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DISCUSSION PAPER SERIES

IZA DP No. 14185

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ISSN: 2365-9793

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ABSTRACT

Lessons from Denmark about Inequality and Social Mobility*

Many American policy analysts point to Denmark as a model welfare state with low levels of income inequality and high levels of income mobility across generations. It has in place many social policies now advocated for adoption in the U.S. Despite generous Danish social policies, family influence on important child outcomes in Denmark is about as strong as it is in the United States. More advantaged families are better able to access, utilize, and influence universally available programs. Purposive sorting by levels of family advantage create neighborhood effects. Powerful forces not easily mitigated by Danish-style welfare state programs operate in both countries.

JEL Classification: H44, H24, J12, J18

Keywords: inequality, social mobility, family influence, power of place

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* We thank Rafeh Qureshi for highly competent research assistance. We have drawn on our joint work with Neil Cholli, Sadegh Eshaghnia, Miriam Gensowski, Kristian Karlson, and Rafeh Qureshi. This research was supported in part by: an anonymous funder, The Rockwool Foundation, and The American Bar Foundation. The views expressed in this paper are solely those of the authors and do not necessarily represent those of the funders. The Web Appendix can be found at https://cehd.uchicago. edu/Denmark_inequality.

1 Introduction

Many American policy analysts point to Denmark as a model welfare state with low levels of income inequality and high levels of social mobility in income across generations. It has in place many social policies now advocated for adoption in the U.S.: free college tuition, universal access to high-quality health care, equality of per pupil expenditures across all neighborhoods, universal high-quality pre-K, and generous childcare and maternity leave policy. In addition, there are well funded social security, disability, and unemployment programs in Denmark. Inequality in disposable income is much lower than in the U.S.

Yet, despite generous social policies, family influence on many child outcomes in Denmark is comparable to that in the U.S. Common forces are at work in both countries that are not easily mitigated by welfare state policies. Denmark achieves lower income inequality and greater intergenerational income mobility primarily through its tax and transfer programs and not by building the skills of children across generations and promoting their human potential more effectively.[1]

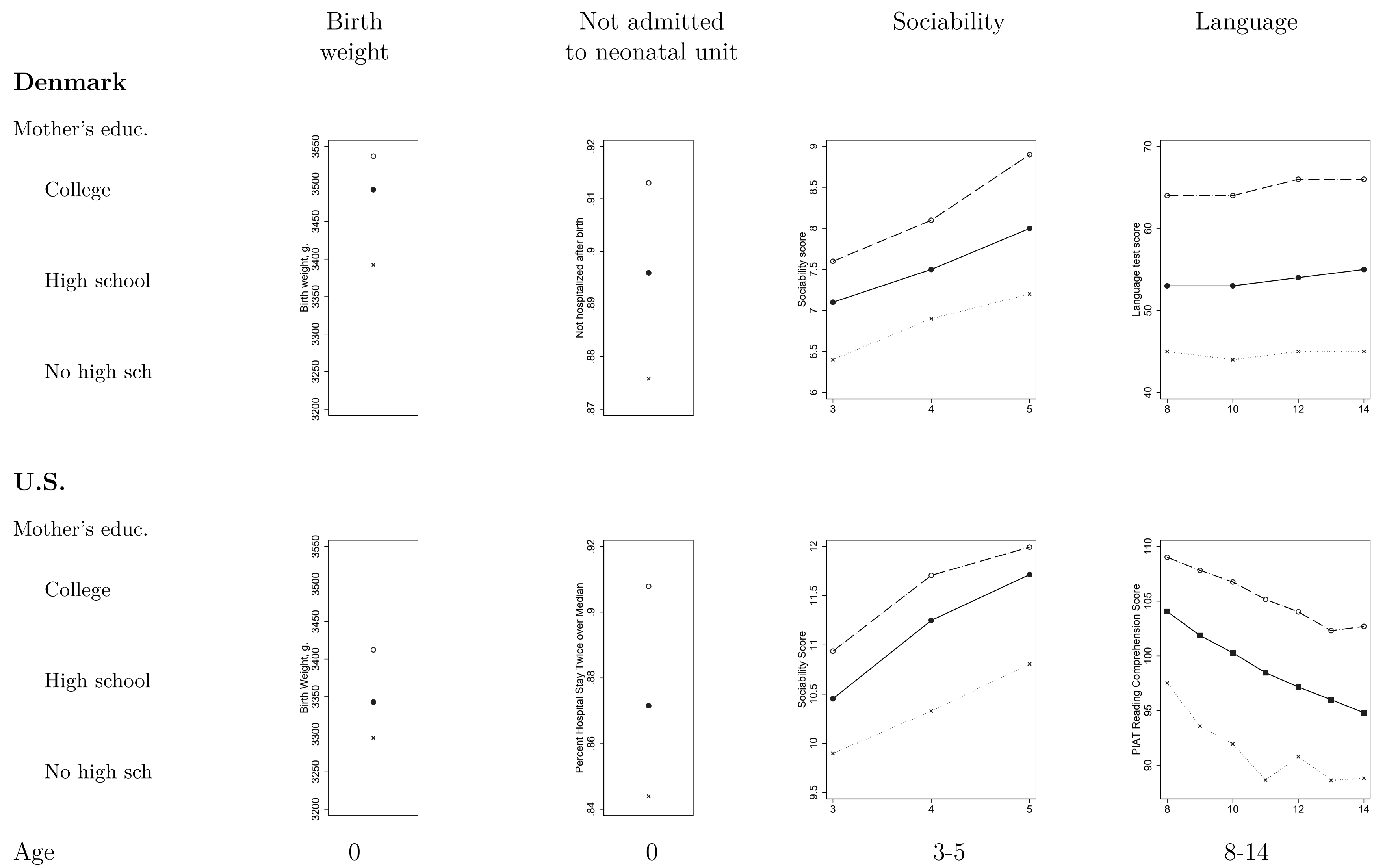
Despite the generosity of the Danish welfare state and equality in access for all citizens, substantial inequality of child outcomes remains across social and economic classes. Figure 1 documents these gaps and compares them to their U.S. counterparts. Children of college-educated women do substantially better than children of secondary school dropouts on many dimensions in both countries.[2]

Denmark is a laboratory for understanding the origins of inequality and social immobility. In the U.S., inequalities in the public services that are equally provided at a high level in Denmark are major topics in discussions of social mobility. However, if equal Danish provision of services does not eliminate inequality in many important life outcomes, the origins of inequality and social immobility lie elsewhere. Consequently, an uncritical adoption of Danish policy initiatives may not be effective as a way to ensure equality of opportunity.

[1]See Landersø and Heckman (2017) and Section 2 below. Carneiro et al. (2015) find similar results for Norway. Parenthetically, we make no statements about the *fairness* of the systems in the two countries. For example, there is arguably greater social cohesion in Denmark (witness the U.S. versus the Danish response to COVID-19) and events such as disability or unemployment have less dramatic consequences for individuals' standard of living.

[2]Since scales of some of the measures differ across countries, quantitative comparisons are not always exact, but many are.

Figure 1: Life cycle



Note: The figure shows children's life course outcomes by their mother's education for Denmark and the U.S. Scale differences for some dimensions impair full comparability across countries. However, the overall pattern with differences in all outcomes across the life persist in both countries. Birth weight is the same scale and outcome – levels are lower in the US but gaps top-bottom are the same in the two countries. Data on admission to neonatal units differ in definition and can thus not be compared 1:1. Test scores are also not the same, so we can only compare patterns. The data are described in Web Appendix C.

This paper reports three major findings from our ongoing joint research on Danish and American inequality and social mobility.[3] (1) Intergenerational educational mobility is about the same in both countries for the most recent cohorts. Transmission of skills across generations is equally strong in both countries, despite stark differences in income inequality and offered public services.

(2) The traditional literature on the intergenerational transmission of economic status compares snapshots of lifetime incomes of parents and children.[4] This approach gives only a limited picture of the transmission of lifetime well-being across generations. Using Danish register data on lifecycle income, we find that intergenerational elasticities of income (IGE) of lifetime well-being are much higher than those estimated using incomes measured over a small window of ages. Accounting for uncertainty and credit market restrictions increases estimated dependence across generations. Well-being is much more tightly linked across generations in Denmark than conventional snapshot measures of lifetime income indicate.

(3) We expand the analysis of family influence beyond the traditional analysis of IGEs of income to include choices of neighborhood, peers, and schools as parental investments in their children. We present compelling evidence of purposive sorting by parents in making neighborhood choices. Our evidence calls into question the assumptions underlying the recent neighborhood influence literature – that timing of residential choice is random with respect to the lifetime gains for children.[5]

Public policy should be better informed about the role of the family and markets in shaping child outcomes and in complementing or undermining public policy. The family influence in shaping the child is universally accepted.[6] Families operate through multiple channels. (i) Through direct parental interactions with children in stimulating child learning, personality, and behaviors. This comes from direct engagement and by setting examples for children to emulate, including supporting, supplementing, and advising schooling and other activities in which children engage. (ii) Through choice of neighborhoods and localities which influence the quality of schooling and the quality of peers. (iii) Through guidance on important lifetime decisions.

[3]Drawing specifically on (1) Karlson and Landersø (2021), (2) Eshaghnia et al. (2021), and (3) Cholli (2021); Gensowski et al. (2021) which we supplement with additional figures documenting sorting.

[4]See, e.g., Corak, 2013; Lee and Solon, 2009; Mazumder, 2008.

[5]See, e.g., Chetty and Hendren (2018); Chetty et al. (2020).

[6]In the Republic, Plato recognized the power of family influence and recommended state orphanages as a vehicle for promoting equality. The evidence on the adverse impact on child development from separating parents and children is overwhelming. See, e.g., Nelson III. et al. (2019).

However, public policy and social analysts often ignore these fundamental points and neglect the central role of family influence and family response to policy. Effective public policy has to recognize the "Matthew Effect" that declares

"to those who have more is given."

—Matthew 25:29 RSV

More advantaged families are better able to access, utilize, and influence universally available programs. Universal provision of public services does not necessarily mitigate advantages, and indeed may exacerbate inequality.[7] Targeted strategies are generally more effective, although they are often rejected as politically unpalatable.[8]

These forces are especially important in understanding neighborhood effects on child development which have received considerable attention in the recent literature in economics.[9] Families sort by education and affluence. Such sorting has been increasing over the past decades in both Denmark and the U.S. Sorting, coupled with the Matthew Effect, creates neighborhood effects as outcomes of social processes. Put differently, the neighborhood effects reported in the recent literature are likely consequences of the families that sort to them and the synergies so produced. We document the powerful role of Matthew effects in promoting social immobility.

A crucial identifying assumption in the recent literature on neighborhood effects is that the timing of the choice of neighborhood is random across the age of children in families. We document purposive early selection of quality neighborhoods for children that is more pronounced for more educated and affluent parents. This point is important because the data from public records available in the U.S. (and other countries) and used in recent influential studies is limited in its information on many important, previously established determinants of family influence, such as family marital arrangements, parental criminal histories, parental education, ability, parenting styles, and other characteristics.[10] Findings of powerful neighborhood effects in such limited data may just as well be a consequence of the poor quality of the data on family influence, and the sorting of families by socioeconomic status. Neighborhood is a proxy for family characteristics.

[7] For discussion, see Ceci and Papierno (2005). Walters (2018) is a recent example.

[8] See Elango et al. (2016) and our discussion below.

[9] See Chetty et al. (2017), Chetty (2021), and Pinto (2021).

[10] See, e.g., Cunha et al. (2006), Almond and Currie (2011), and Heckman and Mosso (2014).

Therefore, it remains a question whether there exists some intrinsic property of neighborhoods per se that can be eliminated by relocating residents.

Our paper proceeds as follows. Section 2 presents a brief overview of the evolution of the Danish welfare state and illustrates its divergence from the U.S. counterpart. The section then shows how intergenerational mobility in educational attainment *declined* when Denmark moved toward universality in education policies and away from targeting the least advantaged groups even though policies such as free college tuition, universal daycare, and support for public education were rolled out during the same period. For the most recent cohorts operating under universality, educational mobility is similar in the two countries, and associations between test scores and family background are also strikingly similar.

Section 3 adds a new perspective to the discussion of intergenerational mobility of income, which, to date, has focused on the association between child and parent income measured over a narrow set of years and not actual lifetime well-being. We show that intergenerational lifetime well-being is more closely linked than currently used indicators suggest.

Section 4 shows the purposive sorting of parents across neighborhoods. It documents the similarity of sorting patterns in the U.S. and Denmark. We show the powerful role of parental influence in shaping public expenditure even when equality is mandated. We apply our analysis of the Danish data to interpret the evidence on the validity of recent studies based on limited U.S. data on the power of neighborhoods. Danish data are much richer and allow us to examine in greater detail assumptions used to analyze U.S. data. We demonstrate the strong sorting patterns of families in picking neighborhoods. This analysis sends a clear message about the failure of identifying assumptions invoked in U.S. studies. Estimated neighborhood effects proxy family characteristics and family actions, not some mysterious property of "zip code" or place. Accounting for these characteristics greatly weakens estimates of neighborhood effects and illustrates the power of family rather than place.

2 Welfare state targeting and educational mobility across the 20th century

The foundation of the Danish welfare state was laid during the late 19th century when reforms relating to old-age support, poverty relief, and health insurance were introduced. Nevertheless, around 1900 Danish welfare policies were not fundamentally different from those in the rest of Northern Europe, including Germany and the U.K., and were by no means more generous.[11] While social security was expanded throughout the 20th century, it was not until the 1960s and 1970s that most of the policies that Denmark is known for today were implemented.[12] For example, universal health care (1970), universal childcare (1960s),[13] and universal old-age pensions (1960) are all funded by income taxes. Prior to that time, policies were insurance-based but with coverage increasingly expanded (particularly from the mid-1930s onward) by, e.g., mandatory participation.[14] A similar change also took place for education policies where, for example, expenses for primary and lower secondary education increased substantially while child-to-teacher ratios decreased.[15]

This evolution and divergence from other countries is illustrated by Fig. 2, which shows public

[11] They were, however, far more generous than national policies in the U.S.

[12] The Social-Democrats (who were in government for most of the period from the early 1920s to the early 1980s and the leading party behind the welfare expansion) initially favored increased means tested support for low-income groups, but during the late 1940s and 1950s gradually changed the focus towards universal policies. The evolution of the Danish welfare state during the period considered in this section is described in detail in Andersen et al. (2012) for years 1933–1956, Andersen et al. (2012) for years 1956–1973, and Andersen et al. (2013) for years 1973–1993.

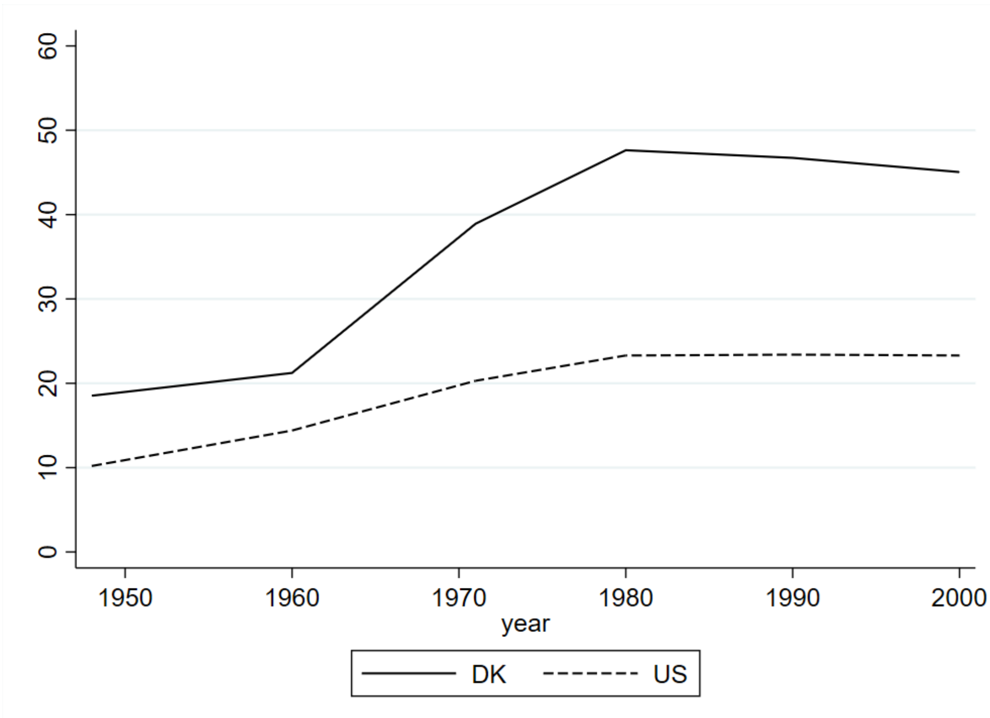
[13] Here, access to child care became universal. However, usage was far from universal. The fraction of 0-6 year olds enrolled in daycare were: 6.4% in 1958, 7.3% in 1965, 27.4% in 1975, 52.8% in 1985, 65.0% in 1995, 76.6% in 2000 Statistics Denmark (2001).

[14] The background was the strong economic growth during the decades following WWII. The Danish GDP per capita was almost 40% lower than the U.S. in both 1920 and 1950, compared to a difference of approximately 20% in 1972. Moreover, the post WWII years in Denmark were characterized by rapid changes in occupational structure, production, and technology, dubbed the second industrial revolution—several decades after what is known as the second industrial revolution in e.g., the U.S. This also included the mechanization of agriculture, which Fig. A.1 (in `https://cehd.uchicago.edu/Denmark_inequality`) illustrates by showing the number of workhorses and tractors in Denmark and the U.S. across the first two thirds of the 20th century.

[15] Fig. A.2 illustrates the changes following a reform on public schools in 1958 on Danish schools' teaching resources (from Karlson and Landersø, 2021). Fig. A.2a and b shows pre- and post-reform trends in total expenditures, indexed to the 1957/1958 school year. Fig. A.2c shows the number of school-age children per teacher (in municipal schools) in Denmark from 1949 through 1963. Furthermore, in tandem with the changes in primary and lower secondary schools, the number of academic high schools also increased: 70 high schools in 1954, 92 in 1967, 125 in 1975, and 156 in 1985.

spending and transfer payments across all levels of government as a fraction of GPD for Denmark and the U.S. from 1950–2000. Following a gradual increase after WWII, the fraction for Denmark increased from around 20% in 1950 to almost 50% by 1980. In contrast, public spending and transfer payments as a fraction of GPD in the U.S. were around 15% in 1950 (around 6 percentage points lower than Denmark) but less than 30% in 1980.

Figure 2: Public spending and transfer payments, as percentage of GDP, Denmark and U.S.



Source: U.S. is based on Federal Budget of the United States, from 1948-2000. Denmark is based on Statistics Denmark (2001).
Note: The figure shows public expenditures and transfer payments (excl. defense and interest payments) as percentage of GPD for Denmark and the U.S.

How did the expansion of the welfare state affect inequality in Denmark? Inequality in after-tax income is lower over the period 1970–2010 in Denmark compared to that of the U.S. (Atkinson and Sogaard, 2016). Moreover, policies such as the introduction of universal childcare have been shown to increase the education of children from disadvantaged families.[16] Thus, a link between the Danish welfare state and equality of opportunity and greater social mobility seems plausible.

[16]See, e.g., Havnes and Mogstad (2011, 2015) for Norway.

Fig. 3a shows estimates from regressing children's years of schooling on parents' years of schooling for cohorts born from 1911-1986 in Denmark and the U.S. (Karlson and Landersø, 2021). While educational mobility appears to be relatively stable in the U.S. across the 20th century with estimates around 0.4[17], the Danish counterpart varies dramatically. Early in the 20th century, educational mobility was much lower in Denmark than in the U.S. with estimates around 0.55. However, for cohorts born during the early 1940s onward, educational mobility increases rapidly (estimates decrease) reaching a level of around 0.3 for cohorts born during the mid-1960s. Public spending and transfer payments in Denmark relative to those in the U.S., thus, follow a similar trend as the relative difference between the mobility estimates shown in Fig. 3a for cohorts born until the mid-1960s.

For cohorts born in the 1970s and 1980s in Denmark, however, educational mobility declined. Fig. 3b focuses on Denmark and zooms in on the changes in educational mobility for each cohorts born from 1956–1987. The zenith of mobility was experienced for cohorts born in the early and mid-1960s. Cohorts born from the mid-1970s onward experience rapidly declining mobility. In consequence, for the cohorts born in the mid-1980s, estimated educational mobility in Denmark is similar to that in the U.S. with estimates around 0.45, and this convergence is in stark contrast to welfare expenditure in the two countries.[18]

While welfare policies may have diverged during the latest decades, the two countries have converged in terms of educational levels. In Appendix A[19] we show that the average years of schooling of children (parents) for cohorts born from 1955–1986 have increased from around 11.5 years (9.5 years) to around 14 years (13 years), whereas educational levels in the U.S. reported have been almost constant. As examined in depth in Karlson and Landersø (2021), the increasing educational mobility in Denmark for cohorts born from the mid-1940s to the mid-1960s stem from a substantial expansion of lower secondary schooling (following major schooling reforms) particular for children from rural areas. Only around 60% of children born around 1940 in Denmark completed lower secondary schooling, compared to almost 100% of the corresponding cohorts in the U.S.

[17]See Cameron and Heckman (1998).

[18]Fig. A.3a shows a similar conclusion is reached if we instead consider, for example, upward mobility (fraction with higher education than their parents).

[19]See Fig. A.4.

(Goldin and Katz, 2008). However, following a strong pattern of convergence, this gap was closed within 15-20 years.

Turning to the other tail of the education distribution, college completion rates remained far lower in Denmark (and almost constant at 10-15% across the first two-thirds of the 20th century) than in the U.S for almost the entire century. Convergence is initiated for cohorts born from around 1970 onwards, where Denmark is characterized by rapidly increasing college and university completion rates.[20] While there is equal access to public services, universal child care (rolled out first for cohorts born in the late 1960s), no tuition costs for education, and generous education support,[21] it is predominantly children from well-educated families that drive the college expansion. Comparing the 1960 and 1985 cohorts, college completion was around 10% and 20%, respectively, of children whose fathers have less than high school. For children whose fathers have a high school degree as their highest level of education, the corresponding college completion rates are around 15% and 30% respectively. Finally, for children whose fathers have a college degree, college completion rates have increased from 30% to 60%, showing Matthew Effects at work. Fig. 4a begs the question: why do education gaps remain in Denmark?

Fig. 4b shows cognitive test score ranks for the all males born in 1958 and 1988 in Denmark by their parents' income percentiles,[22] along with cognitive test score ranks across parents' income percentiles for children from the CNLSY data. The figure illustrates two points: First, no striking differences appear when comparing the association between children's test scores and parents' income percentiles in Denmark and the U.S. Second, the association between children's cognitive test scores and parents' income is strikingly similar for Danish cohorts born 30 years apart.[23] Although the 1988 cohort is born after the rapid welfare state expansion previously described and the 1958 cohort is born just before the expansion took off, the associations between test scores and

[20] Fig. A.5 illustrates the differences in college completion for high school graduates between the two countries. The differences between selection into college exactly mirror the differences in estimated educational mobility.

[21] First introduced in 1970 (and initially means-tested in parental income), and substantially expanded in 1988 (an expansion studied in Nielsen et al., 2010).

[22] The cognitive test at conscription has remained the same during the entire period.

[23] Fig. A.6 illustrates an indirect consequence of persistent skill gaps and differences in educational attainment for use of public services. The figure shows total public education support received by children by parental income percentiles and year of birth. As education levels have increased, so have transfers of education support — but mainly to children from affluent families.

parents' resources are practically identical. Family influence retains its tight grip.

In the Appendix to this paper we illustrate skill gaps and how early in life they appear. Language test scores across parental education at ages 8 and 14 in Denmark and the U.S. for children born in the early 2000s are virtually identical.[24] Taking children whose parents have a college degree, for example, approximately 30% are in the top-quintile while only around 10% are in the bottom-quintile in both Denmark and the U.S.[25] Furthermore the correlation between Danish children's GPA and their parents' years of schooling remains sizeable and has, if anything, been increasing during the latest two decades.[26]

Equality in access to services is not the same as equality of opportunity. While the notion of a close link between the Danish welfare state and social mobility at first appears to be supported, it holds only for selected cohorts. The longitudinal focus in this section tells a different story. Even though the Danish welfare state expanded dramatically (while that in the U.S. did not) with policies such as universal daycare, tuition-free college education, and generous educational support, the same fundamental inequalities in education and skill formation and intergenerational dependencies are observed in both countries.

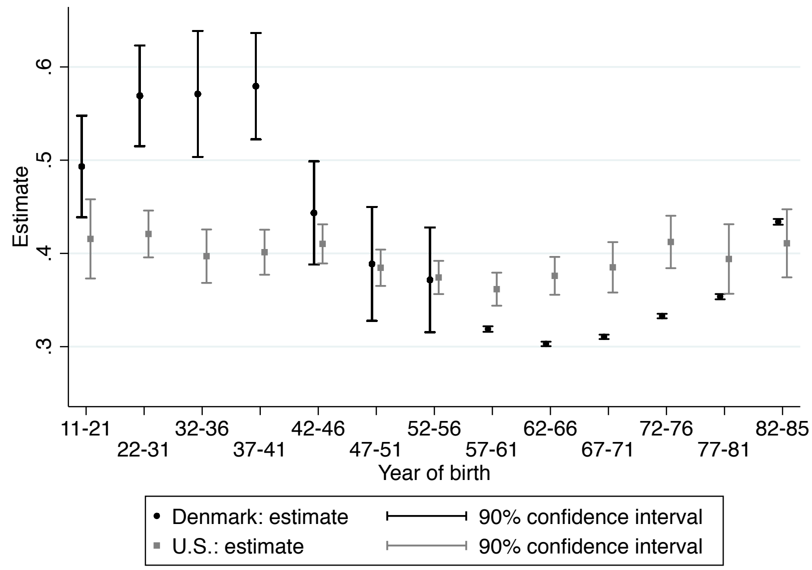
[24] See Table A.1.

[25] In addition, children in the top-quintile at age 8 are more likely to move down in the test score distribution between ages 8 and 16 if they have low-educated parents, while children in the bottom-quintile at age 8 are more likely to move up in the test score distribution between age 8 and 16 if they have highly-educated parents

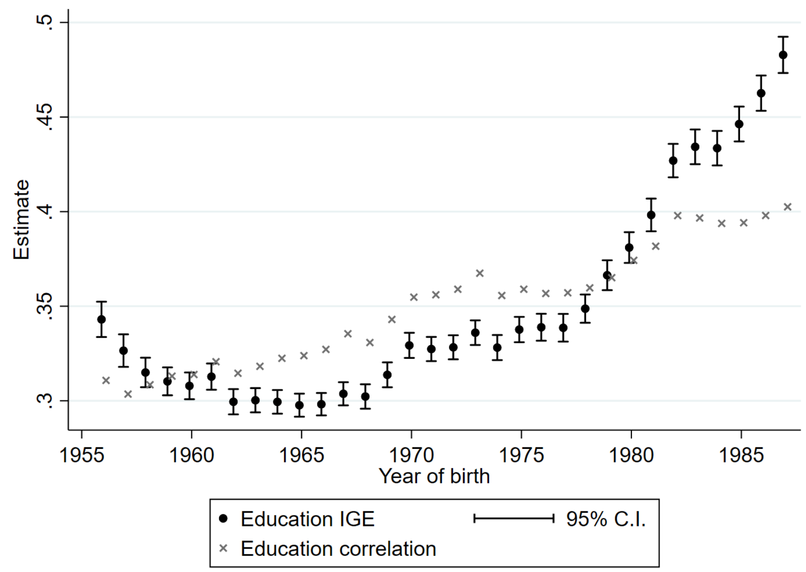
[26] See Fig. A.7.

Figure 3: Educational mobility by year of birth and country

a) Children's years of schooling regressed on parents' years of schooling, Denmark and the U.S., year of birth 1911-1986



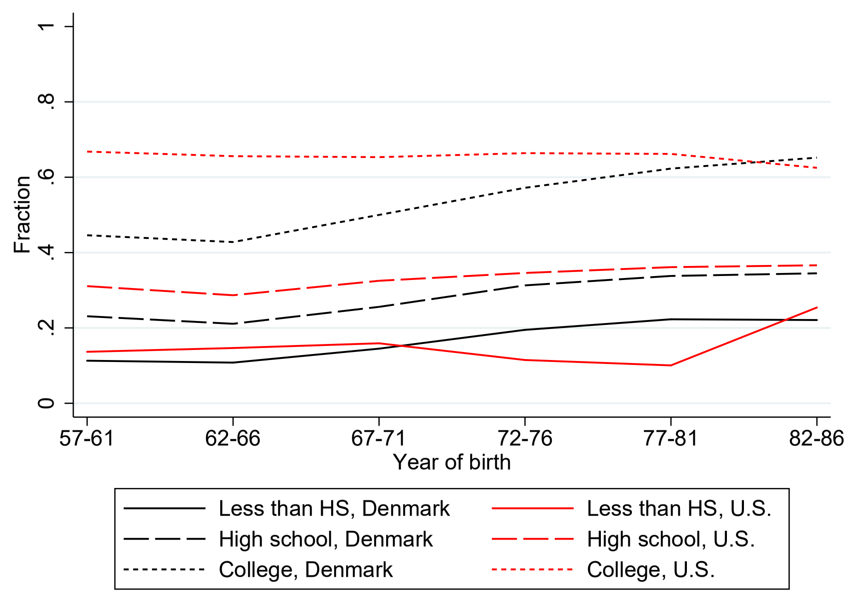
b) Educational mobility, zooming in on year of birth 1956-1987 for Denmark



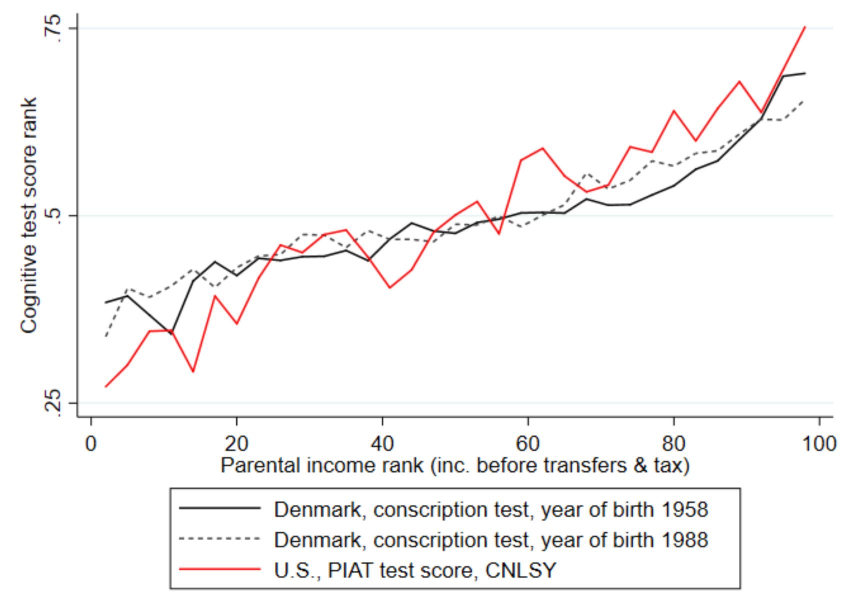
Source: Karlson and Landersø (2021).
Note: Fig. a) shows educational mobility by birth year for Denmark and the U.S. estimated as the β_t's in: $E^C_{i,t} = \alpha_t + \beta_t E^P_{i,t} + u_{i,t}$, where $E^C_{i,t}, E^P_{i,t}$ are years of schooling of children and parents in cohort bin t. Fig. b) shows regression coefficients for a child years of schooling on parents' average years of schooling, and the correlation coefficients between parents' average years of schooling and child years of schooling, by child birth years 1956–1987, for Denmark. Danish estimates are based on survey and register data, and U.S. estimates are based on the General Social Surveys (GSS). The data are described in Web Appendix C.

Figure 4: College completion and cognitive test scores, by parental background, year of birth, and country

a) College completion by parents' education



b) Cognitive test scores by parents' income rank



Source: Fig. a) Landersø and Heckman (2017) (Web Appendix Figure A.30e) and extends it with the U.S. counterpart (based on GSS data).
Source: Fig. b) Karlson and Landersø (2021).
Note: Fig. a) shows the fraction of each cohort that completes college (15 years of schooling or above). Highest education of parents: No high school/dropout: less than 12 years of schooling; High school: 12-14.9 years of schooling; College: 15 years of schooling or above. Fig. b) shows ranks of cognitive test scores (Denmark: taken at conscription at age 18 , U.S. PIAT test scores at age 14) by their parents' income rank (total gross income excluding public transfers). The correlation between cognitive test scores and years of schooling is 0.466 for the 1958 cohort in Denmark, 0.435 for the 1988 cohort in Denmark, and 0.459 for CNlSY sample.

3 Intergenerational Transmission of Well-being

Conventional measures of intergenerational income mobility compare the income of the father (or the parents) and the income of the eldest son (or the income of the family of the eldest son, or the average family income across children at comparable ages) to measure intergenerational mobility in welfare (see, e.g., Corak, 2013; Lee and Solon, 2009; Mazumder, 2008). Such estimates are intended to compare lifetime well-being across generations.

Using synthetic cohort data, Mincer (1974) shows that labor earnings measured in the mid-30s provide a rough and ready measure of the annuity value of lifetime earnings. Thus, if interest focuses on the IGE of earnings, this approach may be valid. Earnings are the major component of income for most people so this practice may yield a good approximation for the intergenerational IGEs of lifetime income.

However, the traditional approach gives an incomplete account of intergenerational mobility. There are sizable intergenerational differences in educational attainment, income trajectories, timing of family formation (age of marriage, cohabitation and childbearing), family size, timing of childbearing, and divorce dynamics. As presented in the previous section, later generations in Denmark, on average, acquire more formal education. This means that they are more likely to have low (or zero) income at young ages when in college, compensated with a higher (and steeper) income profile later when entering the labor market after completing college (or graduate school). Comparing snapshots of incomes at the same age window across generations at a relatively early stage of the life cycle (which is usually done in empirical studies due to data limitations) gives a distorted picture of intergenerational persistence. In addition to the difference in educational attainments across generations, there are also differences in terms of the timing of family formation and family size.

Eshaghnia et al. (2021) address these issues. They construct life-time measures of IGE, which take into account intergenerational differences in life-cycle dynamics. The measures they propose paint a different picture of income and welfare mobility compared to traditional measures in the literature. Lifetime measures better reflect long-term intergenerational mobility in society. The perception of intergenerational dependence changes when we take life-cycle differences across generations into account.

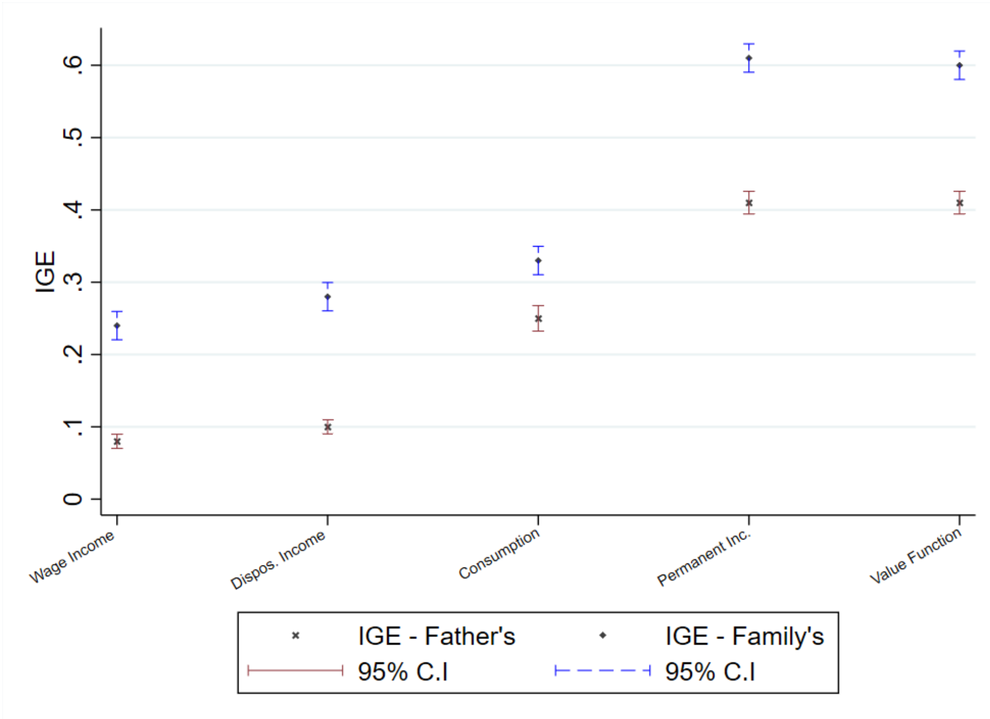
Eshaghnia et al. estimate a variety of lifetime welfare IGEs for father-son pairs and family-children pairs using different measures of lifetime well-being. The IGEs range from traditional measures based on wage income in a narrow age interval to consumption-based measures, measures of discounted lifetime income, and measures based on value functions that account for: (a) uncertainty and income smoothing based on welfare state taxes and transfers; (b) imperfect credit markets; and (c) returns to financial markets. Figure 5 reports estimates from their paper for both family-based and individual (father-son) measures.

In the figure, *wage income* is measured as taxable salary excluding self-employment income.[27] *Disposable income* is "income with transfers" combined with calculated rental value of individual's homes for homeowners minus tax payments. *Consumption*[28] is imputed total household expenditures from the relationship between Danish Expenditure Survey and Danish register data using equivalence scales for consumption to adjust for household composition.[29] *Permanent income* is obtained by annuitizing the sum of individuals' future expected income given current characteristics discounted to the present (Expected PDV)[30] and net assets, annuitized by a constant discount rate.[31] *Value function* is the monetized value utility of the optimal consumption choices over the life cycle. See Eshaghnia et al. (2021) for discussion of each of these measures and estimates based on them.

A clear pattern emerges. Family-based IGEs are larger than individual-based IGEs. This is, in part, due to the operation of assortative matching. Measures based on long-term measures of income flows are higher than the narrow snapshot measures. The permanent income IGE, for example, is twice as high at family level (four times as high at the individual level) as the conventional disposable income IGE. While there remains an open question about corresponding estimates for other countries, Fig. 5 nevertheless shows that the traditional approach followed by a large literature across several decades only provides a limited picture of the transmission of lifetime well-being across generations, and for Denmark, greatly underestimates its magnitude.

[27] This income definition is the one used for the Danish estimate reported in Corak (2013).
[28] We impute consumption following Browning and Leth-Petersen (2003).
[29] This measure captures long-run income. See Friedman (1957).
[30] We explain the measure and the formula used in Appendix B
[31] $r = 0.04$.

Figure 5: IGE Estimates (Ages 30-35 of Parents and Children)



Source: Eshaghnia et al. (2021).
Note: Precise definitions of the concepts of income and consumption are given in Appendix B. Sample of children restricted to 1981-82 cohort of native Danes. The IGE is the slope coefficient from the log-log regression of child measure on father (family) measure: $log(y^f) = \alpha + \beta * log(y^p)$ where y^c denotes the average (over 30-35) of child measure, and y^c denotes the average of father (family) measure when the child was 0 to 17 years old. Family incomes are the sum of mother's and father's income.

4 Sorting

Increasing sorting in neighborhoods by family status is a well documented trend (Logan et al., 2018; Reardon et al., 2018; Reardon and Owens, 2014). Similarities of families who live in the same neighborhood can be measured in many different ways. Fig. 6a, reprinted from Reardon and Bischoff (2011), presents estimated income segregation across households' income percentiles (where 0 is no segregation and 1 is full segregation).[32] The figure shows that in the U.S., segregation is high at both ends of the income distribution and is increasing over time. As shown in Fig. 6b, comparable patterns are at work in Denmark where segregation is also highest in the tails and increasing over time.[33]

4.1 Evidence of positive sorting across the childhood

While Fig. 6 illustrates sorting in Denmark, the figure only gives a snapshot of the underlying decision making. *Sorting is a dynamic process across childhood.*

As is obvious to any parent, family residential decisions are generally made early in the lives of children. Figures 7a and b examine the mothers' neighborhood of residence in the years leading up to the birth of her first child and through the life of the child until age 15, classified by the mothers' final education level. Fig. 7a shows the average household income in the parish of residence (relative to average household income in Denmark). The figure documents a strong sorting pattern into different areas that is initiated *even before* the first child is born when average income levels in areas of residence diverge. When the firstborn reaches school age, the average household incomes in parishes of mothers with a university degree is around 30% above that of the country-average.[34]

Figure 7b shows that geographical mobility declines rapidly after children enter school, and

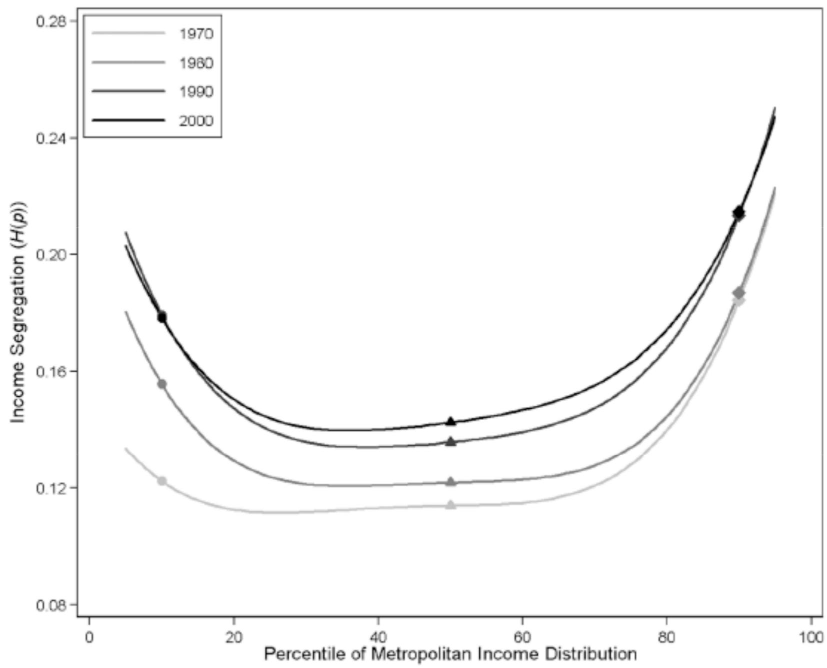
[32] Reardon and Bischoff (2011) use a Theil (1971) index to form a scale that ranges from 0-1 across income percentiles.

[33] Figure A.8 extends this finding by considering segregation for different income types in Denmark. It shows that segregation decreases if after-tax and transfer income is used — particularly in the middle of the income distribution. In other words, neighborhoods in Denmark appear similar when considering the disposable income of residents, but this relates to the redistribution of income and not necessarily the absence of sorting.

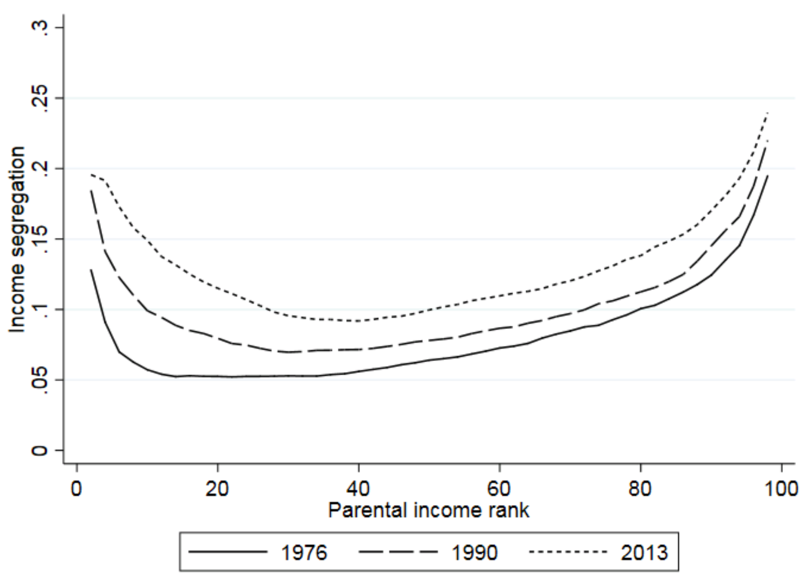
[34] Parishes correspond approximately to a small census-tract in the U.S. Figure A.9 replicates Figure 7 using more granular neighborhood definitions while considering both neighborhood crime and income. The figure shows that the narrower the area definition, the stronger the sorting.

Figure 6: Income Segregation Patterns in the U.S. and Denmark, by year

a) U.S. neighborhoods



b) Denmark, schools



Source: Fig. a) Reardon and Bischoff (2011).
Source: Fig. b) own calculations.
Note: Fig. b) shows the similar statistic as in Reardon and Bischoff (2011) for parents in school catchment areas in Denmark using income W/o transfers. While shapes and trends within each country are comparable, levels in the U.S. and Denmark are not directly comparable i) as segregation levels are sensitive to variation in the area definition, and ii) as the statistic is plotted as a function of income percentiles where underlying income distributions differ between the U.S. and Denmark. The data used are described in Web Appendix C.

the decline becomes stronger as mother's level of education increases. Figure 7c shows average income differences between the origin and destination areas (conditional on moving). In the years leading up to the first child's birth, sorting into affluent areas become increasingly prevalent for highly educated mothers. However, as also seen for the fraction that moves each year, upward neighborhood mobility slows substantially once the child reaches school age (age 7).[35]

Taken together, Figs. 6 and 7 document substantial sorting in Denmark, and that the intensity of the positive sorting between the characteristics of parents and the area of destination varies over children's ages. This creates more socially stratified communities where Matthew Effects can operate at strength.

One good example of this phenomenon is the quality of schoolteachers by clusters of parental characteristics. In Denmark, teacher salaries by neighborhood are mandated to be equal. That is a force for uniform quality of schools across neighborhoods. However, uniform quality is *not* the actual outcome in Denmark.

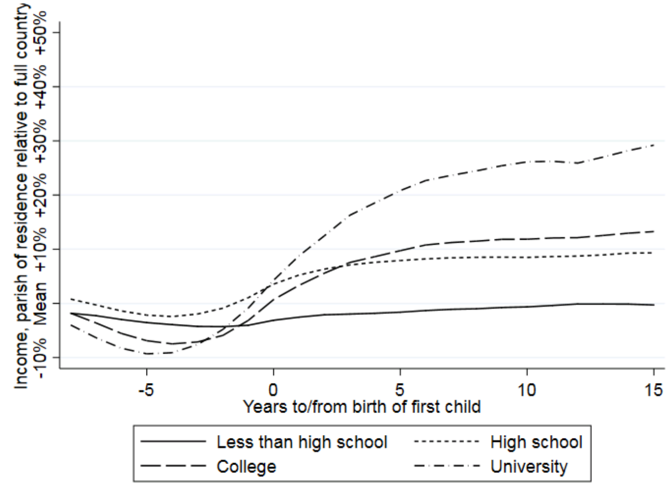
The rich Danish data facilitates a test for equality of schooling inputs. Gensowski et al. (2021) use information on all teachers employed in Danish public schools[36] to construct a measure of school quality by weighting average characteristics of teachers working at a given school (their scholastic test scores) by how well they predict that the children at the school do well in compulsory (externally scored) tests. Figure 8 shows the rank of school quality for each school in Denmark against the average test scores of children in the school in Denmark and their parents' average years of schooling. There is a strong positive association between the characteristics of parents, on the one hand, and the characteristics of teachers on the other, despite equality in wages.

[35]Figure A.10 extends the previous results and consider sorting into neighborhoods nested within larger areas. The figure replicates Figures 7, but considers neighborhood levels (of income and crime) defined by 150 household blocks relative to the municipality, parish, and 600 household blocks that the 150 household blocks are nested in (instead of relative to the entire country). While the sorting patterns become weaker they remain — even when we consider sorting into 150 household blocks nested within 600 household blocks.

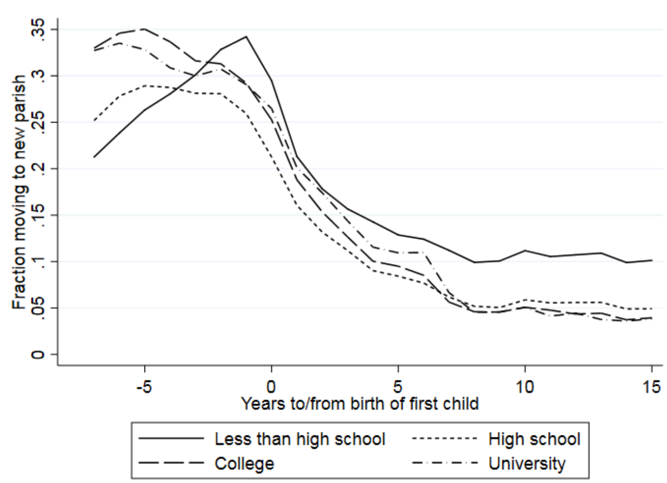
[36]Such as age, tenure, year of graduation, high school GPA, high school GPA in language subjects, teacher college GPA, and unemployment spells.

Figure 7: Average income in area of residence and moving pattern, by time to/from birth of first child

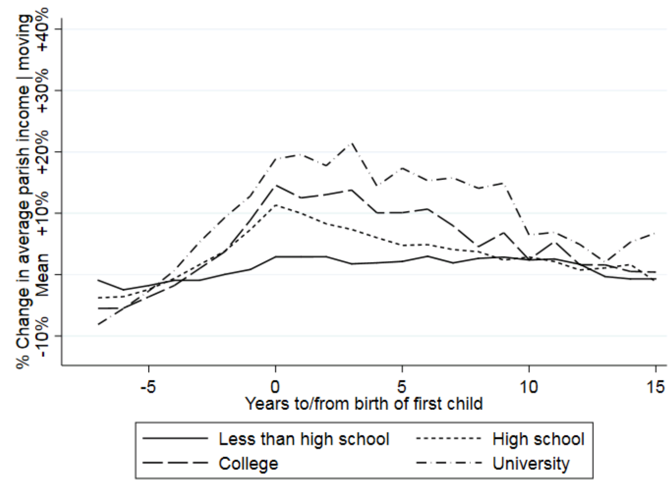
a) Average income in area of residence relative to country average



b) Fraction that move each year



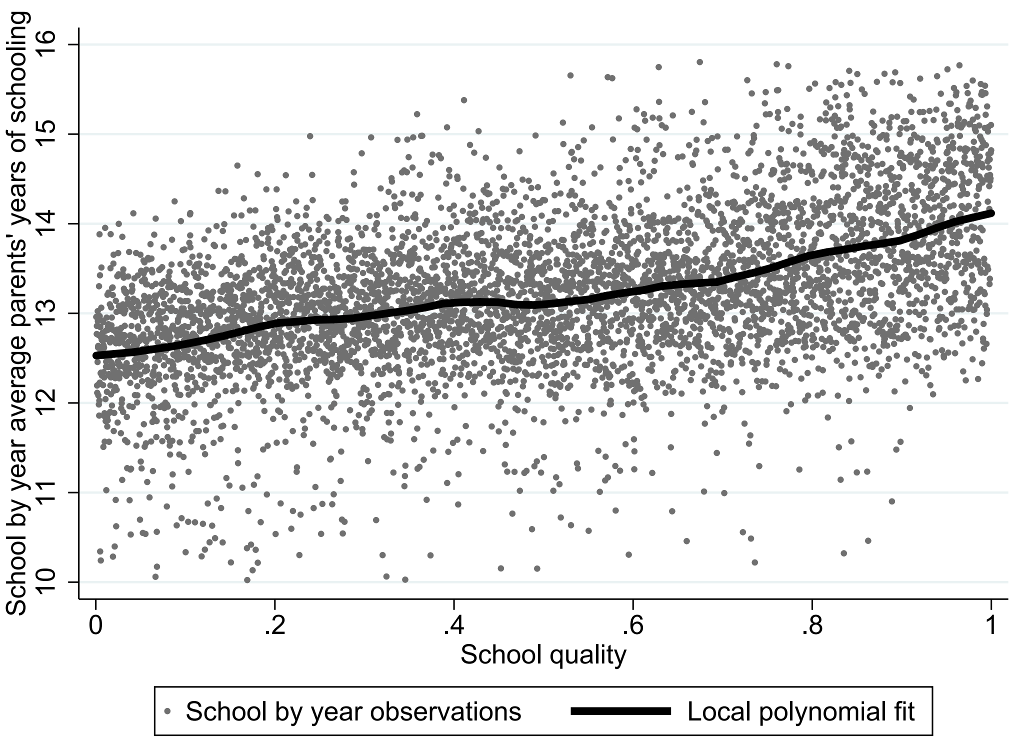
c) Average income, destination-origin



Source: Own calculations.
Note: Figure a) shows average income level in the parish (around 2,000 in Denmark) of residence by years to/from the birth of the first child and mother's education level. The figure is computed for the mothers of cohorts born 1994–1997, and income is measured as gross income excluding public transfers. Figure b) show the fraction that move to a new parish. Figures c) shows the difference between average household gross income excluding transfers between the origin and destination area. The figure is computed for the mothers of cohorts born 1994–1997. The data used are described in Web Appendix C.

The positive sorting between teacher's and parent's characteristics in Danish public schools illustrates that formal equality in teacher salaries does not guarantee equality of opportunity. It shows a Matthew Effect at work where the best services are provided to those from affluent backgrounds. Teachers in affluent neighborhoods are arguably paid more through a non-wage mechanism: by having access to quality students.

Figure 8: Parents' years of schooling, by estimated school quality



Source: Gensowski et al. (2021).
Note: The figure shows parents' years of schooling plotted against the estimated school quality measure from teachers' observable characteristics. The figure also shows a local polynomial smoothing of the relationship between parents' years of schooling and estimated school quality. The figure is based on data for all children/parents/teachers and public schools in 2010-2016.

4.2 Is Zip Code Destiny?

The preceding analysis raises the question: do neighborhood effects capture more than just peer effects and the impact of public goods such as schools due to the characteristics of the neighbors? Are estimated neighborhood effects just artifacts of sorting?

An influential literature studies within-country variation in intergenerational income mobility (see e.g., Chetty and Hendren, 2018; Chetty et al., 2020; Deutscher and Mazumder, 2019; Eriksen and Munk, 2020; Guell et al., 2018, for recent examples). This literature claims to find that there are powerful neighborhood effects, but it does not identify their source. It leaves open the question of whether these differences are due to some attribute of the place or the characteristics of people in the place arising from sorting. To resolve this issue, we now present results where we estimate area-specific intergenerational income mobility coefficients.[37] The baseline neighborhood mobility model is

$$Y_{in}^{c} = \alpha_n + \beta_n^{IGE} Y_{i_n}^{p} + \varepsilon_{i_n} \tag{1}$$

where $n \in \mathcal{N}$ indexes areas, defined as parishes, and Y_{in}^{c}, Y_{in}^{p} are child's and parents' log- income without transfers.

Fig. 9a plots the distributions of the parish-level estimates of $\hat{\beta}_n$ with and without the addition of family controls. The additional set of controls is statistically significant. The mean (across neighborhood) IGE declines from 0.310 to 0.108. Accounting for family variables missing in the American datasets reduces the IGE by 2/3, indicating much less of a pure "neighborhood" effect. Cholli (2021) tests the hypotheses both at parish and municipality level: $H_0 : \beta_n = \beta_{n'}$ for all $n, n' \in N, n \neq n'$, and fail to reject H_0 in 99% and 96% of tests, respectively. Following the literature reporting neighborhood effects, the estimates of β_n vary greatly across n (as in e.g., Chetty et al., 2018), but the estimates are not precisely determined. This is true both at the parish and municipal level. These results are consistent with a recent analysis of a Seattle study by Mogstad et al. (2020) who investigate claims of strong neighborhood effects in test scores in Bergman et al. (2019). Accounting for sampling error, they do not reject the hypothesis that β_n are the same across all neighborhoods.

At the same time the estimates of β_n in Denmark are not zero, however.[38] Fig. 9b shows how inclusion of individual family variables, here exemplified by parents' education, parents' crime,

[37] While our focus here is mainly area defined as parishes, similar arguments apply to other definitions whether commuting zone or census block. Similarly, we focus on the IGE, but similar concerns also apply to e.g., rank-rank estimates.

[38] Number of municipalities: 273: average sample size: approximately 2,000 children per municipality; significant $\hat{\beta}_n$ at 5%-level: 99.6%. Number of parishes: 1,921: average sample size: approximately 250 children per parish; significant $\hat{\beta}_n$ at 5%-level: 62.7%. Cholli (2021).

and mother's labor force participation, reduces estimated values. For each family variable, the distribution of the estimated β_n is shifted towards zero. *Family is a major determinant of* β_n

4.3 Neighborhood Effects as Statistical Artifacts

Estimated neighborhood effects may be a consequence of the misspecification of the $\ln Y^C - \ln Y^P$ relationship. Two sources of misspecification are plausible. The first likely misspecification is from the omission of crucial family background variables that predict child outcomes, and that are grouped due to the social sorting processes previously described. The second is for the functional form of the estimating equation. While the log-linear specification of the IGE equation is traditional, Landersø and Heckman (2017) show that the relationship between Y^C and Y^P is fundamentally nonlinear in Denmark. We consider each explanation singly in the order presented. Both may be at work.

Continuing from the previous subsection, the first source of estimated neighborhood effects as artifacts emerges when crucial family influence variables known to be important determinants of child outcomes like parental education, parenting style, criminal histories, ability, and the like are omitted when estimating the $\ln Y^C - \ln Y^P$ relationship.[39] Parents sort on these variables.[40] The evidence for such sorting is strong in Denmark, as previously discussed. If these variables are clustered through social sorting processes, estimated neighborhood effects will be stand-ins for the omitted variables.[41] Specifically, let $Y^C_{i,n}$ be written as

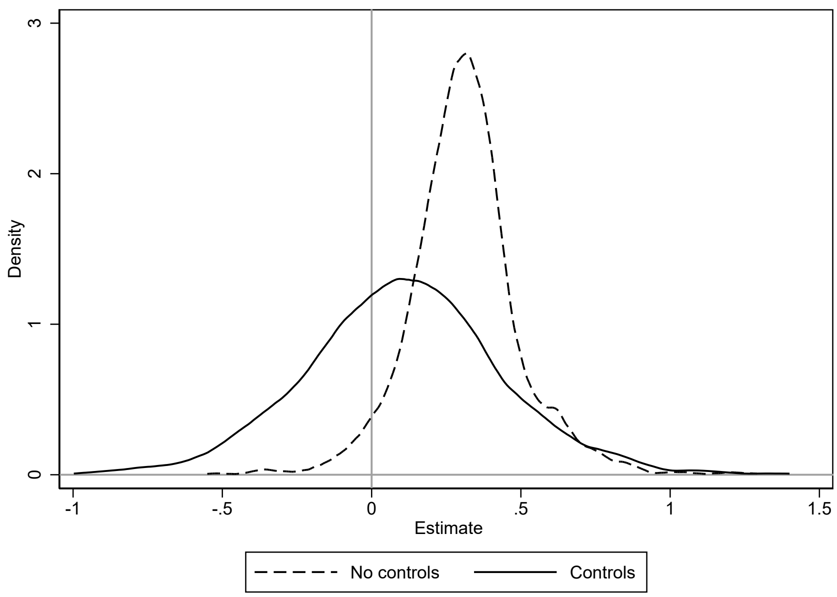
$$\ln Y^C_{i,n} = \alpha_n + \beta_n \ln Y^P_{i,n} + \Gamma_{i,n} X_{i,n} + U_{i,n} \tag{2}$$

where U are unobserved variables and where $X_{i,n}$ is a vector of parental influence variables for family i in neighborhood n. Suppose that the X are clustered in neighborhoods $n = 1, \ldots, N$ and let $D_{i,n}$ be a dummy indicator variable indicating membership in neighborhood n, where $\sum_{n=1}^{N} D_{i,n} = 1$ for

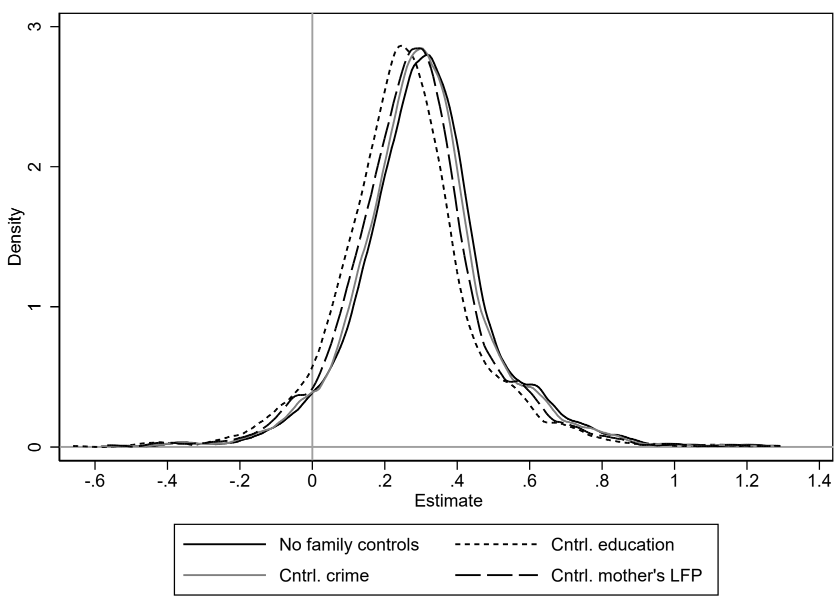
[39] See, e.g., Todd and Wolpin (2005), Cunha et al. (2006), and Currie and Almond (2011).
[40] For evidence in the U.S., see Logan et al. (2018); Reardon and Bischoff (2011); Reardon et al. (2018); Reardon and Owens (2014).
[41] Theil (1958).

Figure 9: Empirical distribution of $\hat{\beta}_n^{IGE}$

a) Distribution of $\hat{\beta}_n^{IGE}$ with and without family controls



b) Illustration of how the distribution of $\hat{\beta}_n$ changes using selected family controls



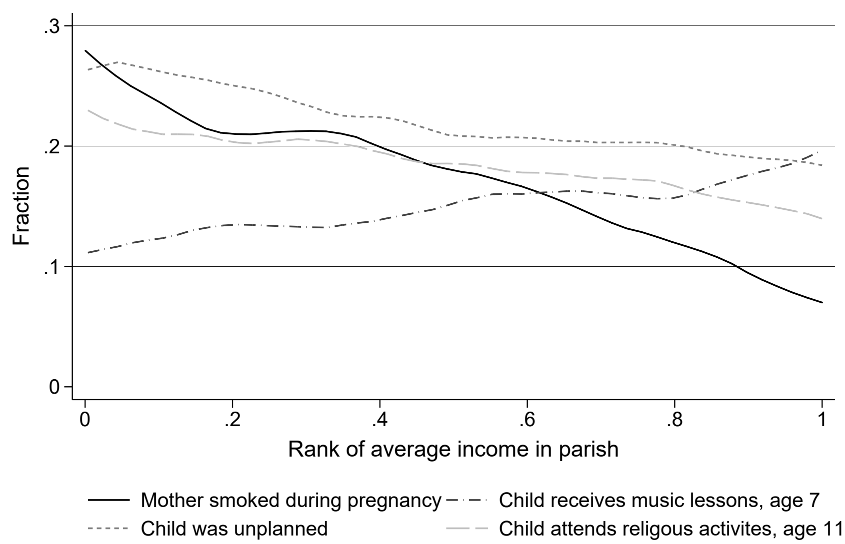
Source: Cholli (2021).
Note: The figure shows distributions of IGE estimates for parishes in Denmark (around 2,000 in Denmark; roughly the size of small U.S. Census tracts). Figure a) shows the densities for Income W/o transfers with and without controlling for family characteristics in each neighborhood: parents' age, child gender, household assets, mother's labor supple, parents' education, household size, marital status, parents' hospitalizations, parents' crime. Figure b) illustrates the impact of individual family variables.

all i. Suppose that we omit $X_{i,n}$ but we fit a neighborhood model

$$\ln Y_{i,n}^{C} = \alpha + \Delta_n D_{i,n} + \beta_n Y_{i,n}^{P} + \tau_n Y_{i,n}^{P} D_n + \varepsilon_{i,n} \tag{3}$$

omitting $X_{i,n}$. Invoking the standard omitted variable bias analysis of Theil (1958), if the X are stratified by n, in general neighborhood effects will be estimated even when $\Delta_n = 0$ and $\tau_n = 0$ so that, in truth, there are none. Fig. 10 shows some evidence on sorting on the basis of parenting variables in Denmark.

Figure 10: Differences in X across average income in parish of residence



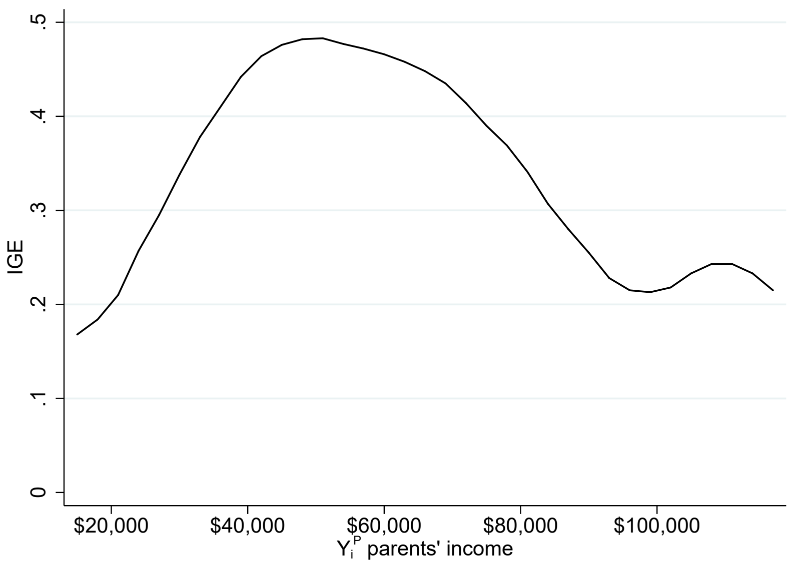
Source: Own calculations.
Note: The figure shows information about mothers and children across the rank of average income of all parents in the parish of residence at age 7. *Mother smoked during pregnancy* is based on register data information of all births in 2010. The remaining outcomes are from the Danish Longitudinal Study of Children. All associations between average income in parish of residence and outcomes are significant with $p < 0.001$. The data are described in Web Appendix C.

The data analyzed by Chetty and Hendren (2018); Chetty et al. (2020) and others emulating their work omit many important variables known to predict child outcomes. Reported neighborhood effects may well be artifacts of inadequate data that lack the variables shown to be important in a large body of literature on family influence.

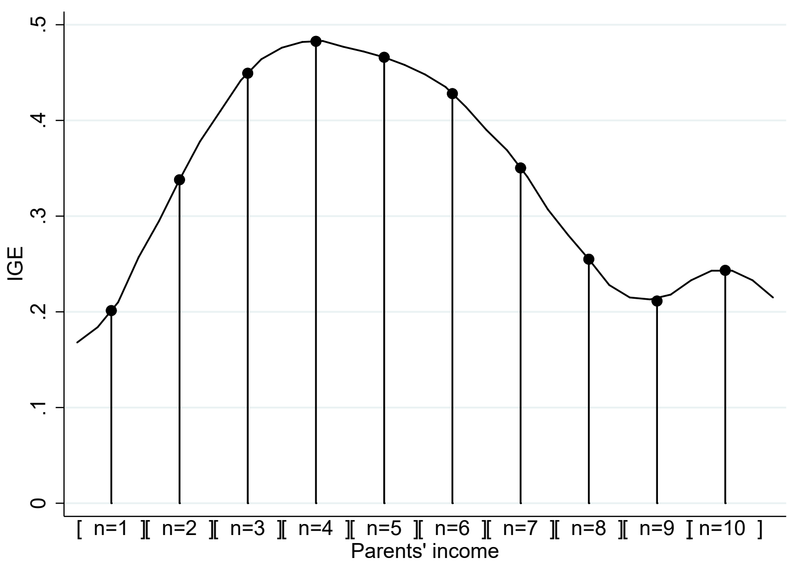
The second source of estimated neighborhood effects as artifacts emerges from the nonlinearity in the relationship between Y^C and Y^P as illustrated in Fig. 11a, which plots the estimated IGE against family income in Denmark. If parental income is clustered due to sorting, running a linear regression of $\ln Y^C$ on $\ln Y^P$ when Fig. 11a characterizes the data can generate the estimated neighborhood effects. Suppose, for example, that parental income is perfectly stratified as shown in Fig. 11b. Neighborhood effects would appear to be present strictly as a consequence of forcing a linear IGE relationship onto data generated by a nonlinear one in the presence of sorting on Y^P.

Figure 11: Slopes of Non-linear $\ln Y^C - \ln Y^P$ Curve as a Function of Y^P, Danish Cohorts 1972–1984

a) Slope of $\ln Y^C - \ln Y^P$ relationship



b) IGEs for the case of perfect sorting



Source: Own calculations.
Note: The figure replicates and expands Figure 1a from Landersø and Heckman (2017), (who consider cohorts born 1973-1975) using cohorts born 1972-1984 instead. Figure a) shows nonlinear-IGE estimates from local linear regressions of log-child income W/o transfers on log-parent income W/o transfers. Child income is measured as the average between age 31 and 35. Parental income is measured as the average of both parents' income when the child was aged 8–14. Figure b) illustrates how sorting on parental income Y^P may generate perceived neighborhood effects. The dashed vertical lines mark division of neighborhoods if perfectly stratified on Y^P. The data are described in Web Appendix C.

5 Summary

This paper compares social mobility and inequality in U.S. and Denmark. Without doubt, after taxes and transfers, Denmark has a more equal income distribution and greater intergenerational social mobility in terms of income. This is a consequence of its tax and transfer policies and not because of its skill formation policies.

Despite many generous social policies and equality of access for all Danes, family influence on many child outcomes in Denmark is comparable to that in the U.S. Common forces are at work in both countries that are not easily mitigated — not even by Denmark's generous welfare policies. Therefore, uncritical adoption of Danish policy initiatives is unlikely to be effective in the U.S. as a vehicle for creating equality of opportunity.

Denmark is a laboratory for understanding the origins of inequality and social immobility because its generous provision of social services does not eliminate inequality in many important life outcomes across generations. Thus, the origins of inequality and social mobility lie elsewhere. Families shape child outcomes and affect the utilization of programs even when these are universally available.

Our analysis encourages a critical examination of conventional wisdom from earlier studies of inequality and social mobility. It raises several important questions for future research. While our understanding of intergenerational mobility has long been defined by regressions of the log of children's income on the log of parents' income (or more recently ranks of income) measured in their 30s, lifetime measures that better reflect long-term intergenerational mobility in society are higher than the narrow snapshot measures.

The persistence of inequality in human capital formation and education in Denmark suggests that it will be fruitful to pursue a much deeper understanding of how parents affect child development, including both direct interactions and purposive sorting in making neighborhood choices (and thereby influencing school quality among others aspects of neighborhood). Estimated neighborhood effects for child outcomes and social mobility may arise simply as consequences of sorting effects. Our finding that sorting is a dynamic process across childhood not only questions the interpretation of earlier work, it also begs further analyses of the factors determining how, when, and under which conditions families decide where to live, and how these decisions shape children's lives.

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WEB APPENDIX

Lessons from Denmark about Inequality and Social Mobility

James Heckman Rasmus Landersø

This draft, February 23, 2021

List of Figures

List of Tables

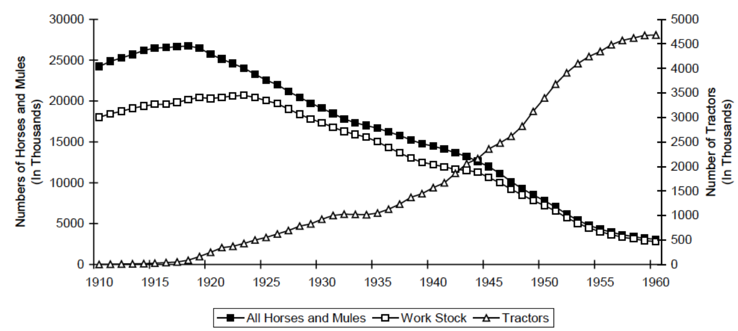
A Additional results

A.1 Results from Section 2 in the main text

Figure A.1: Number of workhorses and tractors in agriculture, Denmark and the U.S.

a) Denmark

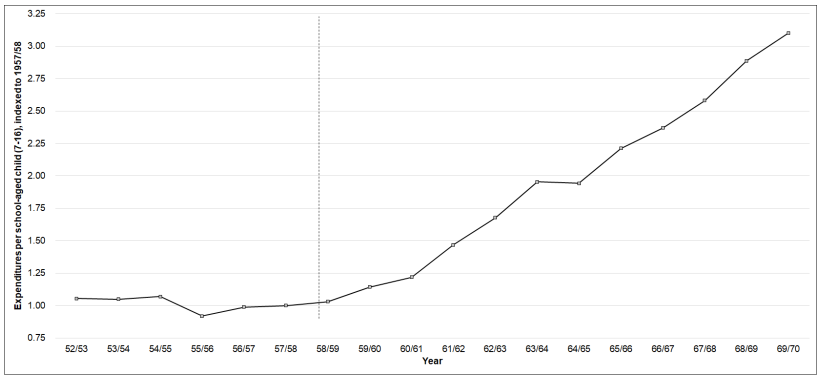
b) U.S.



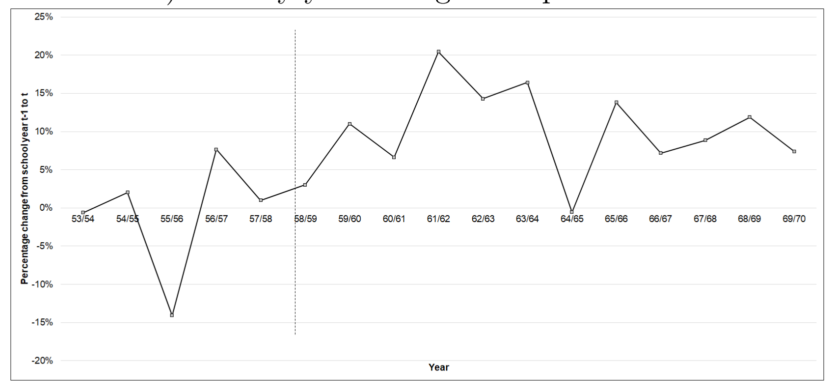
Source: Denmark: Statistics Denmark (2017). Source U.S.: Olmstead and Rhode (2000)

Figure A.2: Impact of the 1958 reform on school expenditures and number of teachers

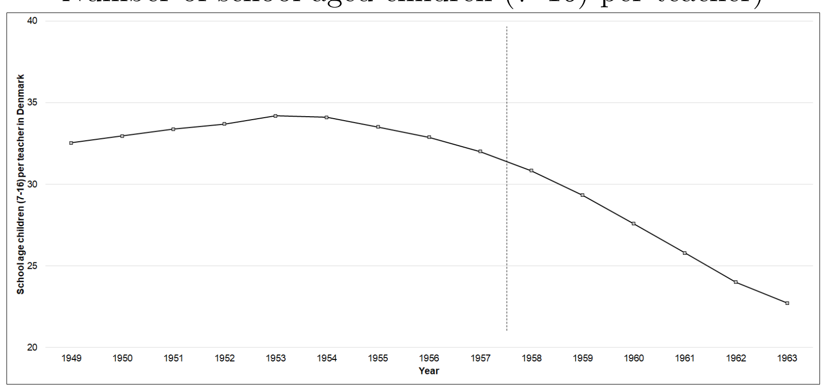
a) Expenditures per school-aged child (7–16)



b) Year-by-year change in expenditures

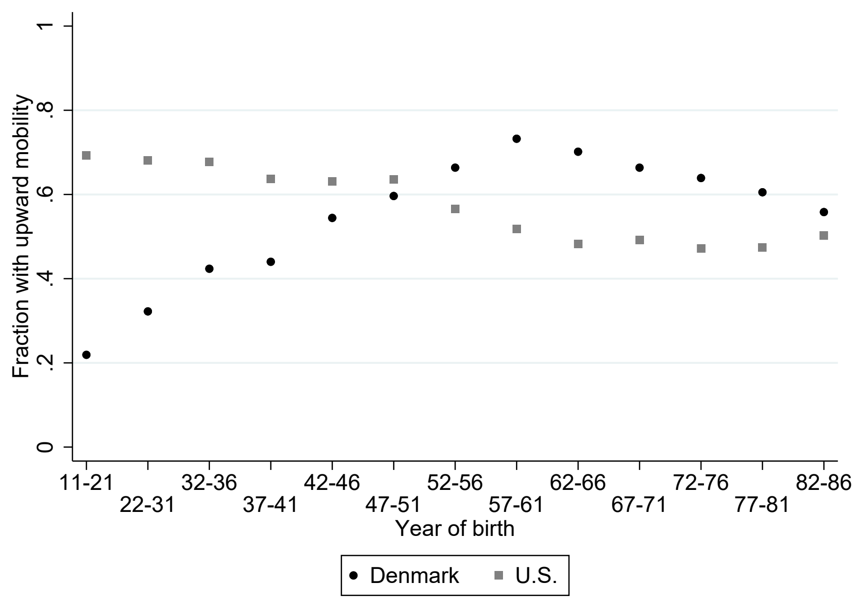


Number of school-aged children (7–16) per teacher)



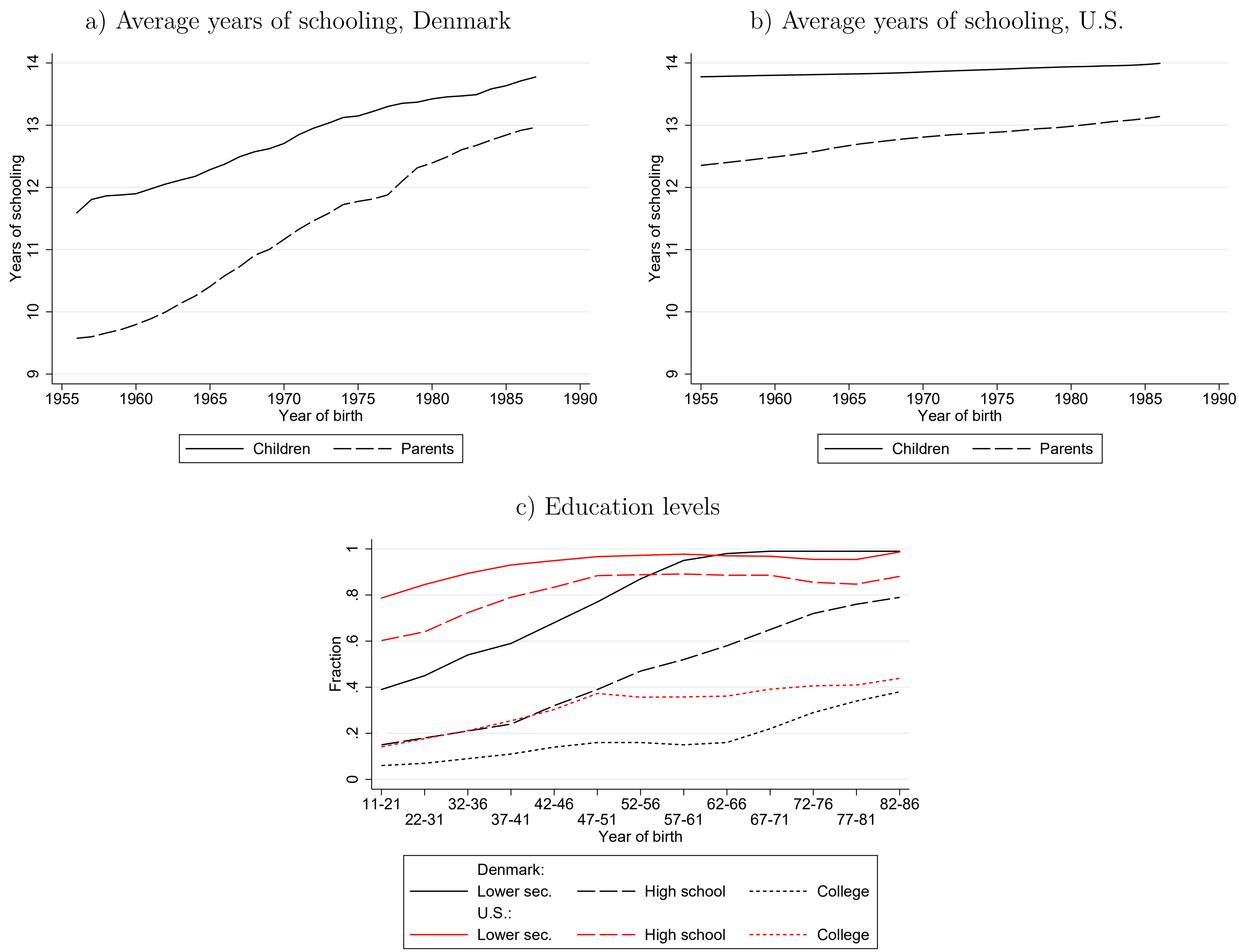
Source: Karlson and Landersø (2021).
Note: The figure is based on administrative data from the Statistical Yearbooks, 1954–1971. a) shows by year the total municipality expenditure per child aged 7–16. b) shows the year-by-year change in the total expenditure. We use the size of each birth cohort (reported by Statistics Denmark) to estimate the number of school-age children, because the specific cohort-sizes are reported in 5-year bins before 1970.

Figure A.3: Upward mobility: Fraction with higher education than their parents by child birth year and country



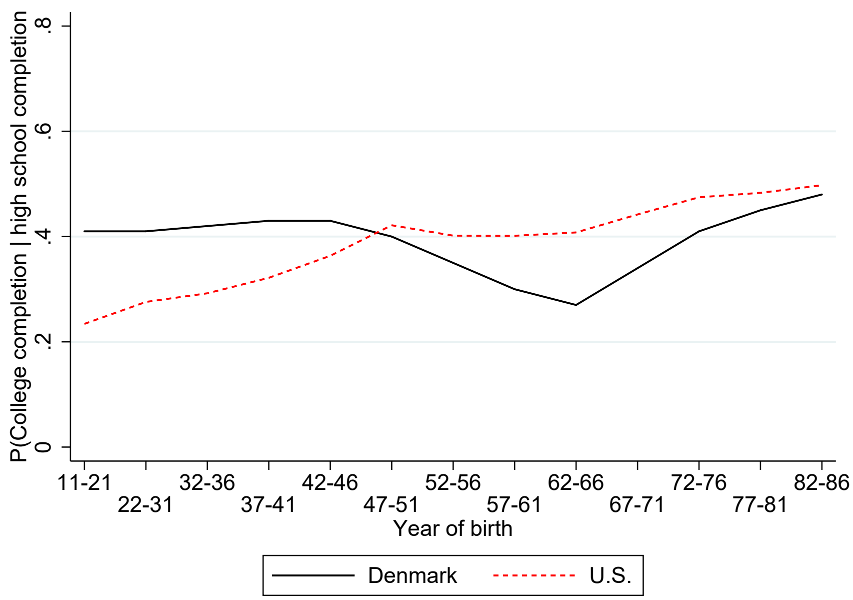
Source: Karlson and Landersø (2021).
Note: Fig. a) shows the fraction of children with higher years of schooling than their parents (highest of mother and father). Danish estimates are based on survey and register data, and U.S. estimates are based on the General Social Surveys (GSS).

Figure A.4: Education levels by child birth year and country



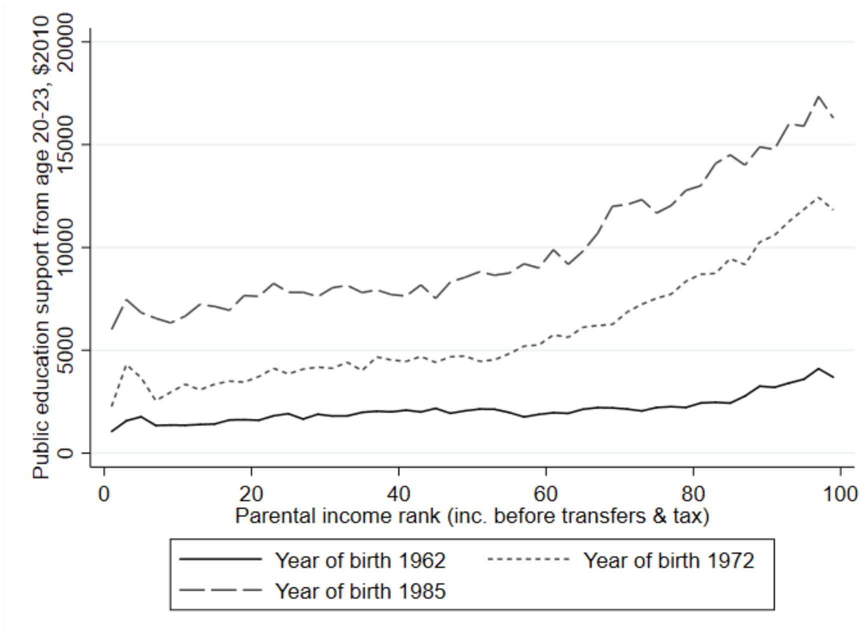
Source: Karlson and Landersø (2021).
Note: Fig. a) shows education levels; lower secondary (at least 9 years of schooling), high school (at least 12 years of schooling), and college (at least 15 years of schooling). Figs. b) and c) show average years of schooling for children and their parents (highest level of father and mother) by birth year. Danish estimates are based on survey and register data, and U.S. estimates are based on the General Social Surveys (GSS).

Figure A.5: Probability of completing college conditional on high school completion, by child birth year and country



Source: Karlson and Landersø (2021).
Note: The figure shows the probability of completing college (defined as 15 years of schooling or higher) conditional on completing high school (defined as 12 years of schooling). Danish estimates are based on survey and register data, and U.S. estimates are based on the General Social Surveys (GSS).

Figure A.6: Public education support in Denmark from age 20-24 by parents' income rank and year of birth



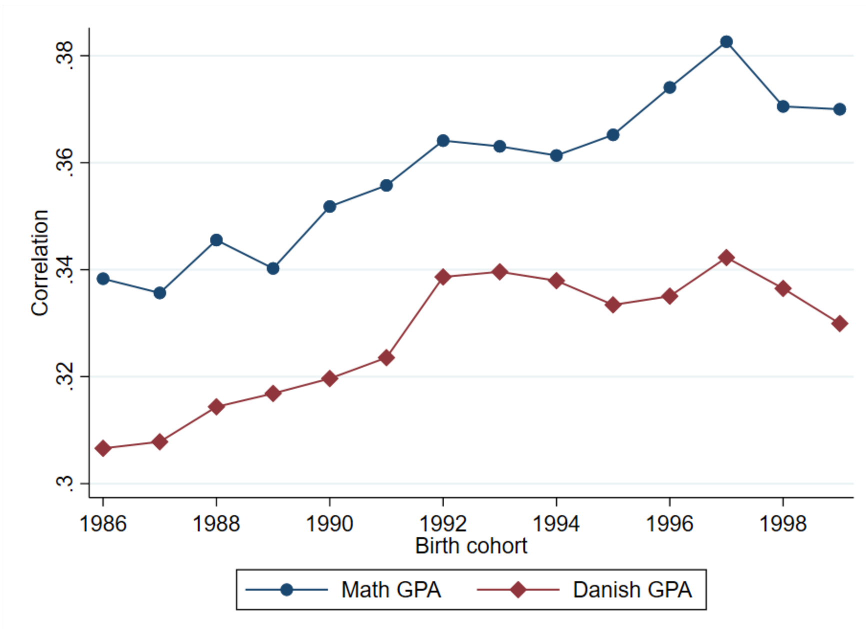
Source: own calculations.
Note: The figure shows the total education support (Statens Uddannelsesstøtte) received from age 20–24 for the 1962, 1972, and 1986 cohort, respectively, by their parents' income rank (total gross income excluding public transfers) measured when the children are age 20-22. The data are described in Web Appendix C.

Table A.1: Children's language test score quintiles in grade 2 and 8, by parents' education, Denmark and the U.S.

	1st quintile	2nd quintile	3rd quintile	4th quintile	5th quintile
Parents less than college					
Grade 2					
Denmark	0.25	0.21	0.21	0.19	0.14
U.S.	0.24	0.22	0.20	0.18	0.15
Grade 8					
Denmark	0.25	0.22	0.20	0.18	0.15
U.S.	0.25	0.22	0.20	0.19	0.15
Parents college or higher					
Grade 2					
Denmark	0.12	0.16	0.19	0.23	0.29
U.S.	0.11	0.16	0.22	0.23	0.29
Grade 8					
Denmark	0.10	0.16	0.20	0.24	0.30
U.S.	0.12	0.15	0.20	0.24	0.29

Source: Hjorth-Trolle and Holm (2021).
Note: The table shows children's language test score quintiles measured in grade 2 and 8 (at age 8 and 14) by parents' highest education (less than college vs. college or higher). Results for Denmark are based on full population register data, and results for the U.S. are based on NLSY97 data. Parents with less than high school constitute 67% of the sample in both countries.

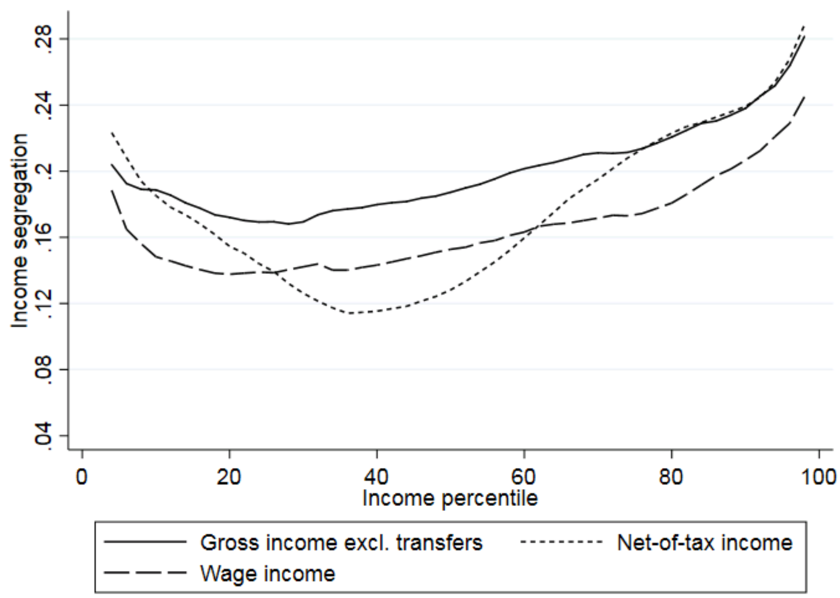
Figure A.7: Correlation between children's 9th grade GPA and parents' years of schooling



Source: own calculations.
Note: The figure shows the (Pearson) correlation between children's math and Danish GPA (written, external scored exams) in grade 9 (age 16), and parents' years of schooling for cohorts born 1987–2001. The data are described in Web Appendix C.

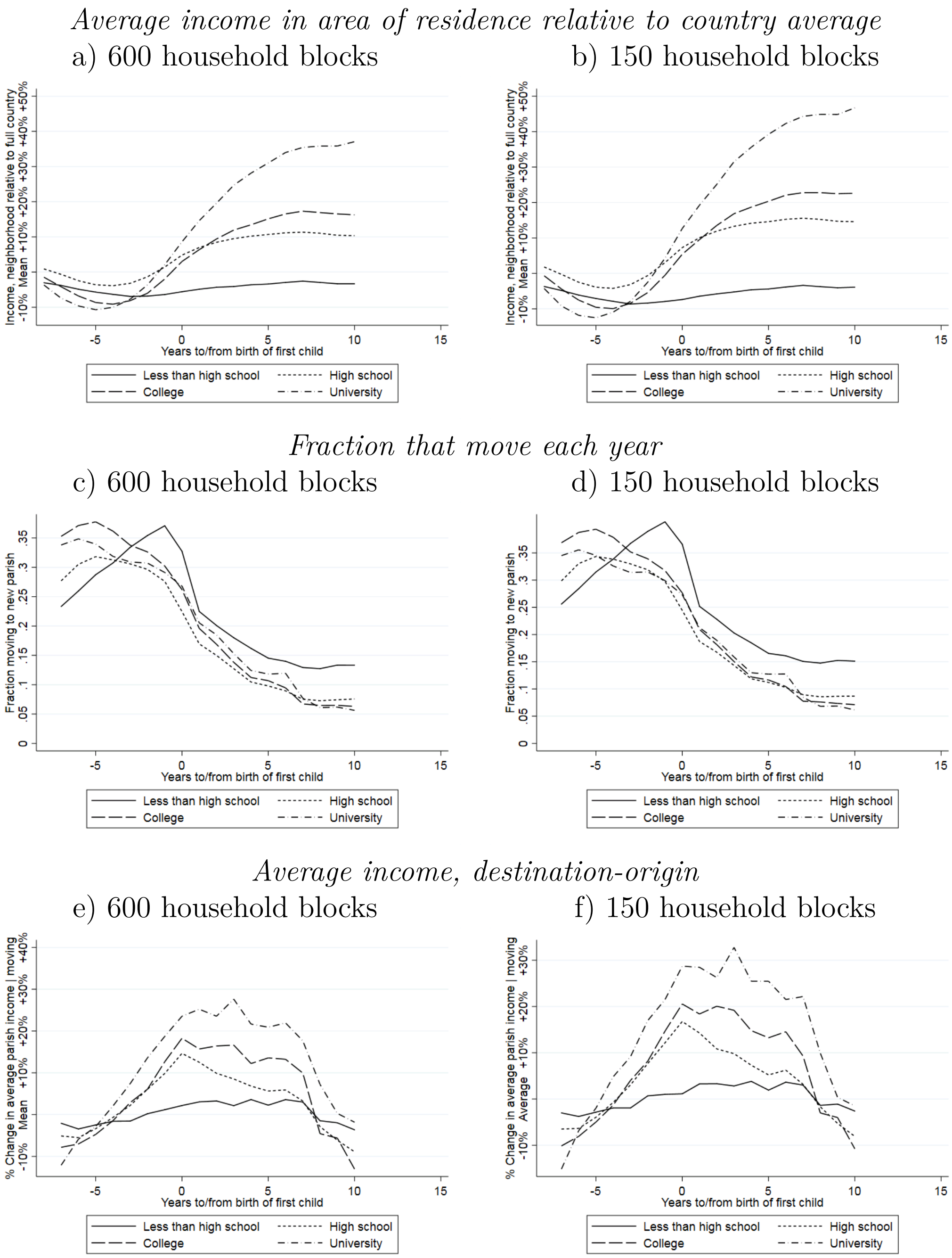
A.2 Results from Section 4 in the main text

Figure A.8: Income segregation for families with children by income type, Greater Copenhagen area



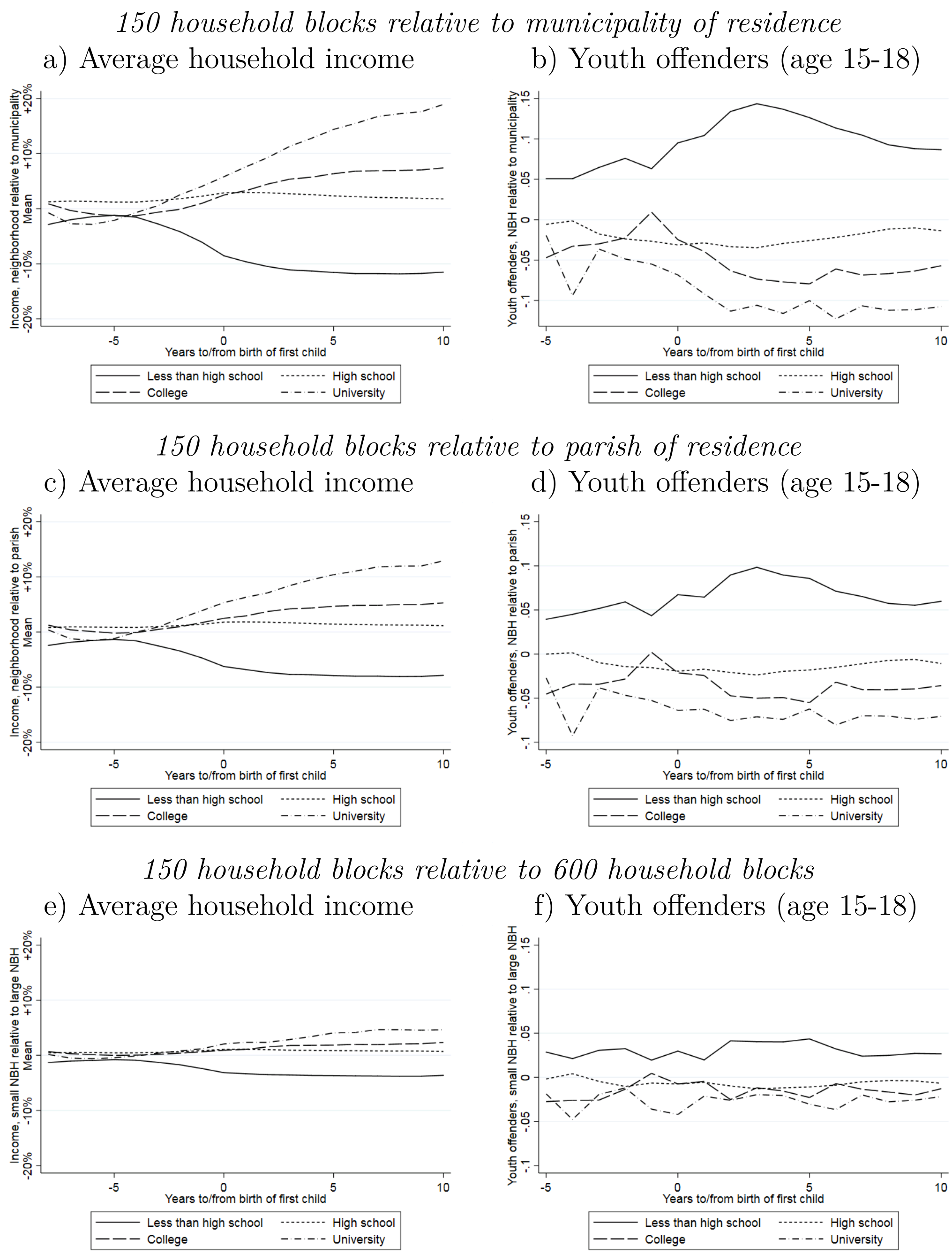
Source: own calculations.
Note: The figure shows income segregation as also measured in Fig. 6 for 150 household blocks in the Greater Copenhagen area (the capital area of Denmark). The data are described in Web Appendix C.

Figure A.9: Average income in area of residence and moving pattern, by time to/from birth of first child and area type



Source: own calculations.
Note: The figure shows average income level in the parish / large neighborhood / and small neighborhood of residence by years to/from the birth of the first child and mother's education level. The figure is computed for the mothers of cohorts born 1994–1997, and income is measured as gross income excluding public transfers.

Figure A.10: Household income and fraction of adolescents (age 15-18) who are charged with a crime; neighborhood where mothers (and child) lives, relative to levels in larger areas



Source: own calculations.
Note: The figure shows. in the small neighborhood of residence, i) the average household income of all families and ii) the average fraction of adolescents (age 15-18) who have been charged with a crime in a given year. The figure present these statistics by mothers' education and relative to the levels in larger areas (in which the small neighborhood is nested). The figure is computed for the mothers of cohorts born 1994–1997. The data are described in Web Appendix C.

B Lifetime Measures of Well-being

B.1 Variable Definitions for Figure 5

Variable	Definition
Wage Inc.	**Summary:** Total wage income. **Details:** Taxable salary including perks, tax-free salary, anniversary and severance pay as well as the value of stock options. The salary is after deduction of contributions to employer-administered pension schemes and contributions to the Danish labour market supplementary pension fund (ATP).
Disposable Inc.	**Summary:** Total income minus taxes and interest expenses. It includes public transfers and the rental value of own home. **Details:** The following items are added: total salary income, remuneration, social security contributions, net profits from self employment, public transfers (unemployment benefit and severance pay, excluding civil servants), private pensions paid, interest income and realized gains on securities, residual income including child support. The following items are subtracted: interest expenses, taxes, labor market contributions and special pension, maintenance paid/contributions to a former spouse as well as to children under age 18. Finally, the estimated rental value of own home is added.
Household Consumption	**Summary:** Total household expenditures, imputed from the relationship between survey consumption from Danish Expenditure Survey and Danish registers. **Details:** Total household expenditures, imputed from the relationship between total expenditures from Danish Expenditure Survey (1997+) on variables found in the register: household disposable income and net assets in t and $t-1$. The imputation is conducted using a random forest estimator with hyperparameters selected by 5-fold cross-validation.

Exp. PDV of Disp. Inc. (PDV)

Summary: The expected present discounted value of disposable income.

Details: Let PDV denote the expected present discounted value of disposable income. We use a recursive formula to compute the PDV at time t for individual i, going back from age $T = 85$. We calculate the expected disposable income for an individual at t given a rich vector of individual characteristics, z_{it}, and calculate the discounted expected future sum for the remainder of an individual's life:

$$PDV_{it} \equiv E\left[\beta(d_t + PDV_{t+1})|z_{it}\right],$$

where d_{it} is the dividend at time t, and is comprised of disposable income. At the end of life, PDV_{iT} is 0.

Permanent Income

Summary: The annuitized value of PDV and financial wealth.

Details: We define Permanent Income PI_{it} as

$$PI_{it} = (PDV_{it} + a_{it})\frac{r}{1-(1+r)^{t-T}}$$

where PDV_{it} is PDV as defined above and a_{it} is the total value of a household's assets net of liabilities. We use a constant rate of discount $r = 0.04$, and $T = 85$.

Value Function

Summary: The sum of flow utility and the discounted expected value of following the optimal policy in the future.

Details: Similar to the Permanent Income estimation process, we use a recursive method to the estimate value function as follows:

$$V(j, z_j) = u(j, z_j) + \beta E[V(j+1, z_{j+1})|j, z_j]$$

We specify a CRRA utility function, i.e. $u(c_{it}) = \frac{c_{it}^{1-\rho}-1}{1-\rho}$. For a benchmark comparison, we also estimate value function when we specify a linear utility function, i.e. $u(c_{it}) = c_{it}$. In case of linear utility, the value function is equal to the expected present discounted value of future consumption. The measure of consumption here is the adult equivalent consumption measure (household consumption with equivalence scale).

C Data Appendix

Construction of Fig. 1

Danish data:

- Birth weight: The figure is constructed from information of child birth weight (from birth register MFR) merged to information on mother's years of schooling (from the educational register UDDA) using unique individual identifiers of child and mother. The figure considers children born 2000–2004. Mothers' education is measured in 2014.

- Admission to neonatal ward: The figure is constructed information of treatment in the neonatal ward (from birth register MFR) merged to information on mother's years of schooling (from the educational register UDDA) using unique individual identifiers of child and mother. The figure considers children born 2000–2004. Mothers' education is measured in 2014.

- Sociability scores: The figure is based on information from Bleses et al. (2018) (using survey information).

- Test scores: The figure is based on information on language tests from Beuchert and Nandrup (2018) (using register data on mandatory tests for all children in Danish schools).

All subfigures in Fig. 1 for Denmark exclude immigrants and descendants.

Mother's education categories are defined as:

- Less than high school: Years of schooling < 11

- High school: $11 \leq$ Years of schooling < 15

- College: Years of schooling ≥ 15

U.S. data:

- Birth weight: The figure is constructed child birth weight using children of the NLSY79 dataset (CNLSY). The National Longitudinal Survey of Youth 1979 (NLSY79) is a longitudinal nationally representative dataset of individuals born between 1957-1964 in the US.

- Admission to neonatal ward: As there is no information about the nature of hospital stays for children around birth, this figure tracks what percent of children born have hospital stays that are at least two times the length of the median hospital stay of 3 days. The figure considers children born from all years for individuals in the NLSY79.

- Sociability scores: The figure is constructed from sociability scores recorded in the CNLSY. More details about the sociability scores are available at https://www.nlsinfo.org/content/co children/topical-guide/assessments/temperament-how-my-child-usually-acts

- Test scores: The figure is constructed from PIAT reading comprehension test scores recorded in the CNLSY, for children between 8 and 14 years of age. More details about the PIAT scores are available at https://www.nlsinfo.org/content/cohorts/nlsy79-children/topical-guide/assessments/piat-reading-reading-recognitionreading.

Construction of Fig. A.6

To construct the figure, we first use the demographic register (BEF) to identify (non-immigrant) individuals born in 1962, 1972, and 1985, respectively, including both own and parents' unique individual identifiers. We then merge this data to the income register (IND) with information on education support transfers when individuals were aged 20-24. Finally, using parents' unique individual identifiers, we add information on parents' income when the child was aged 20-22 (i.e., years 1982-1984 for the 1962 cohort and so forth) and rank parents' income W/o transfers within each borth cohort in question.

Construction of Fig. A.7

The figure is constructed by first combining the exam-grade register (UDFK) with the demographic register (BEF) including information on year of birth and parents' unique individual identifiers. We then add information on parents' years of schooling from the education register (UDDA).

Construction of Fig. 6b and Fig. A.8

To construct Fig. 6b, we first use the demographic register (BEF) to identify the cohorts in question along with parents' unique identifiers. We merge this to the student-institution register (KOTRE) that contains information on students in Danish educational institution (lower-secondary schools, which we consider, upper secondary institutions, and post-secondary institutions). We thereby identify the schools the different cohorts attended when they were in grade 8. Finally, we combine the data with information of parents' income from income register (IND).

To construct Fig. A.8, we first combine the demographic (BEF) and residential (BOL) registers for 2004 to identify each household's 150 household block of residence (see Damm and Schultz-Nielsen, 2008) and whether there are any children present in each household. We next limit the data to households with children living in the Greater Copenhagen area, Finally, we merge this data to the income register (IND) to identify each household's income.

Construction of Fig. 7, Fig. A.9, and Fig. A.10

To construct the figures, we first combine the demographic (BEF) and residential (BOL) registers for each year from 1982–2012 to identify each household's municipality, parish, 600 household block, and 150 household block of residence (see Damm and Schultz-Nielsen, 2008, for a description of the blocks). We then merge this data to the income register for each year to identify each household's income and calculate average income for each area-type. Similarly, we merge information on crime charges from the crime charges register, and calculate the fraction of adolescents aged 15-18 who have been charged for a non-traffic related crime.

Next, we identify women who have their first child in the years 1994-1997 using the demographic register. From the residential register, we identify the mothers' municipality, parish, 600 household block, and 150 household block of residence (see Damm and Schultz-Nielsen, 2008) in each year before and after the birth of her first child. We also merge information on mother's completed education (measured 10 years are the birth of her first child) from the education register.

Finally, we combine the data with average income and youth offenders in each area and year to the mothers' area of residence in each year before and after the birth of her first child.

Construction of Fig. 10

To construct the figure, we first combine the demographic (BEF) and residential (BOL) registers with the income register (IND) to calculate parish average income W/o transfers as the average income of all parents (excluding immigrants) with children aged 5-11 in 2015 (to be used for the outcome *smoking during pregnancy*) and 2002 (to be used for the remaining outcomes). We then rank the parishes from 0-1. Next, we merge information from the Danish Longitudinal Study of Children (DALSC) to parish of residence using the demographic and residential registers in 2002 and plot averages of the variables in question across parish income rank. Similarly, we merge information from the birth register for children born in 2010 with the demographic and residential registers in 2015, and plot the fraction of mothers who are reported as smoking during the pregnancy in the birth register (MFR) across parish income rank.

Construction of Fig. 11

To construct the figure, we first use the demographic register (BEF) to sample cohorts born 1972-1984 and we exclude immigrants. We then merge this data to the income register (IND) when the children were aged 31–35 (i.e. 2003-2007,...,2015-2019 depending on cohort) and calculate the average annual income. Using the unique individual identifiers of parents, we next add information on parents income when the child was aged 8-14 (i.e. 1980-1986,...,1992-1998 depending on cohort) and calculate the average annual income of parents (the mean of the mother's and father's income irrespective of whether they live together). The estimation procedure follows Landersø and Heckman (2017).

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