Trends in inequality of opportunity: studying heritability of education over time in the Netherlands

Marjolijn Das (presenter), Mayke Nollet

Introduction

Inequality of educational opportunity and its trend over time is one of the most prominent policy concerns in Western countries. Inequality of educational opportunity can be defined as a situation where children with similar innate capabilities have different educational outcomes as a result of their different circumstances. These circumstances most notably include the family background, for instance parental cultural capital and socio-economic status, but they may also include neighbourhood characteristics, teachers and school.

In the social sciences, intergenerational transmission of education is often used as an indicator of inequality of opportunity. European studies on this topic give mixed results with regards to trends, and there are large contextual differences (Breen *et al.,* 2009; Shavit and Blossfeld, 1993). Some recent studies point to an increased influence of family background in younger Dutch cohorts (Timmermans *et al*., 2018; Chmielewskie, 2019) which has widely been interpreted as evidence for increasing inequality of opportunity.

This reasoning however ignores the influence of genetic factors (Wolfram *et al.*, 2024). Even if all children would have equal educational opportunities, genetic factors will ensure that parents and children still resemble each other in their educational attainment to at least some extent. Therefore, to study trends in inequality of opportunity, patterns of intergenerational transmission alone provide insufficient information: genetic influences should be explicitly considered and modeled. Twin studies are designed to do just that. The classical twin design parses out the relative influences of genes versus the shared environment by making use of the difference in genetic relatedness of monozygotic versus dizygotic twins. If the influence of the shared environment increases over time and the genetic influence wanes, this represents increasing inequality of opportunity (Heath *et al.*, 1985): innate capacities become less important and the environment (family background, neighbourhood and school influences etc) becomes more important in determining a child's educational outcome.

Most twin studies do not study trends over time; they are often based on survey information and need to pool birth cohorts. The current study uses population-wide data on twins and siblings from integral registers of Statistics Netherlands which allows for the investigation of detailed trends over time. The main research question reads "*Did inequality of educational opportunity change over time in the Netherlands, and in which direction?*".

Data and methods

The study population is based on complete birth cohorts and consists of 27 399 same sex twins and 163 340 same sex (full) siblings of Dutch origin[1] born between 1964-1997. Data are sourced from the System of Social Statistical Datasets of Statistics Netherlands[2] which includes longitudinal demographic, educational and socio-economic register information, mostly integral. Our method is an adaptation of the ACE model in the classical twin design. The ACE model (Plomin *et al*., 2013) uses monozygotic twins (MZT, 100% related) and compares them with dizygotic twins (DZT, 50% related on average). The difference in the correlation between MZT and DZT is used to decompose the variance in an outcome in relative variance components:

A= (additive) genetic, or heritability =2*(rMZT-rDZT)

C= shared environmental =rMZT-A

E =nonshared environmental =1-A-C

with rMZT the correlation between MZT and rDZT the correlation between DZT.

The Dutch registers do not have information on zygosity of twins, so MZT and DZT cannot be distinguished from each other. Instead, the sex composition of different twin types can be used. Opposite sex twins are always dizygotic whereas same-sex twins are composed of MZT and DZT. The relative shares of MZT and DZT within the group of same-sex twins can be calculated using Weinberg's rule (Fellman and Erikson, 2006), and translated into an average relatedness on the group level. In our population, the average relatedness of same-sex twins was 75%-80%. Same-sex siblings (50% related on average) were used as a reference group. We adapted the ACE model from there. See Figlio *et al*. (2017) and Erola *et al*. (2022) for the details of the method.

[1] This study does not include migrants and children of migrants as this would introduce too much heterogeneity in the environmental influences (country of origin, age of immigration, language proficiency etc.)

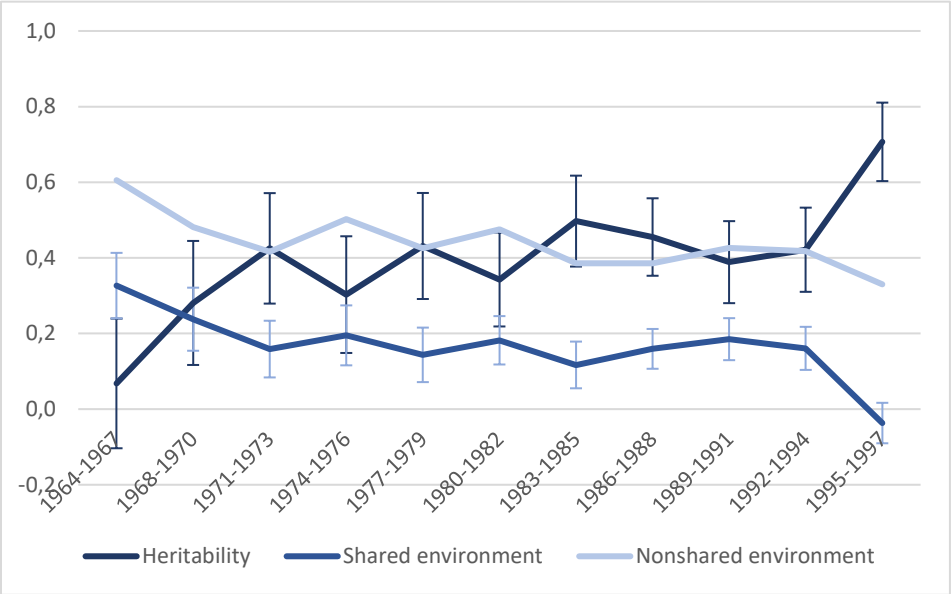
[2] Accessible under restrictions through https://www.cbs.nl/nl-nl/onze-diensten/maatwerk-en-microdata/microdata-zelf-onderzoek-doen

The outcome variable is educational attainment in adulthood (2021), measured in the number of school years minimally needed to acquire that education level (Van der Veer *et al.*, 2021).

Results

Heritability of education increased over time, whereas the influence of the shared environment decreased (Figure 1). Heritability increased most steeply at the beginning and end of the study period. In the earliest birth cohorts (1964-1967) heritability was low (0.07) and the influence of the shared environment was sizeable (0.33). In the most recent birth cohorts (1995-1997) heritability was 0.71 and no significant influence of the shared environment remained. A sizeable share of variation was due to the nonshared environment.

Figure 1. Heritability (A), shared (C) and nonshared (E) environmental influences over birth cohorts with 95% confidence intervals of A and C



Conclusion

The results strongly suggests a decrease in inequality of opportunity in the Netherlands over these birth cohorts. Educational attainment became increasingly determined by innate capabilities, whereas circumstances in the youth such as family resources appeared to have mattered less and less for people's educational outcomes. Our results contrast with a number of studies on intergenerational transmission and highlight the importance of parsing out genetic and environmental effects when studying family influences and inequality of opportunity. It is important to note that this decrease of inequality of opportunity is most

likely the result of environmental factors acting on the entire population: decades of educational policy and societal changes such as women's emancipation.

This study was limited to birth cohorts 1964-1997 of native Dutch origin. Future research should focus on other groups. First, younger cohorts should be investigated. It is possible that inequality increased again recently, for instance as a result of new educational policies or societal changes like the COVID-19 crisis. Second, future studies should focus on migrants and their children. They are a relevant group for policy makers, subject to more diverse environmental influences and often showing higher social mobility. Patterns of inequality of opportunity may be very different in these groups.

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