

Ethnic residential segregation in Stockholm before, during, and after the 2015-16 migrant crisis

DEFINING SEGREGATION

Segregation can be defined as the unequal distribution of social entities across a social space. Those entities can be anything from people or individuals, artifacts such as buildings or industries, institutions, and organizations. A social space can be literal or figurative, and can also be discrete (a house, or a neighborhood), continuous (coordinates), or relational (the position in a social network). Segregation exists if social entities with differing values on at least one attribute are also unequally distributed in the social space that contextualizes them. Researchers within the field are concerned with investigating the causes of segregation, identifying the patterns, and unveiling the consequences that it brings about.

ETHNIC RESIDENTIAL SEGREGATION

A consolidated and yet currently thriving field for segregation studies is that of spatial segregation. Particularly, the spatial divide of individuals by socio-economic status and race is of long-standing interest to social scientists. While the separation of individuals by their characteristics has been observed under different geographical, social and temporal contexts – we find segregation in the labor market, in schools, and across geographical units, at the levels of gender, race, religion, age, socioeconomic status (SES), and more (Schelling 1971; Bygren 2013), in this paper I will concentrate on residential segregation by ethnicity. Residential segregation is concerned with the distribution of households of different characteristics and has been identified by researchers as a perpetrator of socioeconomic inequality (Benard & Willer 2007; Massey, Gross, and Egger, 1991). More broadly, segregation matters because the environments people are situated in bring about real-life consequences. In the context of residential segregation, the neighborhoods people reside in will affect their lives on many dimensions, for example their educational opportunities, access to resources, social networks, and job opportunities, in what is known as neighborhood effects (Benard & Willer 2007;

Wilson, 1996; Bruch & Mare 2006). Critically, location can be connected to differential health outcomes, if a group with one characteristic is bound to live in poor housing, or lacking access to clean water and/or services. In the US, discriminatory legislation in the post-war suburbanization boom actively prevented black communities from integrating with whites. That meant that black communities were living together regardless of their individual income level, and therefore blacks, compared to whites, lived in economically heterogeneous neighborhoods. Starting in the 1970s, changes in legislation allowed black households to more freely choose where to live, resulting in rising income segregation of blacks as middle-class black households sought housing elsewhere (Reardon and Bischoff 2011). While much of the literature of residential segregation is interested in the white/black divide in the US, patterns of segregation can be found in Europe as well, although levels in EU cities are said to be lower than on the other side of the Atlantic (Musterd 2005). Some studies have attempted to do cross-country or cross-EU cities comparisons in an attempt to identify how different structural barriers, for example welfare regimes, different policies, and housing market systems, might account for the levels of segregation in a given country or city (Andersson et al 2018; Tammaru et al 2016). Here, however, I will focus on neighborhoods across the city of Stockholm, in Sweden.

STOCKHOLM AND THE 2015-16 MIGRANT CRISIS

Sweden forms an interesting case study because generally low levels of income inequality and friendly integration policies suggest that racial and socioeconomic segregation might be lower than elsewhere. However, a recent migrant crisis between 2015-2016 has seen over 2 million refugees from the Middle East and Africa seeking asylum in Europe. Of those, just under 200'000 entered Sweden, a country with a relatively low population compared to its European counterparts (Cosgrave et al 2016). The recent arrival of this large number of refugees raises the question of how ethnic residential segregation has changed here in Sweden after the migrant crisis. Looking at Stockholm as a one city-case study can be justified by the fact that the city has a high share of the national immigrant population. While this is not necessarily the case for all first-generation migrants in Sweden, many of the newcomers can also be expected to sit at the bottom of the income distribution. This is in line with theories of assimilation hypothesis (Alba & Nee 1997), or the idea that initially there are large initial differences between migrants and natives upon entering the country, which tend to fade overtime. Thus, given the crisis has only recently happened, we can expect stark differences in terms of income and spatial integration between the recent migrants and natives, as well as first generation migrants who

might have relocated to Sweden a decade ago. Nonetheless, I expect that even without distinguishing between sub-levels of minority groups, the large wave of immigration will have altered patterns of ethnic residential segregation in Stockholm to some degree. Many newly arrived migrants might also be concentrating in particular Stockholm neighborhoods, which can have generated processes of “white flight” or “white avoidance”, the idea that natives will either move away from, or avoid relocating to, neighborhoods with a highly diverse ethnic composition (Bråmås 2006). In fact, Bråmås (2006) has observed that residential segregation increased in Sweden in the 1990s as a result of natives’ patterns of residential mobility, with many relocating to majority-dominated neighborhoods. Thus, I expect residential segregation to have increased in Stockholm after the migrant crisis of 2015-16.

THE DIMENSIONS AND MEASURES OF SEGREGATION

There is not a single way to measure spatial segregation, and in fact the field of segregation studies has lacked cohesivity from a measurement perspective. In a 1988 paper, Massey and Denton took on the challenging endeavor to bring rigor and structure to the multitude of methods proposed by segregation researchers. In their well-established paper, they evaluate over 20 potential indices of segregation. The different measures were not all entirely dissimilar, and in fact could be placed in five separate categories. The difference between the categories lies in the understanding of the concept of segregation. As Massey and Denton (1988) clarify, people can be unequally distributed in a variety of ways. The five dimensions in which segregation can be captured include: evenness, exposure/isolation, clustering, concentration, and centralization.

EVENNESS - As Blau (1977) explains, evenness measures the degree to which individuals from two groups are underrepresented or overrepresented in the sub-areal units of a city. If the proportion of Swedish people living in Stockholm is 70%, and all ethnical minorities together form the remainder 30%, then the city is said to be even if all its neighborhoods maintain the proportions of 70 and 30. Unevenness is a well-established dimension in residential segregation studies, and that is partly due to the popular measure of unevenness called the Dissimilarity Index D (Duncan and Duncan 1955). D measures, on a scale between 0 and 1.0, the share of people that would have to relocate across neighborhoods for the city to be perfectly even. Whilst often seen in segregation studies and having the strength of not being sensitive to the relative size of the migrant population, the dissimilarity index has also its limitations. First, it assumes that non-zero segregation, or the baseline, would be a perfectly even relative distribution of groups across neighborhoods, which is highly unrealistic. This poses risks of

obtaining misleading D values for cities with small sub-areal units or small minority proportions, what is known as the small area unit problem (Cohen, Falk and Cortese 1976). While D is not that problematic if wanting to get a snapshot of segregation in a city at a single point in time, the small unit problem can lead to misinterpretations when comparing the city overtime. A solution to the issue is to follow Cortese, Falk and Cohen's (1976) suggestion to use, instead of D , a standard score calculated from D , which they call the Standard Score Index Z . The standard score index is obtained after computing the expected value of D and its variance under the hypothesis of random assignment of individuals across units. Taken D , we subtract the expected value of D under random assignment and divide the result by the standard deviation of D under random assignment. The resulting value, Z , is the standard score index, and offers insights into how the observed distribution of individuals across unit areas differs from a random distribution.

EXPOSURE – The second most popular dimension of segregation is exposure, capturing the extent to which minority and majority groups encounter one another (Massey and Denton 1988). It differs from evenness as the former is sensitive to the share of a population, while the latter is sensitive to its spatial distribution (Hennerdal and Nielsen 2017). Nonetheless, exposure can be highly informative of, as Massey and Denton (1988) put it, the experience of segregation. While evenness tells us whether people are proportionally spread across sub-unit areas, exposure tells us whether they are likely to meet each other. Think of a city with a high share of minority members. Even if they are evenly spread across the city, their level of exposure to majority groups will be lower than in a city with substantially more majority members than minority ones (Massey and Denton 1988). While there are many variations of indices of exposure, I here propose the revised index of isolation R^* , as adopted by Benard and Willer (2007), which adjusts for the relative share of minority group in the population. R^* captures an individuals' degree of exposure to same group members. The index also ranges from 0 to 1.0, and higher values indicate higher probabilities to be living near same group members. The index of isolation can thus be very useful to see whether, overtime, minority groups have tended to become more in touch with one another or more dispersed, accounting for changes in numbers overtime.

CLUSTERING and CENTRALIZATION – The remainder measures can also prove very useful to measure patterns of segregation, but I will exclude them from this analysis given the context of the study. Clustering measures the extent to which the neighborhoods where minority members live are also geographically located near one another. High levels of clustering in socioeconomic terms can be highly problematic for the disadvantaged group

chances to have the same opportunities as more advantaged clusters, in terms of access to resources, social integration, information, and job opportunities. Stockholm minority-dense neighborhoods are well scattered around the city, separated by bodies of water, and often middle-class or affluent neighborhoods as well, thus clustering will not be considered.

Centralization is a form of clustering that focuses on whether minority groups are clustered in the center of a city, and is often relevant to segregation studies on US cities, where minorities often occupy central spaces, while the majority group instead spreads out to the suburbs. In Sweden, however, the location of minority groups is often the edges of the city. With minorities often coinciding with lower incomes, these areas are also understood as being less attractive, compared to inner city neighborhoods, or particularly wealthy suburbs (Musterd and Andersson 2005). These less attractive neighborhoods are usually characterized by multi-floor buildings that the Swedish Government built in the 1960s to accommodate the large influx of individuals to cities across Sweden, in what is known as the Million Program housing project (Östh et al 2018). Overtime, however, individuals have moved to more attractive areas and these neighborhoods now serve as cheap housing for migrants (Andersson et al 2018).

THE APPROACH – K-nearest neighbors

Before being able to measure patterns of residential segregation, I need to address the issue of geographic scale. As Hennerdal and Nielsen (2017) explain, calculations of spatial segregation require the specification of where the data is aggregated, and those choices will be affecting the results. This is known as the MAUP, the modifiable area unit problem, and it has two components. The first one is the issue of scale, which is the number of units my data is split in. In the case of my study, this could smaller or larger unit areas. The second component is the aggregation level, which is concerned with how unit area borders are drawn. Hennerdal and Nielsen (2017) add a further component, which is the area of reference, the overall area within which the data is contained and then subdivided, noticing that changes to the area of reference borders also lead to differential results in segregation estimates. One way to minimize the MAUP is to use what is known as the k-nearest neighbors approach (Östh et al 2015). Instead of adopting administrative borders, the approach uses the number of nearest neighbors to each individual in the area of reference. To test for multiple geographical scales, as emphasized by Reardon et al (2008), one can choose to test for different number of nearest neighbors. This approach has the advantage of solving problems of fictive borders and choosing among geographical aggregate modes and scales, all while maximizing the relevance of the segregation measurement based on the experience of each individual. Availing of proximity to

others as a way to capture people's surroundings' composition, you also account of the social roles the people near you might fulfil. The idea is that the nearest 1000 people will be relevant in your daily life, no matter if they are in your same block or if they are in a rural region. For each individual, a *bespoke* neighborhood is computed, and given the borders are defined by the chosen number of neighbors, most individuals will have a unique neighborhood (unless living in the same household). Thereafter, the composition of the bespoke neighborhood is used to generate buffer populations and compute aggregate segregation statistics (Östh et al 2015). To conclude, when using the k-nearest neighbors approach, you can measure segregation using most indices, allowing me to use the indices I deem most relevant for my study. The problem of the area of reference is here ignored since the study is concerned with the border-defined city of Stockholm.

CAUSES AND MECHANISMS OF RESIDENTIAL SEGREGATION

Residential segregation is a complex to break down because its existence is due to a multitude of causes (Benard & Willer 2007). As Schelling (1971) explains, residential segregation can happen both voluntarily and involuntarily. Individuals can deliberately segregate due to individual preferences on the composition of the neighborhood of choice; but they can also segregate as a result of structural barriers, such as a nation's particular housing market system, the welfare regime type, housing market discrimination, or refugee dispersal policies (Andersson et al. 2018; Tammaru et al. 2016; Skifter Andersen et al. 2016).

Sweden is characterized by a generous welfare state and a history of policy interventions that have attempted to promote social integration of both socioeconomically disadvantaged individuals and ethnic minorities (Andersson et al 2010). In the 1970s, Swedish housing policy focused on promoting diversified housing mix at the neighborhood level, to promote diversity of social classes and demographic groups. In the 1980s, Sweden introduced dispersal policies for immigrants, in an attempt to avoid the formation of concentrations of minority groups in housing estates at the edges of large cities (Andersson et al 2010). Such policies were thereafter deemed unsuccessful, as most refugees chose to relocate to immigrant-dense areas, given that they were often sent to municipalities that had availability of housing precisely because job opportunities were scarce and facing depopulation from natives. In light of the history here described, one question that comes to mind is: why do immigrants choose to live in neighborhoods with other immigrants? However, segregation might happen in other ways as well, other than the relocation of minorities to minority-dense neighborhoods. Some minorities

might move to more integrated neighborhoods, necessarily altering the ethnic composition of the area, generating thereafter the aforementioned phenomenon of “white flight”, or “white avoidance” (Bråmås 2006). In the migrant crisis of 2015-16, the placement of refugees was a problematic question for authorities, as the large numbers of incomers created a shortage of temporary housing and lead to the opening of emergency accommodation centers across the country. Upon relocating to more stable housing, refugees might have availed of their migrant-dense social networks to form decisions on where to settle, initiating a process of self-selection into migrant-heavy neighborhoods. Additionally, asylum-seekers in Sweden have the option to arrange their own housing to live with relatives or friends already in the country, therefore end up becoming geographically in proximity. One thing emerging from all the aforementioned possible mechanisms contributing to ethnic residential segregation, is the fact that individual actions are what essentially generate segregation, without segregation being the primary interest of the individuals involved in its generative process. This micro-macro view of processes of segregation has been a central point of Schelling’s (1971) research on threshold models for individual residential preferences.

DATA

The data used for this study is individual register data about people residing in the Stockholm municipality, available at Statistics Sweden. Of interest are the individual’s home address in the form of coordinates, and his/her ethnicity as understood by country of birth. Bråmås (2016) explains that data about ethnic self-identification is not available in Sweden, thus one must use country of birth instead. This means that I will not be able to distinguish between first generation migrants and refugees, and it is actually beyond the scope of the study to do so. In this study, first generation migrants are therefore considered non-Swedish, while second- and third-generation migrants fall under the Swedish category. Separating groups by birthplace can be interesting to capture a more detailed pictures of different groups experiences (e.g. EU vs non-EU migrants), however in this study I will not make such a distinction. Socioeconomic status variables can also be obtained to assess the level of correlation between ethnic and SES segregation. As the research question revolves around changes to ethnic residential segregation patterns before and after the 2015-16 migrant crisis, I will avail of Swedish Register data from 2013, just before the large influx of refugees, of 2016, at the peak of the crisis, and 2019, to allow for the relocation of refugees to stable housing after living in emergency and temporary accommodation during and in the immediate aftermath of entering Sweden.

RESULTS

To calculate ethnic residential segregation, I avail of Cortese, Folk and Cohen's (1976) Standard Score Index Z , as a more reliable way to measure evenness in a city overtime. I also compute the revised index of isolation R^* , as proposed by Benard and Willer (2007). Similarly to Östh et al (2015), I generate my bespoke neighborhoods for the following numbers of nearest neighbors k : 100 (the neighborhood), 5000 (a community), 50000 (the small-city), 300000 (the metropolitan region), which should help in identifying patterns of segregation at different levels of geographic scale (Reardon et al 2008). I thereafter calculate the aggregate statistics for segregation using the two chosen indices, which is more easily done through a software called EquiPop (Östh 2014).

Separate map plots showing 1) the dissimilarity of individuals across the city of Stockholm, and 2) the isolation levels of non-Swedish can be produced, one for each k computed. I find that for lower k values, the results are more fine-grained, thus I can obtain a more detailed picture of levels of segregation at small-scale levels. Large-scale levels can often omit information, as including a larger number of neighbors in the calculation will likely incorporate a higher variety of neighbors by ethnicity, especially if the city has high unevenness but low clustering levels, as could be in a city like Stockholm, with immigrant-dense populated neighborhoods scattered across the outskirts, in more than just one direction. As Östh et al (2015) explain, large k values are useful to obtain a picture of people's exposure to different groups in their broader dimensions of life (e.g. schooling, leisure, work), whereas small k values offer insights into the composition of one's local community (e.g. bus stop encounters, shopping, neighbors).

Table 1 – Z scores and R^* scores for k -nearest neighbors in Stockholm in 2013, 2016, 2019

	2013		2016		2019	
k	Z	R^*	Z	R^*	Z	R^*
100	0.40	0.35	0.45	0.43	0.41	0.40
5000	0.33	0.32	0.37	0.35	0.35	0.33
50000	0.30	0.26	0.31	0.26	0.32	0.29
300000	0.19	0.18	0.19	0.18	0.20	0.20

The above results show the Z and R^* index scores for Stockholm during 2013, 2016 and 2019. What I find is similar trends for both indices, which is reassuring. Furthermore, I find that

segregation increased at the small-scale level during 2016, to reduce slightly in 2019, yet being generally higher than in 2013. A similar trend was not found for larger k values, where generally segregation has kept increasing overtime, yet at a smaller pace. These results are in contrast with Malmberg et al (2018) results of segregation trends overtime in Sweden between 1990-2012, where they noticed that while for all the migrants isolation increased at small scale levels, that was not the case at large k values. Here, instead, small-scale level segregation peaked during the crisis for lower k values. This could be the product of the mobility dynamics and settlement processes in Stockholm, that operated during and after the crisis. At the arrival stage, many individuals probably concentrated in small dense areas (including emergency centers), but overtime dispersed to other areas, while still remaining in the metropolitan region where most other migrants live. That could explain why at large k values segregation simply kept increasing overtime.

IMPLICATIONS FOR INEQUALITY

It is often stated that levels of inequality go hand in hand with levels of segregation. While it can be very challenging to disentangle the effects of one on the other, it is important to identify the ways they each feed on one another and critically alter life outcomes of particular groups. In this study, I find a general increase of ethnic residential segregation, leaving completely out the socioeconomic dimension. As other researchers have pointed out, however, oftentimes minority groups also occupy the bottom of the income distribution. In Stockholm, minorities often live in cheap housing estates, often situated in poorer neighborhoods. When thinking in terms of neighborhood effects, increase in levels of ethnic residential segregation can implicate a rise in ethnic inequality, particularly in terms of SES (Bruch and Mare 2006). Migrant-dense neighborhoods can prevent minority groups from integrating in the dominant culture and can disadvantage them by hindering their knowledge of job opportunities, schooling opportunities, and more. They can also foster negative behavioral trends around individual outcomes, such as joblessness, single motherhood, and teenage motherhood (Massey, Gross & Eggers 1991). So long groups are residentially segregated by ethnicity, and ethnicity is correlated with income, segregation can have detrimental effects on several inequality dimensions affecting ethnic minorities.

POLICY PROPOSALS

It is hard to propose policy to counter level of residential segregation when the causes of segregation are unknown, and so are its effects. Policies, after all, are made in the attempt to

prevent particular negative outcomes or prevent the problem from arising altogether. But what might look like a positive policy to reduce residential segregation, might not actually have positive results. An example is the dispersal policies the Swedish government has had in place: they have reduced levels of segregation but were deemed inefficient as individuals ended up relocating to migrant dense neighborhoods at a later stage anyway. And it can be debated that placing them in job-scarce regions to begin with might have even had detrimental effects to their social networks and career opportunities. What type of policy do we deem would reduce residential segregation by ethnicity, while guaranteeing a long-term positive outcome for minorities? One suggestion would probably revolve around minimizing the process of “selective migration” (Andersson & Bråmås 2004), the idea that those migrants leaving a neighborhood differ in socioeconomic terms by those entering or staying. In the 2000s, Sweden initiated so-called area-based policies, where known migrant-dense neighborhoods were given special funding to improve on areas such as education, health, employment. One aspect funding did not consider, however, was the appearance and appeal of housing, and the success of the policy was determined at the neighborhood level, missing on the fact that migrants whose SES improved left the neighborhood. Importantly, such policies did not alter levels of ethnic segregation (Andersson et al 2010). One direction would be to promote the relocation of migrants to a larger selection of neighborhoods, promoting funding schemes making housing in more attractive neighborhoods affordable to all. But that is also dependent of the question, as Andersson et al (2010) point out: what is more effective, in reducing inequalities, between minimizing neighborhood effects, by improving the individual neighborhoods, or helping individuals with different characteristics to mix with one another across neighborhoods, promoting integration?

FUTURE RESEARCH

One way to approach the issue of figuring out the causes and effects of segregation is through simulation. As Schelling (1971), Bruch and Mare (2006), and Benard and Willer (2007) propose, one way to test different processes is through agent-based models (ABMs). While ABMs can prove useful, especially if calibrated with empirical data, to identify the relationship between individual behavior and macro outcomes, they can also offer powerful insight in prediction. Future research could therefore avail of ABMs to test out the implication of different policy proposals and assess which would most successfully reduce segregation and inequality. One such question for research could be: what would more successfully reduce

inequality between a policy focusing on promoting mixed housing and one dedicated to minimizing differences in neighborhood effects across neighborhoods?

Another direction for research that originates from this paper's findings is: given the levels of residential segregation observed, what explains them? To what extent do individual preferences account for the observed rise in segregation, as opposed to the phenomenon of white flight, or structural barriers such as the housing market and language?

Finally, there is a third suggestion for future research, which does not really generate from the findings, but I deem equally interesting. Whilst much of the residential segregation literature has debated over issues of scale, comparability, and measurement, very few studies have incorporated the concept of time in their research design. When studying segregation at the residential level, one is essentially placing that individual within his household, and making inferences based on residing in a particular neighborhood. Looking at residential segregation makes indeed a lot of sense if one is interested in the way people's home location affects their lives. For example, in the event of constructing a choice set for schooling options, an individual can be penalized by having to send his child to a school within the neighborhood, all while the neighborhood SES can impact the amount of resources the schools might have. Alternatively, if free to choose which school to send his child to, one might still be constrained by living in a highly clustered city, where perhaps most schools in a reasonable distance radius are still worse off compared to the ones on the opposite end of town. This example is to show that the home location has its relevance in studies of the impact of spatial segregation on future outcomes. However, one important argument for segregation studies is that segregation prevents individuals' access to valuable information, for example about job opportunities or housing. As Granovetter (1973) reported, most people obtain employment through their *weak* ties, the informal relations they have. When conducting studies about spatial segregation to portray a picture of individuals' exposure to different racial or socioeconomic groups, however, using residential information can generate a rather skewed image of reality. This is because segregation by night, or residential segregation, can vary extensively during daytime, when people commute to work, which can be especially relevant in Europe, where more extensive public transport systems are in place, allowing people to bridge neighborhood barriers and minimize the effects of housing market discrimination and proximity to jobs (Musterd 2005). In recent years, there has been an emerging, yet still small, body of research interested in mapping spatial segregation by day and nights (Van Ham & Tammaru 2016; Ellis et al. 2008; Östh et al. 2018). Such studies have brought about interesting findings: using mobile phone data to generate spatial trajectories, Swedish researchers have found that segregation decreases

in Sweden's metropolitan areas during the day, an indication that people come together during work life (Östh et al. 2018). This makes sense if we think that most people might work in the central area of a city, and has interesting consequences for those who remain behind in neighborhoods that empty out of individuals during the day but do not see an equal diverse arrival of workers within its borders, suggesting perhaps that the opportunity to enlarge a social networks might drop significantly for some stayers. But another life domain remains even further unexplored when it comes to spatial segregation: leisure time. People are observed in terms of where they live and where they work, but what about where they spend their free time? Leisure time can pose interesting opportunities and challenges to researchers of spatial segregation. Opportunities include adding a critical dimension of life to better understand who people get exposed to. Studies about leisure time have historically availed of Time Use Surveys to map how different socio-economic and ethnical groups spend their free time. In a spatial segregation study, however, one could attempt to use mobile phone data to differentiate between spatial segregation patterns at the residential, work, and leisure level, by categorizing location between the three categories. Such a practice comes with its challenges. Some people work weekends, some other work nights, some cultures prefer spending their free time within the family, and the family affluence will highly determine which type of activities its household members will be able to pursue. Nonetheless, it can be an illuminating endeavor for researchers to attempt to portray a more domain-specific image of patterns of spatial segregation. Thus, I propose the following research question as a suggestion for expansion of this study: to what extent do the observed patterns of residential segregation resemble patterns of spatial leisure segregation, as well as work spatial segregation?

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