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'Second Generation' - The Moving Patterns of the  
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# **Ethnic Segregation, Economic Segregation and the ‘Second Generation’ - The Moving Patterns of the Descendants of Non-Western Immigrants in Oslo**

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**Abstract:** Research into the neighbourhood attainment and social and geographic assimilation of the ‘second generation’ or the children of immigrants may shed new light on assimilation processes and the emergence and persistence of residential segregation patterns in western societies. Recent studies from Norway have shown both a high degree of socioeconomic assimilation among the descendants of non-western immigrants, and comparatively low geographic mobility among this group in Oslo. Children of non-western immigrants perform on par with the children of natives with similar socioeconomic backgrounds when it comes to income and educational attainment (Hermansen 2016), but they tend to reside in neighbourhoods with relatively high proportions of immigrants, close to where they grew up (Hundebo 2016; Søholt and Astrup 2009b). In other words; socioeconomic assimilation does not necessarily imply geographic assimilation. In this paper, I investigate the moving behaviour of the descendants of non-western immigrants in Oslo, and compare it to that of natives and non-western immigrants. I use highly detailed geocoded register data covering the years 2000-2014, with information on the place of residence of each individual residing in the city, combined with demographic information, register data on income and the composition of their k-nearest neighbours. I find the moving patterns of descendants of non-western immigrants to be both similar to and different from those of natives; descendants of non-western immigrants tend to both live in neighbourhoods with relatively high proportions of immigrants and low proportions of high-income individuals, and to move between such neighbourhoods. High-income individuals tend to move to more affluent areas with a lower proportion of immigrants, regardless of their own immigrant background. However, the residential patterns of descendants of non-western immigrants do not contribute to the overall ethnic and economic segregation levels in the city.

**Key words:** ethnic segregation; economic segregation; Oslo; second generation; descendants of immigrants; moving patterns

## **1. Introduction**

Recent large-scale immigration from non-western countries, and public debates about integration of immigrants has spurred increased interest in residential segregation patterns in Europe. Ethnic segregation may exacerbate processes of social exclusion and marginalization of immigrant groups and inhibit the integration and participation of immigrants and their descendants. Further, the native-born children of early cohorts of non-western immigrants have finished their educational careers and entered the labour market in increasing numbers over the recent years. While some researchers consider the educational and labour market outcomes of descendants of immigrants to be a litmus test of integration (Schnell 2013), their residential assimilation remains understudied.

The moving patterns of descendants of non-western immigrants may provide information about the degree of spatial integration of this group. Further, the contribution of descendants of non-western immigrants to overall ethnic and economic segregation levels may inform on the direction we may expect urban segregation levels to take in the future, as this group is expected to grow in relative size.

In this paper, I attempt to shed light on these processes by studying both the moving behaviour of non-western immigrants, their descendants and the native population in the Norwegian capital Oslo, and the contribution that descendants of non-western immigrants make to overall ethnic and economic segregation levels and trends in this city. In addition, the present paper contributes to the literature on residential segregation by applying very fine-grained administrative register data on the place of residence of each individual in the full population of Oslo during the years 2000 to 2014. Using these data, I measure segregation and neighbourhood compositions using the k-nearest neighbours approach.

## **2. History and context**

The patterns of socioeconomic, and later ethnic, segregation in Oslo have been shaped through the city's long history, since it was relocated in 1624 following a major fire. In the city's early history, from the relocation onwards, the main social dividing line in Oslo could be drawn between the city center and the more peripheral districts. Whereas the comparatively affluent city center was predominantly home to the families of officials and merchants, the families of workers, artisans

and traders mostly inhabited the periphery. Gradually, the social geography of the city changed. More and more people from the upper strata of society moved towards the north and west, while many workers moved from rural areas to find work in the emerging industries during the 1800s. In the latter half of the 19th century, the twin processes of urbanization and industrialization had a strong impact on residential patterns. Factories were built along the river Akerselva, and to some degree Loelva, utilizing the rivers for power. Workers mostly took up residence in the areas surrounding the riverbanks and near the main roads leading into the city from the east, while the upper classes moved westward. Population growth and expansions of the city border eastwards, combined with the injunction that houses within the city must be built in brick, stone or mortar, which was more expensive than wood, led to poor migrants from the countryside settling further eastwards. These developments, combined with the forces of social homophily, housing regulations such as those favoring single-household villas on the west side, the construction of public transportation systems, and numerous other factors, contributed to the emergence of the major east/west divide in Oslo. This divide is in broad terms characterized by a wealthy west and a poorer east, and the symbolic border cuts through the city from north to south slightly west of the river Akerselva (Myhre 2017).

Private constructors dominated in a comparatively unregulated housing market until the Second World War. However, the post-war period was characterized by the municipality taking a more active role in construction, and by large-scale affordable housing projects in the suburbs. This resulted in the establishment of several satellite towns for the working class – mostly in the east. The city centre became less densely populated while large apartment buildings rose on the outskirts of the city (Myhre 2017). More recently, the socioeconomic segregation has taken on an ethnic dimension. With modern large-scale immigration from non-western countries, a clear pattern of ethnic segregation has emerged. Poor non-western immigrants have predominantly settled in the central and, later, eastern parts of the city, including the apartment buildings from the post-war period (Wessel 2017). Additionally, the housing sector has been deregulated, particularly in a series of reforms in the period 1983-1984 that included the deregulation of housing prices, changes in housing tenure regulations and credit system changes (Wessel 2017).

While the city has evolved over the years, the old divisions between the east and the west have persisted. The perception of the city as divided between the east and the west by a single line is obviously a highly simplified one. For instance, the “west side” is commonly taken to also include

a relatively affluent strip along the eastern side of the Oslo fjord in the southern part of the city (see for instance Wessel (2017)). Clusters of student dwellings and areas dominated by apartment blocks further provide heterogeneity in the west, while middle-class households dominate many areas in the east. Gentrification and similar processes also contribute to the fuzziness of the segregation patterns. Nonetheless, the east-west divide is a common conception shared by many residing in the city, and studies consistently find large and systematic socioeconomic differences between the two parts (see for instance Andersen and Ljunggren 2014; Toft 2018; Wessel 2015; Wiborg 2017; Ljunggren and Andersen 2015).

### **3. Theory and prior research**

#### 3.1 The emergence and persistence of segregation patterns

A number of theories aim to explain the emergence of segregation along ethnic, socioeconomic, or other lines. Some theories explain segregation in terms of individuals' preferences for own-group and out-group neighbourhood composition and selective moves (see for instance Clark (2002); Clark and Coulter (2015); Clark and Fossett (2008); Emerson et al. (2001); Fossett (2006); Krysan (2002); Van Ham and Feijten (2008)) and the seminal work by Schelling (1971)). Commonly denoted as ethnocentrism (Charles 2003), the main assumption in this strand of theory is that people prefer to live in neighbourhoods with a certain proportion of own-group members, and that they selectively move if the proportion of other-group members becomes too large. Such moves create a cascading effect that generates large-scale segregation patterns. This line of theory is commonly applied to the study of ethnic segregation. Several studies have documented moving patterns that can be said to be consistent with it, such as white/ native flight and/ or white/ native avoidance (Aldén et al. (2015); Bråmås (2006); Crowder (2000); Crowder et al. (2011); Crowder and South (2008); Hall and Crowder (2014); McAvay (2018); Rathelot and Safi (2014)), or similar patterns among minorities (Boschman and Van Ham 2015). Further, this strand of theory may be extended to socioeconomic segregation if people identify with their own socioeconomic group and prefer a certain proportion of own-group members in their neighbourhood. This perspective is similar to the notion of homophily (Bottero 2004) or status discrepancy (Galster and Turner 2017) as a motivator for mobility. Own-group preferences do not necessarily presuppose negative attitudes

toward other groups. However, prejudice, racism and hostility towards out-group members would produce similar segregation patterns. In the US literature on segregation, such attitudes have been shown to be prevalent and contribute to segregation. Further, a fear of white hostility has been argued to contribute to minority groups' preferences for not residing in all-white neighbourhoods (Charles 2003). Yet, more mundane preferences than those based on ethnicity or economic resources may also affect where people move. For instance preferences for living close to one's relatives, preferences for the physical properties and cultural connotations of the surrounding neighbourhood, preferences for schools etc., may also contribute to segregation along ethnic and economic lines (Søholt and Lynnebakke 2015).

The *spatial assimilation model* states that as the social status, educational level, income etc. of immigrant groups rise, they will tend to move into better neighbourhoods and to geographically assimilate with the majority population. According to this model, ethnic segregation is driven by systematic socioeconomic differences between ethnic groups, not just their ethnic neighbourhood preferences. As such, ethnic segregation may come about as a by-product of economic disparities between groups (Charles 2003; Pais et al. 2012). Unlike the theories about own-group and out-group preferences, this theory does not rely on the assumption that people are ethnocentric or prejudiced. Rather, it is sufficient that individuals or households prefer high-quality dwellings and neighbourhoods (Follain and Jimenez 1985). In other words; under the spatial assimilation theory, upwards economic mobility entails upwards geographic mobility. Numerous studies have found empirical support for this general pattern (examples include (Alba et al. 1999; Fong and Wilkes 1999; Iceland and Nelson 2008; Massey and Denton 1985; South et al. 2005; South et al. 2008)), but also heterogeneity between groups; the residential patterns of some immigrant groups seem to fit better with this theory than those of others. However, in Nordic cities, Wessel et al. (2017) found little support for a relationship between earnings mobility and spatial assimilation among non-western immigrants, and Turner and Wessel (2013) found only mixed support for this model in Oslo.

On the other hand, the *place stratification theory* emphasizes the structural obstacles that ethnic minorities may face when attempting to attain a good neighbourhood (Charles 2003). According to this strand of theory, individuals want to live in "good" neighbourhoods; implicitly, neighbourhoods with high socioeconomic status and a limited proportion of ethnic minority individuals (Pais et al. 2012). However, powerful ethnic majority groups may attempt to maintain

geographical and social distance from minority and low-status individuals through regulations, discrimination etc. The theory comes in two versions. The strong version states that minority individuals are less able than majority individuals to convert socioeconomic resources into neighbourhood quality; even economically resourceful minority individuals end up in relatively disadvantaged neighbourhoods. The weak version states that minorities face higher barriers for entry into advantaged neighbourhoods and are forced to pay more to attain equally “good” neighbourhoods as their socioeconomically similarly situated native peers (Pais et al. 2012). In other words; minorities pay a premium for access to advantaged neighbourhoods. The implicit notion that all individuals prefer affluent, “white” neighbourhoods is highly questionable, as neighbourhood preferences are diverse (Pais et al. 2012), but the possibility of structural obstacles as a contributor to residential segregation is an important point.

*Housing market discrimination* – in part subsumed under the place stratification theory – may also contribute to ethnic segregation (Charles 2003). Homeownership is widespread in Norway, as 77% of households own their dwelling, while social housing is relatively limited, comprising 4 % of the housing stock (Statistics Norway, na-a, na-b, na-c). As such, most owned dwellings are sold on the open market, to the highest bidder. This mechanism, combined with regulations against discrimination likely limit the degree to which discrimination may directly affect the availability of owned housing for immigrants. Yet, there is a possibility that the availability of mortgage loans may be limited for immigrants due to discrimination (Pager and Shepherd 2008; Skovgaard Nielsen et al. 2015). On the rental market, on the other hand, there may be substantial discrimination. Although it is illegal for landlords to discriminate on the basis of ethnicity, religion, sexuality etc, it is very difficult to assess on what basis landlords choose among potential renters. However, Søholt and Astrup (2009a) have documented self-reported experiences of discrimination in the rental market among immigrants from Somalia and Iraq, as well as stated preferences for not renting to immigrants among landlords.

The *racial proxy hypothesis* and the *race-based neighbourhood stereotyping hypothesis* may also inform a discussion on segregation in Oslo, although the terms “ethnic proxy” or “ethnicity-based neighbourhood stereotyping” may be more suitable for this case. These hypotheses assume that people see ethnic composition as a proxy for other neighbourhood properties, and that it is these properties, and not the ethnic composition of the neighbourhood per se that affect moving decisions (Charles 2003). In the Norwegian case, this may for instance translate into immigrant-

dense neighbourhoods being perceived as more troubled with crime, poverty etc., and thus avoided by people who have the economic resources to live elsewhere. If these hypotheses hold true, we may expect both natives and non-western immigrants and non-western descendants to move away from, or avoid, neighbourhoods with high proportions of non-western immigrants, as such neighbourhoods would be assumed to be of lower quality.

Further, individuals may also prefer living in mixed neighbourhoods. Several studies have shown a preference for mixed neighbourhoods to be more prevalent among ethnic minorities than among ethnic majority groups (see for instance Clark 1991, 2002, 2009). In summary, such studies often find that the ethnic majority tends to prefer neighbourhoods with a large proportion of own-group members, while many ethnic minority individuals have weaker preference for neighbourhoods with a high proportion of own-group members. Also, minority individuals with higher income and educational level tend to prefer integrated neighbourhoods with a more even mix, in contrast to the assumption of ethnocentrism. In Norway, Søholt and Lynnebakke (2015) have found immigrants to express such preferences for integrated neighbourhoods.

In addition to these broad theoretical contributions, it is important to add that structural conditions, history, geography, building regulations, housing policy etc. likely also have a strong impact on segregation patterns. The topography and natural surroundings of the city, incremental expansions of the urban area, historical population growth, zoning regulations, housing policies, and specific regulations determining what types of dwellings can be built where, all shape the social geography of a city through mechanisms such as geographic differences in labour market conditions, housing quality and housing prices (Musterd 2005; Myhre 2017).

### 3.2 The case of the “second generation”

The descendants of non-western immigrants constitute an interesting case for studying moving patterns and segregation. On the one hand, they are born and (for the most part) raised in Norway, and have similar language skills and experiences as the native population. On the other hand, many also have cultural and family ties to the country of origin. On average, they also grow up in more disadvantaged neighbourhoods with a higher proportion of immigrants, and in socioeconomically disadvantaged families. Also, many have phenotypical traits such as skin colour, or other signals such as a foreign-sounding name, that sets them apart from the native population and may make them targets of discrimination or avoidance behaviour from the ethnic majority. Such avoidance

behaviour may manifest as out-mobility from neighbourhoods with a high proportion of immigrants, among natives.

According to Portes and Zhou (1993), descendants of immigrants may follow patterns of *segmented assimilation*, whereby some assimilate into mainstream society, while others assimilate into disadvantaged communities and groups. If there are patterns of segmented assimilation in Oslo, we may thus expect socioeconomic differences in the moving patterns of descendants of non-western immigrants, whereby well-off individuals may tend to move into more affluent neighbourhoods with a lower proportion of immigrants, while less well-off individuals do not.

With regard to own-group preferences, the Schelling model predicts that if descendants of non-western immigrants primarily identify with their parents' ethnic group, their moving patterns should translate into increased ethnic segregation. If descendants of non-western immigrants primarily identify with the native population their moving patterns should translate into residential integration with the native group. However, the model may be extended to economic segregation; if individuals prefer to reside in neighbourhoods dominated by their own socioeconomic strata, we should find moving patterns that contribute to economic segregation among both natives, non-western immigrants and descendants. In other words; we should find that well-off non-wester immigrants and descendants move to more affluent areas, following the pattern of well-off natives.

It is also worth noting that the moving patterns observed in this paper do not constitute a proper test of the mechanisms that may explaining these patterns. A number of alternative explanations are possible. For instance, high-income individuals moving to high-income areas may be driven by a preference for better housing, rather than preferences for affluent neighbours. Similarly, a low propensity to move out of neighbourhoods with a high proportion of non-western immigrants and descendants among non-western descendants, or a low propensity to move out of neighbourhoods with a high proportion of natives among natives may be driven by a preference for living close to family or friends, as suggested by Ruud (2001). As such, it is important to stress that the results presented here are descriptive, and should not be interpreted as an affirmation or refutation of any specific mechanisms or theories.

### 3.3 Segregation in Europe and Norway

Historically, research on residential segregation has been dominated by studies of American cities, and particularly the segregation of the African American population and, later, the Hispanic

population and different immigrant groups. But, more recently, researchers have shown increasing interest in residential segregation in Europe. Studies of socioeconomic segregation in European cities generally find the poor to be less segregated from the rest of the population than the rich. In fact, a general pattern seems to be that the poor and the middle class or middle-income groups are fairly integrated in Europe, while the richest are the most segregated (Musterd 2005). A comparison of socioeconomic segregation levels in European capitals (with neighbourhood definitions that are not strictly comparable across contexts), found socioeconomic segregation levels to be on the rise, but found Oslo to have a comparatively low level of socioeconomic segregation (Tammaru et al. 2015). Studies of ethnic segregation in Europe have found highly varying, but stable levels of segregation in European cities and countries (Andersson et al. 2018; Musterd and Van Kempen 2009), while ethnic segregation levels have been shown to be moderate in Oslo compared to other Nordic capitals (Skifter Andersen et al. 2016). Few studies have investigated the residential integration of the descendants of non-western immigrants in Europe. However, Shon (2011) found these groups to be somewhat more spatially integrated than the immigrant population in France.

The inequalities and segregation patterns in Oslo have been subject to extensive research, and a 400-page anthology on inequalities and segregation in Oslo was recently published (Ljunggren 2017). Studies of socioeconomic segregation have consistently found systematic differences between the east and the west, with trends indicating increased segregation in later years, and, notably, high and increasing segregation of the most affluent segments of the population (Andersen and Ljunggren 2014; Toft 2018; Wessel 2015; Wiborg 2017). Focusing on class divisions, Ljunggren and Andersen (2015) have shown that the segregation patterns in Oslo follow both a vertical and a horizontal dimension. Applying a Bourdieuvian approach, they found segregation to follow both an upper class/lower class dimension and a cultural/economic one.

With regard to ethnic segregation, studies from Oslo consistently find that the proportions of immigrants is higher in the eastern, central and southern parts of the city (Blom 2006a, 2006b; Wessel 2017). Wessel et al. (2018) have shown that this overall pattern is driven in part by natural demographic change but attenuated by international migration, while Nordvik and Turner (2015) found little evidence of native flight in Oslo.

Similarly, several studies have investigated segregation and geographical differences in Oslo along other, related dimensions. For instance, several studies and statistics show significant differences between city districts in health and mortality (Elstad 2017; Norwegian Institute of

Public Health 2016), employment (Norwegian Institute of Public Health na-a), education (Statistics Norway na-d) children's reading and math skills and high school dropouts (Norwegian Institute of Public Health na-b, na-c, na-d), and numerous other indicators. It should come as no surprise to inequality and segregation researchers that advantages and disadvantages tend to be clustered in different neighbourhoods and that neighbourhoods with high concentrations of poor people and immigrants also tend to score worse on indicators of welfare, status etc.

In this paper, I start off from three findings previously established in the literature concerning segregation and assimilation in Oslo and Norway:

- 1) High-income groups and people with high wealth are highly segregated in Oslo and dominate the west, while low-income groups and immigrants are more concentrated in the east and south (Andersen and Ljunggren 2014; Toft 2018; Wessel 2015, 2017; Wiborg 2017).
- 2) Descendants of non-western immigrants have an upwards social mobility comparable to that of natives (Hermansen 2016).
- 3) Descendants of non-western immigrants are less geographically mobile than socioeconomically similarly situated natives or descendants of western immigrants (Hundebo 2016; Sørholt and Astrup 2009b); they tend to reside closer to their parents and not move to affluent areas at the same rate as natives with similar socioeconomic characteristics.

Taken together, these findings imply that natives who experience upward social mobility will tend to move to more affluent neighbourhoods to a greater extent than descendants of non-western immigrants. While this low geographic mobility among upwardly mobile descendants of non-western immigrants may contribute to increasing ethnic segregation, it may also serve to reduce socioeconomic segregation.

In this paper, I first investigate whether the main pattern of low geographic mobility among descendants of non-western immigrants is present in my data. In doing this, I document group differences between natives and descendants of non-western immigrants with comparable incomes in their propensity to move and the average distances moved. I then describe the differences in ethnic and socioeconomic composition of the origin and destination neighbourhoods of Oslo or these groups. Finally, I investigate whether the residential patterns of descendants of non-western immigrants affect ethnic and economic segregation in Oslo.

## 4. Data and methods

### 4.1 Data

The analyses presented here rely on detailed individual-level register data from the population register and tax return register, linked to geographical coordinates on each individual's place of residence on the 1st of January each year. These high-quality administrative register data are provided by Statistics Norway, and made available through the project ResSegr ("Residential segregation in five European countries - A comparative study using individualized scalable neighbourhoods"). The data contains information on each individual's birth year, income, immigrant background and country of origin, home municipality and coordinates for place of residence, located on a grid consisting of 100x100 meter grid cells. Information from different data sources is matched by a unique personal identifier. I first extract those individuals who resided in Oslo on the 1st of January in at least one year between 2000 and 2014. From these individuals, I construct a panel dataset spanning the years 2000-2014. This dataset contains information on fixed characteristics, age, grid cell coordinates, income, moves, moving distance in meters, the neighbourhood characteristics of the neighbourhood each individual resides in at the beginning of each year, and the characteristics of the destination neighbourhood at the beginning of the year for years in which an individual moves. Since I do not have information on income after the year 2014, and since I only have geocodes from the year 2000 onwards, the panel dataset spans the time period 2000-2014.

Neighbourhood characteristics are calculated using the k-nearest neighbours approach for the 1000 nearest neighbours of each grid cell. The proportion of non-western immigrants (and descendants) in a neighbourhood is measured as the proportion of this group among the 1000 nearest neighbours aged 25-64 to the grid cell that the individual resides in. The proportion of high-income individuals is similarly calculated as the proportion of individuals among the 1000 nearest neighbours aged 25-64 to with an income in the top decile that year. These proportions are calculated using EquiPop – a specialized software that calculates the neighbourhood composition of each grid cell (Östh 2014).

For analyses, I restrict the sample to persons resident in the municipality of Oslo each year who are in the age span 25-64. This means that people are included in the sample if they both reside in Oslo and are between 25 and 64 years old on the 1st of January each year. Individuals are left-

censored before moving to Oslo for the first time and before turning 25, right-censored after leaving Oslo for the last time and after turning 65, and interval censored if they are between 25 and 65 and temporarily reside outside the city. Only moves within the city are measured, so that for instance a move from a neighbourhood in the city to a place outside the city results in censoring but is not counted as a move. The municipality of Oslo covers a large part of the urban area, although the urban area does not stop sharply at the municipality border. I also condition on having non-missing information on income, immigrant status and country background.

There are two important drawbacks to basing a study of moving patterns and segregation on municipality borders.

The first drawback relates to the endogenous exclusion of moves. When people decide on whether and where to move, options are not restricted to dwellings within the city borders. If, for instance, people prefer to live in neighbourhoods with a high proportion of affluent people or a high proportion of people from their own ethnic group, this may induce them to leave the city or move into it. Excluding moves into and out from the city may introduce a bias when studying the moving patterns of different groups.

If, for instance, natives and descendants of non-western immigrants have an equal propensity to move, but descendants have a stronger tendency to move out of the city while natives have a stronger tendency to move within the city, restricting the analyses to moves within the city may give the false impression that descendants have a lower propensity to move at all. Thus, it is important to interpret the results as pertaining to intra-city moves only.

The other drawback relates to the arbitrariness of city borders when measuring a neighbourhood's composition. The urban area of Oslo does not stop at the municipality border. Many people reside in municipalities bordering the city. When neighbourhoods are truncated at the city borders, neighbours living outside the borders do not count towards an individual's neighbourhood. This is clearly not ideal, as the neighbourhoods along the border will then not include the nearest neighbours of each individual, but the nearest neighbours residing in Oslo of each individual.

However, neither of these issues are resolved by expanding the geographical area under study, as this would merely move the borders further out. Also, the calculation of income quantiles requires that the population is clearly defined. Expanding the area under study to include

neighbouring municipalities would mean that the income distribution studied does not reflect the distribution of incomes in Oslo, but the distribution of incomes in the total area under study.

The segregation patterns in Oslo in 2014 are illustrated in Figure 1. Notice that people with high incomes are highly segregated and cluster in affluent areas in the west, and along a narrow strip bordering the fjord to the south. Non-western immigrants and descendants are concentrated in the east and south, and in the city centre.

## 4.2 Definitions

In this paper, I define a move in year  $t$  as residing in a different 100x100 meter grid cell on the 1st of January of year  $t+1$  than on the 1st of January in year  $t$ . This definition includes also very short moves. It is possible to define a move as exceeding some minimum threshold of geographic distance, but conditioning a move on the distance moved would entail that the data would not be representative of all intra-city moves in the period, and lead to an overestimation of moving distances and differences between origin and destination neighbourhoods. An individual's neighbourhood is defined as the nearest 1000 neighbours of the 100x100m grid cell where the individual resides. Income is measured as the sum of after-tax income from wages and salaries, self-employment, property income and transfers received, minus total assessed taxes and negative transfers (Statistics Norway, 2017). The income indicator used is denoted "wies" in the original data file from Statistics Norway. An individual's income quantile is calculated from the income distribution of individuals aged 25-64 who were registered as resident in Oslo on the 1st of January that year. The reason for the focus on the high-income group, as supposed to low-income is twofold. First, it is theoretically relevant, as the spatial assimilation model posits that as they themselves become more affluent, immigrants (and their descendants) should move into more affluent neighbourhoods. Second, high-income individuals are highly segregated in Oslo, but low-income individuals are not (author's own calculations, not shown), making the impact of the moving patterns of descendants of non-western immigrants on top-income segregation a more interesting research topic.

Immigrant background groups are coded by combining two immigrant background indicators. The first indicator pertains to each individual's immigrant status in the population register. The four categories used in this paper are "native", "immigrant", "descendant" and "other". The exact definitions of these categories are provided in Table 1. Country of birth refers to the country where

the mother was resident at the time of birth. The second indicator pertains to each individual's country background, and in this paper, I apply a simple dichotomization by western/non-western countries. This grouping is somewhat arbitrary, and these groups are highly heterogeneous. For immigrants, country background refers to their country of birth. The definitions of immigrants and descendants used here follow the standard classification from Statistics Norway. Those who are Norwegian-born to two Norwegian-born parents are counted as native. Those born abroad (in the sense that the mother was not resident in Norway at the time of birth) with two parents born abroad are counted as immigrants. Those born to a mother who was resident in Norway at the time of birth, with two foreign-born parents are counted as descendants. All others (such as those born in Norway with one Norwegian-born and one foreign-born parent, or those born abroad to two Norwegian-born parents) are grouped in a heterogeneous residual group. For descendants, country background refers to their mother's country of origin, or the country of origin of the father, if the mother's country of origin is unknown. One could argue that descendants are narrowly defined in this paper, and that it should include people with one foreign-born parent. However, for the purposes of studying assimilation processes, it is most relevant to restrict the focus to those without Norwegian-born parents. The most important groups in this paper are "non-western descendants", "non-western immigrants" and "natives". The moving patterns of these groups are described in detail below. Further, when analyzing the impact of the residency patterns of non-western descendants, I use groups consisting of non-western immigrants and non-western descendants versus all others, and non-western immigrants versus all others (while excluding non-western descendants from the analyses entirely). The distinction between western and non-western countries in Europe distinguishes between EU/EFTA-countries (including Andorra, Monaco, San Marino and the Vatican) and non-EU/EFTA-countries

Table 1. Definition of immigrant groups

Immigrant status	
native	born in Norway with two parents born in Norway
immigrant	born abroad with two parents born abroad
descendant	born in Norway with two parents born abroad
other	all others
Country background (for immigrants and descendants)	
western	USA, Canada, Australia, New Zealand and EU/EFTA-countries (including Andorra, Monaco, San Marino and the Vatican)
non-western	all other countries

#### 4.3 Methods

##### *K-nearest neighbours*

To estimate the neighbourhood composition of origin and destination neighbourhoods, and to estimate the level of segregation, I apply a k-nearest neighbours approach with  $k=1000$ . In this approach, an individual's neighbourhood is defined as the 1000 nearest neighbours to that individual. A standard unit of measurement in Norwegian research on segregation is the basic unit ("grunnkrets"). Between 2000 and 2014, the average basic unit in Oslo had between 862 (2000) and 1077 (2014) inhabitants, making a neighbourhood size of 1000 a suitable choice for the present study. Since I only have data on place of residence on a 100x100m grid, all individuals residing in the same grid cell have the same neighbourhood. For the same reason, neighbourhoods may consist of slightly more than 1000 people, since this approach does not discern between people residing within the same grid cell when calculating who the nearest neighbours are.

##### *Regression*

In this paper, the differences in economic and ethnic composition of the origin and destination neighbourhood at the time of the move are calculated as shown in Equation 1, where  $composition_{i,t}$  refers to the proportion of either non-western immigrants and descendants, or people with income in the highest decile, among the 1000 nearest neighbours of individual  $i$  in the year  $t$ . An individual's propensity to move during a year, in the period 2000-2013, is estimated using linear probability models (Equation 2). I calculate the predicted distance moved during a

year, and the distance moved at each move in a similar fashion (Equation 3). When estimating the distance moved at each move, Equation 3 is estimated conditional on having moved within the city that year. The predicted neighbourhood composition of the neighbourhood of residence (Equation 4) is estimated without conditioning on moving, but the predicted change in neighbourhood composition (Equation 5) is conditional on moving that year. All models are fitted separately by sex, and include fixed effects for age and year, and dummies for income vigintiles interacted with dummies for immigrant background groups, generating predicted values for each combination of income vigintile and immigrant background group. Note that these models are parsimonious; they are meant to describe the moving patterns of different groups by income while accounting for differences in age structure and sex composition, not to explain these patterns. As such, no control variables are included.

- 1)  $\Delta composition_{i,t} = origin\ neighborhood\ composition_{i,t} - destination\ neighborhood\ composition_{i,t}$ ,
- 2)  $p(\widehat{move})_{i,t} = \alpha + \beta_1 \cdot age_{i,t} + \beta_2 \cdot year_{i,t} + \beta_3 \cdot income\ vigintile_{i,t} \cdot immigrant\ background\ group_{i,t}$
- 3)  $distance\ \widehat{moved}_{i,t} = \alpha + \beta_1 \cdot age_{i,t} + \beta_2 \cdot year_{i,t} + \beta_3 \cdot income\ vigintile_{i,t} \cdot immigrant\ background\ group_{i,t}$
- 4)  $composition_{i,t} = \alpha + \beta_1 \cdot age_{i,t} + \beta_2 \cdot year_{i,t} + \beta_3 \cdot income\ vigintile_{i,t} \cdot immigrant\ background\ group_{i,t}$
- 5)  $\Delta composition_{i,t} = \alpha + \beta_1 \cdot age_{i,t} + \beta_2 \cdot year_{i,t} + \beta_3 \cdot income\ vigintile_{i,t} \cdot immigrant\ background\ group_{i,t}$

### *Percentile plots and the dissimilarity index*

To assess the contribution of descendants of non-western immigrants to overall segregation levels, I use percentile plots and the dissimilarity index. The percentile plots describe the maximum proportion of people with a given trait (non-western immigrant background or income in the highest decile) among the k-nearest neighbours of each individual, within each percentile of the distribution. For instance, considering the highest income decile, if the 50th percentile has a value of 30 %, half of the population live in neighbourhoods where 30 % or more of their 1000 nearest neighbours have incomes in the highest decile. The plots are weighted by the number of people aged 25-64 in each grid cell. These plots allow me to compare the degree of economic and ethnic segregation, and how these segregation levels are affected by the residential patterns of the descendants of non-western immigrants. The dissimilarity index (D) is a common measure of segregation. With k-nearest neighbours, the calculation is slightly different from the calculation with fixed neighbourhood boundaries. This index for group G is calculated as

$$6) \quad D = \frac{1}{2} \sum_{i=1}^S \left| \frac{g_i}{G} - \frac{\bar{g}_i}{\bar{G}} \right|$$

Where  $D$  is the dissimilarity index.  $S$  is the total population,  $g_i$  is the number of people in the group in the egocentric neighbourhood of individual  $i$ ;  $G$  is the sum of all  $g_i$ ;  $\bar{g}_i$  is the number of people who are not in the group in the egocentric neighbourhood of individual  $i$ ; and  $\bar{G}$  is the sum of all  $\bar{g}_i$  (Malmberg et al. 2018).

#### 4.4 Descriptive statistics

Table 2 summarizes descriptive statistics by immigrant background group for the years 2000, 2007 and 2014, for the age group 25-64, conditional on being resident in Oslo on January 1st that year. Due to the focus of this paper, I only present statistics for the most relevant groups, namely “natives”, “non-western immigrants” and “non-western descendants”, while other immigrant background categories are grouped together in a category denoted “all others”.

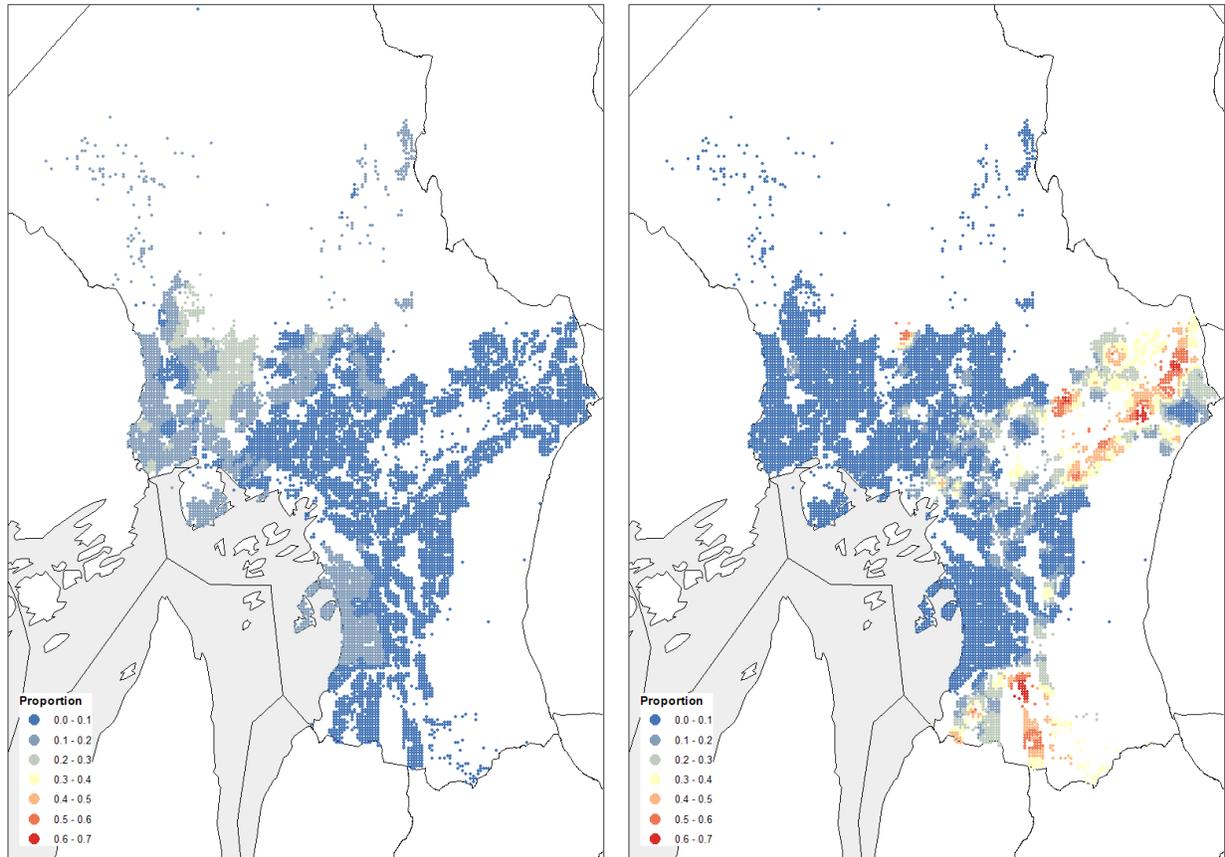
A first point of note is that descendants of non-western immigrants make up a very small proportion of the sample – only about 1.5 percent in the last year. Further, it is worth noting that, disregarding differences in age and sex composition between the groups, non-western immigrants and descendants appear to move both further and more frequently than the group of natives. Also, a very low proportion of non-western immigrants, and a somewhat higher proportion of descendants of non-western immigrants have incomes in the highest decile, while natives are overrepresented in this group. With regard to the composition of the 1000 nearest neighbours of each group, on average, descendants of non-western immigrants reside in the neighbourhoods with the highest concentrations of non-western immigrants and descendants, closely followed by descendants of non-western immigrants. Both non-western immigrants and descendants on average live in neighbourhoods with a below average proportion of people with incomes in the top decile.

The segregation patterns in Oslo in 2014 can be clearly seen from the maps in Figure 1, which show the concentrations of people with incomes in the top decile and the concentrations of non-western immigrants and descendants, respectively. As can be seen, there is very little overlap between the areas with high concentrations of affluent individuals and those with high concentrations of non-western immigrants and descendants. For the sample of individuals aged 25-64, the correlation between these two neighbourhood characteristics is strongly negative throughout the period, with a correlation coefficient varying between  $r = -0.6813$  in 2002 and  $r = -0.6349$  in 2014.

Table 2. Descriptive statistics for the panel by year

Year	2000	2007	2014
Total number of individuals	283364	316655	362529
Proportion of the sample (%)			
Natives	76.07	70.21	60.05
Non-western immigrants	12.02	15.90	19.72
Non-western descendants	0.07	0.65	1.51
All others	11.84	13.25	18.73
Proportion women (%)			
Whole sample	49.91	49.65	49.11
Natives	50.65	50.21	50.18
Non-western immigrants	45.12	48.49	50.46
Non-western descendants	53.20	47.54	48.17
All others	49.94	48.17	44.33
Mean age			
Whole sample	40.78	41.42	41.13
Natives	41.44	42.29	42.32
Non-western immigrants	38.43	39.54	40.41
Non-western descendants	28.67	28.16	30.19
All others	38.96	39.74	38.93
Total number of moves	30150	41092	43664
Mean number of moves			
Natives	0.09	0.12	0.10
Non-western immigrants	0.17	0.17	0.15
Non-western descendants	0.16	0.17	0.15
All others	0.12	0.15	0.15
Mean distance moved, conditional on moving			
Whole sample	397	409	393
Natives	340	341	305
Non-western immigrants	734	642	541
Non-western descendants	745	656	607
All others	421	476	501
Proportion with income in the top decile (%)			
Natives	12.28	13.02	14.47
Non-western immigrants	2.34	2.21	2.59
Non-western descendants	3.45	4.00	4.87
All others	11.59	11.20	9.22
Average proportion of non-western immigrants and descendants in the neighborhood (%)			
Whole sample	12.98	17.53	22.30
Natives	11.78	15.22	18.54
Non-western immigrants	22.42	29.82	35.21
Non-western descendants	17.73	31.04	37.77
All others	11.06	14.38	19.51
Average proportion with income in the top decile in the neighborhood (%)			
Whole sample	10.73	10.73	10.67
Natives	11.17	11.47	11.82
Non-western immigrants	6.13	6.21	6.51
Non-western descendants	7.91	6.14	5.96
All others	12.61	12.49	11.76

**Figure 1.** Proportion of people with incomes in the top decile among the 1000 nearest neighbours in each 100 \* 100 m grid cell in Oslo, 2014 (left). Proportion of non-western immigrants and descendants among the 1000 nearest neighbours in each 100 \* 100 m grid cell in Oslo, 2014 (right).



*Note: In part due to the differences in the overall proportions of non-western immigrants and descendants and people with income in the top decile, the concentration levels for the latter group are lower. A map of the proportion of people with income in the highest decile among the 1000 nearest neighbours of each 100\*100 m grid cell, using colours representing values between 0 and 0.4, rather than 0 and 0.7 is provided as an appendix.*

## 5. Results

### 5.1 Differences in moving patterns

Estimating Equation 2 separately for each immigrant background group and sex, we see that, although the differences are not large, descendants of non-western immigrants have a lower propensity to move at all during a given year than natives in the same income group. Meanwhile,

we see that male non-western immigrants are far more prone to moving within the city than male natives (Figure 2). These patterns are consistent with those observed by Hundebø (2016).

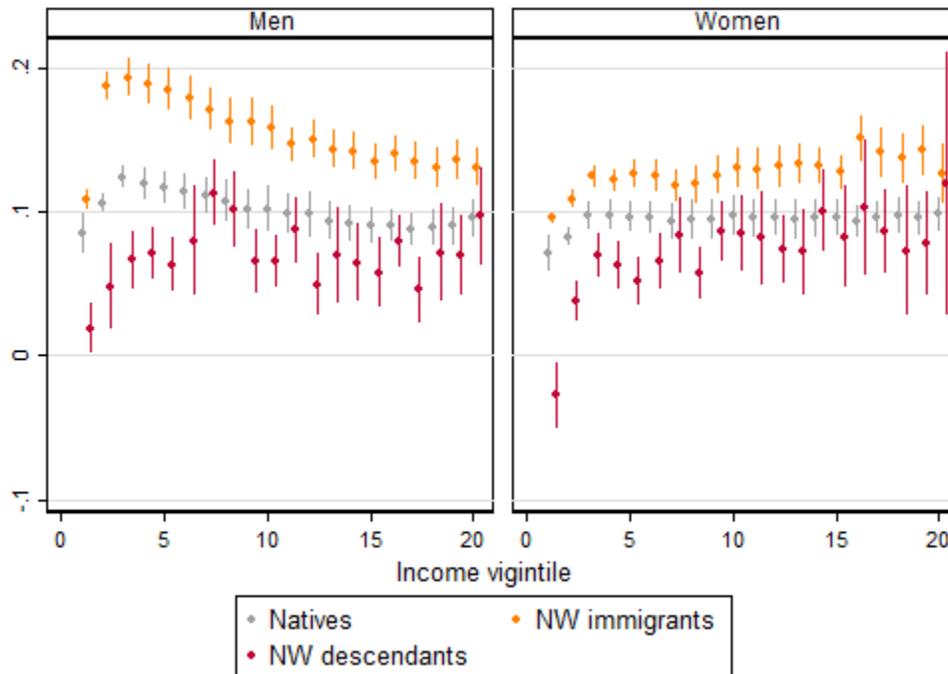


Figure 2. Predicted probability of moving during a year

Estimating Equation 3 while not conditioning on moving, we see that overall, the distance moved does not vary greatly between natives and descendants of non-western immigrants, while non-western immigrants on average move further each year than the other groups (Figure 3). When we condition on moving, we get the predicted distance moved in each year where a move has taken place. These results, provided in Figure 4, show that, although descendants of non-western immigrants move more seldom than natives, they tend to move farther when they do move, and the distances are similar to those of non-western immigrants. However, there is little systematic variation in moving distances by income for moves within the city borders.

The results from estimating Equation 4 for the proportion of non-western immigrants and descendants in the neighbourhood are shown in Figure 5. Here, we see that the proportion of non-western immigrants and descendants in the neighbourhood is much higher among non-western immigrants and descendants than among natives, but that people in the higher end of the income

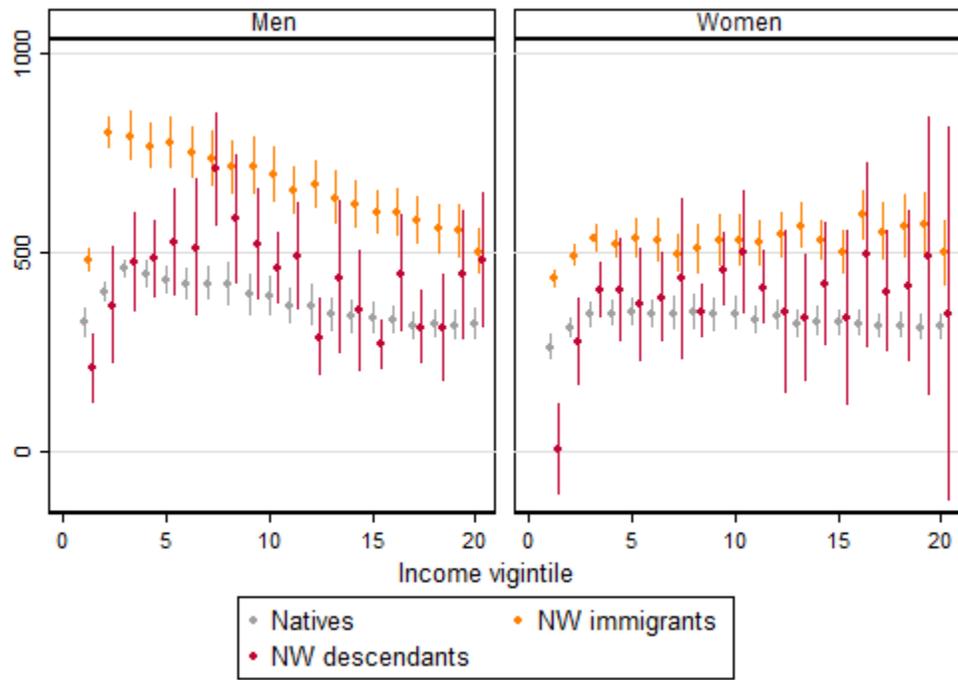


Figure 3. Predicted distance moved during a year, in meters

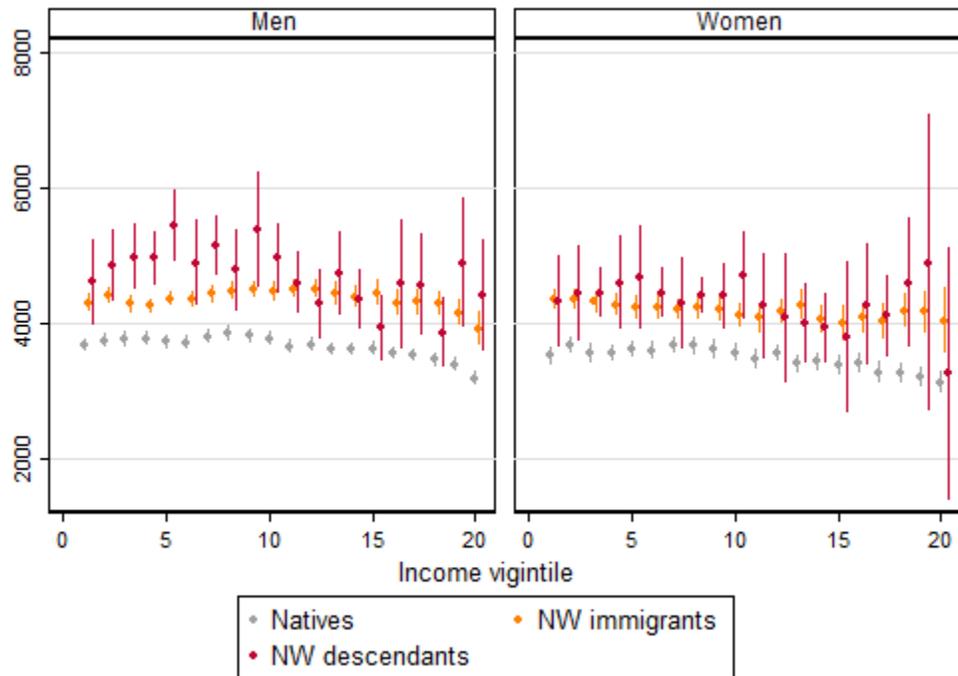


Figure 4. Predicted distance moved at each move, in meters

distribution live in neighbourhoods with a lower proportion of non-western immigrants and descendants. The proportion of non-western immigrants and descendants is also lower among natives at the bottom end of the income distribution. There may be several reasons for this latter phenomenon. For instance, many low-income natives may live in areas dominated by natives (as seen from Figure 1, several areas have low proportions of both high-income individuals and non-western immigrants and descendants). Also, many affluent native people living in affluent areas with a low proportion of immigrants may not have high incomes but rely on their wealth or the income of their spouse.

Estimating Equation 4 for the proportion of people with incomes in the highest decile (Figure 6) shows the same overall pattern as Figure 5, but inverse. The proportion of people with incomes in the top decile is apparently strongly related to income among people in all immigrant background groups, but this relationship is clearly U-shaped among natives. The pattern for descendants of non-western immigrants is largely similar to that of non-western immigrants.

Figure 7 shows results from estimating Equation 5 on the difference in proportions of non-western immigrants and descendants among the 1000 nearest neighbours of the origin and destination grid cell in the year when an individual moves. Contrary to the initial expectations, these results indicate that when descendants of non-western immigrants in the upper half of the income distribution move within Oslo, they do tend to move to neighbourhoods with a slightly lower proportion of non-western immigrants and descendants, on average. The differences between descendants of non-western immigrants and the other groups are substantial but modest. This does suggest a positive relationship between economic success and spatial assimilation in the “second generation”.

Estimates from Equation 4, predicting the difference in proportions of people with income in the highest decile among the 1000 nearest neighbours of the origin and destination grid cell in the year when an individual moves are presented in Figure 8. These results indicate that people with high incomes tend to move to more affluent neighbourhoods, regardless of immigrant background group. While this tendency is somewhat weaker among non-western immigrants than among natives, the differences between descendants of non-western immigrants and natives are small – especially among men.

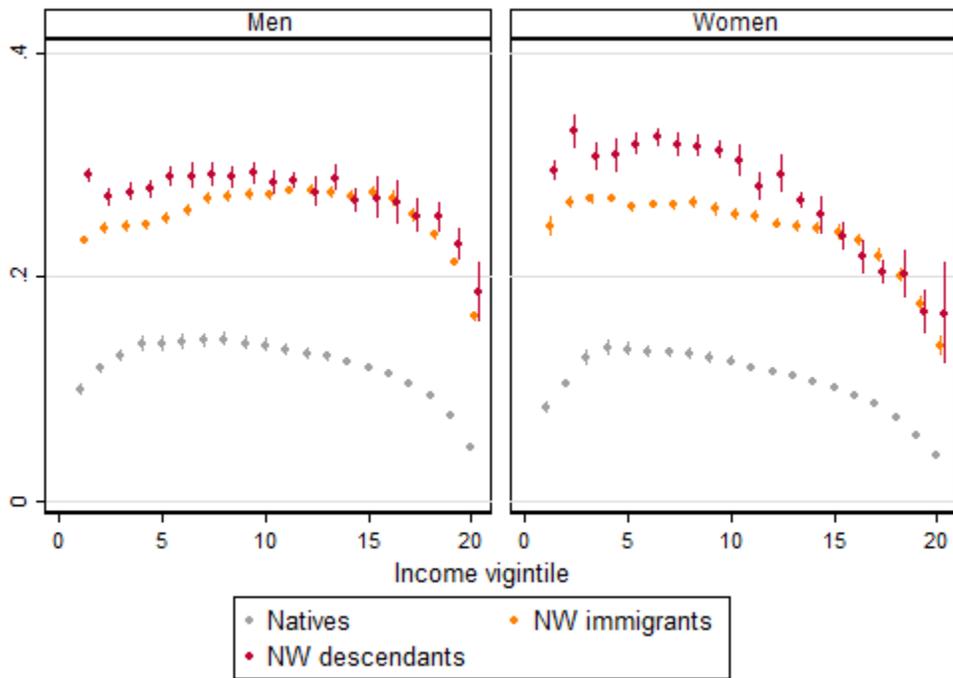


Figure 5. Predicted proportion of non-western immigrants and descendants among the 1000 nearest neighbours

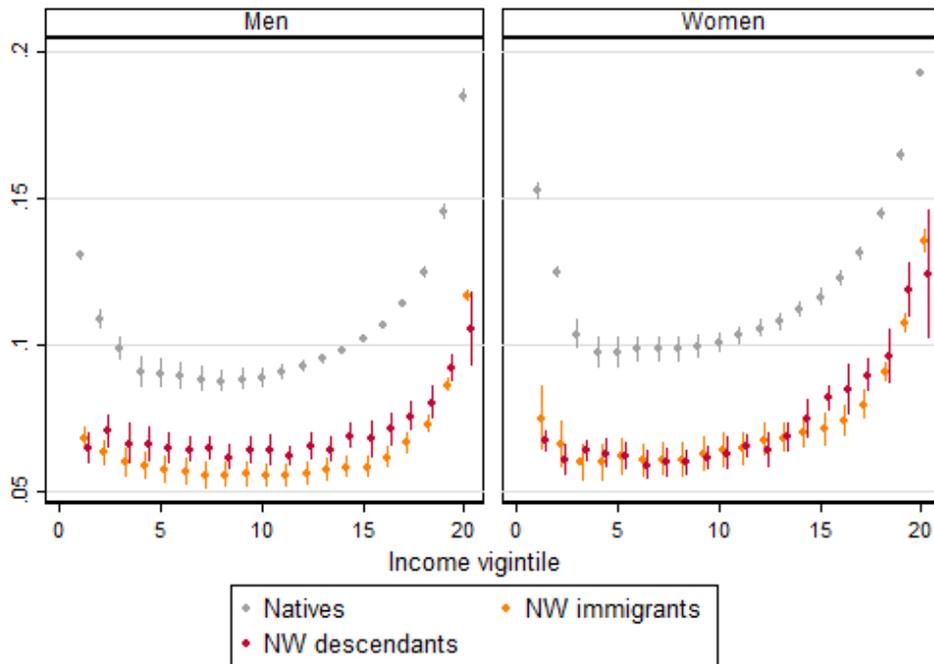


Figure 6. Predicted proportion of people with incomes in the highest decile among the 1000 nearest neighbours

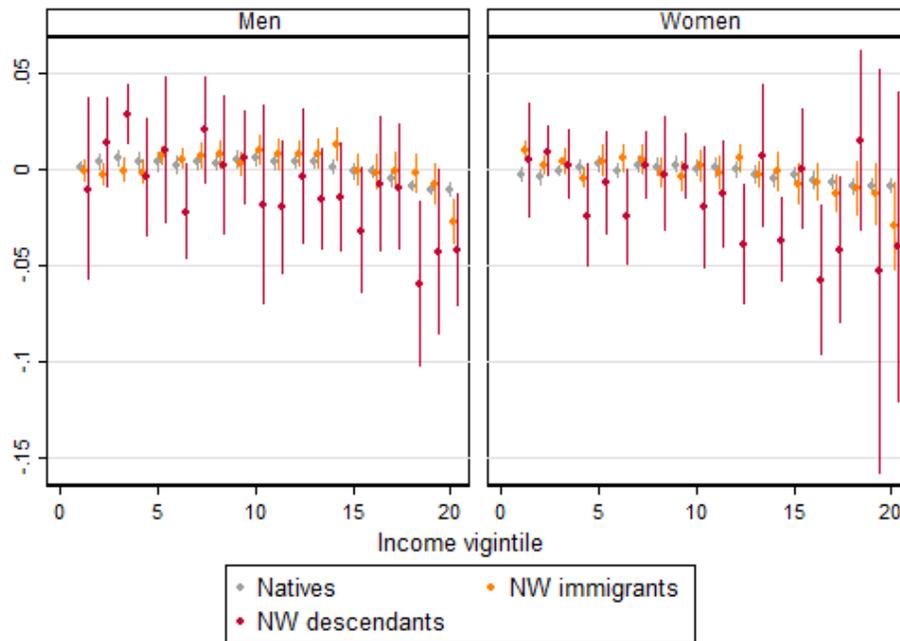


Figure 7. Predicted difference between the origin and destination neighbourhood in the proportion of non-western immigrants and descendants among the 1000 nearest neighbours

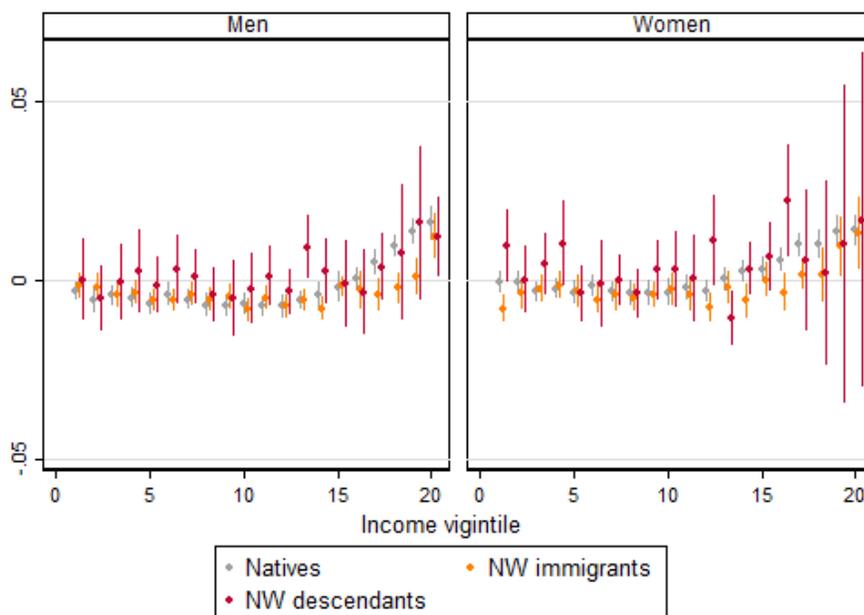


Figure 8. Predicted difference between the origin and destination neighbourhood in the proportion of people with income in the highest decile among the 1000 nearest neighbours

The patterns presented in Figure 7 and 8 may in part be driven by differences in income levels and ethnic composition in the initial neighbourhoods. Since descendants of non-western immigrants start off in neighbourhoods with higher proportions of immigrants and lower proportions of people with high incomes compared to natives, even random moves would produce patterns where they move to areas with relatively lower proportions of immigrants and relatively higher proportions of people with high incomes, compared to natives. Nonetheless, the finding that descendants of non-western immigrants with high incomes do tend to move to neighbourhoods with higher concentrations of high-income individuals and lower concentrations of non-western immigrants is consistent with the notion that economic success is related to spatial assimilation in the “second generation”.

## 5.2 Percentile plots

Percentile plots for the proportion of neighbours with non-western immigrant background are shown to the left in Figure 9. These plots show the percentile distribution of the proportion of people with non-western immigrant background in individualized neighbourhoods of 1000 individuals in 2014. These plots can be interpreted such that if, for instance the 40<sup>th</sup> percentile (on the x-axis) has a value of 5% (on the y-axis) in the income plot, 40 percent of the population lives in neighbourhoods where 5% or fewer of their 1000 nearest neighbours have incomes in the top decile. A flat, horizontal line would indicate perfect integration, while a steeper, more concave line indicates a higher degree of segregation. In the two lines plotted in this figure, the solid red line shows the distribution of neighbours aged 25-64 with non-western immigrant background, where descendants of non-western immigrants are counted among the non-western immigrant background group. The second, dashed orange line shows the distribution of neighbours aged 25-64 who are non-western immigrants, while descendants of non-western immigrants are excluded from the data entirely. This approach is not common in research on residential segregation, and is somewhat crude, but it serves as a simple illustration to the question; what does the ethnic segregation pattern in the city look like when we include descendants of non-western immigrants in the non-western immigrant group, compared to when we exclude descendants of non-western immigrants from the analysis altogether. As can be seen, the differences are very small. In other words, the residential patterns of descendants of non-western immigrants appear to have very little effect on the overall levels of ethnic segregation in Oslo. The miniscule difference points towards

this group contributing to marginally increased ethnic segregation, likely driven by the highly skewed distribution of their origin neighbourhoods, rather than their moving patterns.

Similarly, percentile plots for incomes in the highest decile in 2014 are shown to the right in Figure 9. These plots show the percentile distribution of the proportion of people with income in the highest decile in individualized neighbourhoods of 1000 individuals in 2014. The figure includes two such plots. The first line (solid, dark blue) shows the distribution when all individuals aged 25-64 are included, while the second line (dashed, light blue) shows the distribution when descendants of non-western immigrants are excluded. Similarly as the plot for ethnic segregation, this plot shows what the top-income segregation pattern in the city looks like when we include all individuals in the age group, compared to when we exclude descendants of non-western immigrants. As we can clearly see from this figure, the two lines are nearly identical. In other words, the effect of the residential patterns of descendants of non-western immigrants on overall economic segregation in Oslo is close to zero.

### 5.3 Segregation indices

To supplement the percentile plots, and to document how the contribution of descendants of non-western immigrants to economic and ethnic segregation in Oslo has changed over time, I have also calculated the dissimilarity index for the years 2000-2014, both while including and excluding descendants of non-western immigrants. These results are plotted in Figure 10. The figure shows two interesting features. First, there is a striking degree of stability in the ethnic and economic segregation levels in Oslo over time. Second, descendants of non-western immigrants apparently do not contribute to economic and ethnic segregation in Oslo to any substantive degree. This latter point can be seen by comparing the dissimilarity index for people with income in the highest decile and people with non-western immigrant background, respectively, where descendants of non-western immigrants are included to the corresponding lines where descendants of non-western immigrants are excluded. These are practically identical. The only exception is a very minor difference in the level of ethnic segregation in the latest years, indicating a miniscule contribution towards increased ethnic segregation.

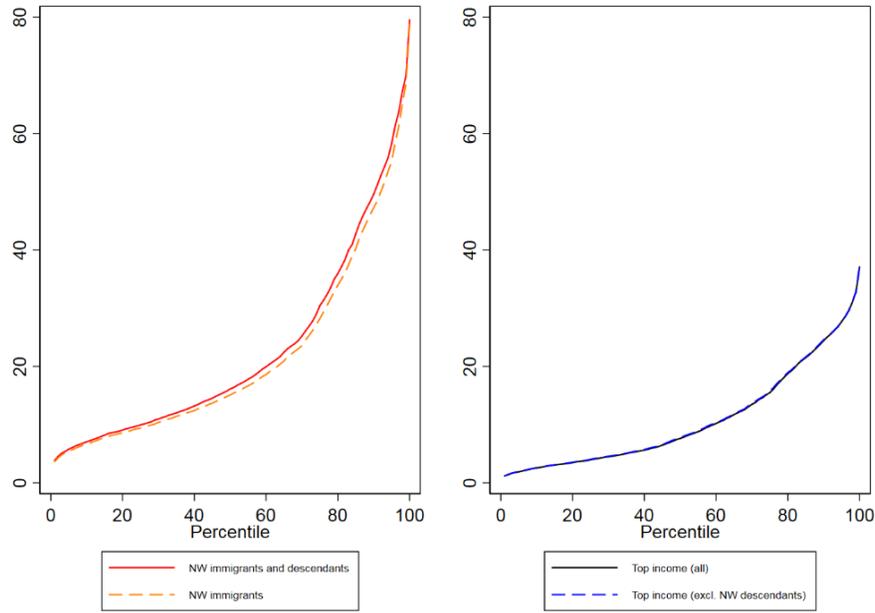


Figure 9. Percentile plots for the degree of concentration of people with non-western immigrant backgrounds while including and excluding descendants of non-western immigrants (left) and the degree of concentration of people with income in the highest decile while including and excluding descendants of non-western immigrants from the sample (right)

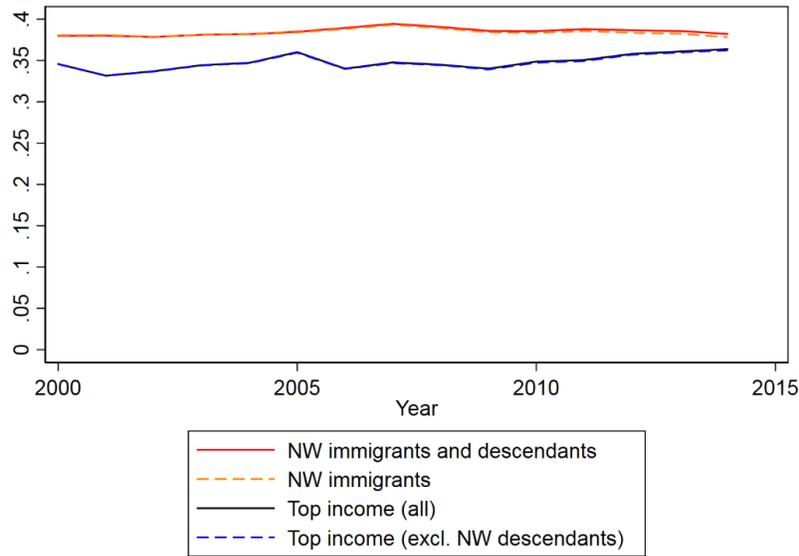


Figure 10. Dissimilarity index for the years 2000-2014, comparing the degree of segregation of people with incomes in the top decile and people with non-western immigrant backgrounds to the segregation of these groups when descendants of immigrants are excluded

## **6. Discussion and conclusions**

In an age of large-scale international migration, the integration of immigrants and their descendants in different social arenas such as education, the labour market, the housing market, the political system, social networks etc. is of major importance to avoid social exclusion, poverty and disenfranchisement, to reduce ethnic segregation and discrimination, and to promote social cohesion. In the research literature, much attention has been paid to the educational and labour market outcomes of immigrants and their descendants, both in Norway and other national contexts. Additionally, many researchers have studied ethnic segregation in urban areas, and how segregation patterns emerge and are influenced by international migration. However, relatively few studies have investigated the residential patterns of the descendants of immigrants – the so-called “second generation”. This paper contributes to the literature by studying the moving behaviour of this group and documenting their contribution to overall ethnic and economic segregation in Oslo, the capital city of Norway.

The motivation for this study lies in recent findings indicating a high degree of economic assimilation, a low degree of spatial assimilation and low geographic mobility among descendants of non-western immigrants. These findings in combination point towards the moving behaviour of this group having a two-pronged effect on residential segregation in Oslo. On the one hand, low geographic mobility and limited spatial assimilation among descendants of non-western immigrants in general suggests that this group should contribute to increased ethnic segregation. On the other hand, low geographic mobility of economically successful descendants of non-western immigrants should contribute to reduced economic segregation, since this group should have a weaker tendency to move to affluent neighbourhoods than their native peers.

The results were not in line with these expectations. First, the results indicate that economically successful descendants of non-western immigrants do move to more affluent neighbourhoods and neighbourhoods with a lower proportion of non-western immigrants and descendants. However, the overall contribution of descendants of non-western immigrants to ethnic and economic segregation is, for all practical purposes, zero. There are two important reasons for this. First, while descendants of non-western immigrants constitute an increasing proportion of the population in Oslo, their share of the total population is still small. This means that their potential contribution to overall segregation patterns is limited. Second, their origin neighbourhoods have lower proportions of high-income individuals and higher proportions of non-western immigrants and

descendants. Although the moving behaviour of descendants of non-western immigrants in Oslo is similar to that of the native population, such moves are not sufficient to outweigh the differences in the composition of the origin neighbourhoods. As such, it is unlikely that the moving patterns of the “second generation” will have a strong impact on ethnic and economic segregation in Oslo in the near future.

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**Appendix**

Proportion of people with incomes in the top decile among the 1000 nearest neighbours of each 100\*100 m grid cell in Oslo, 2014, with colours representing the range 0-0.4

