Online Appendix for: “Measuring Absolute Income Mobility: Lessons from North America and Europe”

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Appendix 1. Specification Parameters Compared Across Countries

To facilitate meaningful comparisons we match our specifications as closely as possible across the countries in our sample. However, the considerable variation from country to country in both data sources and data structures prevents us from implementing the exact same specification in every country. Tables A1.1 and A1.2 provide an overview of the parameters used in the baseline specification for in each country. Details on the exact specifications, data, and methods used for each country's analysis are provided in Appendix 2.

Table A1.1 indicates the method of absolute mobility calculation and the birth cohorts included in each country's analysis, as well as the income sources that are included. In every country labor income (wages and self-employment) and income from unemployment and Social Security/pensions are included. Capital income is not available in the register data we use for Norway, Sweden, and the Netherlands, or the survey data we use in the UK. For maximum comparability, we thus exclude capital income from our primary specification in Canada and the US as well. In Finland our data do not distinguish capital from labor income, so we include both in the analysis. Similarly, in Canada, the Netherlands, and the UK data on income from government transfers include social transfer programs in addition to unemployment and pensions.

TABLE A1.1. METHOD, COHORTS INCLUDED, AND INCOME SOURCES INCLUDED BY COUNTRY

Country	Method	Start Cohort	End Cohort	Income sources included			
				Labor / Self-employment	Capital	Unemployment / Social Security	Social Transfers
Canada	Linked records (population)	1977	1985	X		X	X
Finland	Linked records (population)	1963	1990	X	X	X	
Netherlands	Linked records (sample)	1973	1984	X		X	X
Norway	Linked records (population)	1964	1988	X		X	
Sweden	Linked records (population)	1960	1980	X		X	
UK	Copula and marginals	1964	1987	X		X	X
US	Copula and marginals	1940	1985	X		X	

Table A1.2 describes the way child and parent families are defined, the way parent age is determined, and the sample of children included in the analysis for each country. The approach in each country is largely determined by the structure of that country's register data. In some countries, such as Finland and Norway, children are linked to their biological parents, whether or not they live in the same household. In other countries, such as Canada and Sweden, children are linked to the parents with whom they live at a particular point in time.

Because parents may not be born in the same year as one another, determining the year in which parent income should be measured to compare to the child's income at age 30 is not entirely straightforward. We use the father's age alone in Norway; the father's age if the father is present and the mother's age if there is no father present in Canada, Finland, the Netherlands, Sweden, and the US; and the parent whose age results in the higher total family income in the UK.

TABLE A1.2. FAMILY DEFINITION, PARENT AGE DEFINITION, AND CHILD SAMPLE BY COUNTRY

Country	Parent Family Definition	Parent Age Definition	Child Family Definition	Child Sample
Canada	Parent with whom the child lived at age 16-19 + spouse	Father if present, mother if no father present	Child + spouse (statuatory or common law marriage)	Children in country at age 16-19
Finland	Biological parents	Father if present, mother if no father present	Child + spouse/cohabiting partner	Children in country at age 30
Netherlands	Biological father (if alive, mother if not) + spouse/ cohabiting partner	Father if present, mother if no father present	Child + spouse/cohabiting partner	Children born in country and residing there in 1995
Norway	Biological parents	Father	Child + spouse/cohabiting partner	Children born in country
Sweden	Parents with whom the child lived when head of household aged 30	Father if present, mother if no father present	Child + spouse or co-parent (childless cohabiting partners excluded)	Children born in country
UK	Head + spouse	Parent whose age results in higher total income	Child + spouse/cohabiting partner	Children in country at age 30
US	Head + spouse	Father if present, mother if no father present	Child + spouse	Children born in country

In all countries, grown children are linked in the register data to a spouse if they are legally married. In most countries, they are also linked to a partner with whom they cohabit even if they are not legally married, but this is not universal: in Sweden, for instance, a link is only possible when two people are legally married or parents of the same child.

Many of the countries in our sample have had relatively high levels of immigration in recent years. Among our sample countries in 2019, foreign-born residents made up 21.3% of the population in Canada, 6.9% in Finland, 13.4% in the Netherlands, 18.2% in Norway, 20.0% in Sweden, 14.1% in the UK, and 15.4% in the United States (United Nations Department of Economic and Social Affairs 2019). Where possible, we restrict our sample to children who were born in the country being analyzed. However, in Canada, Finland, and the UK we are not able to impose this restriction. In Canada our sample consists of all children who lived in the country between ages 16-19. In Finland and the UK it consists of all children who lived there when they themselves were 30 years old (note, however, that to be included in our analysis sample in Finland we must also observe children's parents at age 30, which has the effect of excluding many immigrant children).

Appendix 2. Detailed Methodology by Country

A1.1: Canada

Intergenerational Income Database (IID).—The IID is a linked administrative database composed of two main components. The first component is the Family File (FF) in which children who were aged 16 to 19 in 1982, 1984, 1986, 1991, 1996 and 2001 were matched with their parents. The calendar years in which the children were 16 to 19 (i.e., 1982, 1984, etc.) are known as *IID cohort years* or *IID cohorts*. The birth years of children in the IID range from 1963 (19 in 1982) to 1985 (16 in 2001).

Table A1.1.1 shows the structure of FF and several hypothetical examples. Each observation in the Family File is uniquely identified by the child's case number. Different children, however, can have the same parent or both parents.

TABLE A1.1.1 INTERGENERATIONAL INCOME DATABASE FAMILY FILE STRUCTURE, CANADA

Observation	Child's case number	Mother's case number	Father's case number
1	A's case number	A's mother's case number	A's father's case number
2	B's case number	… (no mother present)	B's father's case number
3	C's case number	C's mother's case number	… (no father present)
…	…	…	…

Notes: This table presents hypothetical examples of file structure in the Canadian Intergenerational Income Database.

An important concept in the IID is the "link year." This is the year in which children were linked to their parents. For most children, the link year is the same as the cohort year. However, in order to improve the IID coverage and reduce the scope of a sample selection, establishing the link between children and their parents was attempted in several subsequent years. For example, most children from the 1982 cohort were linked to their parents using 1982 administrative data. For children who could not be linked to their parents in 1982, an attempt was made to link them in 1983, 1984, 1985 or 1986. The link year in this case is the year between 1982 and 1987 in which the first successful link was established.

The family structure in the Family File represents the family structure in the link year. There is no information on whether the mother and the father are biological parents. Stepparents are deemed to be parents.

The second main component of the IID is the annual T1 files (information from individual tax returns).[1] For the 1982, 1984 and 1986 cohorts, T1 files are available from 1978 to 2016.[2] For the 1991, 1996 and 2001 cohorts, T1 files are available from 1981 to 2016. Each T1 file contains unique individual identifies (case numbers), so that each individual in the Family File—a parent or a child—can be linked to his or her tax return records in year *t* if they filed a tax return in that year. Not all variables are available for all years; changes in the variables availability reflect primarily changes in the tax code.

Weights.—Certain criteria have to be satisfied for a child 16 to 19 to be selected into the IID: the child had to have a Social Insurance Number, live with his or her parents, and the parents had to file a tax return at least once during the 5-year linkage window. In each cohort, only about two thirds of all children 16 to 19 satisfy all three criteria; therefore, the size of an IID cohort is about two thirds of the total population of 16- to 19-year-olds. A set of weights was developed by Statistics Canada methodologists to account for underreporting of income among low-income individuals and to make the IID representative of the population. The weights are used in all computations related to absolute mobility rates.

Family unit.—The family unit in the IID consists of only parents and their children. This definition is consistent with the Census data definition of the "census family." Note that a census family is different from a household since a household may

[1] The Canadian T1 form is roughly similar to the 1040 IRS form in the United States.

[2] At the time of writing.

include other relatives living at the same address (same household). Household information is not available in the IID and only census families can be identified.

As mentioned above, children's parents are either biological parents or stepparents with whom children lived during the link year. Children's own marital status and their spouses (if they are married or in common-law relationship) can be identified from the T1 files.

Total family income.—The total family income is the combined income of the spouses. If children have both parents present in the Family File, the total income of parents is computed as the parents' combined income in the year when one of the parents was 30. If the parents reached age 30 in different years (e.g., father was 30 in 1982 and mother was 30 in 1984) and their family income can be computed for both years, the family income in the year when the father was 30 is retained for further computations. If only one parent is present in the Family File, that parent's income at age 30 is the parental family income at age 30 used in the computations.

The family income of children is the combine income of children and their spouses in the year in which the child was 30. If the child was not married at the age of 30, the child's family income is his or her own income in that year.

The definition of the total before-tax income used in the computations is the same as the definition of total income used by the Canada Revenue Agency (Canada Revenue Agency 2020). The total family income used in the analysis excludes capital gains, dividends, investment income and rental income.

Inflation factor.—All dollar amounts are converted to 2015 constant dollars using the all-items Consumer Price Index; see Statistics Canada, Table 18-10-0005-01: CPI, all-items, Canada, 2002=100, 2005 basket (formerly CANSIM, Table 326-0021). An alternative deflation factor used for a robustness check is real Gross Domestic Product, volume index 2012=100, Table: 36-10-0129-01 (formerly CANSIM 380-0101).

Main sample structure and caveats.—The structure of the IID creates some inconsistency across cohorts with respect to the age at which parents had their children. The inconsistency stems from two constraints imposed by the structure of the IID. The first constraint is imposed by the earliest year in which parents' income is available. For the cohorts born between 1963 and 1970, the first year in which parents' income could be observed at age 30—or any age for that matter—is 1978 (first T1 file). This means that parents' income could be observed only for parents born *after* 1948.

The second constraint is related to the age at which parents could reasonably have their children. Parents born after 1948 would have to be 15 or younger to have children in 1963. This essentially excludes the 1963 birth cohort from the analysis. Even for children born in 1970, the age range at which their parents could have them is 19 to 22 assuming that one wishes to exclude those who became parents before reaching 19. (The upper bound is determined by the 1948 cut-off.)

For all cohorts born in 1972 or later, the first year in which the incomes of their parents could be observed is 1981, which means that only children whose reference parents were born in 1951 or later can be included in the analysis. (The reference parent is the parent who was 30 in the year in which the parental income is observed; e.g., if a mother-father couple was observed in 1984, and the father was 30 in that year while the mother was 28, the father was the reference parent.) An important point here is that, as we move along the cohort spectrum toward more recent cohorts, the age range at which parents could have their children widens. For children born in 1985, the last cohort that can in observed at age 30 (in 2015), the age at which their parents could have their children is 19 to 34. Hence, whereas we can observe only 30-year-old parents of the 1970 birth cohort who had their children when they were between 19 and 22 years of age, we can observe 30-year-old parents of the 1985 birth cohort who were 19 to 34 when they had their children.

To mitigate the effects of this cross-cohort inconsistency to some degree, only children born between 1977 and 1985 are included in the main analysis. The age range at which their parents could have them and other related information is shown in Table A1.1.2.

TABLE A1.1.2 DETAILS OF MAIN SAMPLE, CANADA

Children's birth cohort	Reference parent's birth cohort	Reference parents' age when child is born	Years parents' income is observed	Year child's income is observed
1977	1951-1958	19 to 26	1981-1988	2007
1978	1951-1959	19 to 27	1981-1989	2008
1979	1951-1960	19 to 28	1981-1990	2009
1980	1951-1961	19 to 29	1981-1991	2010
1982	1951-1963	19 to 31	1981-1993	2012
1983	1951-1964	19 to 32	1981-1994	2013
1984	1951-1965	19 to 33	1981-1995	2014
1985	1951-1966	19 to 34	1981-1996	2015

Notes: Parents' and children's family income is observed at age 30.

Robustness: restricted sample.—One way to gauge the impact of the problem described above is to restrict the sample for all cohorts to only those children who were born when their parents were between 19 and 26 years old. This restriction is not likely to completely eliminate the cross-cohort inconsistency because the fertility age increases across cohorts and an increasingly large number of parents who were over 26 when their children were born may be excluded from the analysis, but it is an informative robustness check. The mobility rates for the main and restricted sample are presented in Table A1.1.3. They match closely for early cohorts, and are 2-3 percentage points lower than those in the main sample for cohorts born after 1980.

TABLE A1.1.3 COMPARISON OF MAIN AND RESTRICTED SAMPLES, CANADA

Children's birth cohort	Absolute mobility main sample	Absolute mobility restricted sample
1977	0.584	0.584
1978	0.589	0.596
1979	0.584	0.596
1980	0.580	0.592
1982	0.565	0.586
1983	0.566	0.590
1984	0.567	0.591
1985	0.573	0.607

Notes: Absolute mobility is measured using before-tax total income. The restricted sample is limited in all cohorts to children who were born to parents between 19 and 26 years old, the age range available in the main sample for the 1977 birth cohort.

A2.2: Finland

The Finnish sample is derived from total-population register-based longitudinal data provided by Statistics Finland (Statistics Finland 2020). These data include annually updated information between 1987 and 2020, and are complemented with information from censuses from 1970, 1975, 1980, and 1985. In these data, all individuals residing in Finland (including immigrants) on the last day of each aforementioned calendar year are observed. Subjects are linked to their parents with the help of personal identification numbers. Data collection information along with quality descriptions are available from Statistics Finland.

Information on income was obtained from the Finnish Tax Administration database based on tax files of the National Board of Inland Revenue. The income variable incorporates the annual sum of all forms of income that are subject to state taxation. This includes wages, capital income, and taxable income transfers such as unemployment benefits. Some income transfers, such as social assistance and housing allowance, are not subject to tax, however, and are thus not included in the measure. As capital income can be distinguished from other forms of income only from 1993 onward, and disposable income is only available from 1995 onward, it is not possible to present results for Finland for other forms of income, as in Figure 6 of the main text.

Due to low parent match rates for child cohorts born before 1963, we restrict our analysis sample to the 1963-1990 birth cohorts. For these cohorts, 54 to 91 percent of cohort members could be matched to at least one parent (Table A2.2.1). Income is measured at the same age for both parents and children, for most of the cohorts at the age of 30 (Table A2.2.1). Especially for the older cohorts, however, data availability does not enable observing incomes exactly at this age because of the data structure; if measurement for income at the age of 30 is not available, the closest possible age to 30 (ranging from 31 to 34) has been used. For the same reason, the match rates for the very youngest cohorts are lower as these cohorts were not yet 34 when the most recent data were collected (Table A2.2.1). Note also that because for most parent cohorts we observe income data only every five years, it is not possible to present results for Finland using income averaged over multiple sequential years, as in Figure 5 of the main text.

Parental income was defined as the combination of the income of the biological or adoptive father at the measurement age and the income of the biological or adoptive mother during the same calendar year. If father was not present in the data, mother's income at the measurement age was used. Approximately 64 % of parents live together at the time of income measurement (ranging from 65 % for the oldest and 59 % for the youngest studied cohort). Offspring income was defined as the combination of the income of the individual and their spouse (if a spouse is identified). This includes all cohabiting couples, both married and non-married. Income measures were converted to constant 2019 Euros using an index provided by Statistics Finland.

Even though our data include information on immigrants, their number is low and is thus not relevant when interpreting the results. Only 1.4 % of the individuals in the sample were born outside Finland (ranging from 0.5 % for the oldest and 1.9 % for the youngest studied cohort). Two reasons explain the low number: First, the proportion of population born outside Finland is comparatively low, particularly for the oldest cohorts. Second, many of the immigrant children's parents are not present in the data as they were not residing in Finland at the measurement age.

Table A2.2.1. Characteristics of the studied sample, Finland

Birth cohort	Sample N	Match rate	Mean measurement age	Mean parental income	Median parental income	Mean offspring income	Median offspring income
1963	41765	0.54	32.39	26841	23386.6	43094.4	41219.3
1964	45973	0.6	32.34	29195.1	26306.9	44045.6	41974.7
1965	48945	0.66	32.28	31199.4	29034.6	45565.7	42729.7
1966	52890	0.71	32.25	33246.3	31628.6	47045.2	43913.6
1967	55802	0.76	32.2	34642.9	33358.9	47911.4	44859.4
1968	56869	0.8	32.18	35700.1	34506.2	49474.7	46080
1969	54571	0.83	32.16	36533.1	35399.8	50262.1	47153.9
1970	55212	0.86	32.13	37809.9	36639.3	51679.2	48299.7
1971	54873	0.88	32.12	38965.5	37753.5	53119.4	49936.6
1972	53781	0.89	32.07	39808.8	38694.9	54303.4	51002.6
1973	52240	0.9	32.08	40274.6	38876.3	55716.5	52625.6
1974	57971	0.9	32.05	40543.7	39179.3	56858.3	53817.5
1975	61290	0.91	32.01	41075	39801.8	57178.2	54671.2
1976	62893	0.91	31.96	42217.8	41016.7	57879.1	55354.3
1977	62362	0.91	31.91	42802.5	41657.5	57757	55924.4
1978	61318	0.9	31.84	43064.8	41890.3	57299.8	55206.9
1979	61108	0.9	31.76	42712.8	41448.5	56628.7	54895.8
1980	60967	0.89	31.65	43076.4	41870.2	56392.5	54555.5
1981	61496	0.89	31.54	44639.5	43376.3	55987.4	53964
1982	64015	0.88	31.41	44956.8	43807.7	54905.5	53261.7
1983	64628	0.88	31.3	44881	43562	54877.7	52563.3
1984	62922	0.87	31.18	44979.4	43662.7	53641.5	51905.2
1985	60722	0.86	31.04	45683.1	44409.6	53340.9	51685.6
1986	58675	0.85	30.92	46261.3	44841.2	53924.1	51250.8
1987	54183	0.8	30.59	46531.9	45178	53258.3	50962
1988	54142	0.76	30.34	46913.2	45525.1	52964.5	50503.3
1989	51781	0.74	30.16	46801.1	45458.6	53003.8	50520
1990	47417	0.66	30	46910.5	45592.2	52610.5	49386.6

A2.3: The Netherlands

The Netherlands has register data available that directly links children to parents and tracks incomes over time, hence we are able to measure absolute mobility directly. However, while parent-child links are established since 1966, *population-wide* register data on income is only available since 2003. Therefore, for parental income we still rely on register data, but only among a random *sample* of the Dutch population, as described below. We compute the household incomes of children and their parents at age 30, adjust for inflation using the Dutch consumer price index with 2015 as baseline year, and calculate the fraction of children whose incomes exceed their parents'.

Data construction and representativeness.—The sample of children consists of individuals born between 1973 and 1984 (inclusive) of whom both parents were born in the Netherlands: 2,077,136 children in total ("GBAPERSOONTAB"). Children are then matched to their parents using personal identifiers ("KINDOUDERTAB"). We use the population-wide income register 2003-2017 to measure income of the children around age 30 ("INTEGRAAL PERSONEN/HUISHOUDENS INKOMEN"). To measure income of the parents around age 30, we use the sample income register ("IPO") which is available for 1981, 1985 and annually from 1989. Given the restriction that we require observations on both children's and parent's income, our final cohort sizes are as shown in Table A2.3.1.

TABLE A2.3.1. NUMBER OF OBSERVATIONS BY BIRTH COHORT, THE NETHERLANDS

Birth year	Observations
1973	2,899
1974	3,274
1975	3,769
1976	4,139
1977	4,453
1978	4,985
1979	5,241
1980	5,669
1981	5,970
1982	5,684
1983	5,782
1984	5,835

Notes: This table provides the number of observations for each birth cohort in the Netherlands data.

To assess the representativeness of our sample compared with the population of children born in the same birth year, we compare the mean taxable income of our sample to the mean taxable income of all children in the same cohorts (see Table A2.3.2). We distinguish between (i) children in our sample, (ii) those for whom we do not observe parental income (i.e., due to random sample of the parental income register), (iii) those for whom we do not observe the child's income (e.g., due to child death or emigration before age 30), and (iv) those for whom we have neither parental nor child's income around age 30.

TABLE A2.3.2. MEAN BIRTH YEAR AND MEDIAN TAXABLE INCOME BY STATUS (OBSERVED, NOT OBSERVED), 1973-1984 BIRTH COHORTS, THE NETHERLANDS

Category	Birth year	Taxable income in 2014
Analysis sample	1979.11	€ 25,540
Parental income not observed	1978.39	€ 25,719
Child income not observed	1979.50	€ 21,967
Neither parent nor child income observed	1977.89	€ 24,914

Notes: This table compares the mean birth year and median taxable income in our sample with those of other subsets of 1973-1984 birth cohorts in the Netherlands, to assess the representativeness of the linked sample.

From Table A2.3.2 it becomes clear that our analysis sample is very similar in terms of birth year and taxable income to the children for whom parental income is not observed. In fact, the reported difference is not statistically significant. Hence, while we lose a significant proportion of children in the relevant cohorts due to the sample nature of our data on parental income, the fact that the characteristics of our observed children are very similar to the population of children from the same cohorts is reassuring. It seems safe to say, therefore, that we observe a fairly representative sample of the population of children born between 1973 and 1984. Note that the average taxable income for those where child income is not observed around age 30 is substantially lower. This is partly due to the fact that for most of these individuals income is not observable, and that income is observed only for a selected subset of individuals (e.g. those who emigrated and returned to the Netherlands by 2014). As the group of individuals for which child income is not observed only makes up 0.5 percent of the entire 1973-1984 birth cohort, excluding these individuals from the estimation sample is not likely to be problematic.

Income source and measurement.—We use "gross income", measured as the sum of labor income, social employee insurances (UI, DI), and social benefits (old age benefits, survivor benefits and welfare), minus the income insurance premiums, as our income measure. Gross income only measures personal income, and therefore does not include income items that cannot easily be assigned to one individual in a couple, like capital income and child allowances. We sum the two gross personal incomes for a couple to derive a measure of the couple's gross income. Net (pos-tax) income is available in the data, yet major changes in the computation of net income in 2001 and 2011 render the absolute values of net income incomparable across children and parents. We therefore report estimates for gross income only. While gross income measures for parent income and child income are both register-based, the exact source differs.

Parent income: Parent income is obtained from the IPO ("InkomensPanelOnderzoek") in 1981, 1985 and 1989-1999 annually. The IPO 1981 was a 3.3% sample of all Dutch addresses and samples all household members (~170,000 households). IPO 1985 includes all 1981-sampled households that were still living on the same address in 1985; but additionally samples a large refreshment sample (~180,000 households). Starting from 1989, a core sample of ~75,000 households was selected from the 1985 sample, and is longitudinally followed-up annually since then.

Parent income is paternal income at age 30 (or closest age in interval 25-35) plus their partner's income in the same year.[3] We convert Dutch guilders into Euros by using an exchange rate of 2.20371. A partner refers to either the married or registered spouse, or a cohabiting partner. In case the father is not present, we take maternal income at age 30 (or closest age in interval 25-35). In about 4.5% of the cases one of the individuals in the household was not the biological parent of the child, but our results are robust to excluding these observations (see Table A2.3.11 below). We measure parent age using the head of household (father if available, mother if not) in a similar fashion as done for the analyses for Sweden and Finland.

Children's income: Children's income is obtained from population-wide income registers ("IPI/IPATAB" and "IHI/IHATAB") from 2003 to 2017. We select the child's income both at age 30 (or closest age in interval 25-35), and at age X around 30, where X is age at which parental income was defined.

Descriptive statistics.— Table A2.3.3 provides descriptive statistics of the exact age at which income is measured. When using income at age 30, in practice we use income measured at age 30, or the closest age in the range 25-35. This could lead to slight differences in the average age at which we measure income for parents and children. Indeed, columns 2 and 3 of Table A2.3.3 ("Age non-matched") suggest that the mean age of parents at which income is measured is slightly higher than that of their children, especially in the older birth cohorts. This is because income

[3] For children, we use the variable "persink" in the population-wide income register. For parents, this "persink" is not available directly in the sample income register IPO, and instead we sum the variables *ybln, ydin, ywuo, yfrl, ywvu, ywac, yzwu, yaou, yplu, yaow, yaw, yabi, yasu* and *yale*, and substract *pwvg, pipb,* and *pwvw* in IPO 1981, 1985 and from 1989 onwards. We checked the accuracy of our approximation of the "persink" variable in the year 2000, the only year in which all income measures are available, and the correlation is >0.98. Results are available upon request.

for parents was only available for the years 1981, 1985 and from 1989 annually, when these parents were already relatively old.

TABLE A2.3.3. COMPARISON OF AGES AT WHICH INCOME IS MEASURED BY BIRTH COHORT, PARENTS AND CHILDREN, THE NETHERLANDS

Birth cohort	Age non-matched		Age matched
	Age at which income measured, parent	Age at which income measured, child	Age at which income measured (parent and child)
1973	32.89	30.15	33.30
1974	32.71	30.10	33.00
1975	32.43	30.05	32.63
1976	32.09	30.03	32.25
1977	31.82	30.01	31.91
1978	31.44	29.99	31.52
1979	31.12	30.00	31.21
1980	30.81	30.02	30.90
1981	30.51	30.06	30.61
1982	30.27	30.07	30.38
1983	30.04	30.03	29.89
1984	29.88	30.00	29.45

Notes: Parent's age is defined as father's age if the father is present and mother's age if the father is not present.

The distribution of parental age at which income is measured shifts to the left for later cohorts. For this reason, our preferred results are those in which we do not specifically focus on age 30, but rather use the income of the child at the same age for which we observe parental income (see column 4 ("Age matched") of Table 1.4.3. for the average age per cohort).

Table A2.3.4 shows that median gross income among parents is pretty stable over the child's birth cohorts, and around €22,000 lower than the gross incomes of their children in real terms. The number of adults in the family around age 30 is slightly higher for parents than for their children, which likely reflects the tendency for more recent cohorts to partner at a later age.

TABLE A2.3.4. MEDIAN GROSS INCOME AND AVERAGE NUMBER OF ADULTS PER FAMILY BY BIRTH COHORT, PARENTS AND CHILDREN, THE NETHERLANDS

Birth cohort	Gross income around age 30 (median), parent	Number of adults in family around age 30, parents	Gross income around age 30 (median), child	Number of adults in family around age 30, child
1973	€ 38,506	1.91	€ 60,834	1.78
1974	€ 37,609	1.90	€ 61,259	1.78
1975	€ 37,127	1.90	€ 59,908	1.75
1976	€ 36,735	1.92	€ 60,464	1.74
1977	€ 36,434	1.91	€ 60,681	1.74
1978	€ 36,342	1.92	€ 59,918	1.73
1979	€ 35,905	1.93	€ 59,514	1.73
1980	€ 35,530	1.93	€ 58,852	1.72
1981	€ 36,521	1.94	€ 56,680	1.71
1982	€ 36,278	1.93	€ 56,081	1.70
1983	€ 35,990	1.92	€ 53,327	1.69
1984	€ 35,532	1.92	€ 52,063	1.67

Notes: Parent's age refers to father's age when the father is present and mother's age when the father is not present.

Finally, Table A2.3.5 provides the mean and median age at which parents had children over the birth cohorts for children. The mean age increased monotonically over birth cohorts from around 24 to close to 30 over 12 birth cohorts in our sample. Again, this is related to the availability of parental income data, which is limited to certain years.

TABLE A2.3.5. MEAN AND MEDIAN AGE AT WHICH PARENTS HAD CHILDREN, THE NETHERLANDS

Birth cohort	Mean age at childbirth	Median age at childbirth
1973	23.98	24
1974	24.67	25
1975	25.25	26
1976	25.85	26
1977	26.36	27
1978	26.84	27
1979	27.31	27
1980	27.81	28
1981	28.25	28
1982	28.62	29
1983	29.18	29
1984	29.63	30

Notes: Parent age refers to father's age when the father is present and mother's age when the father is not present.

Main results.—Table A2.3.6 presents our main results regarding absolute income mobility at age 30 in the Netherlands for the cohorts 1973-1984. The absolute family income mobility refers to the percentage of children whose family income exceeds their parent's family income in each cohort. In the second column we present the age matched results, and in the third column we present the age non-matched (i.e., child age closest to age 30) results.

TABLE A2.3.6. ABSOLUTE INCOME MOBILITY BY BIRTH COHORT FOR GROSS INCOME AT AGE 30 IN THE AGE MATCHED AND AGE NON-MATCHED SAMPLES, THE NETHERLANDS

Birth year	Absolute income mobility Age matched	Absolute income mobility Age non-matched
1973	0.7787	0.7089
1974	0.7911	0.7061
1975	0.7810	0.6949
1976	0.7858	0.7202
1977	0.7846	0.7377
1978	0.7808	0.7492
1979	0.7774	0.7516
1980	0.7772	0.7546
1981	0.7309	0.7173
1982	0.7284	0.7048
1983	0.7063	0.6838
1984	0.6833	0.6740

Notes: Figure 1 in the main text presents these results for the age matched sample.

Absolute income mobility was relatively high and stable for the cohorts 1973-1980, in the range of 0.78. This implies that for these cohorts about 78% of children earned more than their parents at age 30. The age non-matched results show a fairly similar pattern but are somewhat smaller than the age non-matched results. After 1980, we observe a sharp drop in absolute income mobility of almost 10 percentage points, to an absolute income mobility of 0.68 in 1984. This sharp drop is likely to be caused by the impact of the financial crisis 2008-2010, the effects of which were beginning to be felt around 2010, which is exactly when the 1980 cohort turned 30 years old. Still, even for the cohort 1984 – who turned 30 in 2014, the peak year of the unemployment rate – the absolute income mobility rate still is around 0.68.

Table A2.3.7 presents the same results, but now at age 40. Given the later age, here we observe cohorts only until 1979, but not later cohorts. The absolute income mobility rate is slightly lower than at age 30, but again relatively high and stable. The cohorts after 1980 did not yet turn 40, such that we cannot observe whether the drop in absolute income mobility at age 30 for cohorts after 1980 persisted at age 40.

TABLE A2.3.7. ABSOLUTE INCOME MOBILITY BY BIRTH COHORT FOR GROSS INCOME AT AGE 40 IN THE AGE MATCHED AND AGE NON -MATCHED SAMPLES, THE NETHERLANDS

Birth year	Absolute income mobility Age-matched	Absolute income mobility Age non-matched
1963	0.7463	0.6980
1964	0.7342	0.6931
1965	0.7435	0.6779
1966	0.7443	0.7191
1967	0.7431	0.7275
1968	0.7442	0.7464
1969	0.7484	0.7486
1970	0.7562	0.7551
1971	0.7498	0.7479
1972	0.7519	0.7503
1973	0.7340	0.7302
1974	0.7417	0.7345
1975	0.7277	0.7163
1976	0.7461	0.7294
1977	0.7329	0.7313
1978	0.7587	0.7366
1979	0.7571	0.7239

Notes: Figure A2.2 presents results for the age matched sample.

Robustness and Heterogeneity.—In addition to our primary specification, we conduct several analyses of robustness and heterogeneity. Here we report results for the age matched and age non-matched samples. For certain analyses we reproduce the age matched results presented here alongside results for other countries in Appendix 2.

Standardization: Table A2.3.8 presents our first robustness check, dividing family income by the number of adults present in the household. Since the average number of adults is slightly smaller in the children sample compared with the parents sample, the absolute income mobility rate increases in both the age non-matched and the age-matched sample. The main patterns (relatively high and stable income mobility for cohorts 1973-1980 and a drop afterwards) however hold up when adjusting for differences in household size between parents and children.

TABLE A2.3.8. ABSOLUTE INCOME MOBILITY BY BIRTH COHORT FOR STANDARDIZED GROSS INCOME AT AGE 30 IN THE AGE MATCHED AND AGE NON-MATCHED SAMPLES, THE NETHERLANDS

Birth year	Absolute income mobility Age matched	Absolute income mobility Age non-matched
1973	0.8409	0.7896
1974	0.8541	0.8085
1975	0.8554	0.7968
1976	0.8632	0.8258
1977	0.8695	0.8363
1978	0.8727	0.8518
1979	0.8736	0.8558
1980	0.8741	0.8610
1981	0.8415	0.8412
1982	0.8302	0.8207
1983	0.8107	0.8023
1984	0.8032	0.7940

Notes: Figure A2.3 presents results for the age matched sample.

Median income ratio: An alternative measure for income mobility is the median of the income ratio, where the income ratio is defined as $\frac{y_{i,c}^{child}(a)}{y_{i,c}^{parent}(a)}$, for individual i in cohort c at age a. Table A2.3.9 presents the results in the age non-matched and age-matched samples. The median ratio over these cohorts is around 1.3-1.6, implying that the median child earns 1.3-1.6 times as much as their parents at age 30. Again, a similar pattern shows up over cohorts with slightly increasing but relatively mobility for the cohorts up to 1980, and decreasing median ratio's after 1980.

TABLE A2.3.9. MEDIAN INCOME RATIO BY BIRTH COHORT FOR GROSS INCOME AT AGE 30 IN THE AGE MATCHED AND AGE NON -MATCHED SAMPLES, THE NETHERLANDS

Birth year	Median income ratio Age matched	Median income ratio Age non-matched
1973	1.5379	1.3610
1974	1.5749	1.3430
1975	1.5900	1.3362
1976	1.6044	1.3920
1977	1.6190	1.4746
1978	1.6194	1.5178
1979	1.6108	1.5538
1980	1.6051	1.5667
1981	1.4893	1.4503
1982	1.4646	1.4127
1983	1.3950	1.3520
1984	1.3633	1.3335

Notes: The median income ratio is computed as the median of the ratio of child to parent income for all parent-child pairs.

Father-son mobility: Yet an alternative way of looking at income mobility is by focusing on fathers and sons only, and studying personal gross income rather than family income (Table A2.3.10). The overall mobility rate among fathers and sons is lower compared with studying household income. It is not immediately clear why this rate is lower, but one possible explanation could be the strong increase in female labor force participation after 1980 (Olivetti and Petrongolo 2017; Tijdens 2006), which made the traditional “male as breadwinner” family less common and clearly has influenced the high family income mobility rate in Tables A2.3.6-A2.3.9. Still, also here we observe a relatively stable income mobility rate up until around cohort 1980 and a drop afterwards.

TABLE A2.3.10. ABSOLUTE INCOME MOBILITY AT AGE 30 FOR FATHERS AND SONS ONLY IN THE AGE MATCHED AND AGE NON -MATCHED SAMPLES, THE NETHERLANDS

Birth year	Absolute income mobility Age matched	Absolute income mobility Age non-matched
1973	0.6369	0.4931
1974	0.6189	0.4596
1975	0.6435	0.4854
1976	0.6293	0.5062
1977	0.6369	0.5451
1978	0.6256	0.5782
1979	0.6019	0.5836
1980	0.6221	0.5859
1981	0.6009	0.5898
1982	0.5897	0.5753
1983	0.5756	0.5651
1984	0.5739	0.5782

Notes: Figure A2.3 presents results for the age matched sample.

Excluding irregular observations: As a final sense of robustness, we exclude observations (i) for whom one of the parents is not the biological parent (i.e., about 4.5% of the sample); and (ii) for whom gross income is above €200,000 at age 30 (i.e., less than 1% of the sample). Table A2.3.11 presents the results, and shows that both of these sensitivity tests do not alter any of our results or conclusions.

TABLE A2.3.11. ABSOLUTE INCOME MOBILITY AT AGE 30, EXCLUDING NON-BIOLOGICAL CHILDREN (COLUMNS 2-3) AND TOP INCOMES ABOVE € 200,000 (COLUMNS 4-5), THE NETHERLANDS

Birth cohort	Excluding non-biological children		Excluding top incomes	
	Absolute income mobility Age matched	Absolute income mobility Age non-matched	Absolute income mobility Age matched	Absolute income mobility Age non-matched
1973	0.7864	0.7177	0.7769	0.7081
1974	0.7987	0.7130	0.7883	0.7029
1975	0.7856	0.7001	0.7803	0.6942
1976	0.7913	0.7255	0.7837	0.7175
1977	0.7900	0.7406	0.7829	0.7369
1978	0.7850	0.7526	0.7796	0.7477
1979	0.7804	0.7556	0.7768	0.7506
1980	0.7815	0.7582	0.7768	0.7541
1981	0.7351	0.7209	0.7302	0.7164
1982	0.7335	0.7103	0.7276	0.7032
1983	0.7113	0.6873	0.7037	0.6813
1984	0.6895	0.6783	0.6810	0.6716

Notes: Robustness analysis.

Heterogeneity by sex and partner status: Table A2.3.12 presents the absolute income mobility rates by gender of the child separately. The income mobility rate (based on household income) for daughters and sons is fairly comparable.

TABLE A2.3.12. ABSOLUTE INCOME MOBILITY AT AGE 30 BY GENDER, THE NETHERLANDS

Birth cohort	Men		Women	
	Absolute income mobility Age matched	Absolute income mobility Age non-matched	Absolute income mobility Age matched	Absolute income mobility Age non-matched
1973	0.7809	0.7072	0.7765	0.7103
1974	0.7782	0.6810	0.8039	0.7323
1975	0.7948	0.6915	0.7672	0.6982
1976	0.7867	0.7085	0.7849	0.7320
1977	0.7791	0.7348	0.7897	0.7405
1978	0.7852	0.7436	0.7766	0.7549
1979	0.7663	0.7432	0.7883	0.7602
1980	0.7759	0.7493	0.7782	0.7599
1981	0.7254	0.6968	0.7361	0.7384
1982	0.7122	0.6869	0.7433	0.7228
1983	0.6852	0.6636	0.7260	0.7043
1984	0.6628	0.6578	0.7026	0.6902

Notes: Absolute income mobility is measured using household income, but analyzed separately by gender.

In Table A2.3.13 we present the results stratified by single children and children with a partner. As expected, the income mobility rates are much larger among children living in a couple compared with children who are single. Note that early-cohort singles may be different from later-cohort singles; whereas the latter are much younger and still about to find a partner, the former may have explicitly chosen to remain single (e.g., as they prefer to focus on pursuing a career and making a lot of money, etc.).

TABLE A2.3.13. ABSOLUTE INCOME MOBILITY AT AGE 30 BY CHILD PARTNER STATUS, THE NETHERLANDS

Birth cohort	Single children		Children with a partner	
	Absolute income mobility Age matched	Absolute income mobility Age non-matched	Absolute income mobility Age matched	Absolute income mobility Age non-matched
1973	0.5707	0.3815	0.8508	0.8295
1974	0.5968	0.3488	0.8600	0.8422
1975	0.5775	0.3506	0.8597	0.8363
1976	0.5754	0.3897	0.8712	0.8656
1977	0.5485	0.4010	0.8748	0.8740
1978	0.5408	0.4170	0.8757	0.8923
1979	0.5137	0.4071	0.8765	0.8971
1980	0.5006	0.4346	0.8850	0.8932
1981	0.4504	0.3843	0.8616	0.8890
1982	0.4639	0.3901	0.8463	0.8607
1983	0.4666	0.3593	0.8138	0.8483
1984	0.4208	0.3569	0.8084	0.8455

Notes: Household income is the income of the child alone for single children and the child plus partner for children with a partner.

A2.4: Norway

Data sources

The data source is full population data from Statistics Norway. Children may be matched to parents using personal identifiers. Incomes are based on "pensionable income": pre-tax wages and taxable social insurance transfers (such as unemployment and sickness benefits). This data series is available from 1967, when the National Insurance Act was adopted.

The income data is individual-based, and family incomes were computed as follows. Child family income at age a is the sum of own income and spouse income in the current year, where the spouse is identified by an id based on address (including but not limited to married couples). This link is only available from 1987. Parent family income at age a is calculated as the sum of father income at age a and mother income in the same calendar year. Fathers and mothers are identified by links to the child identifier. Incomes were deflated to constant 2015 kroner using Statistics Norway's Consumer Price Index. The GDP deflator used in the check of sensitivity to the deflator was computed from Statistics Norway's National Accounts data (table 09189 in the StatBank)

Absolute mobility for child cohort c is computed as $\frac{1}{N_c}\sum_{i=1}^{N_c} 1\{y_{i,c}^{child}(a) \geq y_{i,c}^{parent}(a)\}$, where N_c is cohort size and $y(a)$ is income at age a as defined above. In the main analysis $a = 30$. For sensitivity analyses, rates at several other choices of age were calculated.

Sample selection

The available income data span 1967 – 2018. For the main analysis of absolute mobility at age 30, cohorts born 1964 – 1988 are used. Because income is only available from 1967, for the 1964 birth cohort only fathers who were 27 or younger at childbirth (i.e., 30 in 1967 or later) will be included in the sample of parent-child incomes. Choosing 1964 as the starting year was a trade-off between sample selection and series length. The sample includes second generation immigrants (born in Norway with parents born abroad) but not first-generation immigrants (born abroad with parents born abroad). For analyses at older ages, the sample was extended so that fathers of the oldest child cohort were always at most 27 at childbirth. E.g., in the analysis of mobility at age 50, the oldest child cohort was born in 1944. Fathers who were 50 in 1967 were therefore 27 at childbirth.

Figure A2.4.1 plots match rates for a = 30 and shows that only a very small fraction of non-matches is due to missing id link, and the fraction with missing father income at age 30 decreases significantly from the 1964 to the 1988 cohort. The main reason is that fathers older than 30 in 1967 have no income observations. Figure A2.4.2 shows boxplots of fathers' ages at childbirth by cohort for the main sample, and Table A2.4.1 shows means and medians.

Descriptive statistics

Table A2.4.2 shows mans and medians of family incomes at age 30, as defined above. For all cohorts, incomes of the child generation is above their parents at the same age.

Table A2.4.3 reports Gini coefficients, rank-rank slopes, and intergenerational elasticities by child cohort. The Ginis are consistently higher in the child generation. The R-R slopes and IGEs are consistently low but increasing somewhat from the late seventies: It is well known that IGEs based on single years are biased downwards as measures of intergenerational mobility, and the estimates here are below what is typically reported for Norway.

Table A2.4.4 shows couple rates for children and parents by child cohort. As explained above, for the child generation couples are identified using a spouse link which also includes cohabitants. The parent matches are based on links to the child. For parents, the fractions with two incomes are computed as well. Only a very low fraction of children could not be matched to parents at all. For the oldest cohort, only 9.3% of parents could be identified with two positive incomes. This fraction increases by cohort as the average age of father at childbirth increases, c.f. Figures A2.4.1 and A2.4.2, and participation among mothers increases.

Table A2.4.5 shows out of labor force (OLF) rates and education rates at 30 for parents. As pensionable income includes unemployment benefits but not permanent disability benefits, absence of an income record in a year is a good proxy for non-participation. Ongoing education is recorded in the national education register and updated on a yearly basis but is not available until 1975. Therefore, the actual fraction of parents in education is underestimated in the oldest child cohorts. Table A2.4.6 reports the according rates for children.

Table A2.4.7 shows individual participation rates at 30 by year. Men's participation rates are quite comparable across generations. These rates differ from those in the previous table because each child cohort averages parents from several birth cohorts.

Sensitivity to the age restriction

Income is only available from 1967, and in the main analysis we estimate mobility rates for cohorts born 1964 or later. Thus, for the oldest child cohort income at age 30 is only available for parents 27 or younger at childbirth. This implicit age restriction on fathers may bias the estimated absolute mobility estimates. If older fathers, who are not in the data, had benefited less from income growth at age 30 than those that are included, absolute mobility could be over-estimated. To get an impression of a potential bias, we estimated absolute mobility at 30 for a sub-sample with only fathers aged 27 or less at childbirth. Figure A2.4.3 compares rates for this restricted sample to the main estimates reported in the paper. The graph suggests that estimated absolute mobility may be somewhat biased downwards for the oldest child cohorts.

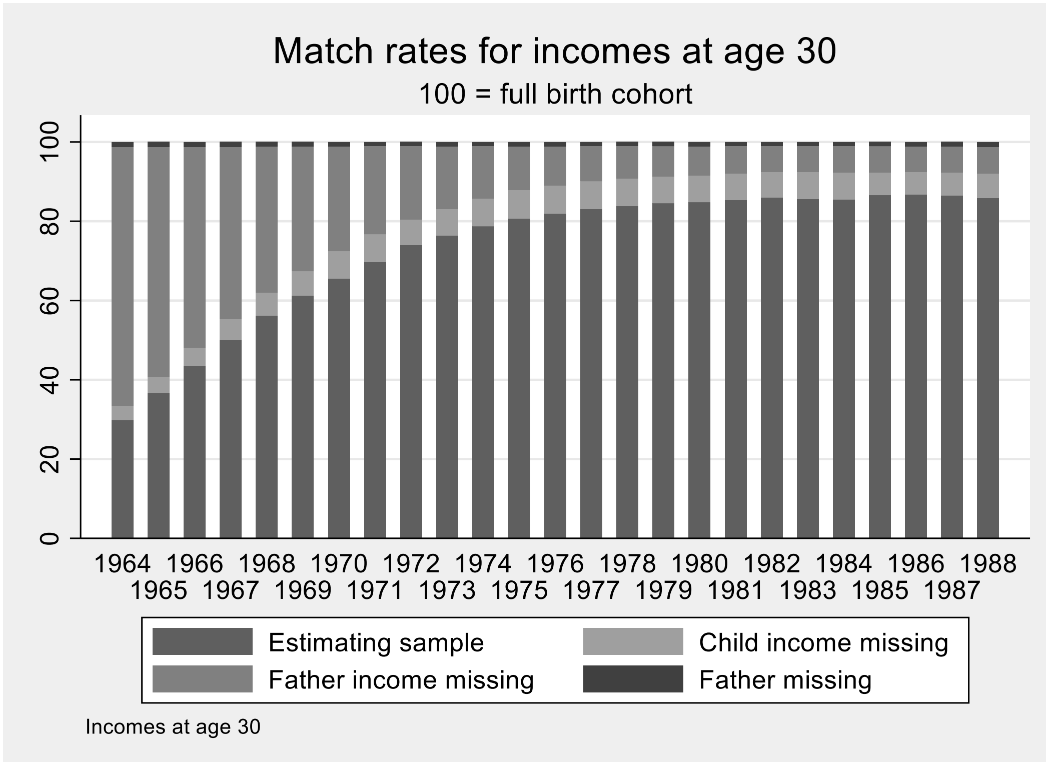
Match rates for incomes at age 30
100 = full birth cohort
0
20
40
60
80
100
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
Estimating sample
Child income missing
Father income missing
Father missing
Incomes at age 30

Figure A2.4.1

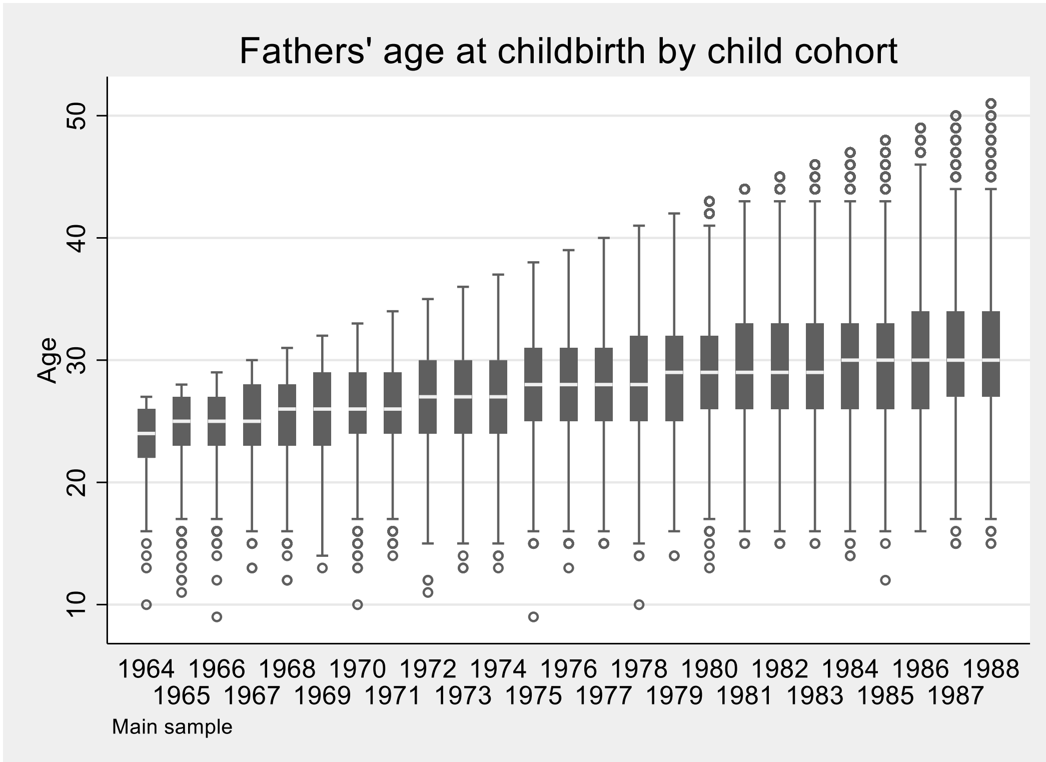
Fathers' age at childbirth by child cohort
Age
10
20
30
40
50
1964 1966 1968 1970 1972 1974 1976 1978 1980 1982 1984 1986 1988
1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987
Main sample

Figure A2.4.2

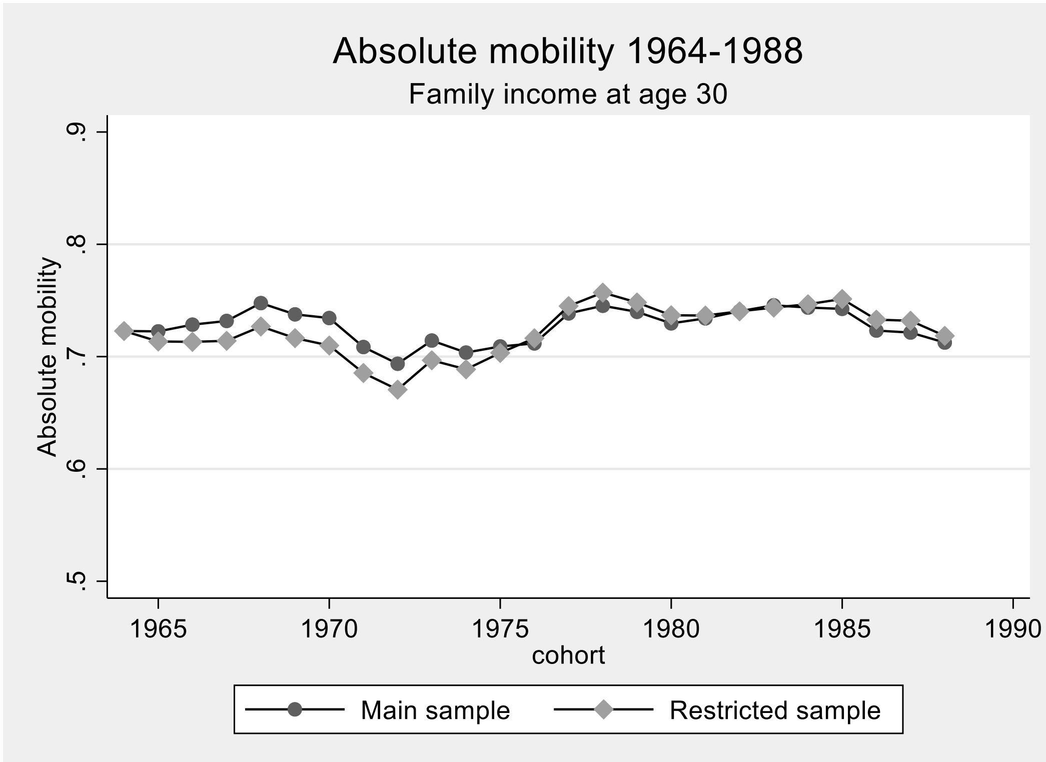
Absolute mobility 1964-1988
Family income at age 30
Absolute mobility
.5
.6
.7
.8
.9
1965
1970
1975
1980
1985
1990
cohort
Main sample
Restricted sample

Figure A2.4.3

Table A2.4.1 Father's age at childbirth

Child cohort	N	Mean	Median
1964	18,998	24.1	24
1965	23,633	24.5	25
1966	28,393	24.9	25
1967	32,650	25.3	25
1968	37,341	25.7	26
1969	41,065	26.0	26
1970	42,053	26.4	26
1971	45,426	26.7	26
1972	47,408	27.0	27
1973	46,791	27.3	27
1974	47,017	27.5	27
1975	45,472	27.8	28
1976	43,896	28.1	28
1977	42,436	28.4	28
1978	43,492	28.8	28
1979	43,722	29.0	29
1980	43,592	29.2	29
1981	43,648	29.4	29
1982	44,289	29.6	29
1983	43,055	29.9	29
1984	43,283	30.0	30
1985	44,527	30.1	30
1986	45,903	30.3	30
1987	47,093	30.4	30
1988	49,906	30.5	30

Table A2.4.2 Family income at 30 (2015 NOK)

	Parents		Children	
Child cohort	Mean	Median	Mean	Median
1964	301858	288002	445911	434247
1965	309079	294767	449443	438484
1966	314942	300000	463436	452933
1967	323371	307080	487533	468526
1968	332286	315329	507015	496084
1969	341618	324088	517778	503825
1970	350661	332759	524711	509536
1971	358144	340411	519355	491120
1972	366455	348263	524952	487548
1973	371864	354167	549207	528501
1974	376359	358904	545306	517440
1975	383427	365896	568591	545711
1976	387644	369424	580392	557793
1977	394095	376913	625096	599376
1978	398693	380977	643877	623465
1979	403520	388034	647985	622186
1980	409003	393380	648251	626897
1981	414248	398945	666955	646742
1982	418813	405076	684954	661984
1983	425952	413223	697670	675256
1984	431008	418783	705406	686155
1985	435425	424696	705961	679826
1986	443748	432310	691623	664969
1987	449542	439945	691555	662855
1988	460349	452342	694997	668775

Table A2.4.3 Gini coefficients, rank-rank slopes and intergenerational earnings elasticities at 30

Child cohort	Gini parents	Gini_childre	R-R slope	IGE
1964	0.20	0.29	0.10	0.12
1965	0.21	0.29	0.09	0.12
1966	0.21	0.29	0.10	0.13
1967	0.21	0.29	0.10	0.12
1968	0.21	0.28	0.10	0.12
1969	0.22	0.29	0.11	0.14
1970	0.21	0.29	0.10	0.12
1971	0.21	0.30	0.10	0.11
1972	0.21	0.31	0.08	0.11
1973	0.21	0.29	0.08	0.12
1974	0.21	0.30	0.08	0.10
1975	0.21	0.30	0.07	0.10
1976	0.21	0.30	0.07	0.10
1977	0.21	0.30	0.08	0.10
1978	0.21	0.30	0.09	0.12
1979	0.21	0.30	0.08	0.12
1980	0.21	0.30	0.08	0.11
1981	0.22	0.30	0.09	0.12
1982	0.22	0.30	0.08	0.11
1983	0.22	0.30	0.10	0.12
1984	0.22	0.30	0.10	0.13
1985	0.22	0.30	0.11	0.12
1986	0.22	0.30	0.10	0.11
1987	0.22	0.29	0.11	0.12
1988	0.22	0.29	0.11	0.11

Notes: Family incomes at 30. R-R slope = slope of regression of child income rank on parent income rank.

IGE: slope of regression of log child income on log parent income

Table A2.4.4 Couple rates at 30

	Children	Parents		
Child cohort	Couple rate	Not matched	2 parents	2 parents with positive income
1964	58.8 %	1.3 %	89.4 %	9.3 %
1965	58.1 %	1.3 %	86.5 %	12.1 %
1966	58.0 %	1.3 %	83.3 %	15.4 %
1967	58.1 %	1.3 %	79.2 %	19.5 %
1968	58.0 %	1.2 %	74.3 %	24.5 %
1969	57.5 %	1.2 %	69.7 %	29.2 %
1970	57.1 %	1.1 %	64.8 %	34.1 %
1971	50.4 %	1.0 %	60.7 %	38.3 %
1972	46.2 %	1.1 %	56.3 %	42.6 %
1973	53.4 %	1.2 %	52.6 %	46.3 %
1974	50.3 %	1.0 %	49.4 %	49.6 %
1975	53.3 %	1.1 %	45.7 %	53.2 %
1976	52.2 %	1.1 %	43.1 %	55.8 %
1977	52.1 %	1.0 %	40.9 %	58.0 %
1978	51.9 %	1.1 %	38.7 %	60.3 %
1979	51.7 %	1.1 %	37.2 %	61.8 %
1980	51.9 %	1.1 %	35.1 %	63.8 %
1981	52.5 %	1.0 %	33.4 %	65.6 %
1982	52.8 %	1.0 %	31.8 %	67.1 %
1983	52.9 %	1.0 %	30.7 %	68.3 %
1984	56.2 %	1.0 %	29.7 %	69.3 %
1985	56.1 %	1.1 %	28.5 %	70.4 %
1986	55.9 %	1.1 %	27.0 %	71.9 %
1987	55.6 %	1.2 %	26.2 %	72.6 %
1988	55.2 %	1.3 %	25.3 %	73.5 %

Note: Children couples = matched to cohabitant Parent couples = Child matched to father and mother

Table A2.4.5 Out of labor force (OLF) and in education at 30, parents

	Fathers			Mothers		
Child cohort	OLF	In education	OLF and in education	OLF	In education	OLF and in education
1964	48.3 %	0.1 %	0.0 %	84.9 %	0.1 %	0.0 %
1965	39.8 %	0.2 %	0.0 %	81.2 %	0.1 %	0.1 %
1966	31.6 %	0.4 %	0.1 %	77.1 %	0.3 %	0.2 %
1967	25.2 %	0.6 %	0.1 %	72.4 %	0.4 %	0.3 %
1968	19.8 %	0.8 %	0.1 %	66.9 %	0.5 %	0.4 %
1969	16.2 %	1.0 %	0.1 %	62.2 %	0.7 %	0.4 %
1970	12.9 %	1.2 %	0.1 %	57.4 %	0.8 %	0.5 %
1971	10.8 %	1.4 %	0.1 %	53.7 %	1.0 %	0.5 %
1972	9.0 %	1.6 %	0.2 %	50.0 %	1.2 %	0.6 %
1973	8.0 %	1.9 %	0.2 %	46.6 %	1.5 %	0.7 %
1974	7.0 %	2.1 %	0.2 %	44.2 %	1.6 %	0.7 %
1975	6.4 %	2.4 %	0.2 %	41.1 %	1.8 %	0.7 %
1976	6.1 %	2.5 %	0.2 %	39.0 %	2.1 %	0.8 %
1977	5.9 %	3.0 %	0.2 %	37.0 %	2.3 %	0.8 %
1978	5.8 %	3.1 %	0.3 %	35.1 %	2.8 %	0.9 %
1979	5.7 %	3.4 %	0.3 %	33.7 %	3.2 %	1.1 %
1980	5.9 %	3.5 %	0.3 %	31.7 %	3.7 %	1.1 %
1981	5.9 %	3.6 %	0.3 %	30.1 %	4.4 %	1.3 %
1982	5.7 %	4.1 %	0.4 %	28.7 %	4.9 %	1.5 %
1983	5.9 %	4.1 %	0.4 %	27.5 %	5.1 %	1.5 %
1984	6.2 %	4.4 %	0.5 %	26.4 %	6.2 %	1.7 %
1985	6.2 %	4.7 %	0.5 %	25.2 %	6.7 %	1.9 %
1986	6.1 %	5.1 %	0.5 %	23.7 %	7.5 %	2.0 %
1987	6.3 %	5.1 %	0.5 %	22.9 %	7.7 %	2.0 %
1988	6.6 %	5.3 %	0.5 %	21.9 %	8.6 %	2.3 %

Table A2.4.6 Out of labor force (OLF) and in education at 30, children

	OLF			In education			OLF and in education		
Child cohort	Overall	M	F	Overall	M	F	Overall	M	F
1964	10.7 %	7.6 %	13.9 %	8.0 %	7.4 %	8.6 %	1.2 %	0.9 %	1.6 %
1965	10.1 %	7.1 %	13.2 %	8.1 %	7.8 %	8.5 %	1.2 %	0.8 %	1.5 %
1966	9.8 %	7.0 %	12.8 %	8.5 %	7.8 %	9.2 %	1.2 %	0.9 %	1.6 %
1967	9.7 %	6.9 %	12.6 %	8.3 %	7.9 %	8.8 %	1.2 %	0.7 %	1.6 %
1968	9.5 %	7.0 %	12.1 %	8.4 %	7.7 %	9.1 %	1.2 %	0.7 %	1.6 %
1969	9.4 %	7.0 %	11.9 %	8.7 %	7.4 %	9.9 %	1.1 %	0.6 %	1.7 %
1970	9.7 %	7.6 %	11.9 %	9.3 %	7.7 %	11.0 %	1.1 %	0.7 %	1.6 %
1971	9.4 %	7.7 %	11.1 %	9.6 %	8.3 %	11.0 %	1.0 %	0.8 %	1.3 %
1972	8.3 %	7.0 %	9.7 %	10.2 %	8.6 %	11.9 %	0.8 %	0.5 %	1.1 %
1973	8.2 %	7.1 %	9.3 %	10.7 %	9.1 %	12.3 %	0.8 %	0.5 %	1.1 %
1974	8.5 %	7.7 %	9.4 %	10.1 %	8.8 %	11.5 %	0.8 %	0.6 %	1.0 %
1975	8.6 %	7.9 %	9.3 %	10.4 %	9.0 %	11.8 %	0.9 %	0.5 %	1.2 %
1976	8.4 %	8.0 %	8.8 %	10.3 %	9.0 %	11.6 %	0.8 %	0.6 %	1.0 %
1977	8.1 %	7.8 %	8.4 %	10.0 %	8.5 %	11.5 %	0.7 %	0.5 %	0.9 %
1978	7.9 %	7.6 %	8.2 %	9.8 %	8.7 %	11.0 %	0.7 %	0.5 %	0.9 %
1979	7.7 %	7.5 %	8.0 %	10.1 %	8.5 %	11.7 %	0.7 %	0.5 %	0.9 %
1980	7.8 %	7.5 %	8.0 %	10.2 %	8.9 %	11.6 %	0.7 %	0.6 %	0.9 %
1981	7.4 %	7.3 %	7.5 %	10.3 %	8.8 %	11.8 %	0.7 %	0.5 %	0.9 %
1982	7.3 %	7.3 %	7.3 %	10.6 %	9.2 %	12.1 %	0.7 %	0.5 %	0.8 %
1983	7.7 %	7.6 %	7.8 %	11.1 %	9.7 %	12.7 %	0.8 %	0.7 %	0.9 %
1984	7.7 %	8.0 %	7.5 %	11.2 %	9.9 %	12.5 %	0.8 %	0.7 %	0.8 %
1985	6.6 %	6.4 %	6.8 %	11.1 %	9.8 %	12.6 %	0.7 %	0.6 %	0.8 %
1986	6.5 %	6.6 %	6.4 %	11.5 %	9.9 %	13.1 %	0.8 %	0.8 %	0.8 %
1987	6.7 %	6.7 %	6.7 %	11.4 %	10.0 %	12.9 %	0.7 %	0.7 %	0.7 %
1988	7.1 %	7.2 %	7.1 %	11.4 %	10.1 %	12.8 %	0.8 %	0.7 %	0.8 %

Table A2.4.7 Participation rates at 30 by year

Year	Fathers	Mothers	Year	Sons	Daughters
1967	92.3 %	28.3 %	1994	92.4 %	86.1 %
1968	93.2 %	32.8 %	1995	92.9 %	86.8 %
1969	93.2 %	33.8 %	1996	93.0 %	87.2 %
1970	93.4 %	38.3 %	1997	93.1 %	87.4 %
1971	93.9 %	42.1 %	1998	93.0 %	87.9 %
1972	93.8 %	44.8 %	1999	93.0 %	88.1 %
1973	93.9 %	47.6 %	2000	92.4 %	88.1 %
1974	94.3 %	57.0 %	2001	92.3 %	88.9 %
1975	94.5 %	58.9 %	2002	93.0 %	90.3 %
1976	94.8 %	60.8 %	2003	92.9 %	90.7 %
1977	95.0 %	64.9 %	2004	92.3 %	90.6 %
1978	94.8 %	67.2 %	2005	92.1 %	90.7 %
1979	94.9 %	69.0 %	2006	92.0 %	91.2 %
1980	95.1 %	71.0 %	2007	92.2 %	91.6 %
1981	94.5 %	72.4 %	2008	92.4 %	91.8 %
1982	94.3 %	72.6 %	2009	92.5 %	92.0 %
1983	94.2 %	73.2 %	2010	92.5 %	92.0 %
1984	94.0 %	74.5 %	2011	92.7 %	92.5 %
1985	94.8 %	77.1 %	2012	92.7 %	92.7 %
1986	94.7 %	78.8 %	2013	92.4 %	92.2 %
1987	95.2 %	80.8 %	2014	92.0 %	92.5 %
1988	95.1 %	80.1 %	2015	93.6 %	93.2 %
1989	94.6 %	78.7 %	2016	93.4 %	93.6 %
1990	93.9 %	78.4 %	2017	93.3 %	93.3 %
1991	93.3 %	78.3 %	2018	92.8 %	92.9 %
1992	92.5 %	77.7 %			
1993	92.1 %	77.4 %			
1994	92.1 %	78.0 %			
1995	91.7 %	76.6 %			
1996	91.4 %	77.2 %			
1997	91.1 %	77.7 %			
1998	90.0 %	78.3 %			
1999	88.2 %	80.1 %			
2000	87.7 %	78.4 %			
2001	88.6 %	84.1 %			
2002	87.5 %	75.0 %			

Included parents are born after 1937

A2.5: Sweden

Our main sample is based on the full population of Swedish non-immigrants, born 1960-1984. We observe about 100,000 individuals per cohort, which is essentially the full population. We use household identifiers in the Swedish censuses from 1960, 1970, 1975, 1980, 1985, and 1990 to link the individuals of the main sample to their cohabiting parents. We define the child's parents in the year the head of the household (father if present, mother if not) was 30 years old or, if information from this year is missing, the census year in which the head of the household was *closest* to age 30. Families are identified based on cohabitation, where cohabitants/spouses are identified based on address and family status (i.e. not only marital status or biological link to the child). Thus, married as well as non-married parent couples are identified.

We then use register data from 1990-2014 to identify the households and potential spouses of the individuals in the main (child) sample. This measure is slightly different from the one above, being based on a family identifier that links those who are either married or have children together. Thus, in the child generation we will not identify unmarried partners without joint children as belonging to the same family and therefore potentially underestimate the family incomes of those households. Importantly, however, both these definitions are constant over cohorts within each generation. As shown in Figure A2.5.1, we still end up with a level difference in the share of couples (i.e. two-parent households; married or cohabiting) between the child and parental generations. This difference partly reflects a real trend in terms of a postponement of family formation and a decrease in marriage rates, but is also due to mechanical reasons.

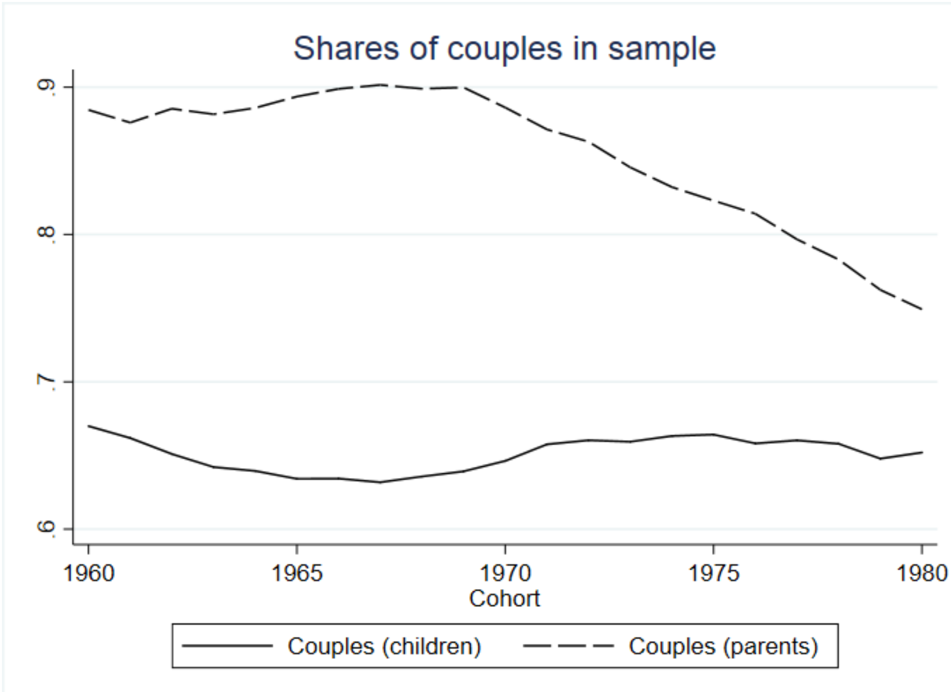

FIGURE A2.5.1. SHARE OF COUPLES IN GROSS INCOME SAMPLE BY CHILD BIRTH COHORT, PARENTS AND CHILDREN, SWEDEN

Notes: Parent couples are identified at age 30 (or closest observed age) based on address and family status. Child couples are identified at age 35 only if they are married or have a child together.

The first mechanical reason is that the parental household of the child can only be identified once the child is born, while the households of the child generation are almost always identified at age 30, irrespective of whether they will have a partner or own children in the future, and thus includes more singles. Second, as explained above, unmarried partners without children are identified as singles in the child generation. For this reason, we identify spouses in the child generation at age 35 rather than age 30. As shown in Figure A2.5.2, by age 35 most people in the child generation have married and formed families. This choice decreases the mechanical differences in two-earner households between the two generations.

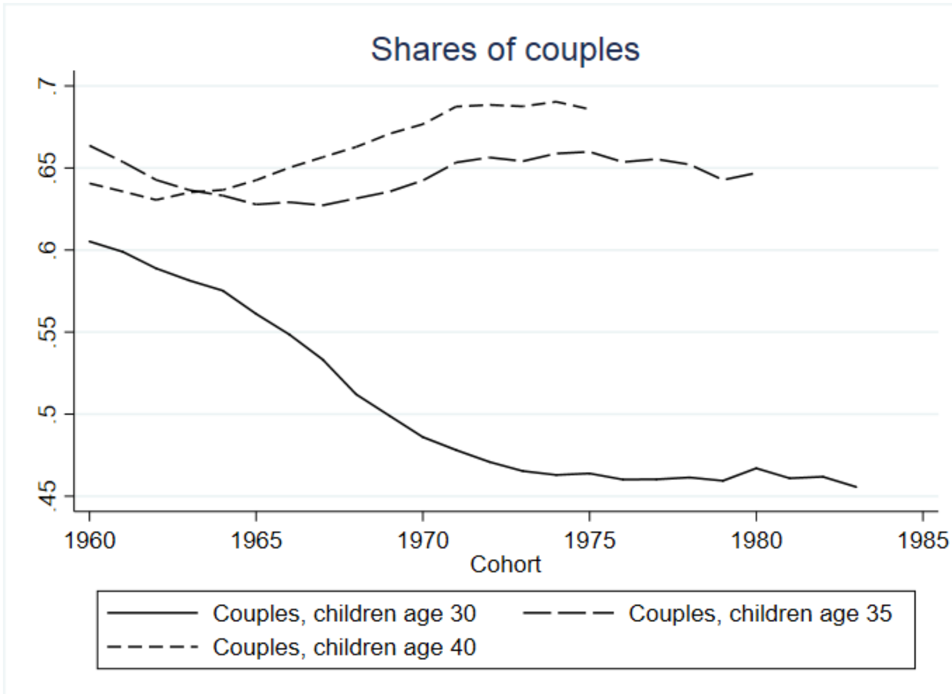

FIGURE A2.5.2. SHARE OF COUPLES IN CHILD GROSS INCOME SAMPLE IDENTIFIED AT CHILD AGES 30, 35, AND 40, SWEDEN

Notes: Children are identified as members of a couple if they are married or have a child together. Because many Swedish children in recent birth cohorts have formed families between the ages of 30 and 35, the couple match rate is much higher when identified at age 35 than at age 30. In our main analysis we identify child couples at age 35, then sum the age 30 incomes of both members to calculate child family income.

We use two income measures. Our main income measure is gross annual family earnings at age 30, stemming from population-wide tax declaration files. This measure covers gross labor income, business income, and unemployment benefits, and is available for the years 1968, 1971, 1973, 1976, 1979, 1980, 1982, and every year 1985-2015. To construct family gross earnings, we take the gross individual earnings of the child in the year the child was 30 years old, and then add the gross earnings of the child's spouse from the same calendar year, if a spouse is identified. To construct parental family income, we follow the same procedure, summing up the parents' gross individual earnings in the year the head of the household was 30 years old, or if this is a gap/missing year (e.g. 1974 or 1978), in the year closest to age 30. We exclude those for which we cannot observe the incomes of the household head in any of the ages 25-35. We construct this measure for the (child) cohorts born 1960-1983.

We also have access to individualized disposable income for the years 1975, 1979, 1982, 1985, and 1990-2014, also based on tax data. This measure covers all incomes and transfers net of taxes. We use these in the exact same way as above, enabling us to create measures of family disposable income for both generations of the (child) cohorts born 1965-1984. All incomes are deflated to constant 2016 kronor using the CPI. Absolute mobility is the cohort mean of an indicator for whether the child's income surpasses the parental income at the same age.

Given the restrictions above, we are able to match the children in the censuses to a parental household for about 99 percent of the population and observe their incomes at age 30 for about 90 percent of the population. These fractions are also fairly constant over time. The fraction for which we also observe parental incomes at around age 30 is between 80 and 90 percent, and this fraction increases slightly over cohorts, especially for the earliest cohorts. This is a consequence of the fact that we require parental incomes to be observed at around age 30 and the first year of income data is 1968 (or 1975 for disposable income). However, from cohorts born around 1970 and onwards (or somewhat later for disposable income), there is not much of a trend in the fraction for which we observe parental incomes at around age 30.

A2.6. The United Kingdom

Method.—We follow the "copula and marginals" method as described by Chetty et al. (2017), calculating absolute income mobility for each cohort by comparing the average incomes in each pair of quantile cells from the child and parent marginal income distributions and assigning an upward mobility rate of 1 to those cells if the child income is greater than the parent income. We then compute the overall absolute mobility rate by taking the mean across all pairs of cells weighted by the probability in the copula that a child born to parents in the parent cell would end up in the child cell as an adult.

Data.—We use three surveys for this analysis: the Family Expenditure Survey (FES) and the Family Resources Survey (FRS) provide information on marginal earnings distributions, and the British Cohort Study (BCS) provides data for the copula.

Family Resources Survey: The FRS was a continuous representative household survey, starting from 1993-94, that covers questions on a wide range of topics relating to their financial circumstances including receipt of Social Security benefits, housing costs, assets and savings. We use the FRS from 1994 onwards, i.e. the year from when incomes are reported, to construct the children's sample.

Households are included in our sample if the head of household is on average 30 years old (28-32 years) and if they reported any income. We consider the person with the highest individual income as the head of the household. The head of the household is male in 58 percent of households (inclusive of single-person households). As the FRS began in 1994, the earliest birth cohort of children is 1964 (1994 - 30). Similarly, as the latest survey is from 2017, the last birth cohort is 1987 (2017-30). We have about 46,000 households satisfying these restrictions.

Individual income is the sum of labor earnings, self-employment earnings, pensions and other benefits and transfers. We sum individual income among partners (spouse, cohabiting and civil partners) to create the gross combined income, and across all members of the family to create the family income. Net income is defined as gross income less taxes.[4] We only include households whose family income was positive.[5] We also conduct specifications that normalize the household income with the square root of family size, and the spousal income with the number of partners in the household, as robustness checks. Incomes are inflated to constant 2016 pounds using the UK Consumer Price Index.

Family Expenditure Survey: The FES is an annual representative household survey designed to determine the basket of goods and services for the consumer price index. The survey is digitally available from 1968 and provides detailed individual level information on all members of the household, including their year of birth, their relation to other members and their labor earnings. We use the FES to construct the marginal income distribution of parents, as we have earnings records from as early as 1968. The FES was converted to another survey after 2000 – we only use the years between 1968-2000.

As with the children's sample, parent's households are only included if the head of the household was 30 years old on average (28 - 32 years), and if they reported any income. In addition, to qualify as a *parent*, the household must include a child born between 1964-1987. We use the birth cohort of the child to match the children to their statistical parents. Our sample size, after the restrictions, is about 26,000 fathers.

Incomes and corresponding normalizations are the same as defined for the FRS.

British Cohort Study: The BCS sampled all children born in a particular week in 1970 and collected data at several points in childhood and periodically through the age 50 survey in 2020. Parental incomes were collected at age 16 of the child

[4] Net incomes are only available from 1996 onwards.

[5] About 160 households that satisfied the age restriction reported no or zero family income.

(average age of father's was 39 years), and the adult gross earnings of the child are available from the 2000 sweep at age 30. In total, we have income information for about 3,900 parent-child pairs.

The BCS parental income data is measured in 1986 when the cohort members are 16. It is available in 11 bands which indicate gross income without benefits. This data is first adjusted into a continuous variable using a Singh-Madalla distribution. It is then converted into net data by measuring the median share of tax paid by households within each band using the 1986 Family Expenditure data and subtracting that from the continuous data. Finally, the data is adjusted to better represent disposable income by the addition of child benefit according to family structure and the rates prevailing at the time.

The adjustments repeat those carried out to make the data comparable to a previous cohort in Blanden, Gregg and Macmillan (2013) and are beneficial as they generate 10 fairly equal deciles which are not present in the original data. As is demonstrated in Section IV.A of the main text, estimated rates of upward mobility appear to be relatively insensitive to the copula used, at least among empirically observed copulas.

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A2.7. The United States

To estimate absolute income mobility in the United States, we follow the "copula and marginals" approach introduced by Chetty et al. (2017). Like they do, we use a copula constructed from IRS tax records for the 1980-82 US birth cohorts, as presented in Chetty et al. (2014). Parent incomes are sourced from the 1940-2000 Decennial Censuses and the 2010 and 2015 American Community Survey. Child incomes are sourced from the 1968-2021 Current Population Survey Annual Social and Economic Supplements. Both child and parent data were downloaded from IPUMS (Flood et al. 2022; Ruggles et al. 2022). For maximum comparability to the other countries in our sample, in our baseline income measure we exclude capital income and social transfers other than Social Security and unemployment insurance. All incomes in our baseline specifications are inflated to 2014 dollars using the CPI-U-RS. We determine parent age using the father's age when a father is present and the mother's age when a father is not present.

Figure A2.7.1 compares our baseline upward mobility estimates to the baseline from Chetty et al. (2017). As it shows, our results closely track those from Chetty et al., and to the extent that they diverge it is largely due to our definition of parent age using fathers when present rather than the parent whose income results in the higher total.

In addition to comparing our baseline specification to that of Chetty et al. (2017), Figure A2.7.1 presents two further robustness checks, showing results for a specification that includes children born outside the United States and a specification in which we use the Current Population Survey to calculate parent as well as child incomes. Each of these specifications produces upward mobility estimates roughly five percentage points lower than our baseline specification for the cohorts where both are possible.

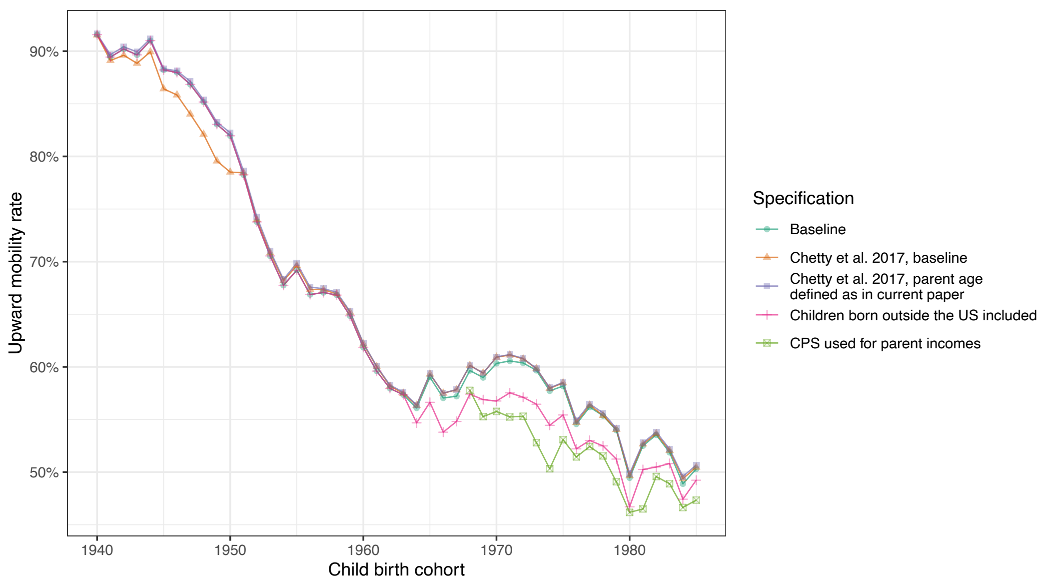

FIGURE A2.7.1. ALTERNATE SPECIFICATIONS, UNITED STATES

Notes: This figure plots upward mobility for the US sample calculated with alternate specifications.

For our disposable income specification, we supplement the Current Population Survey with data from the Columbia Historical Supplemental Poverty Measure (SPM) dataset (Wimer et al. 2022). This data augments the Current Population Survey with estimates of income from cash or near-cash transfers, including the Supplemental Nutrition Assistance Program, the National School Lunch Program, the Low-income Home Energy Assistance Program, the Special Supplemental Nutrition Program for Women, Infant, and Children, Federal Economic Stimulus and Economic Recovery payments, the Earned Income Tax Credit, and the Aid for Families with Dependent Children and Temporary Assistance for Needy Families programs. We use this data to define both parent and child incomes in the disposable income specification.

Appendix 3. Summary Statistics

Tables A3.1 and A3.2 present summary statistics on the demographic and economic characteristics respectively of the earliest and latest cohorts for each country in our sample. A few points are worth highlighting. First, the average parent age at childbirth increased substantially during our sample period in many of the countries we study. This means that for later cohorts, more years passed between when the parents and children were 30 years old, which could have the effect of increasing rates of upward mobility simply because there was a longer period of economic growth between income measurements. Second, in most countries and cohorts a greater percentage of parents were married than of children. This means that parent family income will be higher by construction in the baseline series. Third, income inequality was generally higher among children than among parents, and tended to increase over time for most countries in our sample.

One caveat in this data is that measurement of the fraction of children in school at age 30 is imperfect in some countries. In Canada, children are reported as being in school if they reported a positive tuition deduction, which is correlated with school attendance but not a direct measure. Similarly, in Sweden we report the fraction of children who received a study grant for full time study, but each individual is only eligible for the study grant for six years over their lifetime and by age 30 some students may no longer be eligible. In the UK and US we are not able to report education information.

Table A3.1 Selected demographic summary statistics

Country	Cohort (only first and last years shown)	Number of children in sample	Focal parent age at income measurement		Child age at income measurement		Focal parent age when child was born		% of children matched to 2 parents (parent couple rate)	% of children with spouse / cohabiting partner (child couple rate)	% of children in school when income measured
			Mean	Median	Mean	Median	Mean	Median			
Canada	1977	113,850	30.0	30.0	30.0	30.0	23.9	24.0	93%	57%	11%
	1985	245,700	30.0	30.0	30.0	30.0	28.2	28.0	91%	54%	11%
Finland	1963	41,765	32.4	33.0	32.4	33.0	24.2	25.0	96%	74%	4%
	1990	47,417	30.0	30.0	30.0	30.0	29.1	29.0	98%	62%	6%
Netherlands	1973	2,899	33.3	34.0	33.3	34.0	24.0	24.0	89%	78%	0%
	1984	5,835	29.5	30.0	29.5	30.0	29.6	30.0	91%	67%	12%
Norway	1964	18,998	30.0	30.0	30.0	30.0	24.1	24.0	99%	59%	8%
	1988	49,906	30.0	30.0	30.0	30.0	30.5	30.0	99%	55%	11%
Sweden	1960	29,132	32.2	32.0	30.0	30.0	23.8	24.0	88%	67%	3%
	1980	80,367	29.9	30.0	30.0	30.0	29.6	29.0	75%	65%	8%
UK	1964	2,618	30.4	31.0	30.0	30.0	32.9	32.0	89%	64%	*
	1987	1,196	30.2	30.0	30.1	30.0	30.7	30.0	81%	63%	*
USA	1940	1,614	33.0	32.0	30.0	30.0	32.6	32.0	98%	83%	*
	1985	2,093	30.5	31.0	30.0	30.0	28.9	29.0	69%	44%	*

*Data not available

Table A3.2. Selected economic summary statistics.

Country	Cohort (only first and last years shown)	Mean parent income (real local currency)	Median parent income (real local currency)	Mean child income (real local currency)	Median child income (real local currency)	Parent Gini coef.	Child Gini coef.	Rank-rank slope (relative mobility)
Canada	1977	58,780	58,210	73,210	65,300	0.30	0.37	0.22
	1985	62,790	59,890	76,260	67,050	0.33	0.39	0.20
Finland	1963	26,841	23,387	43,094	41,219	0.46	0.32	0.10
	1990	46,910	45,592	52,611	49,387	0.23	0.36	0.14
Netherlands	1973	40,881	38,506	63,343*	60,834	0.26	0.28	0.23
	1984	38,453	35,532	53,951*	52,063	0.27	0.29	0.16
Norway	1964	301,858	288,002	445,911	434,247	0.20	0.29	0.10
	1988	460,349	452,342	694,997	668,775	0.22	0.29	0.11
Sweden	1960	253,050	241,476	330,745	346,177	0.28	0.27	0.13
	1980	293,737	298,576	443,984	439,811	0.29	0.32	0.13
UK	1964	17,576	16,692	30,992	27,352	0.22	0.34	0.27
	1987	26,936	23,816	39,624	33,852	0.36	0.33	0.27
USA	1940	17,899	17,390	56,324	53,112	0.37	0.30	0.34
	1985	52,087	46,012	55,721	44,200	0.37	0.46	0.34

*Due to extreme outliers, the mean child income for the Netherlands is calculated excluding the highest-earning 1% children

Appendix 4. Trends in Relative Income Mobility

As described in the main text, a key component of copula and marginals approach is the parent-child rank transition matrix, or copula. In the course of validating the copula and marginals approach, we produce 100x100 and 10x10 copulas for a wide range of countries and birth cohorts. These are provided for future researchers through the AEA Data and Code Repository. We recommend caution in using these copulas to study relative income mobility, since there are well known challenges with measuring income in a single year (Mazumder 2005; Nybom and Stuhler 2017; Solon 1992). Rather, these empirical copulas are provided as inputs into future studies of absolute income mobility—researchers can choose a copula that they believe approximates that for a population they are studying, or apply the full range of copulas to estimate bounds.

In Figure A4.1, we show trends in the rank-rank correlation of parent and child income over time, measured from the 100x100 copulas, and in Figure A4.2 we show trends derived from the 10x10 copulas. The patterns shown are broadly in line with recent research on national patterns of relative income mobility (e.g. Bratberg et al. 2017; Corak 2016; Smeeding, Erikson, and Jäntti 2011).

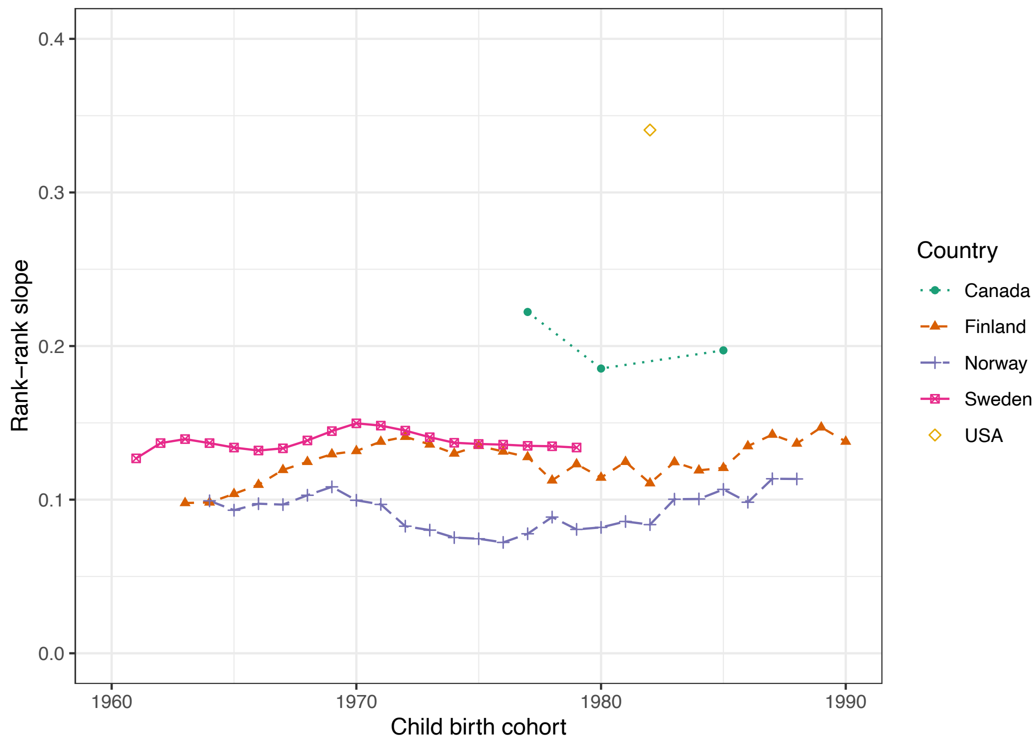

FIGURE A4.1. RANK-RANK SLOPES OF EMPIRICAL 100X100 COPULAS

Notes: This figure plots rank-rank slopes among the empirically observed 100x100 copulas from our sample. Rank-rank slopes are calculated by regressing the child rank in a given copula cell on the parent rank in that cell, weighting by the fraction of all children who fall into that cell.

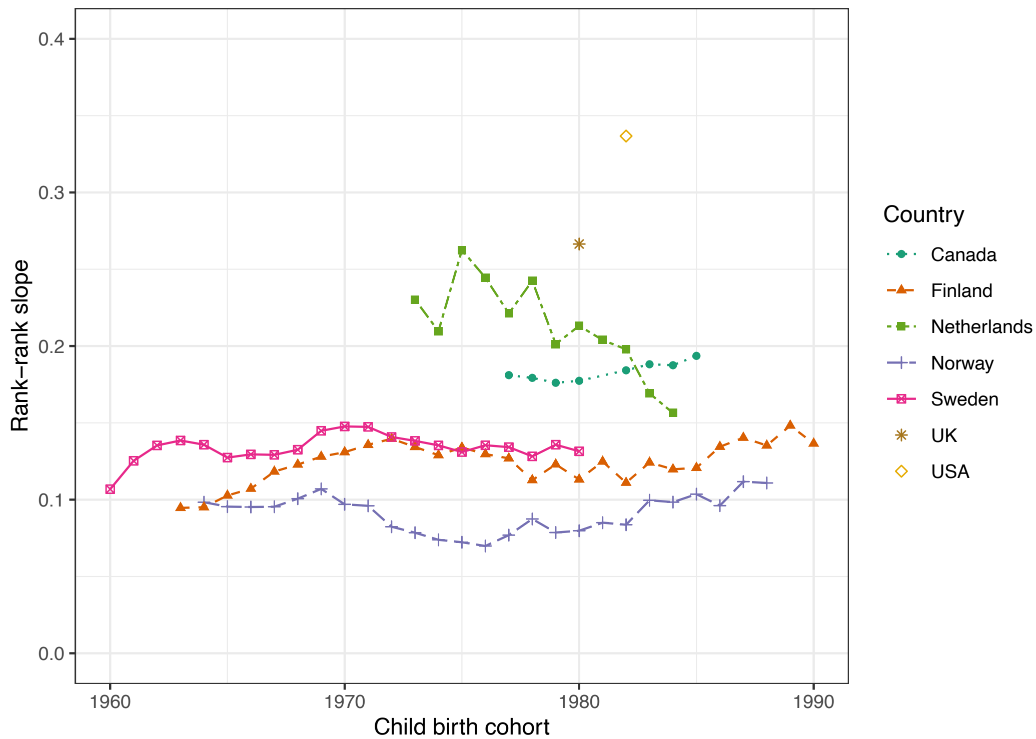

FIGURE A4.2. RANK-RANK SLOPES OF EMPIRICAL 10X10 COPULAS

Notes: This figure plots rank-rank slopes among the empirically observed 10x10 copulas from our sample. Rank-rank slopes are calculated by regressing the child rank in a given copula cell on the parent rank in that cell, weighting by the fraction of all children who fall into that cell.

Appendix 5. Comparison of current analysis with Berman (2022)

In a recent paper, Berman (2022) presents estimates of trends in upward absolute income mobility in 10 countries calculated solely from historical marginal income distributions for the full population. Here we present a detailed comparison of our results with Berman's and identify potential sources of differences where they exist. This analysis complements and largely corroborates a similar analysis reported in Appendix C of Berman (2022).

Figure A5.1 overlays our baseline upward mobility estimates with Berman's for the countries and periods where the samples overlap. There are two main differences between the estimates. First, in certain countries—most notably the UK, as well as Sweden for cohorts born in the 1960s—there are substantial differences in estimated levels of upward mobility, with our estimates being as many as 15 percentage points higher or lower than Berman's. Second, for some of the countries in the sample, most notably Norway, Sweden, and the UK, our trend differs from Berman's.

We believe that the main source of the discrepancies between our results and Berman's, where they arise, is the use of different data for the marginal income distributions. Specifically, we use data on incomes of 30-year-olds only while Berman uses distributions for the full population of each country. Because economic trends sometimes have different impacts on people of different ages (Hoynes, Miller, and Schaller 2012), the income distribution of the full population is not always an accurate proxy for the incomes of a specific birth cohort. Additionally, when constructing the income distributions for parents, we include only those adults who had children, which may be a selected subset of the population with systematically different income patterns from adults of similar age who did not have children. As we show below, the difference between our results and Berman's for the United Kingdom—the country with the single largest discrepancy—can be fully accounted for by the difference in the marginal distributions we use rather than the difference in methodology.

FIGURE A5.1. COMPARISON OF BASELINE ABSOLUTE INCOME MOBILITY ESTIMATES WITH THOSE OF BERMAN (2022)

Notes: This figure compares the current paper's estimates of absolute upward income mobility with those of Berman (2022) for the countries and cohorts where the samples overlap. Berman's estimates are constructed using full-population marginal income distributions, as opposed to the linked parent-child age 30 samples used here. In many cases the results are remarkably consistent, but in some instances they differ substantially, likely because of the greater specificity of our income measures.

Detailed Comparison of Results for the United Kingdom.—Berman (2022) presents a cross-country analysis of absolute income mobility, simplifying the methodology in Chetty et al. (2017) further by introducing two changes. First, he uses the method of generalized Pareto curve interpolation (Blanchet, Fournier, and Piketty 2017) to derive the marginal income distributions using two points—the mean and some measure of inequality, which in this case is the top 10 percent share of incomes. In addition, he assumes that the joint parent-child incomes follow the bivariate log-normal distribution.[6] Second, he shows that the rank correlation is a sufficient statistic to capture the details in relative mobility. Both these changes make it even easier to compute absolute mobility, and he demonstrates this by estimating it for several countries, including the UK. However, these results do not conform with our findings.

The reason for this discrepancy, as we show, is Berman's use of a more aggregated dataset that does not fully capture the changes to household level income and inequalities for 30-year-olds. His marginal income distributions are constructed using pre-tax national income for adults from the World Inequality Database (WID). As the WID does not report estimates at the micro-level, there is no cohort-level information. As a result, these marginal income distributions can only be attributed to specific years, and he compares these distributions across every 30 years. In contrast, we rely on survey data focusing on specific cohorts of interest. We can observe individual and household incomes within a narrow age-band, in our case age 30. And, because we can observe relationships within each cross-section, we can match parents and children using the birth cohort of the child. This accounts for the changing age of fertility across the years. Importantly, the high-quality surveys that inform our analysis are the same ones used by the UK government to understand changes in household income and inequalities.

[6] Chetty et al. (2017) argue that incomes cannot be well-approximated by such a distribution, but Berman shows that this assumption leads to a maximum of 10 percentage point difference between his estimates and those of Chetty et al. (2017).

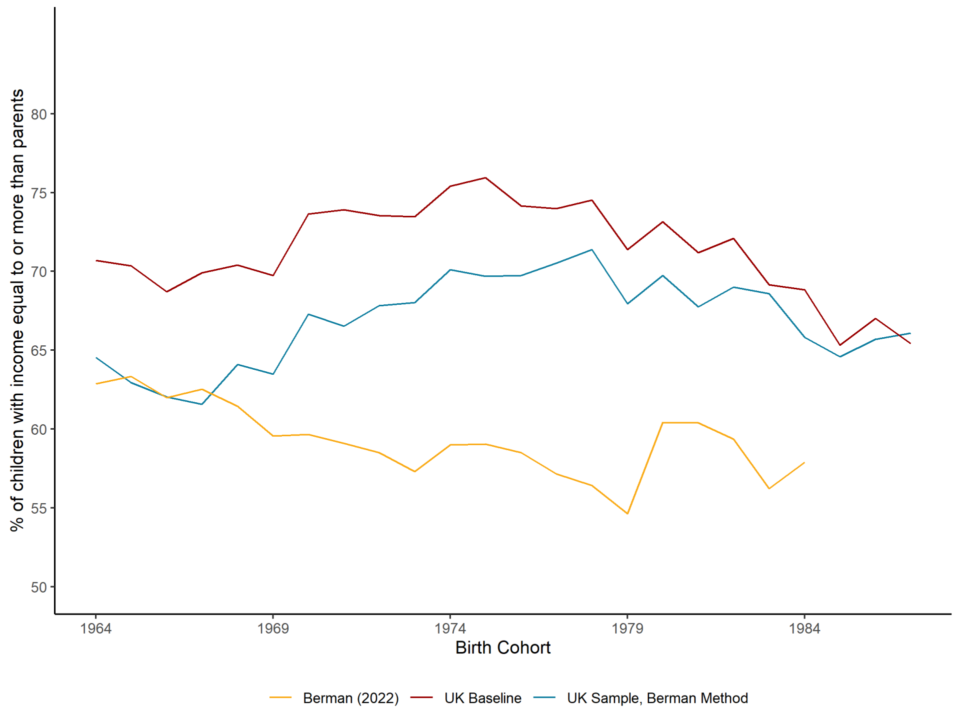

FIGURE A5.2. COMPARISON OF BASELINE ESTIMATES OF ABSOLUTE MOBILITY IN THE UNITED KINGDOM

Notes: This figure explore the sources of the difference between our estimates of absolute income mobility in the United Kingdom and those of Berman (2022). The difference between the baseline results of the present paper (red) and those of Berman (yellow) is substantial. However, if we apply Berman's method to our more detailed income distribution data (blue) the results match quite closely. This both confirms the power of Berman's approximation method and highlights the importance of having accurate and specific data on the income distributions of parents and children. In this case, income trends for young adults in the UK during this period diverged from those for the overall population.

In Figure A5.2 we present the absolute mobility estimates reported in Berman (2022)[7] in yellow, along with our baseline estimates in red and estimates using our baseline sample and his method in blue. Our baseline results diverge both in terms of the trend and the level. Berman finds that absolute income mobility in the UK declined consistently between 1994 and 2009. On the other hand, we find that absolute income mobility among 30-year-olds in the UK grew between 1994 and 2005, after which it began to fall. Compared to his estimates, our baseline results

[7] Berman (2022) presents results from 1989-2014, which correspond to the 1969-1984 birth cohorts using the terminology of the present paper. As we do not have estimates between 1989-1993, we only report his findings from 1994.

are about 15 percentage points higher in 2004 (1974 birth cohort) and 10 percentage points higher in 2014 (1984 birth cohort).

To probe the sources of this difference, we first show that when both methods are applied to the survey data that we use, they generate approximately the same level of absolute income mobility. To be precise, we calculate the average real weekly income and the Gini coefficient of income for each year in our sample, and then interpolate to generate the full distribution. Following Berman (2022), we assume that the rank correlation for the UK is 0.3. Together, these two components provide the estimates of absolute income mobility shown in blue in Figure A5.2. The baseline results and the comparison with Berman's method produce very similar estimates (not significantly different). In other words, the methodology produced by Berman (2022) matches up well with the established methodology of Chetty et al. (2017). This implies that the differences in our estimates are due to the data used.

Second, we show why using survey data is more appropriate in this regard. To understand how using aggregate national statistics that do not refer to specific age groups can skew the results, in Figure A5.3 we compare the level of inequality between three sources: the top 10 percent income share from the WID, the Gini coefficient in our sample of 30-year-olds, and the Gini coefficient for the entire population of Great Britain published by Cribb, Norris Keiller, and Waters (2018), which we use as a benchmark. Strictly speaking, the top 10 percent income share and the Gini coefficient are not directly comparable but they are both measures of inequality and used for the same end in the method proposed by Berman (2022).

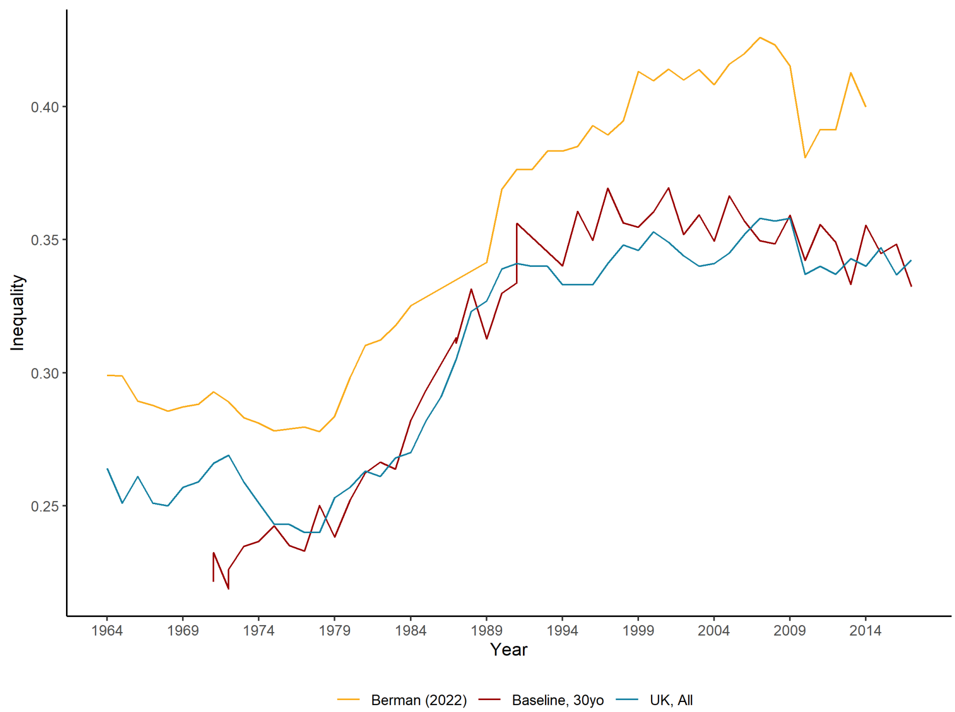

FIGURE A5.3. THREE MEASURES OF INEQUALITY IN THE UNITED KINGDOM, 1961-2017

Notes: The red series shows the baseline estimates of Gini computed on gross household income, where at least one adult member is 30 years old. The blue series shows the Gini coefficient for equivalized household net income in Great Britain reported by Cribb, Norris Keiller, and Waters (2018). The yellow series shows the top 10% share of pre-tax national income for adults as reported by Berman (2022).

The Gini coefficients for 30-year-olds and for the entire population are similar for the most part, particularly for the years 1974-1990 and 2008-2014. On the other hand, the top 10 percent income share is much higher than the Gini coefficient. This would not be a problem in and of itself, but there is a much larger difference with the benchmark for the sample of children (after 1994) compared to the sample of parents (prior to 1988). These discrepancies in the inequality experienced among children and parents help explain why Berman (2022) finds much lower levels compared to our results.

The final issue is to compare the growth in income across the sample. We use the average income reported for parents and children in Berman (2022) to construct a series from 1977-2014. We do this to compare his results with the reported growth in mean real equivalized household disposable income of individuals by the Office for National Statistics (Webber and O'Neill 2019), which we consider as the benchmark. As a comparison, we also plot the growth rate in unequivalized household income from our baseline sample for the same period. These comparisons are illustrated in Figure A5.4.

Once again, we find that the growth rate in incomes (although using different definitions) are very similar in trend between the benchmark and our baseline sample. The main difference is that the sample of 30-year-olds experience slightly lower levels of growth over time. On the other hand, the growth rate reported in WID is much lower than the benchmark and this difference increases with time. What this means is that the children in the WID sample experienced much less growth in the mid-1990s than the benchmark, but they also suffered from a lower decline after the Great Recession. As a result, not only is absolute income mobility lower in levels, the trend is also different. Without the sharp rise in incomes in the 1990s, Berman (2022) does not find increasing absolute mobility during that era, and instead finds that absolute mobility consistently declined.

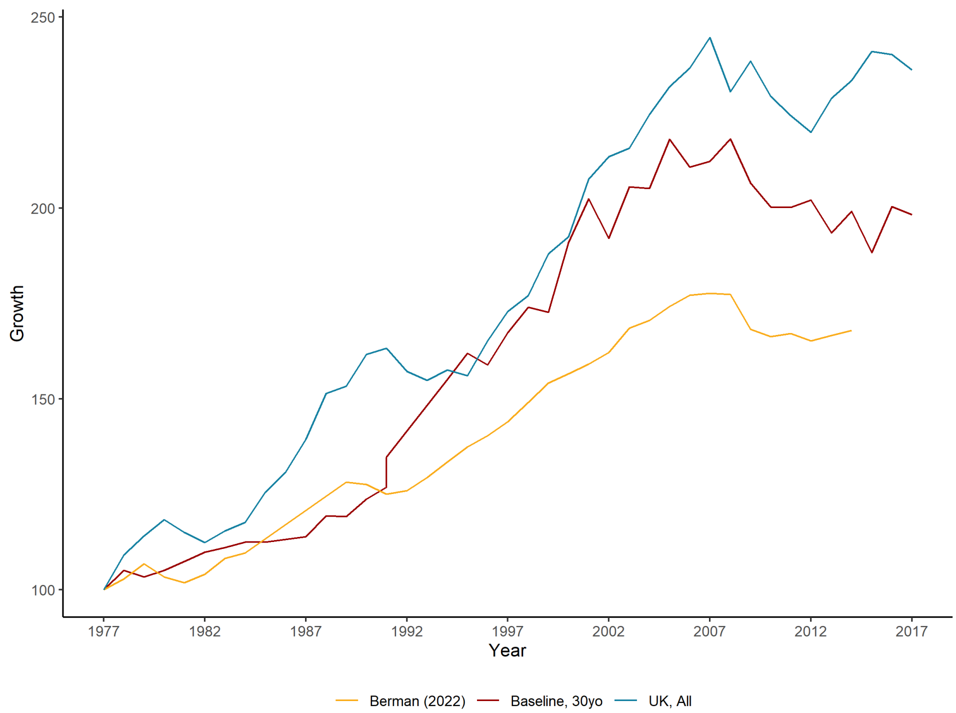

FIGURE A5.4. INCOME GROWTH IN THE UNITED KINGDOM, 1977-2014

Notes: Trends in average net household incomes are presented as a percentage of the 1977 value of each series, which is set to 100. Berman (2022), shown in yellow, uses the pre-tax national income for all adults, equivalized using an equal split. Our baseline series, shown in red, reports unequivalized pre-tax income for 30-year-olds, while the blue series reports equivalized disposable household income as measured by the Office for National Statistics (Webber and O'Neill 2019).

Appendix 6. Comparison of Trends in Median Income in Our Sample with Trends from the Luxembourg Income Study

To validate our income data, we compare trends in median income among our sample children with trends in the median income of 30-year-olds in the Luxembourg Income Study (LIS; Luxembourg Income Study 2023). These comparisons are presented in Figure A6.1. For maximum comparability, we exclude capital income and social transfers from the LIS data. In the LIS data we use household income, while we use child plus spouse income only in our sample. In Finland, the Netherlands, Norway, and Sweden the two series closely follow each other, while in Canada, the UK, and the US the LIS series exceeds the sample series but displays similar trends over time.

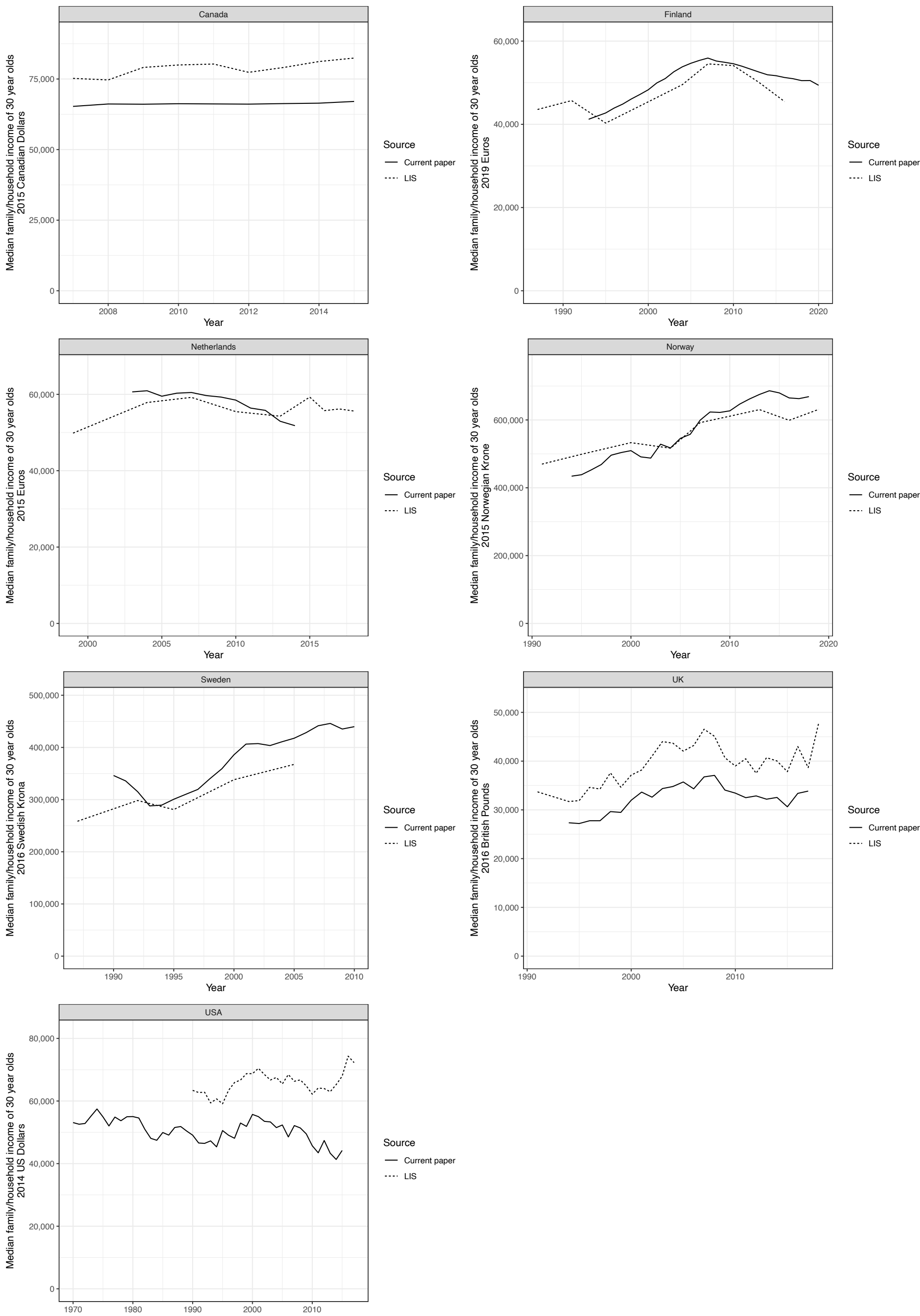

FIGURE A6.1. COMPARISON

Notes: Median household (LIS) and family (current paper) income of 30-year-olds over time, Luxembourg Income Study and current paper. Note that the x-axis is scaled to show the full range of years available for each country and differs from country to country, while the y-axis is in units of local currency.

Appendix 7. Validation of Approximation Methods Proposed by Katz and Krueger (2017)

Katz and Krueger (2017) documented a striking correlation—0.995—between the rate of upward absolute income mobility calculated by Chetty et al. (2017) and the difference between the real median incomes of children and parents in the Chetty et al. sample. They proposed that the difference in median incomes might be useful as an approximation of absolute income mobility when data constraints prevent direct computation of the latter. They also proposed the fraction of children out-earning the median parent, rather a child's own parents, as another potential approximation. Here we test the generalizability of the correlations presented by Katz and Krueger for the US case. Figure A7.1 displays the upward mobility rate (panel A) alongside the normalized median income difference between parents and children (panel B) and the fraction of children out-earning the median parent (panel C) for the countries and birth cohorts in our sample.

Like Katz and Krueger, we find a very high correlation between upward mobility and the real median income difference in many cases: in the US the two quantities are correlated since 1960 at 0.974 (over the full 1940-1985 sample we observe a correlation of 0.996 for the US), in Sweden at 0.994, in the Netherlands at 0.986, and in Finland at 0.987. However, the correlation is weaker in other countries: in Canada it is 0.881, in the UK 0.902, and in Norway 0.623. Because of the variation in correlation strength across countries we do not recommend using the median income difference as a direct substitute for absolute mobility when it is impossible to compute absolute mobility from available data. Another challenge posed by this method is translating from median income differences measured in units of local currency to absolute mobility rates measured as a percentage of a child cohort: even when the correlation is high, it is not possible to say a priori how many dollars or kroner of difference are equivalent to a given percentage point increase in absolute mobility without knowing the mobility rate for at least a subset of cohorts.

The correlations between absolute mobility and the fraction of children out-earning the median parent are generally higher than those with the median income difference but still vary from country to country. In the US the correlation is 0.974, in Finland 0.984, the Netherlands 0.985 and in Sweden 0.990. In Canada the correlation is 0.902 while in Norway it is 0.885. In the UK our data do not permit us to calculate the fraction of children out-earning the median parent.

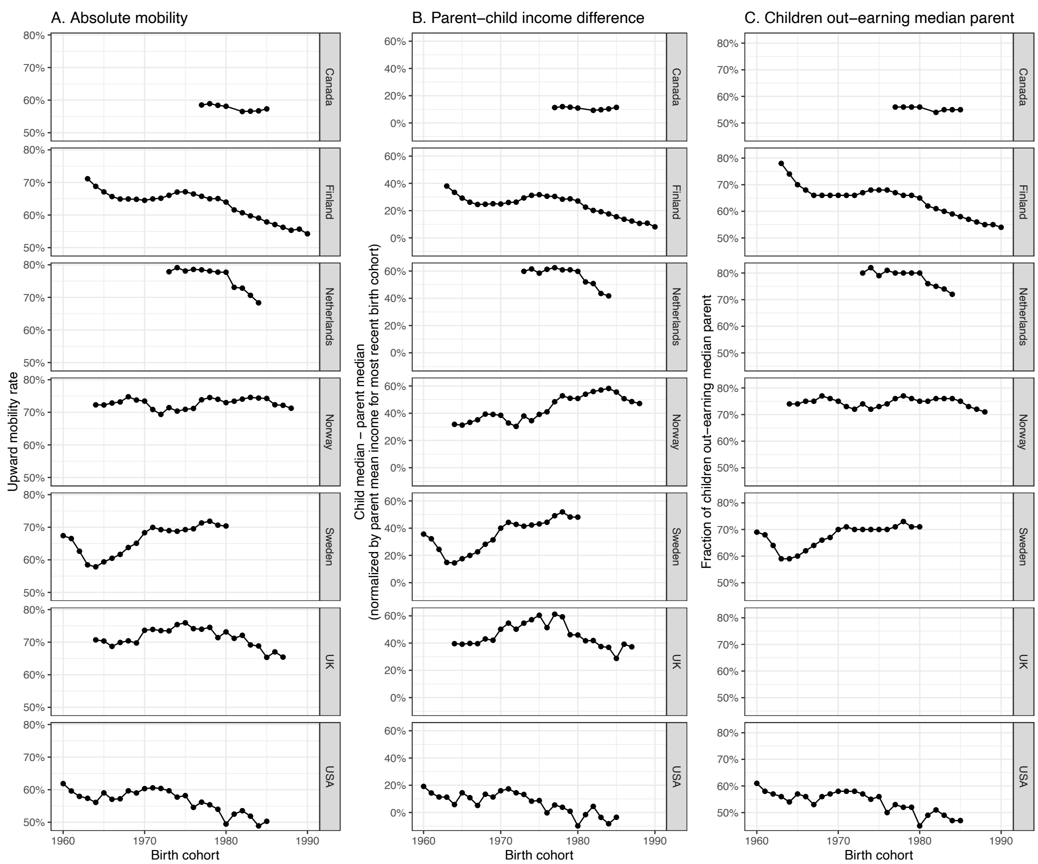

FIGURE A7.1. VALIDATION OF KATZ-KRUEGER APPROXIMATION

Notes: This figure compares the upward mobility rate (A) with the difference in median incomes between sample parents and sample children (B) and the fraction of children out-earning the median parent (C). For comparability across currencies, the median income difference is normalized by the mean parent income for the most recent birth cohort. In many of the countries in our sample the quantities are correlated at above 0.97, but in Canada, the UK, and especially Norway the correlation with the median parent-child income difference is much lower and that with the fraction of children out-earning the median parent is somewhat lower. We are not able to calculate the fraction of children out-earning the median parent in the UK.

Appendix 8. Decomposition of Sources of Difference Between All Pairs of Cohorts Differing in Their Absolute Mobility Rates by more than 10 Percentage Points

To explore the potential drivers of variation in upward mobility rates and the utility of decomposition methods for determining the drivers of differences in absolute mobility rates, we conduct a decomposition analysis of the sources of difference for all 2,008 pairs of cohorts in our baseline analysis whose upward mobility rates differed by at least 10 percentage points and for which it was possible to compute 100-cell copulas and marginal distributions. This involves comparing cohorts from different countries, for instance the 1985 US birth cohort compared to the 1988 Norway birth cohort, as well as cohorts from the same country, such as the 1989 Finland birth cohort compared to the 1963 Finland birth cohort. We limit this comparison to cohorts beginning with 1960 to avoid giving undue influence to the 1940-1960 US cohorts. For each pair of cohorts, we conduct a decomposition exercise in which we individually substitute a) the copula, b) the amount of inequality among parents, c) the amount of inequality among children and d) the child-parent mean income ratio of the higher mobility cohort for that of the lower mobility cohort, and see how much of the mobility gap closes as a result.

As shown in Figure A8.1, across the 2,008 cohort pairs the ratio of mean child to parent income was consistently the most important contributor to differences in absolute income mobility. For the median cohort pair, the child-parent mean income ratio accounted for 66.0% of the gap on its own. Second most important was the amount of inequality in the child marginal income distribution, which at the median accounted for 37.1% of the gap but had somewhat more variation. Both the copula and the amount of inequality among parents had slight negative effects on average, increasing the gap by 2.4% and 11.3% respectively at the median.

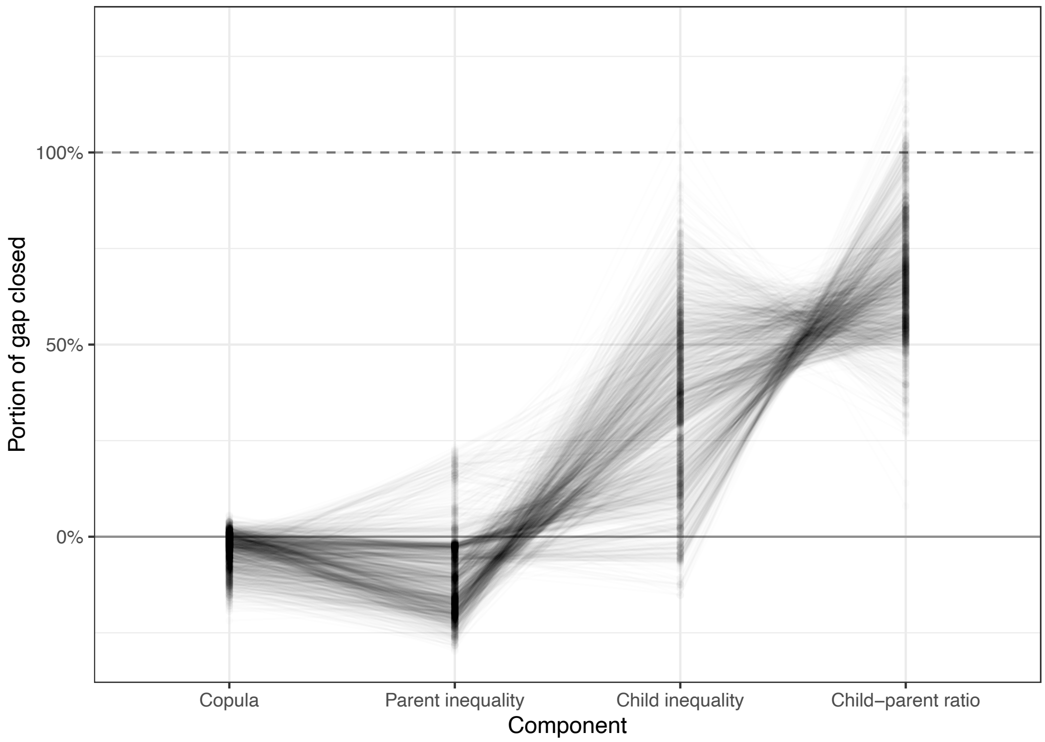

FIGURE A8.1. COMPONENTS OF VARIATION FOR ALL PAIRS OF COHORTS DIFFERING BY MORE THAN 10 PERCENTAGE POINTS

Notes: This figure presents results from a decomposition exercise investigating the drivers of differences in upward mobility across all 2,008 pairs of cohorts whose upward mobility rates differ by more than 10 percentage points in our baseline sample. For each pair, we substitute each of the four components that collectively account for the entire difference from the high-mobility cohort for that in the low-mobility cohort while keeping the other three components from the low-mobility cohort, and display the percentage of the gap closed as a result. The lines connect the four observations for each cohort pair.

As discussed in the main text, the child-parent mean income ratio is influenced by a large number of factors, including the rate of economic growth, the extent to which the incomes of young adults keep pace with economic growth, the average age difference between children and parents, and trends in family structure. Some of these factors have very different substantive interpretations and policy implications from one another. We report these results on the importance of the mean income ratio in part to caution future researchers on the need to be judicious when interpreting the results of decomposition exercises.

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