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Development of Educational Segregation Measured using Longitudinal Population Scale Network Data

Keywords: network analysis, segregation, complete population, longitudinal, education level

Extended Abstract

Introduction Segregation is an important social issue and an enduring theme for sociologists and policy makers. Educational segregation can promote 'social bubbles', reinforce societal polarisation processes and lead to lower social cohesion (Blossfeld and Shavit, 2010; Iyengar et al., 2019). Furthermore, it decreases social mobility and capital, less contacts outside the group leads to more opportunity inequality: a larger, more mixed network is an important form of social capital on the labour market. Segregation is in essence a network property by addressing to what extent people from different groups are connected to each other either directly or indirectly. Using network data covering the entire population of the Netherlands (van der Laan et al., 2022), we investigate how educational segregation changed over time, as well as elicit age-specific patterns.

Data Statistics Netherlands derived a population scale network for the entire Dutch population (van der Laan et al., 2022). This network is derived from official administrative government registers and includes family members, household members, colleagues, class mates and neighbours at multiple times points, from January 1st 2009 yearly up until January 1st 2020. Using these longitudinal networks we look at the development of educational segregation between 2013 and 2020[1] for persons between 25 to 55 years old. At 25 most people will have reached their final education level and above 55 data on education level is less complete.

Methods We largely follow the methods as used by van der Laan et al. (2022). First, we removed the family relations between household members only keeping the household relations. Second, weights were determined for each relation for each ego: the relations for each layer (family, household, work, neighbourhood and school) were given an equal total weight. This ensures that each layer is equally important in the network. Third, each ego is given a weight. Persons with a known education level have a weight larger than zero (to correct for missing values in education level). Persons younger than 25 and older than 55 are given a weight equal to 0. Note that these persons are kept in the network as conduits but they don't contribute directly to the measured segregation of the target population . Finally, a localised random walk (localised page rank) was performed for each person in the network (Ballester and Vorsatz, 2014). This results in an exposure score for each person to each of the four education levels. The exposure of a person to their own education level compared to the expected exposure for that education level is a measure of segregation (V from Massey and Denton (1988)) The result is a segregation score for each individual in each of the 8 years. These individual scores can be aggregated to age, education level, etc. Furthermore, by linking the results from different years, it is possible to measure how, at an individual level, the segregation score has changed.

[1] In 2013 there has been a change in the data on education level. This introduces artifacts for specific age groups and education levels for 2009-2012.

Results Figure 1 shows the mean segregation score as a function of age, education level and year. The segregation is highest for the lower and master educated. Generally, the segregation increases until the age of 30–35 after which it stays stable for a number of years. For bachelor and master educated the segregation increases further after 45-50 years. This seems to be a cohort effect of persons born before 1970 as this effect shifts by a year each year and could be (partially) related to changes in the data source for diplomas obtained after the mid-80s.

In order to look purely at the age effects, the individual segregation in year t can be compared to that in year t+1. Figure 2 shows the correlation between segregation in two sequential years. The differences between the different years are small. Only 2019 for intermediate level educated seems to differ somewhat. This could be caused by the COVID-19 pandemic in 2020 which could have affected the work network in 2020 (this is also visible in the next figure). In general segregation is strongly correlated in time. The correlation is lower at younger ages. In this period the networks of persons show more changes: persons are moving address more often, they are finding partners and developing their careers.

Figure 3 shows the average change in individual segregation from year t to year t+1. For most education levels the segregation increases in the ages from 25 to approximately 30. After that the segregation decreases slowly. In general the differences between the different years are small. Only for the lower educated, the variation is larger where in more recent years the decrease in segregation seems to be somewhat smaller. It should also be noted that the year-on-year change in segregation is small relative to the overall differences in segregation between the different education levels. Therefore, the segregation one has around the age of 30 for a large part determines the segregation at later ages.

Conclusion Using the longitudinal networks, it is possible to measure the segregation of persons with respect to education level for different time periods in a persons life. This makes it possible to study the effect various properties of persons (in this case age) have on segregation and its development. The lower and master educated show the highest average segregation. In general, the segregation develops until the age of 35 after which it shows a slow decrease as persons get older.

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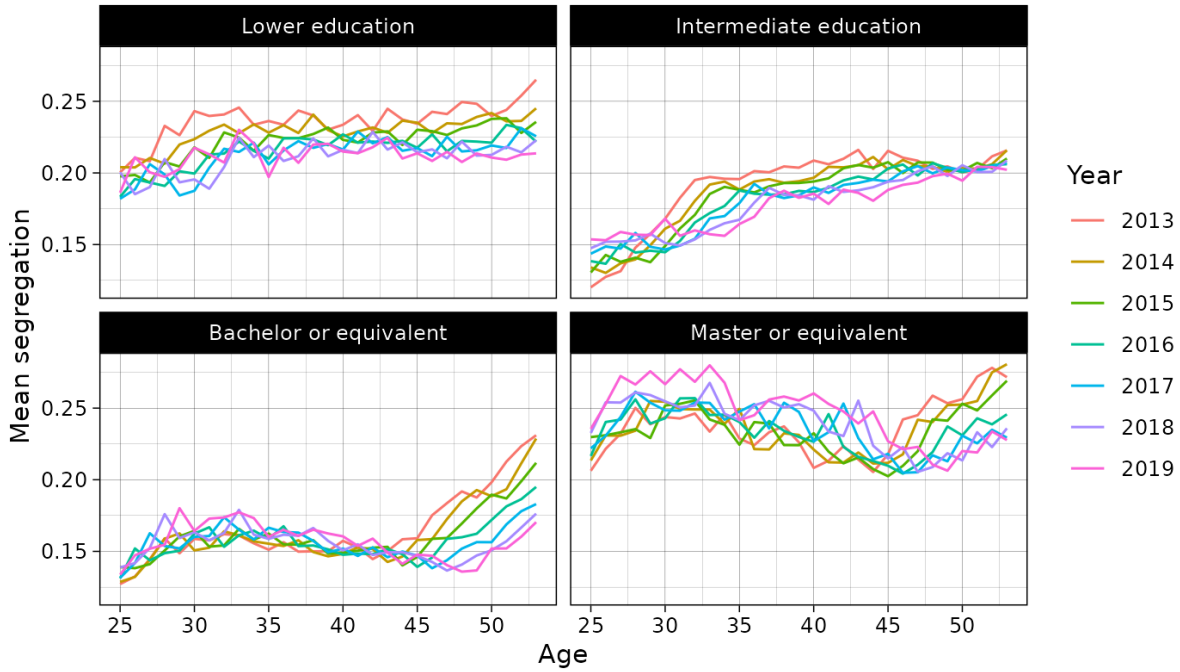

Figure 1: Educational segregation as a function of age for different years and education levels.

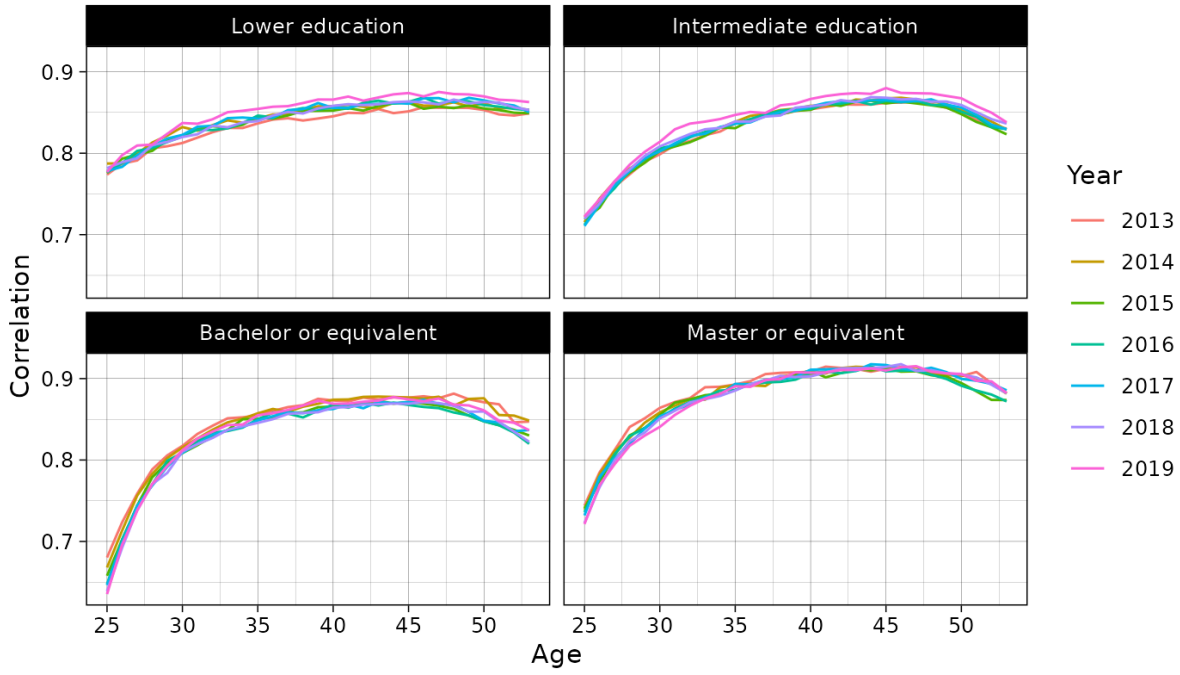

Figure 2: Correlation between individual educational segregation of year t and year t+1 as a function of age (measured in year t) for different years t and different education levels.

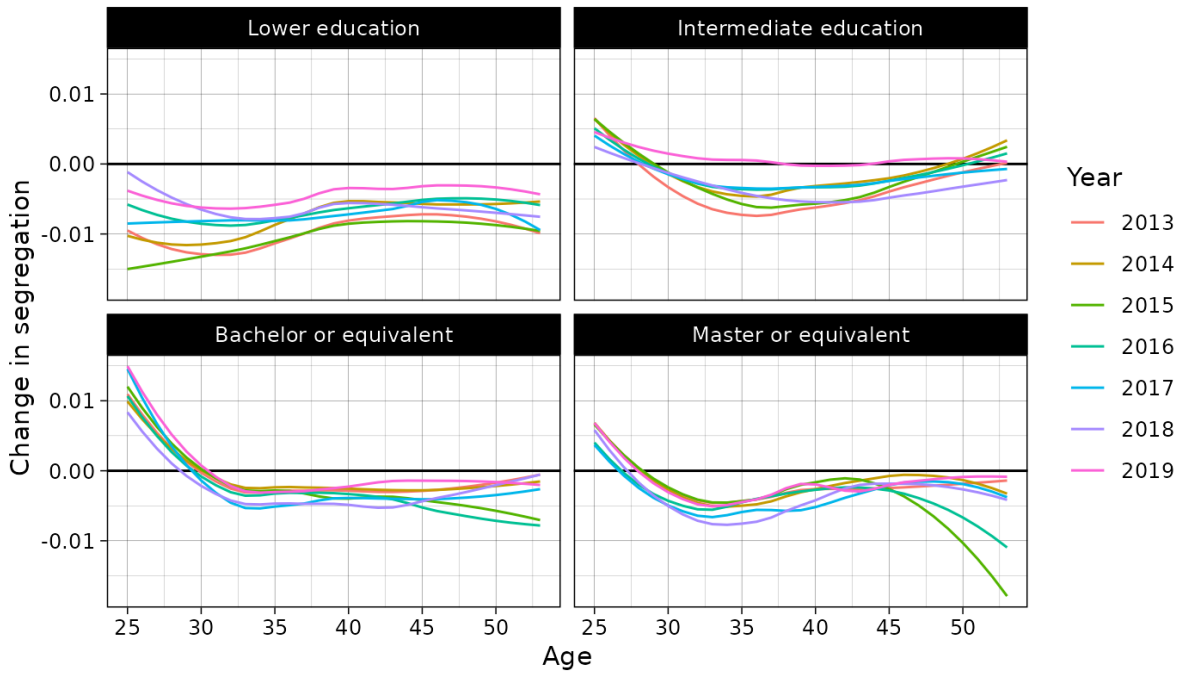

Figure 3: Smoothed development of educational segregation between year t and year t+1 as a function of age (measured in year t) for different years t and different education levels.