e., Estonians). The formation of co-ethnic networks can be further amplified by the linguistically divided school system in Estonia (Masso & Soll, 2014). Schools are similar to the workplaces in being a domain for 'forced' social contact, affecting the transmission of segregation between activity places, life domains and generations, and making them an important element in the vicious circle of segregation (van Ham et al., 2018).

Exposure to different ethno-linguistic groups in activity locations such as work and residential neighbourhood
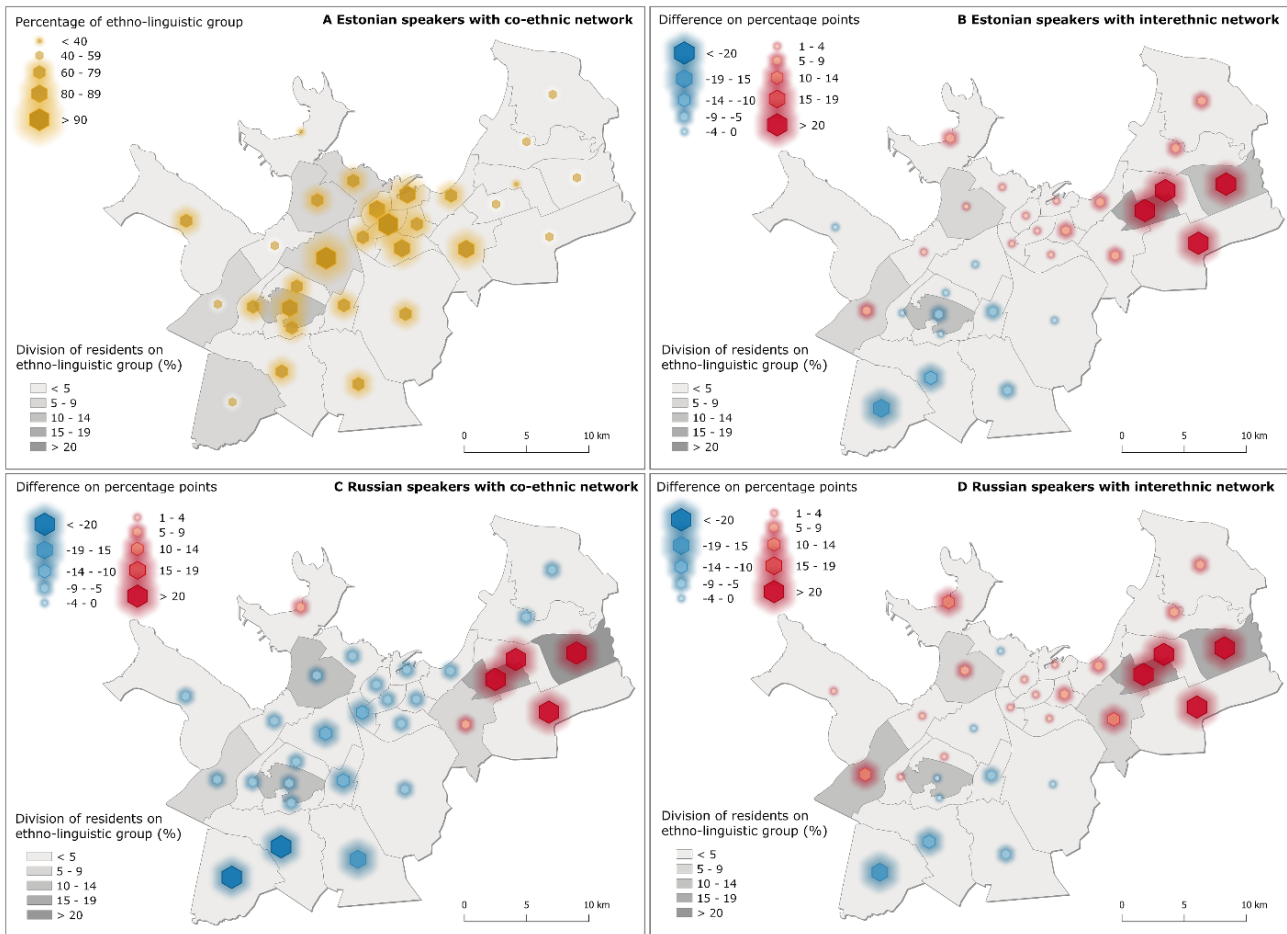
Figure 5. Comparison of visited districts in Tallinn by ethno-linguistic background and network composition: (A) Estonian speakers with co-ethnic networks (reference category), (B) Estonian speakers with interethnic networks, (C) Russian speakers with co-ethnic networks, and (D) Russian speakers with interethnic networks. Differences are presented as percentage points (weighted data).

plays an important role in the formation of interethnic relationships (Eisnecker, 2019; Hall et al., 2019). Life in a neighbourhood that is ethnically mixed leads to networks that are more heterogeneous (Eisnecker, 2019), as also confirmed by our study. People who live in districts with a higher proportion of residents from another ethno-linguistic group have more interethnic networks, and this applies to both Estonian and Russian speakers.

While the connection between social networks and spatial mobility has been proved in previous studies (Phithakkitnukoon et al., 2012; Puura et al., 2018), we further find that the ethno-linguistic composition of networks is related to the spatial behaviour of individuals. Estonian and Russian speakers with co-ethnic networks form two extremes in terms of the extent and ethnic composition of the activity space: the former have the widest and the latter have the narrowest activity spaces. This indicates that the social isolation (closed networks) of the minority is also evident in their spatial behaviour. In contrast, having an interethnic network leads to visits to destinations with more people from the other ethno-linguistic group, which in turn indi-

cates a higher potential for interethnic contact. Russian speakers with interethnic (open) networks can be associated with higher levels of integration: they have broader activity spaces and visit places with higher proportions of Estonians than Russian speakers with co-ethnic networks. Thus, interethnic social ties bring them closer to the majority population. A similar tendency can also be applied to Estonian speakers with interethnic networks: they visit more places with higher proportions of Russian residents, but their activity spaces are smaller than those of Estonian speakers with co-ethnic networks. For some reason, the more open networks of such Estonian speakers do not translate into wider spatial behaviour, which lies somewhat add odds with the common understanding of open networks (Heizmann & Böhnke, 2016).

Social networks and mobility are considered important mechanisms in the process of acculturation and in the (re)production of segregation because they provide access to information, opportunities, and social support (Krysan & Crowder, 2017; van Kempen & Özüekren, 1998). In the present study, we have outlined the complex relationships between the ethno-linguistic

composition of different parts of the activity space and the vicious circle of segregation, social networks, and spatial behaviour. Our study shows that exposure to ethno-linguistically mixed activity places in Tallinn is associated with the tendency to have interethnic networks and to visit places outside Tallinn with higher proportions of the other ethno-linguistic group. Interethnic networks can be either the cause or the effect of spatial mobility and exposure of this kind. Visits to minority-rich areas may lead to the creation of an interethnic network, but existing interethnic networks can also lead to visits to minority-rich areas. From the perspective of minorities, having common activity locations with majorities and the creation of interethnic networks must be considered essential for overcoming the vicious circles of segregation (Kukk et al., 2019; van Ham et al., 2018).

Further studies are necessary to explore more deeply the direction of causality between social networks and activity spaces. Something that should certainly be explored in more detail is the question of in which parts of the activity space are social network partners (especially interethnic partners) co-present, and when exactly are bridging ties formed regarding an individual's life-course. This would indicate where and when interethnic ties are (re-)established. Bridging ties are seen to enhance integration. Therefore, it would be a valuable source of input for integration policies which aim to break the vicious circle of segregation.

Our study further confirms the usefulness of mobile phone-based (CDR and call-graph) datasets in segregation studies. We nevertheless acknowledge that the use of a single data source (i.e., mobile phone data) to measure social networks might provide a somewhat limited overview because there are many different channels of communication and a qualitative approach would be needed to better understand causality. However, mobile phone data are a good resource when it comes to estimating close social networks and tracing patterns of human spatial behaviour.

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Article

Daily Mobility Patterns: Reducing or Reproducing Inequalities and Segregation?

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Abstract
Theory states that residential segregation may have a strong impact on people's life opportunities. It is unclear, however, to what extent the residential environment is a good representation of overall exposure to different people and environments. Daily mobility could reduce the negative effects of segregation if people change environments and/or become more mixed. They could also enhance existing segregation patterns if daily mobility produces more segregated environments. This article uses mobile phone data to track daily mobility patterns with regard to residential segregation. We test the extent to which patterns differ between residents in immigrant-dense areas and those from areas with a greater proportion of natives. Results suggest, in line with previous research, that daily mobility patterns are strongly segregated. Phones originating from more immigrant-dense areas are more likely to (1) remain in the home area and (2) move towards other immigrant-dense areas. Hence, although mobility does mitigate segregation to some extent, most people are mainly exposed to people and neighbourhoods who live in similar segregated environments. These findings are especially interesting given the case study areas: two medium-sized Swedish regions with relatively low levels of segregation and inequality and short journey distances.

Issue
This article is part of the issue "Vicious Circle of Segregation: Understanding the Connectedness of Spatial Inequality across Generations and Life Domains" edited by Tiit Tammaru (University of Tartu, Estonia), Siiri Silm (University of Tartu, Estonia), Frank Witlox (Ghent University, Belgium), Maarten van Ham (Delft University of Technology, The Netherlands) and Madli-Johanna Maidla (University of Tartu, Estonia).

1. Introduction

Residential segregation is one of the major urban problems in contemporary Sweden, judging by the attention and number of recent publications by media, government, and academia. Internationally too, the interest in segregation is expanding. As Musterd (2020) points out, summing up his edited handbook on urban segre-gation, this increasing interest is closely related to urban problems emerging during a period of intensified globalization where socioeconomic polarization has grown at the same time as nation states and cities have favoured neoliberal planning and policies. Most of the literature acknowledges that spatial segregation is part and parcel of the production and reproduction of inequality, affecting socialization processes and shaping conditions for

people´s opportunities in life. The growing interest in studying the effects of segregation, often by addressing the issue of neighbourhood effects (Sampson, 2012), has further contributed to strengthening the emphasis on process, dynamics, and how individuals and groups of individuals over long periods of time are affected by their place of residence.

Not least, in relation to the challenges of measuring neighbourhood effects, the issue of spatial scale emerges as a key aspect (R. Andersson, & Musterd, 2010; Kadarik, Miltenburg, Musterd, & Östh, 2021). As argued by Östh and Türk (2020; see also Grannis, 1998, 2005; Kasarda & Janowitz, 1974), this points in the direction of knowing more, not only about where people reside but also about how infrastructure and accessibility shape a neighbourhood's conditions for its residents. Related methodological problems when estimating neighbourhood effects are those of timing and duration of exposure (Galster, Andersson, & Musterd, 2016; Musterd, Galster, & Andersson, 2012). These challenges are often discussed in relation to the life course but are just as relevant on a day-to-day basis (Kwan, 2012; Park & Kwan, 2018). People do not limit their lives to their home neighbourhood but move around in space, experiencing many different environments over the course of a day. Most studies estimating neighbourhood effects ignore daily mobility, implicitly assuming that a neighbourhood's relative location, population composition, and social status reflect its residents' overall exposure to different domains. Previous research has demonstrated that this is erroneous: Residential patterns are rather poor proxies for people's full exposure to different environments and population groups (Browning & Soller, 2014; Jones & Pebley, 2014). Consequently, estimates of neighbourhood effects may turn out to be biased. Uncertainty about actual exposure and a failure to take it into account—the 'uncertain geographic context problem' (Kwan, 2012)—is, according to Park and Kwan (2018), one of the most serious challenges facing neighbourhood effect research. It is especially problematic in relation to those living in the bottom-end of the neighbourhood hierarchy. They are generally assumed to face the most serious negative consequences of segregation and are the target of most anti-segregation initiatives yet their exposure to deprivation risks being exaggerated if their daily exposure to more resourceful areas is not accounted for (Jones & Pebley, 2014; Kwan, 2018; Tan, Kwan, & Chen, 2020).

The work of Y. M. Park, M. P. Kwan and others (apart from those mentioned above; see, e.g., van Ham & Tammaru, 2016; Wong & Shaw, 2011) stress the importance of analysing segregation from a mobility perspective. People's daily travels in and out of neighbourhoods of different composition and characteristics, as well as their length of exposure to different environments, need to be better understood if we are to fully grasp the levels and consequences of segregation. The present study contributes to the research on daily mobility patterns in relation to residential segregation. We analyse daily mobility patterns from neighbourhoods with different ethnic composition in terms of the likelihood of staying put, distance travelled, and the composition of neighbourhoods visited. The distinction of neighbourhoods on the basis of the immigrant population is important. Previous research has demonstrated that mobility patterns are in themselves segregated (e.g., Östh, Shuttleworth, & Niedomysl, 2018; Phillips, Levy, Sampson, Small, & Wang, 2019; Silm & Ahas, 2014a, 2014b; Q. Wang, Phillips, Small, & Sampson, 2018). Overall mobility rates, destinations, and exposure to different environments vary by income, ethnic/racial/language groups, and the characteristics of the origin neighbourhood. The overall aim of the article is to compare and contrast daily mobility patterns from areas of different immigrant composition, in order to discuss how and if residential segregation is overcome by mobility.

Our case study areas are two medium-sized Swedish labour market regions. The size of the chosen regions makes this study stand out from previous work (especially the US-based studies) which has mainly focused on larger cities. In a big city characterized by large distances and multiple local city centres, geographically differentiated mobility patterns are to be expected. Long distances prevent mobility, especially at locations where transport links are poor. In our case study regions, however, most distances can be covered by bike and public transportation is available for most. Population density, degree of cosmopolitanism, and level of segregation are also factors that affect mobility patterns (Phillips et al., 2019). Our case study regions are less densely populated and also have lower levels of segregation compared to large international cities. A second aim of the article is thus to compare the overall daily mobility patterns, in relation to segregation, in medium-sized regions to the results of previous work.

The article answers the following research questions:

- How do daily mobility patterns, in terms of stayers, movers, and mover destinations, differ between neighbourhoods of different immigrant composition? How do these differences relate to overall patterns of residential segregation?
- How do our results, from relatively small regions characterised by short distances and low levels of segregation (in an international comparison), relate to previous findings from large cities/high segregation contexts?

2. Literature Review

Whereas the vast bulk of segregation research focuses on the residential domain, it is increasingly recognized that the place of residence does not capture people's full exposure (van Ham & Tammaru, 2016). A small but growing literature is looking into segregation in

domains other than residence, such as work, school, and leisure (examples of studies include E. K. Andersson, Östh, & Malmberg, 2010; Bygren, 2013; Ellis, Wright, & Parks, 2004; Reardon, 2016; Silm & Ahas, 2014a). An even smaller number of studies set out to compare levels of segregation in different domains. For example, Hall, Iceland, and Yi (2019; see also Ellis et al., 2004) show that residential segregation levels are substantially higher than 'workhood segregation' in the United States. In line with their results, analyses of diurnal mobility patterns in Sweden (Östh et al., 2018) and Estonia (Silm & Ahas, 2014b) find that residential segregation is greater than segregation during the daytime. Marcińczak, Tammaru, Strömgren, and Lindgren (2015) find a close association between residential and workplace segregation in the Stockholm metropolitan region (cf. Pendakur, Pendakur, & Bevelander, 2016, who find little correlation between residential and workplace segregation) whereas Tammaru, Strömgren, van Ham, and Danzer (2016) find very high levels of workplace segregation for newly arrived immigrants to Sweden from the Global South. However, after an initial period of about five years, workplace segregation tends to drop while residential segregation levels remain high. These results thus suggest that people experience lower levels of segregation, and thus in-group exposure, during the day-time, as a consequence of moving into other parts of the city and mixing with others outside of their local neighbourhood. Additionally, Toomet, Silm, Saluveer, Ahas, and Tammaru (2015; see also Kukk, van Ham, & Tammaru, 2017) show that segregation in leisure in Tallinn is far less pronounced than that in both residential and workplace segregation.

There is also a small but growing literature directly concerned with daily mobility patterns in relation to segregation. Part of this research set out to analyse differences in 'activity spaces,' i.e., the geographical areas within which most daily activities occur (for an overview see Cagney, York Cornwell, Goldman, & Cai, 2020). Such spaces are rarely defined by the boundaries of the residential neighbourhood. For example, Shelton, Poorthuis, and Zook (2015) show that the activity spaces of the inhabitants of Louisville's (KY) deprived West End areas are best described as 'fluid,' often crossing into other parts of the city.

A general conclusion is that activity spaces differ between residents in different neighbourhoods, depending on the neighbourhood's relative location, ethnic/racial composition, and social status (Östh, Malmberg, & Andersson, 2014; D. Wang, Li, & Chai, 2013; Zhang, Wang, Kwan, & Chai, 2019). A number of US-based studies have demonstrated that the daily mobility of White, Black, and Hispanic populations takes place mostly in and around areas where the own population group is overrepresented (Browning, Calder, Soller, Jackson, & Dirlam, 2017; Chen & Pope, 2020; Jones & Pebley, 2014; Phillips et al., 2019; Sampson, 2019; Shareck, Kestens, & Frohlich, 2014; Q. Wang et al., 2018; Wong & Shaw, 2011). There is also a distinct class dimen-

sion (Q. Wang et al., 2018). Low-income neighbourhoods dominated by Blacks are especially likely to have other low-income areas as both main sending and receiving areas (Sampson, 2019). These results suggest that daily mobility patterns do not necessarily reduce own-group exposure. Rather, segregated mobility patterns may actually reinforce socioeconomic isolation.

A major explanation for the recent increase in the number of studies analysing residential segregation in relation to moving patterns and/or segregation in other domains is improved access to data. For long, analyses of daily mobility patterns relied on data from travel diaries or surveys, or register data covering home and workplace. Recent technological developments have resulted in increasing numbers of scholars having access to geocoded fine-grained datasets covering large populations. Data based on social media posts, GPS tracking, or mobile phone records provide better means to conduct detailed analyses of spatiotemporal activity patterns. Much of the recent U.S. research on segregated mobility patterns (e.g., Phillips et al., 2019; Sampson, 2019; Shelton et al., 2015; Q. Wang et al., 2018) rely on geocoded data from Twitter and other social media. Another source of fine-grained data suitable for mobility analyses is mobile phone records. Estonian segregation scholars have been especially productive in making use of phone data. Their analyses reveal that the two major language groups in Estonia, Estonian speakers and Russian speakers, exhibit quite different mobility patterns (Järv, Müürisepp, Ahas, Derudder, & Witlox, 2014; Silm & Ahas, 2014a, 2014b; Toomet et al., 2015). Russian speakers (identified by choice of preferred language when signing the contract with the operator) generally have more geographically concentrated activity spaces compared to the Estonian-speaking majority, and they tend to visit fewer places. Russian speakers are also more likely to visit areas where Russian speakers are overrepresented. The largest differences are found in relation to trips out of the study population's home city of Tallinn, but the ethnic pattern is clear also for intra-city mobility. Silm, Ahas, and Mooses (2018) add an age perspective to the analyses. Contrary to spatial assimilation theory, they find no evidence of adaptation over generations: differences in activity spaces are in fact largest in younger age groups.

There is also a growing number of Swedish studies that make use of mobile phone data to analyse mobility and transport patterns, temporal activity patterns and segregation (see, e.g., Blind, Dahlberg, Engström, & Östh, 2018; Dahlberg et al., 2020; Östh et al., 2018; Toger, Shuttleworth, & Östh, 2020). In line with previous research, the Swedish mobile phone studies show that residential segregation is on average more pronounced than daytime segregation. Hence, equating exposure with night-time population composition is erroneous, as stipulated by Kwan's (2012) uncertain geographic context problem. However, low-amenity areas with no or few job opportunities become more segregated during

the day. This result, together with the US and Estonian findings of segregated mobility patterns, calls for more research into how mobility patterns differ between neighbourhoods of different population compositions and different positions in the urban hierarchy.

3. Data and Method

The data used in this study draws from two micro-databases. The first being a population register database, GeoSweden, whose material is compiled and distributed by Statistics Sweden. This population database is longitudinal and contains discrete and annually updated demographic, socio-economic, and geographic individual-level data. We use this population register data (from 2017, the latest year available) to obtain area characteristics, by aggregating the individual data on geographic location. Our main variable for aggregation is the percentage born outside Europe (the most common birth countries being Syria, Iraq, Iran, Afghanistan, Somalia, Turkey, Eritrea, Thailand, India, China, and Lebanon). We categorize areas in three groups based on their share of non-Europeans: category 1, areas with a low share (below the mean, decile 1–7); category 2, areas with a relatively high share (around or above the mean, decile 8–9); and category 3, areas with a high share (the top decile). Although we focus on non-European immigrant concentration, our neighbourhood categorization is also a good reflection of the area's socio-economic characteristics. There is a strong correlation between percentage non-European immigrants and percentages of people with low education, on a low income, or in unemployment, and most of the areas belong to category 3 (with the highest share non-Europeans) and can be described as 'deprived' (see Table 1 for descriptive statistics of the three neighbourhood categories in the case study regions).

To track daily mobility patterns, we use mobile phone data. The MIND database is a Big Data database containing mobile-phone mobility data from one of the major phone operators in Sweden (including around 10–20% of the Swedish population). The MIND dataset tracks (turned-on) phones through their connectedness to GSM-elements mounted on cell-towers. Calling, texting or uploading/downloading is recorded as an event, which means that a temporary phone-ID can be connected to a geocoded point (location of the cell tower). As a phone moves, the service of other GSM-elements take over, and a new geocoded location is recorded. The original data set contains data from every day over multiple years and is obviously too large to make any sense of. We select a workday that has been found to be representative for workdays in general—Thursday, 28 March 2019 (Toger et al., 2020). To test for differences between workdays and holidays (and as a check of robustness), we also select a second day—Saturday, March 30, 2019. As the main focus of this article is daily mobility during workdays, the Saturday results are used sparsely in the article. In 2017, the Swedish Internet agency esti-

mated that 98% of the population owned a mobile phone (Internetstiftelsen, 2017), meaning that mobile phone usage is not restricted to specific demographic groups, though usage is lower among very young and very old.

The Swedish phone data has greater spatio-temporal resolution compared to the Estonian data, but unlike the Estonian data, there is no information on the phone user. The data can only be connected to the registry data on the basis of geography. For determining a crude residential location of each phone, we take the average duration-weighted coordinates of the cell-towers that were connected to between 0.30 am and 7.20 am. The estimated geocoded location is then aggregated to the km^2 midpoint. This procedure renders a spatial representation of a residence that is shared with all other phones ending up within the same km^2 unit. The km^2 unit is hence the basic geographical entity used in this article. We acknowledge that a km^2 unit may differ from a 'neighbourhood,' both administratively and in the minds of people. Yet, we argue that a km^2 unit still corresponds fairly well to what people think of as their nearby area. The areas are also small enough to provide a nuanced pattern of immigrant concentration.

For day-activities, a similar approach is used where the day km^2 midpoint is calculated using the duration-weighted coordinates of the phone between 10 am and 12 am, and 1 pm and 3 pm. The lunch hour is omitted since many phones leave the location of work or schooling for lunch, and our intention is to capture the location used for work, school or other daily activities. In addition to estimating the locations of night-rest and day-activity of each phone, we also calculate mobility behaviour variables for each phone. We aggregate these variables to the night-rest km^2 units so that results can be used to represent the mobility behaviour of the population in each unit. Two measures are developed: total distance and maximum distance. Total distance TD is formulated as:

$$TD_i = \sum_i \sum_t Dist\left(btwxy_e - btwxy_{e-1}\right) \quad (1)$$

Where i represents the individual phone, t represents the time frame of 24h, and e represents the event being recorded as a phone-to-mast connection. The phone's first observed position during a 24h window (t) is computationally made equal to the coordinate of the cell-tower providing the first-used GSM service. The subsequent coordinates represent the between (btw)-XY-position between the currently used cell-tower, and the last known between-XY-position. This means that the x-coordinate (y-coordinate is calculated using the same method) is calculated as:

$$btwx = \min\left(x_{m,i,min}, x_e\right) + \frac{1}{2}abs\left(x_{m,i,min} - x_e\right) \quad (2)$$

where m, i, min represents the GSM-mast of phone i at time min (i.e., the most recent location), and x_e represents the last observed position of any event. This means that the list of locations is updated and grows, and can (as expressed in formula 1) be summed up at phone level.

The maximum distance variable expresses the longest cartesian distance travelled from the coordinates associated with night rest. The calculation can be formulated as follows:

$$MD_{it} = \max \sqrt{(x_o - btwx_j)^2 + (y_o - btwy_j)^2} \quad (3)$$

Where o represents the estimated location of residence, and j represents all other visited locations during a 24-hour period.

The article is mostly descriptive in character. We present a set of tables, graphs, and maps showing the share of stayers, movers within the region, and movers leaving the region from each specific area category. Since the categories are of different size in terms of both population and km^2 units, actual moving patterns are compared to anticipated patterns following the rela-

tive size of each category. For example, since 70% of the population in each region reside in a km^2 belonging to category 1, we anticipate that 70% of all phones in each region will start in a category 1 unit. We further anticipate that 70% of those phones—i.e., 49% of all phones—will remain in a category 1 unit. Numbers higher than 49% means an overrepresentation of mobility between category 1 units.

The descriptive analyses are complemented by two linear regressions, to control for basic demographic, socioeconomic, and geographic features of the km^2 units (see Table 1). The regressions use the share of stayers and distance travelled as dependent variables. These regressions confirm the descriptive patterns in our tables and graphs; for reasons of space and clarity, we have chosen to only refer to results using text. Results are available from the authors upon request.

Table 1. Descriptive statistics of the two regions, total and by area category.

	Falun-Borlänge LMR				Gävle-Sandviken LMR			
	Total	Category 1	Category 2	Category 3	Total	Category 1	Category 2	Category 3
Population	158,030	122,066	24,812	11,152	146,699	90,612	37,502	18,585
Share non-Europeans	7.6%	3.2%	14.1%	41.8%	11.1%	4.2%	17.2%	32.4%
Mean age	42.1	43.3	40.8	32.5	41.6	42.4	41.0	38.7
Share with children (20+)	26.1%	26.7%	20.9%	33.6%	26.7%	28.6%	22.5%	26.4%
Share single parents (20+)	4.1%	3.6%	5.2%	8.4%	4.5%	3.8%	5.2%	6.5%
Share with low education (< 10 years) (20+)	18.1%	16.7%	19.8%	32.8%	20.3%	18.3%	21.4%	28.5%
Share with high education (> 14 years) (20+)	16.0%	17.0%	13.9%	8.1%	15.4%	16.5%	15.4%	9.6%
Share unemployed (20–64)	10.4%	7.8%	15.3%	28.4%	12.6%	8.5%	16.6%	23.7%
Share with low disposable income (20+)	18.1%	16.0%	20.3%	39.4%	18.2%	14.6%	20.7%	31.5%
Share living in rentals	22.9%	14.0%	47.0%	70.0%	29.4%	15.2%	51.1%	54.9%
Number of km^2 units	1856	1725	90	41	1235	1179	38	18
Population per km^2 unit	85.5	63.8	354.2	394.2	118.8	86.9	750.9	876.2
Mean distance to urban core (km)	23.9	24.3	17.0	21.8	19.9	20.0	16.3	18.9

Note: Night-time population (registry data).

4. The Case Study Regions

An important contribution of the article is the focus on medium-sized regions, characterized by relatively short distances. The case study areas are two labour market regions located in mid-Sweden, Falun-Borlänge and Gävle-Sandviken. Labour market regions are functional geographical entities defined on the basis of commuting patterns. Hence, most workday mobility takes place within a labour market region. Aside from location, the two regions share many similarities: They are similar in population size, having roughly 150,000 inhabitants each and can both be described as bi-nodal, formed by two major cities (Falun and Borlänge, Gävle and Sandviken) and the surrounding area (including both smaller cities and countryside). Whereas Falun-Borlänge is somewhat larger in size (reflected by the larger number of km^2 units, 1,856 compared to 1,235 in Gävle-Sandviken; see Table 1 and Figure 1), neither of the regions is highly concentrated or highly dispersed. A majority of the population in both regions live within biking distance or a short car/bus journey from the nearest major city. Like in most other Swedish regions, public transport opportunities are in most cases very good.

Falun-Borlänge has a somewhat smaller non-European population (7.6% of the total population, compared to 10.9% in Gävle-Sandviken) but somewhat higher levels of segregation (segregation index of 0.5, compared to 0.42 in Gävle-Sandviken). The areas with the highest shares of non-Europeans are also more deprived, in terms of them having higher shares of inhabitants with low education, low incomes, and who are unemployed (which probably is a result of the higher concentration of non-Europeans) compared to category 3 units in Gävle-Sandviken. Category 3 units also have a higher share of single parents, people with low educa-

tion, low-income earners, and people living in rental dwellings, all typical markers of relative deprivation in the Swedish context (see Table 1). Gävle-Sandviken, however, has a higher overall level of unemployment and people with low education.

Overall, the non-Europeans have a more concentrated residential pattern compared to the Swedish-born population. Almost three out of four non-Europeans live in about 25% of the populated territory, generally in or near the major cities (Figure 1), in areas that have a higher population density than more peripheral locations. As consequence, a vast majority of all units in our data are categorized as belonging to category 1.

5. Results

The phones in our dataset can act in three different ways: remain in the home km^2 unit, move to another km^2 unit within the region, or leave the region. An individual staying put in the local neighbourhood is more exposed to local conditions than more mobile individuals. Hence, the 'stayers' are central to the analysis. The share of phones staying put is rather similar in both regions: 57% in Falun-Borlänge (Figure 2, left) and 59% in Gävle-Sandviken (Figure 2, right; slightly higher during Saturdays). The number may appear high, but one must remember that the entire population includes children and the elderly. The share of phones staying put is somewhat higher in areas from categories 2 and 3 than in areas from category 1, at least in Falun-Borlänge. Phones starting in category 1 are more likely to leave the region. A regression analysis, including controls related to km^2 unit demographic and socioeconomic composition, confirm that the (sometimes small) differences between categories in terms of share of stayers hold also when controlling for other area features (results not shown).
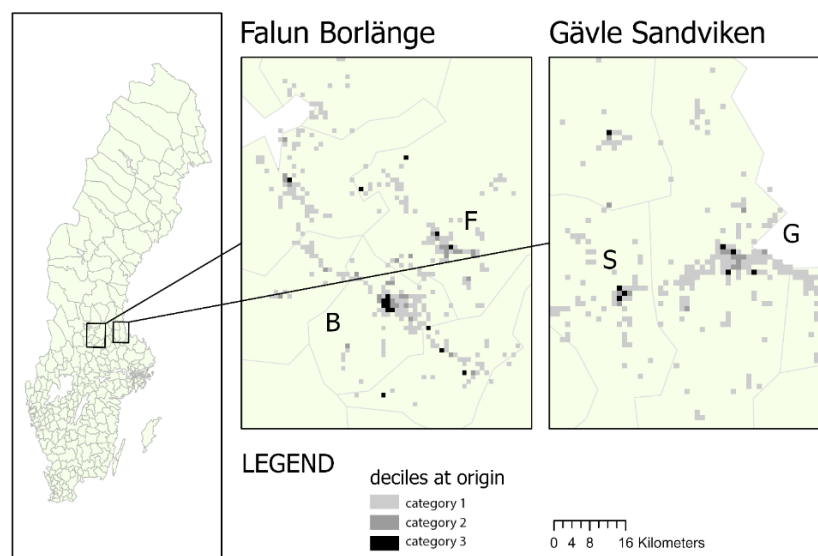

Figure 1. Distribution of km^2 units by category in the two labour market regions. Notes: Empty areas are unpopulated. The map of Sweden indicates the location of the two regions.
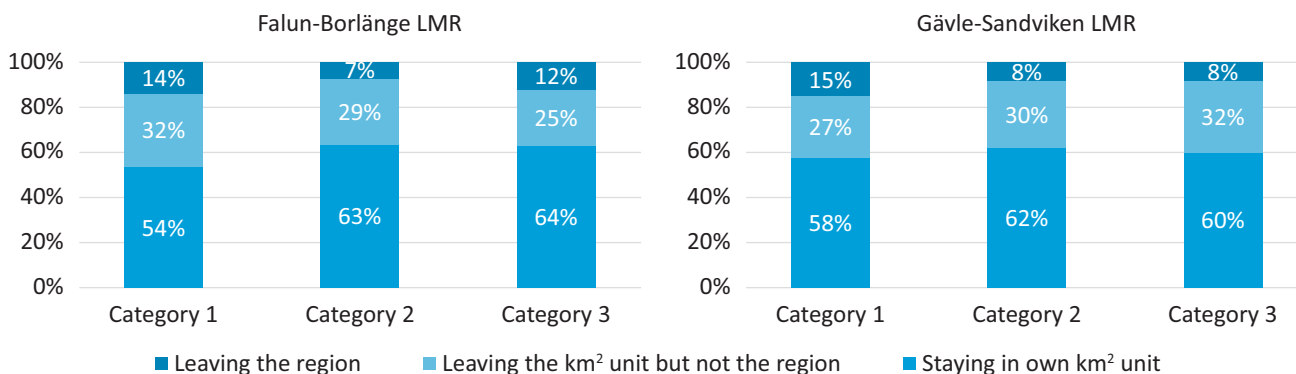
Figure 2. Share of phones staying within their own km^2, leaving their own km^2, and leaving the region: Falun-Borlänge (left) and Gävle-Sandviken (right). Note: Data from 28 March 2019, Thursday.

The share of stayers is higher in areas where the share of non-Europeans is at or above the mean. However, results are only valid for Thursdays. For Saturdays, the ethnic composition is insignificant.

Phones originating in categories 2 and 3 are not only more likely to stay put, they also travel shorter distances when they do move. Figure 3 displays the longest distance phones travel and total distance travelled over the course of a day, by category of the area of origin (mean values). Results show that phones starting in category 1 units are not only more mobile—those who travel are also more mobile in terms of how far they travel. Phones starting in categories 2 and 3 are more likely to remain relatively close to the areas of origin. The average maximum distance travelled is about or less than 3 km for phones starting in categories 2 and 3 in Falun-Borlänge and category 2 in Gävle-Sandviken. The pattern remains when running a regression, controlling for basic demographic and socioeconomic features (results not shown). The regression model also includes distance to the urban core. Hence, differences between categories are not (only) due to differences in locations.

Distance says something about the general travel behaviour of different groups (or, in this case, phones starting in different area categories) but they do not show where people go. In order for daily mobility to reduce exposure to their own neighbourhood environment, people need not only to travel but also to travel to areas different from their own neighbourhood. Previous research suggests that mobility patterns are segregated in the sense that people are more inclined to travel to areas where their own group is overrepresented. Hence, daily mobility does not overcome residential segregation to the extent that would have been the case if travel patterns had been more similar across groups.

Tables 2 shows the origin and destination for the Falun-Borlänge phones data. Table 3 does the same for the Gävle-Sandviken data. Each destination category contains three columns: actual mobility to units that are categorized according to night-time population (registry data), actual mobility to units that are categorized according to daytime population (phone data), and anticipated values. The anticipated values are based on population size. Since 70% of the population reside in category 1 units, we anticipate that 70% of all moves are conducted by phones originating in a category 1 unit and that 70% of those moves (or 49% of the total number of moves) are conducted within the category 1 segment.
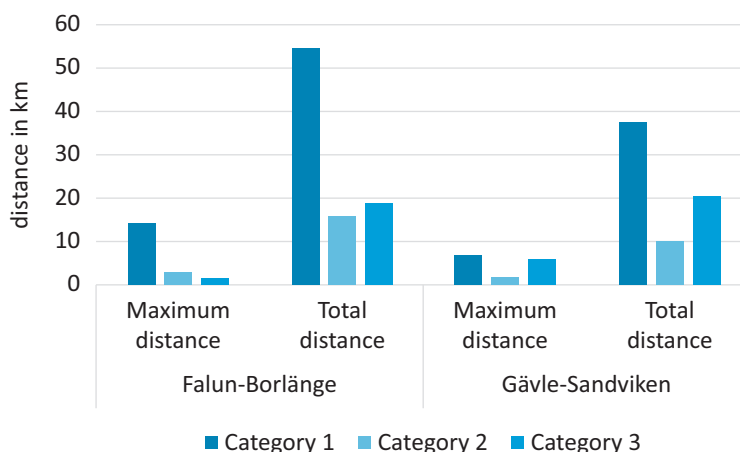

Figure 3. Maximum distance and total distance travelled by area category and region. Note: Data from 28 March 2019, Thursday.

Table 2. Flows across area categories (Falun-Borlänge).

| | Destination | | | | | | | | | | |
| | Category 1 | | | Category 2 | | | Category 3 | | | Total | |
Origin	Actual values Registry data	Actual values Phone data	Anti-cipated values	Actual values Registry data	Actual values Phone data	Anti-cipated values	Actual values Registry data	Actual values Phone data	Anti-cipated values	Actual values Registry data	Anti-cipated values
Category 1	63.1%	49.2%	49.0%	3.0%	16.6%	14.0%	1.4%	1.7%	7.0%	67.5%	70.0%
Category 2	4.1%	0.8%	14.0%	15.7%	10.9%	4.0%	0.8%	2.0%	2.0%	20.7%	20.0%
Category 3	1.5%	0.0%	7.0%	1.0%	1.0%	2.0%	9.3%	10.7%	1.0%	11.8%	10.0%
Total	68.7%	50.0%	70.0%	19.7%	28.5%	20.0%	11.6%	21.5%	10.0%	100.0%	100.0%

Note: Data from 28 March 2019, Thursday.

The anticipated values should be compared to actual mobility to detect over—or under-representation.

The left-hand column in each category show destinations for all phones by origin area category, with destination units categorized according to night-time population. Comparing actual destinations based on registry data to the anticipated values yields that there is a strong orientation towards the own category. The percentages of phones staying in their own category are far above the anticipated values, for all categories in both regions. This is partly due to a very large share of phones staying in their own km² unit, but there is also a strong bias towards the own category among those that do move to another unit. In both regions, over 80% of all phones leaving a category 1 unit go to another category 1 unit (the anticipated value is 70%). For categories 2 and 3, the shares are at about 25% in Falun-Borlänge. These values are all well above the anticipated values of 70/20/10. In Gävle-Sandviken, numbers are lower for categories 2 and 3 (18% vs 6% respectively) which is in line with the total share of phones starting from each category.

That phones in our dataset display a clear tendency to either remain in the home km² unit or move to other areas within the same category result in an under-representation of phones travelling to other area categories. The share of phones leaving category 1 for a category 2 or 3 area is well below the anticipated values.

The same goes for phones leaving the other categories. Phones leaving category 3 areas are especially unlikely to travel to a category 1 area. Only 1.5% and 1.1% of all phones (for Falun-Borlänge and Gävle-Sandviken respectively) start in a category 3 area and go to a category 1 area, compared to an expected value of 7%.

The phones' actual movements across space are displayed in Figures 4–6. The maps show flows of phones starting in each of the three area categories. Phones starting in category 1 move all across the regions. Although most flows are within or between the major cities, there are a large number of flows travelling to/from more peripheral locations and over long distances. Phones starting in category 2 units are more concentrated in the major cities. In Gävle-Sandviken, much movement takes places within the city of Gävle. In Falun-Borlänge, there are more flows between cities and also to smaller, more peripheral cities but there is still a higher concentration of flows to certain places, compared to flows starting in category 1 units. Flows starting in category 3 units are even more concentrated. Almost all flows go to areas within the major cities.

That people travel does however mean that the composition of neighbourhoods changes over the course of a day. Neighbourhoods that originally had a large or small proportion of non-European immigrants might become more mixed as people of different origins leave or visit

Table 3. Flows across area categories (Gävle-Sandviken).

| | Destination | | | | | | | | | | |
| | Category 1 | | | Category 2 | | | Category 3 | | | Total | |
Origin	Actual values Registry data	Actual values Phone data	Anti-cipated values	Actual values Registry data	Actual values Phone data	Anti-cipated values	Actual values Registry data	Actual values Phone data	Anti-cipated values	Actual values Registry data	Anti-cipated values
Category 1	75.5%	46.9%	49.0%	3.3%	30.1%	14.0%	1.5%	3.3%	7.0%	80.3%	70.0%
Category 2	3.2%	0.8%	14.0%	10.4%	2.6%	4.0%	0.5%	10.7%	2.0%	14.1%	20.0%
Category 3	1.1%	0.1%	7.0%	0.7%	0.8%	2.0%	3.8%	4.7%	1.0%	5.6%	10.0%
Total	79.9%	47.9%	70.0%	14.4%	33.4%	20.0%	5.8%	18.7%	10.0%	100.0%	100.0%

Note: Data from 28 March 2019, Thursday.

Gävle Sandviken

Falun Borlänge

LEGEND

flows
—— flow, category 1

deciles at origin
- category 1
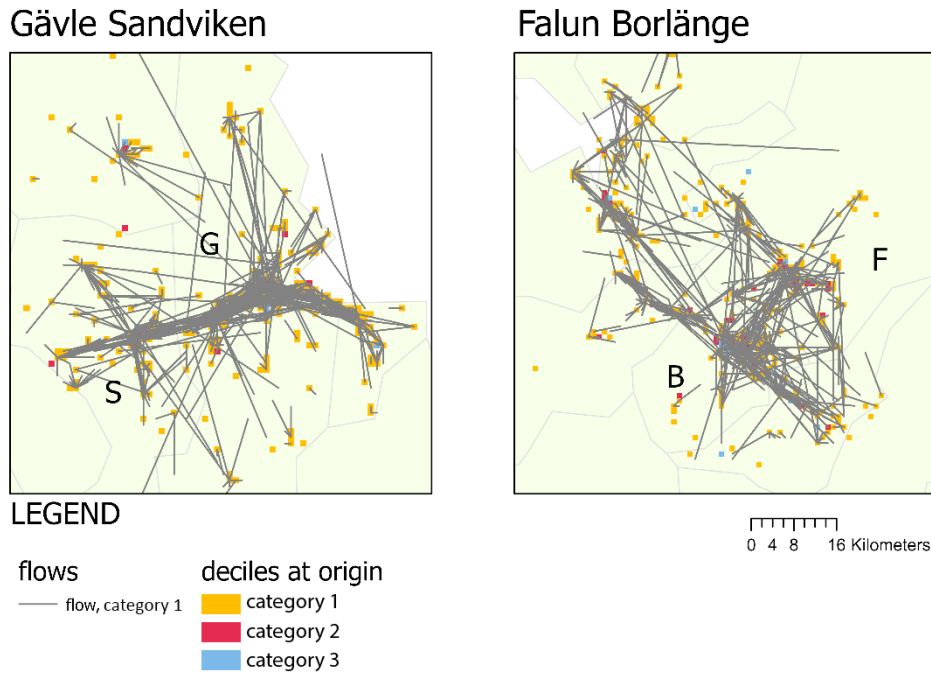- category 2
- category 3

0 4 8   16 Kilometers

Figure 4. Flows starting in category 1. Note: Data from 28 March 2019, Thursday.

the area for work or other activities. Hence, the population composition at night does not necessarily reflect the population that people actually meet and interact with during the daytime. As discussed, phones starting in category 1 units are the most mobile. This might indicate that the population composition of category 1 units is more likely to change (due to both in—and out-mobility) than the composition of people in areas from categories 2 and 3, where a higher share of phones stay put. However,

since flows are biased toward the own area category, the composition of people in category 1 units might not change as dramatically as might be expected, given the high number of movers.

The mid columns within each destination category in Tables 2 and 3 show flows where destinations are categorized according to the daytime population (phone data), rather than the night-time population. We let the characteristics of each phone's user reflect the population
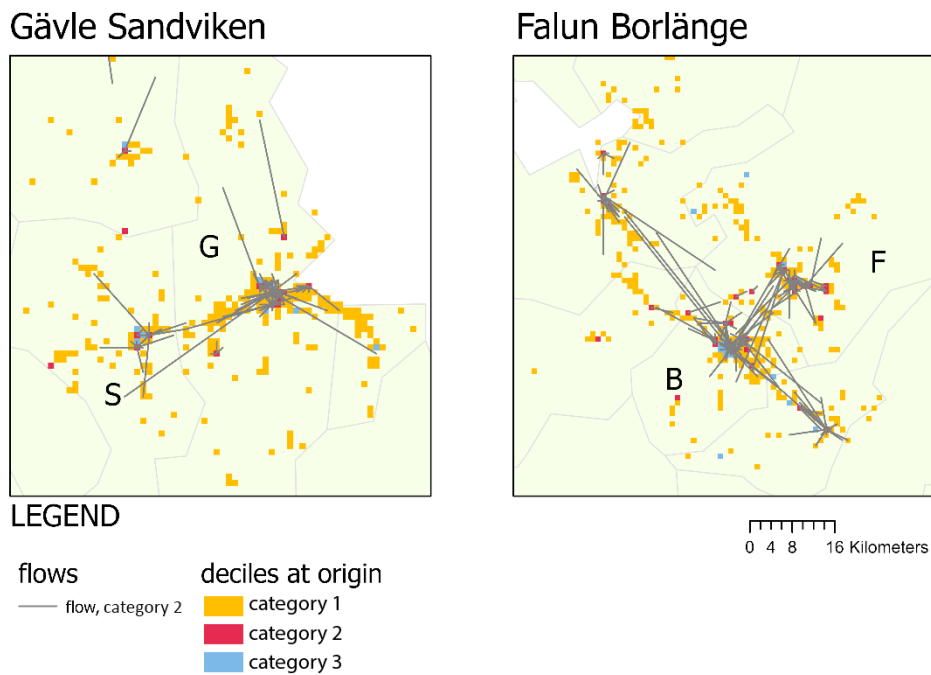
Gävle Sandviken

Falun Borlänge

LEGEND

flows
—— flow, category 2

deciles at origin
- category 1
- category 2
- category 3

0 4 8   16 Kilometers

Figure 5. Flows starting in category 2. Note: Data from 28 March 2019, Thursday.

Gävle Sandviken

Falun Borlänge

LEGEND

flows
—— flow, category 3

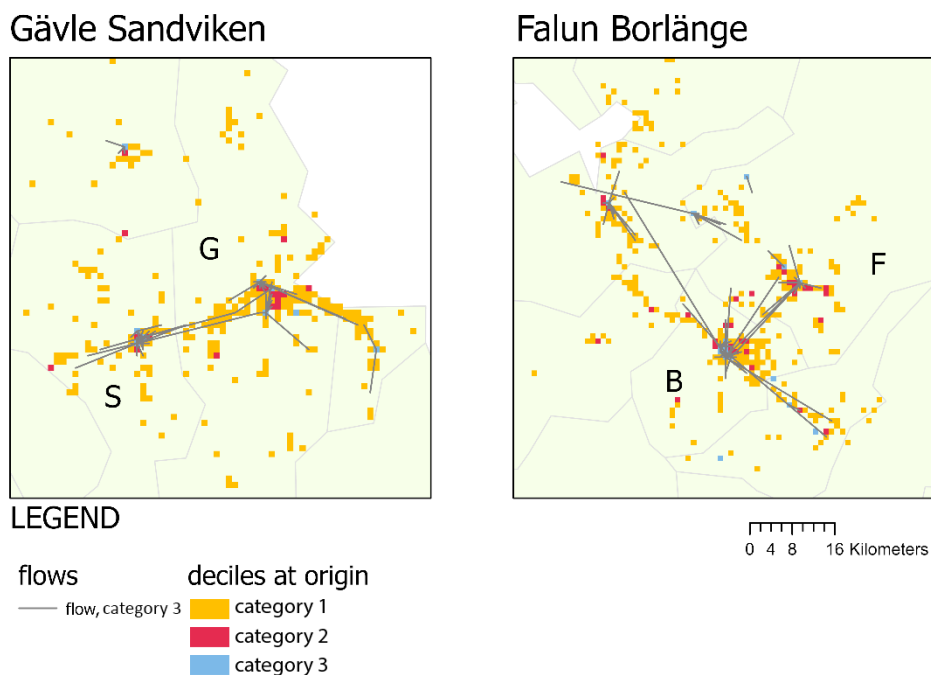deciles at origin
■ category 1
■ category 2
■ category 3

Figure 6. Flows starting in category 3. Note: Data from 28 March 2019, Thursday.

composition of its origin. Hence, a phone starting in a km^2 unit with 50% non-Europeans is regarded as being 0.5 non-European. The categorization uses the same 70/20/10 distribution as the categorization based on the registry data.

When categorising areas according to daytime population, a substantially larger share of all phones travel to areas belonging to categories 2 and 3. About 50% of all phones go to areas from categories 2 or 3, compared to the anticipated 30%. Hence, exposure to non-European people is much larger than exposure to neighbourhoods where non-Europeans reside. However, most phones still travel within their own neighbourhood category. The large share of phones travelling to areas from category 3 are mainly made up of phones start-

ing in categories 2 and 3. Most phones starting in category 1 remain in areas from category 1. They are slightly overrepresented in category 2, in relation to anticipated values, but not for category 3 destinations. Very few phones starting in categories 2 and 3 travel to category 1. Hence, results suggest that mobility patterns remain highly segregated also when looking at daytime rather than night-time populations.

As a final exercise, we checked to what extent area categorization changes on the basis of phones travelling across space (Figure 7). Category 1 units are reclassified to the least extent. About 75% of all km^2 units classified as a category 1 using night-time registry data are also classified as category 1 units when using daytime phone data. Around 20% are reclassified to category 2 and
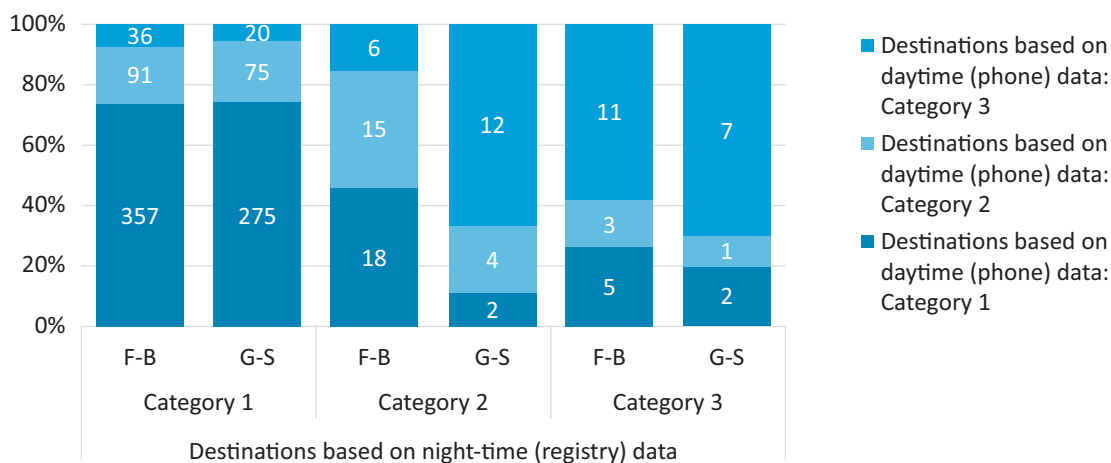

Figure 7. Comparison of the categorization of destinations based on registry data (night-time population) vs. phone data (daytime population). Note: 28 March 2019, Thursday.

about 5% to category 3. Of course, one should keep in mind that category 1 includes all areas with a share non-Europeans below the mean. Hence, some areas need a large inflow of non-Europeans to become reclassified. Areas belonging to the other categories are reclassified to a larger extent. In Falun-Borlänge, 18 out of 39 areas in category 2 are reclassified into category 1 on the basis of the phone data, meaning that there is either a large inflow of phones originating in category 1, or that a smaller inflow of category 1 phones is combined with an outflow of phones from category 2. In Gävle-Sandviken, many category 2 units are also reclassified but into category 3. Hence, the inflow in Gävle-Sandviken to category 2 units is dominated by phones originating in category 3. As for areas from category 3, a majority remain so in both Falun-Borlänge and Gävle-Sandviken. The overall pattern is similar for Saturdays.

These results support the conclusion that phones travel between areas from categories 2 and 3 but that there is less exchange with category 1 units. Phones starting in category 1 travel often and far, but mostly to similar areas. Phones starting in category 2 and especially category 3 are more likely to stay put in their own region. When they do move, most phones go to other areas with a relatively high share of non-Europeans. These are not necessarily the most immigrant-dense residential areas—especially not for phones starting in category 2 units—but areas where a lot of non-Europeans gather during the day-time. Hence, while mobility may alleviate segregation to some extent, we find that mobility patterns are highly segregated which affect people's overall exposure to both places and people.

6. Discussion and Conclusions

Most individuals experience many different environments during the course of the day. They travel to work or school, to see family and friends, and for other activities such as shopping, leisure activities, or simply for fun or exercise. Yet, the academic literature on segregation and neighbourhood effects have failed to sufficiently incorporate this into their theoretical framework and methodological approaches. A vast majority of the literature ignores daily mobility, indirectly assuming that the place of residence accounts for an individual's full exposure to place and other people. The result is potentially biased estimates of both levels of segregation and, in particular, its consequences. Exposure to the physical environment and the people inhabiting it are among the main mechanisms that produce neighbourhood effects (see Galster, 2012). It has been suggested that failure to estimate exposure, by ignoring mobility (referred to as the 'uncertain geographic context problem') is one of the most serious methodological challenges facing neighbourhood effect research.

Recently, there have been calls to broaden the scope of segregation. A small but growing number of studies empirically assess residential segregation in relation to segregation in other domains (predominantly work). They generally find workplace/daytime segregation to be lower, meaning that people leave their home neighbourhoods during the daytime to mix with other people in other environments. Our results support these findings. About half of the phones in our sample leave their home km² units during the daytime, and one should keep in mind that the sample includes both the elderly and children. Travelling 5–10 km is not unusual. Hence, our results support the need stressed by M. P. Kwan, Y. M. Park and others (e.g., Kwan, 2012; Park & Kwan, 2018) to broaden estimates of environment exposure beyond the residential neighbourhood. Like much previous research, this article focuses on daytime workday segregation or workplace segregation. Tentative conclusions from repeating our analyses for Saturdays are that patterns differ between workdays and holidays. We find that a higher share remains within their home km² units on Saturdays and that differences between immigrant-dense and other areas disappear. Previous work on segregation in the leisure domain has however found segregation of leisure to be lower than residential segregation (e.g., Toomet et al., 2015), although evidence for this is scarce. More research is needed to better understand how mobility behaviour changes between workdays/working hours and holidays/spare time and how this affects overall levels of exposure to different environments.

However, in line with previous literature, our results also stress that mobility patterns are in themselves segregated. First, there are differences in mobility levels: People starting in areas with high shares of non-Europeans are more likely to remain in their home unit. The higher levels of unemployment in these units are a probable contributing cause. Second, much of the daily mobility that takes place is oriented towards areas that have similar characteristics to the origin neighbourhood. This is true also when categorizing areas according to the daytime population. People not only go to areas where others from the same neighbourhood categories live but also to places where they go. Thus, although many people leave their home areas during the day, they are still overly exposed to people from similar environments. These findings are important in relation to discussions about exposure and estimates of neighbourhood effects. It is important to recognize that many people are exposed to areas other than the home neighbourhood, but equally important to address what type of environments they visit and whom they meet in these places. If mobility patterns are highly segregated, the residential neighbourhood is a much better proxy for total exposure compared to a situation where mobility results in a high degree of mix.

Our case study regions are relatively small by international standards, both in terms of population size and geographical scope. That we find similarly segregated mobility patterns in small Swedish labour market regions as did Q. Wang et al. (2018) for the 50 largest cities in the United States (and others have found for other

contexts) suggest that segregated mobility patterns are also likely to exist in other cities and countries. The relatively short distances (reinforced by the bi-nodal structures) and good transportation opportunities in our case regions suggest that distance or access to means of travel alone cannot explain the segregated patterns. Other potential explanations are differences in the location of, and frequency of visits to, family and friends, work, and leisure activities. Results from the two regions are very similar, which strengthen the overall conclusions. Minor differences may be due to differences in either data coverage or regional characteristics. For example, the somewhat larger size of the Falun-Borlänge region explains the longer average travel distances. The higher level of segregation and higher level of deprivation in the Falun-Borlänge region might also explain the larger overrepresentation of flows within the category 3 segment. More in-depth analyses are needed to gain knowledge about how relative regional levels of segregation and deprivation affect overall daily mobility.

The results of this and other studies stress that segregation is more than where people live. It is also about how and to where we move, whom we meet, where we work, and how (where, with whom) we spend our spare time. These conclusions have implications for research, which so far has failed to sufficiently acknowledge these other domains in both theoretical models and empirical estimates. It also has implications for measures to combat segregation. To fight segregation and achieve a higher degree of mix, looking at the residential area alone is insufficient. On the other hand, focusing on exposure rather than neighbourhood environments provides more tools to combat segregation and reduce potential negative effects. To reduce exposure to certain environments or population groups, and to achieve a higher degree of mix, is likely to be much easier, cheaper, and faster to implement than measures which aim to change the set-up of the residential environment. Potential measures to increase the heterogeneity of mobility patterns and obtain a higher mix of population groups on a daily basis might include, among others, offering leisure activities in other areas, changing school catchment areas, or increasing initiatives for daily travel. Such measures might increase exposure to other environments and population groups, and hence reduce segregation by exposure, despite not having an (immediate) effect on the overall residential pattern. To further test how such measures affect exposure and segregation, and under what circumstances, is however a task for practitioners and future research.

Acknowledgments

Conflict of Interests

The authors declare no conflict of interests.

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