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ABSTRACT

We estimate rates of "absolute income mobility" – the fraction of children who earn more than their parents – by combining historical data from Census and CPS cross-sections with panel data for recent birth cohorts from de-identified tax records. Our approach overcomes the key data limitation that has hampered research on trends in intergenerational mobility: the lack of large panel datasets linking parents and children. We find that rates of absolute mobility have fallen from approximately 90%for children born in 1940 to 50% for children born in the 1980s. The result that absolute mobility has fallen sharply over the past half century is robust to the choice of price deflator, the definition of income, and accounting for taxes and transfers. In counterfactual simulations, we find that increasing GDP growth rates alone cannot restore absolute mobility to the rates experienced by children born in the 1940s. In contrast, changing the distribution of growth across income groups to the more equal distribution experienced by the 1940 birth cohort would reverse more than 70% of the decline in mobility. These results imply that reviving the "American Dream" of high rates of absolute mobility would require economic growth that is spread more broadly across the income distribution.

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One of the defining features of the "American Dream" is the ideal that children have a higher standard of living than their parents (Samuel 2012). When children are asked to assess their economic progress, they frequently compare their own standard of living to that of their parents (Goldthorpe 1987, Hoschschild 2016). Such measures of *absolute income mobility* – the fraction of children earning or consuming more than their parents – are also often the focus of policy makers when judging the degree of economic opportunity in the U.S. (e.g., Obama 2013).[1]

In this paper, we assess whether the U.S. is living up to this ideal by studying two questions. First, what fraction of children earn more than their parents today? Second, how have rates of absolute mobility changed over time? Despite longstanding interest in these questions, evidence on absolute income mobility remains scarce (Halikias and Reeves 2016), largely because of the lack of large, high-quality panel datasets linking children to their parents in the U.S.[2]

We overcome this data problem by developing a new method of estimating rates of absolute mobility that can be implemented using existing datasets covering the 1940-84 birth cohorts. Our approach combines two inputs: *marginal income distributions* for parents and children and the *copula* of the parent and child income distribution, defined as the joint distribution of parent and child income ranks.

We estimate marginal income distributions for parents and children of the 1940-1984 birth cohorts using cross-sectional data from the decennial Census and Current Population Surveys (CPS). In our baseline analysis, we measure income in pre-tax dollars at the household level when parents and children are approximately thirty years old, adjusting for inflation using the CPI-U-RS. We then show the robustness of our results to a variety of specification choices, such as using alternative inflation adjustments, adjusting for taxes and transfers, and measuring income at later ages.

We estimate the fraction of children who earn more than their parents in each birth cohort by combining the marginal income distributions with the copula in each cohort. For recent birth cohorts, we follow Chetty et al. (2014a) and directly estimate the joint distribution of parent and child ranks using information from de-identified federal income tax returns covering the U.S. population. For earlier birth cohorts, such population-level panel data are not available. We instead proceed in two

[1] In a 2013 speech on economic mobility, President Obama noted that "people's frustrations" are partly rooted "in the fear that their kids won't be better off than they were."

[2] Prior research has studied the level of absolute income mobility for recent cohorts in the U.S. using panel surveys such as the Panel Study of Income Dynamics (e.g., Isaacs, Sawhill, and Haskins 2008, Lopoo and DeLeire 2012; Bengali and Daly 2013; Acs, Elliott, and Kalish 2016). These studies yield conflicting results because estimates of absolute mobility using available panel income datasets are sensitive to econometric assumptions and sample specification (Halikias and Reeves 2016). To the best of our knowledge, there is no evidence on *trends* in absolute income mobility, although prior studies have documented declining absolute mobility in terms of occupational status (Hauser et al. 2000) and educational attainment (Hout and Janus 2011).

steps. First, we report estimates of absolute mobility under the assumption that the copula remained stable across all birth cohorts, a benchmark motivated by evidence of copula stability since the 1970s (Chetty et al. 2014b).[3] Because we have no evidence that the copula was in fact stable prior to 1970, we then construct upper and lower bounds on absolute mobility for each birth cohort by searching over all plausible copulas using linear programming methods.[4] The key technical result of the paper is that these bounds are very tight for the 1940-1950 birth cohorts, allowing us to obtain a reliable time series on rates of absolute mobility despite the lack of historical panel data.

Using this methodology, we find that rates of absolute upward income mobility in the United States have fallen sharply since 1940. Under the benchmark of copula stability, the fraction of children earning more than their parents fell from 92% in the 1940 birth cohort to 50% in the 1984 birth cohort. Rates of absolute mobility fell the most for children with parents in the middle class.

Relaxing the copula stability assumption for earlier cohorts, we find that the rate of absolute mobility for the 1940 birth cohort is bounded between 84% and 98% across all plausible copulas, well above the rates observed for recent cohorts. Absolute mobility is not very sensitive to the copula for the 1940 birth cohort because income grew very rapidly at all quantiles of the distribution between 1940 and 1970. As a result, nearly all children earned more than the highest-income earners in their parents' generation, implying rates of absolute mobility near 100% regardless of which children were linked to which parents.

In more recent cohorts, the copula – i.e., which parents are linked to which children – matters much more because there has been little income growth across most of the distribution since 1980. For the 1984 cohort, the bounds on absolute mobility under alternative copulas span 14% to 88%. Fortunately, the copula is directly observed for these cohorts in tax records. In short, the key piece of missing data that has hampered direct measurement of absolute mobility – the lack of historical panel data linking parents and children – turns out to be inessential for characterizing trends in mobility.

The marked decline in absolute mobility since 1940 is robust to a range of alternative specifications. Most importantly, the qualitative results do not change when we account for potential changes in the quality of goods and new product innovation, which could have important effects on real income. Prior work on bias due to new products in inflation indices suggests that the annual

[3] Copula stability implies that *relative* mobility – the correlation between children's earnings and their parents' earnings – has not changed over time. Several studies have documented that relative mobility has not changed significantly in recent decades using both transition matrices (copulas) and other statistics such as intergenerational elasticities of income and rank-rank correlations (e.g., Lee and Solon 2009, Hauser 2010, Chetty et al. 2014b).

[4] We define the set of "plausible" copulas as copulas under which the distribution of children's incomes is weakly increasing with their parents' incomes (in the sense of first-order stochastic dominance). This restriction rules out perverse copulas that generate negative intergenerational income persistence.

inflation rate measured by the CPI-U-RS may be biased upward by 0.8% (Meyer and Sullivan 2009, Broda and Weinstein 2010). Subtracting 0.8% from the inflation rate each year, we find that absolute mobility declined from 93% to 59% between the 1940 and 1984 cohorts. We also obtain similar results when we (a) use post-tax and post-transfer measures of income instead of pre-tax measures, (b) calculate children's incomes at age 40 (for the 1940-74 birth cohorts) instead of age 30, and (c) adjust for changes in family size over time. Other metrics for upward mobility, such as the ratio of children's income to their parents' incomes, also exhibit similar declines.

We find robust evidence of declines in absolute mobility across subgroups. Absolute mobility fell in all 50 states between the 1940 and 1980 cohorts, although the rate of decline varied, with the largest declines concentrated in states in the industrial Midwest states such as Michigan and Illinois. We also find substantial declines in absolute mobility for both sons and daughters when income is measured at the household level. The decline in absolute mobility is especially steep – from 95% in the 1940 cohort to 41% in the 1984 cohort – when we compare the individual earnings of sons to their fathers.

Why have rates of upward income mobility fallen so sharply over the past half century? There have been two important macroeconomic trends that have affected the incomes of children born in the 1980s relative to those born in the 1940s: lower Gross Domestic Product (GDP) growth rates and greater inequality in the distribution of growth (Goldin and Katz 2008). We consider two counterfactual scenarios to assess the relative contribution of these two factors.

First, we consider a "higher GDP growth" scenario, in which children in the 1980 cohort experience GDP growth from birth to age 30 that is comparable to what was experienced by the 1940 cohort, but GDP is distributed in proportion to GDP shares by income percentile in 2010. This counterfactual expands the size of the economic pie, dividing it in the proportions by which it is divided today. In this scenario, absolute mobility rises to 62%, closing 29% of the gap in absolute mobility between the 1940 and 1980 birth cohorts. Thus, the slowdown in aggregate economic growth in recent decades, although important, does not explain most of the observed decline in absolute mobility.

Second, we consider a "more broadly shared growth" scenario, in which the actual GDP in 2010 is allocated across income percentiles as it was in the 1940 cohort. This counterfactual keeps the size of the economic pie fixed at its observed level, but divides it more evenly, as in the past. In this scenario, the rate of absolute mobility rises to 80%, closing 71% of the gap in absolute mobility between the 1940 and 1980 cohorts.

Together, these counterfactual simulations show that increasing GDP growth without changing the current distribution of growth would have modest effects on rates of absolute mobility. Under the current distribution of GDP, we would need real GDP growth rates above 6% per year to return to the rates of absolute mobility seen in the 1940s. Intuitively, because a large fraction of GDP goes to a small number of high income earners today, higher GDP growth does not substantially increase the number of children who earn more than their parents. Of course, this does not mean that GDP growth does not matter: changing the distribution of growth naturally has smaller effects on absolute mobility when there is very little growth to be distributed.[5] The key point is that reviving the "American Dream" of high rates of absolute mobility would require more broadly shared economic growth rather than just higher GDP growth rates.

The remainder of the paper is organized as follows. Section I summarizes our methodology and data sources. Section II provides baseline estimates under the benchmark assumption of a stable copula. Section III establishes the key result that estimates of absolute mobility for early cohorts are insensitive to the copula. Section IV assesses the sensitivity of the results to alternative price deflators and other specification choices, and presents results on heterogeneity by gender and state. Section V presents the counterfactuals, and Section VI concludes. Details on the methods and supplementary results are presented in the Supplementary Appendix. Code to replicate the results and statistics on absolute mobility by birth cohort, parent percentile, state, and gender can be downloaded from www.equality-of-opportunity.org.

I. Methods and Data

Let y_{ic}^{k} denote the income of child *i* in birth cohort *c* and let y_{ic}^{p} denote the income of his/her parents. In our baseline analysis, we measure income as pre-tax family income (summing income across spouses) at age 30. We measure incomes in 2014 dollars, adjusting for inflation using the CPI-U-RS (research series).[6] In sensitivity analyses, discussed in Section IV, we consider several variants of this income concept: using alternative price deflators, measuring income at age 40, measuring income after taxes and transfers, and adjusting for family size.

We define the rate of absolute mobility in cohort *c*, A_c, as the fraction of children in cohort *c* that earn more than their parents:

[5] Moreover, policies that promote higher GDP growth could also lead to more broadly distributed growth.
[6] The CPI-U-RS is available from 1977 onward. Prior to 1977, we use the CPI-U multiplied by the ratio of the CPI-U-RS to the CPI-U in 1977 to rescale the CPI-U in previous years.

$$A_c = \frac{1}{N_c}\sum_i 1\{y_{ic}^k \geq y_{ic}^p\}, \qquad (1)$$

where N_c is the number of children in the cohort.

We estimate A_c by decomposing the joint distribution of parent and child income into the marginal distributions of parent and child income and the joint distribution of the ranks (the copula). Let r_{ic}^k denote the percentile rank of child *i* in the income distribution for children in birth cohort *c*. Similarly, let r_{ic}^p denote the percentile rank of child i's parent in the income distribution of parents who have children in cohort *c*. The joint distribution of parent and child ranks for cohort *c* is given by $C_c(r^k, r^p)$, the probability density function (pdf) of observing a child with income rank r^k and parental income rank r^p. Let $Q_c^k(r)$ and $Q_c^p(r)$ denote the r^{th} quantile of the child and parent income distributions (measured in dollars), respectively. $Q_c^k(r)$ and $Q_c^p(r)$ summarize the marginal distributions of parent and child incomes. With this notation, we can write absolute mobility as:

$$A_c = \int 1\{Q_c^k(r^k) \geq Q_c^p(r^p)\}\, C_c(r^k, r^p) dr^k dr^p \qquad (2)$$

Intuitively, a child with rank r^k earns more than her parent with rank r^p if the r^k-th quantile of the child's income distribution is higher than the r^p-th quantile of the parent's income distribution, i.e. $Q_c^k(r^k) \geq Q_c^p(r^p)$. The copula, $C_c(r^k, r^p)$, measures the probability that each pair of ranks (r^k, r^p) occurs. Absolute mobility is the fraction of cases where $Q_c^k(r^k) \geq Q_c^p(r^p)$, integrating over the copula.

Equation (2) shows that absolute mobility can be calculated by estimating (a) the marginal income distribution for children (which yields Q_c^k), (b) the marginal income distributions for parents (which yields Q_c^p), and (c) the copula, $C_c(r^k, r^p)$. The rest of this section summarizes how we estimate these three distributions; a detailed description is provided in the Supplementary Appendix.

Children's Marginal Income Distributions. We obtain marginal income distributions at age 30 for children in the 1940-1984 birth cohorts directly from the 1970-2014 March Current Population Surveys (CPS). The sample of children includes U.S.-born members of the 1940-84 birth cohorts who, at age 30, were present in the U.S. and not institutionalized. We exclude immigrants in order to have a consistent sample in which we observe both parents' and children's incomes.[7] We compute family income as the sum of spouses' personal pre-tax income.

[7] The CPS does not ask for respondents' birthplace prior to 1994; hence, for children born before 1964, we cannot exclude immigrants from the sample. Most of the growth in the foreign-born share of the population occurred in recent decades, limiting the bias created by the inclusion of immigrants in early cohorts (National Academy of

Parents' Marginal Income Distributions. Estimating the income distributions of parents at age 30 who have children in a given birth cohort is more complicated because of the lack of historical panel data. We construct parents' income distributions for children in each of the 1940-84 birth cohorts by pooling data from Census cross-sections between 1940 and 2000 (using the 1 percent IPUMS samples). In order to cover all parents using decennial Censuses, we estimate parents' incomes when the highest earner is between the ages of 25 and 35, a symmetric window around age 30.[8]

For example, we estimate the income distribution of parents of children in the 1970 birth cohort as follows. First, we use the 1970 Census and select parents between the ages of 25 and 35 who have a child less than one year old in 1970. Next, we turn to the 1980 Census and select parents between the ages of 26 and 35 who have ten year old children (i.e., individuals who had a child in 1970 when they were between the ages of 16 and 25).[9] Third, to identify parents between ages 35 and 45 who had children less than one year old in 1970, we turn to the 1960 Census and select all individuals aged 25-35. We give this group a weight equal to the fraction of individuals in the 1970 Census between the ages of 35 and 45 who have a child less than one year old in 1970. This approach assumes that the income distribution of those who have children after age 35 is representative of the income distribution of the general population. Such an assumption is unavoidable as one cannot identify parents who will have children in the future in cross-sectional data. Fortunately, this assumption turns out to be inconsequential in practice because most children are born before their parents are 35.[10]

We estimate income distributions for parents with children in each of the other birth cohorts from 1940-1984 using an analogous approach. Summary statistics on parents' and children's incomes by birth cohort are reported in Table S1.

Sciences, Engineering, and Medicine 2015). Moreover, because immigrants' earnings are lower than natives' earnings on average, this bias likely reduces our estimates of absolute mobility in the early cohorts, rendering our estimate of the amount of decline more conservative than the true decline for natives.

[8] The measures of total pre-tax income available in the Census change over time. From 1970 onward, we use the sum of spouses' personal pre-tax income minus income from public assistance. In 1960, we use the sum of spouses' personal pre-tax income. In 1950, we use total family income. In 1940, only income from wages and salaries is available, along with an indicator for non-wage, non-salary income, which we use to impute non-wage income. See the Supplementary Appendix for further details.

[9] For simplicity, we restrict attention to individuals who have children between the ages of 16 and 45 throughout our analysis.

[10] In the Supplementary Appendix, we show that restricting attention to parents who have children between the ages of 25 and 35 – thereby avoiding this assumption entirely – yields very similar results.

Copula. For children born in the 1980s, we estimate a non-parametric copula – a 100 x 100 matrix giving the probability of each child and parent rank pair (r^k, r^p) – exactly as in Chetty et al. (2014a, Online Data Table 1). The sample includes all children born between 1980 and 1982 who are linked to parents based on dependent claiming on tax forms.[11]

For both parents and children, we define family income in the tax records in a manner that is as similar to the measures in the CPS and Census as possible. For those who file tax returns, we define income as aggregate gross income (AGI) plus the non-taxable portion of Social Security and Disability Income. For non-filers, we measure income using third-party information returns, defining income as the sum of the W-2 wage earnings, Social Security and Disability Income, and Unemployment Insurance income.[12] If individuals do not file a tax return and have no information returns filed on their behalf, taxable income is coded as 0.[13]

Following Chetty et al. (2014a), we measure children's incomes as mean income in 2011 and 2012, when children in the 1980-82 birth cohorts are between the ages of 30 and 32. We measure parents' incomes as mean taxable income between 1996 and 2000, the first five years in which population tax records are available.[14] Parents are between the ages of 30 and 60 when we measure their incomes because we limit the sample to parents who have children between the ages of 15 and 40 in 1980-82. Chetty et al. (2014a) show that the distribution of income ranks is stable between the ages of 30 and 60. Because of this rank stability, this approach provides an accurate estimate of the copula that one would obtain if one could observe income ranks at age 30 for all parents.

We exclude parents with zero or negative income when constructing the copula because parents with no earnings typically do not file a tax return and hence cannot be linked to their children based on dependent claiming. This does not pose a problem for measuring absolute mobility because children whose parents have zero income always earn at least as much as their parents. We calculate the fraction of parents with zero income in each cohort based on Census data and include these

[11] This definition of "parents" – based on who claims a child as a dependent – differs from the biological definition of parents used in the CPS and Census. Using birth certificate data to link parents to children yields very similar estimates of the copula (not reported). The population in the tax data also differs slightly from that in the CPS and Census because it includes institutionalized individuals.

[12] For non-filers, we cannot include the spouse's income. However, the vast majority of non-filers of working age are single (Cilke 1998).

[13] Importantly, these observations are true zeros rather than missing data. Because the dataset includes all tax records, we know that these individuals have 0 taxable income.

[14] Chetty et al. (2014a) use multi-year averages of income to mitigate the influence of transitory income fluctuations; however, they show (Chetty et al., Appendix Figure IID) that using annual income measures yields very similar estimates of rank distributions because the degree of transitory variance in income ranks is small in tax records.

individuals when computing average rates of absolute mobility, assigning the group of children whose parents have zero income an absolute mobility rate of 100%.

We define children's percentile ranks r_{ic}^{k} based on their incomes relative to other children in their birth cohort. We include children with 0 income when constructing these ranks, breaking ties at the mean.[15] Likewise, parents are assigned percentile ranks based on their incomes relative to other parents (among those with positive income). The copula is then estimated as a 100×100 matrix that gives the joint probability of each child and parent rank pair (r^k, r^p).

For children born before 1980, we lack the panel data necessary to estimate the copula. Chetty et al. (2014b) use a 0.1% IRS Statistics of Income panel to show that the copula (relative mobility, measured by percentile ranks) is approximately stable from the 1971 birth cohort to the 1984 birth cohort.[16] Motivated by this result, we begin by assuming copula stability across *all* cohorts since 1940, applying the copula estimated for the 1980-82 cohorts to all cohorts. We then compute bounds on absolute mobility searching over alternative copulas, as there is no empirical evidence that copula stability holds going back to 1940.

II. Baseline Estimates

This section presents our baseline estimates of absolute mobility, which assume copula stability from 1940-84 and measure family income in real pre-tax dollars at age 30. Figure 1A plots rates of absolute mobility by parental income percentile for the decadal birth cohorts, 1940-1980. Each series shows the percentage of children earning more than their parents vs. their parents' income percentile, limiting the sample to parents with positive income.

In the 1940 birth cohort, nearly all children grew up to earn more than their parents regardless of their parental income. Naturally, rates of absolute mobility were lower at the highest parental income levels, as children have less scope to do better than their parents if their parents had very high incomes.

Rates of absolute mobility have fallen substantially since 1940, especially for families in the middle and upper class. At the 10th percentile of the parental income distribution, children born in 1940 had a 94% chance of earning more than their parents, compared with 70% for children born in

[15] For example, if 10% of a birth cohort has 0 income, all children with 0 income receive a percentile rank of 5.

[16] The 0.1% sample used by Chetty et al. (2014b) is adequate to assess the stability of the copula using statistics such as rank-rank correlations and quintile probabilities, but it is not sufficiently large to directly estimate the 100 x 100 percentile copula for each birth cohort from 1971-84. This is why we use the 1980 copula estimated from the population tax data for all cohorts.

1980. At the 50th percentile, rates of absolute mobility fell from 93% for children born in 1940 to 45% for those born in 1980. And at the 90th percentile, rates of absolute mobility fell from 88% to 33% over the same period.

Figure 1B aggregates the rates of absolute mobility across parental incomes (including those with zero income) and plots average absolute mobility (A_c) for each birth cohort from 1940-1984. Absolute mobility declined starkly across birth cohorts: on average, 92% of children born in 1940 grew up to earn more than their parents. In contrast, only 50% of children born in 1984 grew up to earn more than their parents. The downward trend in absolute mobility was especially sharp between the 1940 and 1964 cohorts. The decline paused for children born in the late 1960s and early 1970s, whose incomes at age 30 are measured in the midst of the economic boom of the late 1990s. Absolute mobility then continued to fall steadily in the remaining birth cohorts.

III. Bounds Under Alternative Copulas

We now assess the sensitivity of the estimates reported in Figure 1 to the assumption that the copula remained stable at the values observed for the 1980 birth cohort going back to 1940. We do so by deriving bounds on the rate of absolute mobility in each birth cohort, searching over all copulas $C_c(r^k, r^p)$, defined non-parametrically by a 100 x 100 percentile-level matrix.

We restrict attention to copulas satisfying the intuitive requirement that children from higher income families are less likely to have lower incomes. Formally, we assume that the income distribution of children with higher-income parents first-order stochastically dominates (FOSD) the income distribution of children from lower income families:

$$\int_0^{r^k} C_c(r, r^p)dr \text{ is weakly decreasing in } r^p \text{ for all } r^k \quad (3)$$

For each birth cohort, we calculate bounds on absolute mobility by solving for the copulas $C_c(r^k, r^p)$ that minimize and maximize A_c, as defined in equation (2), given the empirically observed marginal distributions, $Q_c^k(r^k)$ and $Q_c^p(r^p)$. We impose two sets of constraints on this problem: the FOSD requirements for each (r^k, r^p) pair in (3) and integration constraints requiring that the columns and rows of $C_c(r^k, r^p)$ sum to 1. This optimization problem has 100 x 100 = 10,000 arguments, which might appear to be computationally intractable. Fortunately, since the objective function in (2) and all the constraints are linear, this problem can be solved rapidly using a standard linear programming algorithm.

The results of this bounding exercise are presented in Figure 2A. The series in circles reproduces the baseline estimates under the assumption of copula stability shown in Figure 1B. The dashed lines show the upper and lower bounds on absolute mobility. The bounds are very tight in early cohorts but grow much wider for more recent cohorts. For example, for the 1940 birth cohort, the bounds on absolute mobility span only 84% to 98%. In contrast, for the 1984 birth cohort, the bounds span 14% to 88%.

The dashed vertical line in Figure 2A demarcates the point after which the copula is known to be stable based on the analysis of tax records in Chetty et al. (2014b). Quite conveniently, the panel data necessary to estimate the copula happen to be available for precisely the cohorts where the bounds are least informative. For earlier cohorts, where the data needed to estimate the copula are missing, the bounds are quite narrow and the copula therefore proves to be unimportant. The upshot of Figure 2A is that even though we cannot identify the copula in early cohorts, we can be certain that absolute mobility has declined sharply since the 1940s.

The rest of this section explains why the bounds are tight in the 1940-50 cohorts but grow wider in more recent cohorts. To begin, Figure 2B plots the marginal distribution of income for children in the 1940 birth cohort and their parents. Income grew very rapidly across all quantiles of the income distribution between 1940 and 1970. As a result, there is very little overlap between the income distributions of children born in 1940 and their parents. For example, a child born to parents at the 80^{th} percentile of the parent income distribution needed to reach just the 14^{th} percentile of the children's income distribution to exceed her parent's income. In the extreme case in which the distribution of child income lies everywhere above the distribution of parental income – i.e., the poorest child earns more than the richest parent – absolute mobility would be 100% irrespective of which children are linked to which parents. Although the 1940 parent and child income distributions are not fully separated, we show below that they are sufficiently close to this scenario to render the copula unimportant for calculating absolute mobility.

In contrast, recent cohorts experienced much less growth across most quantiles of the income distribution (e.g., Goldin and Katz 2008, Autor 2014). Figure 2C illustrates this point by replicating Figure 2B for the 1980 birth cohort. Because growth rates were much lower between 1980 and 2010, there is substantial overlap between parents' and children's income distributions (at age 30) for children born in 1980. Children with parents at the 80^{th} percentile of the income distribution now need to reach the 74^{th} percentile of their cohort's income distribution to earn more than their parents.

Figure 2D shows why the greater degree of overlap between children's and parents' income distributions in recent cohorts leads to wider bounds on absolute mobility. The curves in this figure

plot the income rank a child must reach to earn more than her parents as a function of her parents' income percentile, separately for the 1940 and 1980 birth cohorts. For example, in order to earn more than parents at the 80th percentile, children need to reach the 14th percentile in the 1940 cohort and the 74th percentile in the 1980 cohort, as shown in Figures 2B and 2C.

The copula can be visualized in Figure 2D as the distribution of mass within the (r^k, r^p) square. Absolute mobility A_c can be calculated by summing the mass in the copula that lies above the relevant curve. The empirically observed copula for the 1980-82 cohorts used in our baseline analysis is shown by the shading in the figure, with darker colors representing areas with higher density. The mass is clustered around the diagonal, reflecting positive intergenerational persistence of income. Absolute mobility is 50% for the 1980 cohort because half of the mass of this copula lies above the curve plotted for the 1980 cohort.

Our bounding procedure minimizes and maximizes the amount of mass in the copula that falls above the curves in Figure 2D, subject to the FOSD and integration constraints specified above. Since the child rank required to beat parents is very close to the 45-degree line for the 1980 cohort, rates of absolute mobility are very sensitive to whether the mass in the copula lies just above or below the diagonal. This shows why we obtain wide bounds when searching over all copulas for the 1980 cohort.[17] In contrast, because the child rank required to earn more than parents is very low at nearly all percentiles of the parent income distribution for the 1940 cohort, all feasible copulas generate high levels of absolute mobility for that cohort.

IV. Sensitivity and Heterogeneity Analysis

In this section, we first assess the sensitivity of our baseline estimates to key specification choices, such as the price deflator and definition of income. We then examine heterogeneity in trends in absolute mobility across subgroups.

Sensitivity Analysis. We begin by considering alternative price deflators. Prior work has argued that the CPI-U-RS may overstate inflation by failing to account adequately for improvements in product quality and for the introduction of new goods (Boskin et al. 1996, Broda et al. 2009). Prior work on the measurement of trends in poverty recommends subtracting 0.8 percentage points from the annual

[17] The copulas for the 1980 cohort used to produce the upper and lower bounds in Figure 2A are displayed in Figure S1. The copula that generates the upper bound concentrates mass just below the 1980 curve shown in Figure 2D, while the copula that generates the lower bound concentrates mass just above that curve.

inflation rate implied by the CPI-U-RS to account for such biases (Meyer and Sullivan 2009, Broda and Weinstein 2010). The series in squares in Figure 3A replicates the baseline series on absolute mobility by cohort in Figure 1B using this adjusted price index. As expected, this adjustment increases absolute mobility in recent cohorts, as it increases real income growth rates across the distribution. However, the magnitude of the change is small: with the adjusted series, absolute mobility falls from 93% in 1940 to 59% in the 1984 cohort. Even subtracting 2 percentage points from the inflation rate implied by the CPI-U-RS – a conservative adjustment larger than virtually all existing estimates of the bias due to new goods – still results in a 26 percentage point decline in absolute mobility from 1940-1984 (Figure S2).

We also consider a variety of other commonly used price indices: (a) the Personal Consumption Expenditure Price Index (PCEPI), an index that includes a broader bundle of goods than the CPI; (b) the Producer Price Index (PPI), an index constructed based on prices at the producer level; (c) the GDP deflator, an index that covers all goods used domestically; and (d) the CPI-U series that is most commonly used to measure inflation.[18] All of these alternative indices produce time series of absolute mobility very similar to our baseline estimates (Figure 3A, Figure S2).

Our baseline analysis uses pre-tax measures of earnings rather than net income after taxes and transfers. Conceptually, it is not clear which of these income definitions provides a better measure of absolute mobility, as individuals' sense of progress might differ if they achieve upward mobility through government transfers rather than their own earnings. We assess whether the distinction matters empirically in Figure 3B by replicating our baseline analysis using post-tax and transfer incomes. We estimate tax liabilities for parents and children using the National Bureau of Economic Research TAXSIM model, which is available since 1960. Before 1960, we use data on federal marginal tax rates, adjusted for personal exemptions by marital status and number of children, applying the data in Wilson (2002). We estimate the value of transfers as the sum of Aid to Families with Dependent Children, General Assistance, Supplemental Security Income, and the cash value of in-kind transfers.[19] Accounting for taxes and transfers increases the level of absolute mobility by around 3 percentage points in all cohorts, but does not affect the trend in absolute mobility appreciably. This is because taxes and transfers affect the incomes of both parents and their children,

[18] The CPI-U-RS (research series) adjusts the CPI-U by correcting for substitution between existing products following Boskin et al. (1996), and generates inflation rates about 0.5% lower than the CPI-U.

[19] We obtain estimates of in-kind transfers from Fox et al. (2015), who estimate total benefits from SNAP, WIC, housing assistance, the School Lunch Program, and LIHEAP by combining CPS and administrative data. These data are available starting in 1967; we do not account for in-kind transfers before 1967. Meyer, Mok, and Sullivan (2015) show that transfers are under-reported by approximately 50% in survey data; we find that doubling the amount of transfers reported does not affect our estimates significantly.

and because the expansion of transfer programs in recent years has targeted the bottom of the income distribution, where rates of absolute mobility are already high even in pre-tax terms (Figure 1A).

In our baseline analysis, we measure children's incomes at age 30. One may be concerned that children take a longer time to reach peak lifecycle earnings in more recent cohorts, which could lead to a spurious downward trend in rates of absolute mobility. Figure 3C addresses this concern by replicating our baseline analysis measuring income at age 40 for children (for the 1940-74 cohorts) and at ages 35-45 for parents. This series continues to exhibit a sharp decline in absolute mobility across birth cohorts. The time pattern of the decline is shifted backward by approximately 10 years, consistent with measuring incomes 10 years later.

The fraction of individuals who are married at age 30 and the size of families have both fallen steadily in recent decades (Parker 2015). One widely used approach to adjusting for changes in household size is to divide family income by the square root of the number of family members in the household (e.g., Johnson et al. 2005). Figure 3D shows that when we divide our baseline income measures by the square root of family size, rates of absolute mobility fall from 93% in 1940 to 60% in 1984.[20] As an alternative approach, one can measure income at the individual rather than household level. The series in triangles in Figure 3D compares the individual earnings of sons to their fathers, as in prior studies of intergenerational mobility (e.g., Lee and Solon 2009). Here, we find a steeper decline in absolute mobility than in our baseline specification: the fraction of sons earning more than their fathers fell from 95% in 1940 to 41% in 1984. Together, these results show that accounting for trends in family size and the number of earners does not affect the qualitative conclusion that absolute mobility has fallen substantially.

Beyond the specific factors considered above, one may be concerned that levels of absolute mobility for recent cohorts may still be understated because of increases in fringe benefits, non-market goods, or under-reporting of income in the CPS (Bollinger et al. 2015, Piketty, Saez, and Zucman 2016). As an omnibus approach to assessing the potential bias from such factors, we recalculate absolute mobility for the 1984 birth after increasing each child's income by various fixed dollar amounts. Adding $1,000 to every child's income in 2014 would increase absolute mobility for the 1984 cohort to 51% from the baseline estimate of 50%; adding $10,000 would increase absolute mobility to only 61% (Figure S4). These calculations show that plausible adjustments to children's incomes are unlikely to change the conclusion that absolute mobility has fallen sharply from the rates of 80-90% experienced by children born in the 1940s and 1950s.

[20] Even the most conservative adjustment of dividing by the total number of people in the family continues to show a 26 percentage point decline in absolute mobility (Figure S3).

In our baseline analysis, we define absolute mobility using a discrete measure of whether children earn more than their parents. Figure S5 shows that using other thresholds or a more continuous definition of absolute mobility yields similar results. Panel A shows the fraction of children earning 20% more than their parents or 20% less than their parents. Both of these thresholds generate very similar declines in absolute mobility. In Panel B, we plot the median ratio of child to parent income, a statistic that accounts for the magnitude of the difference between parents' and children's incomes. This statistic declines from approximately 3 in the 1940 cohort to slightly less than 1 in the 1984 cohort. These results show that our findings are not sensitive to the exact metric used to compare children's earnings to their parents.

Finally, in the Supplementary Appendix (Figures S6-S9), we show that the results are also robust to a set of other technical issues that arise from data limitations: (a) adjusting for changes in the definition of family income across Censuses; (b) including immigrants in all years to account for missing data on immigrant status in early cohorts; (c) using a single Census to measure parents' income instead of pooling data across multiple Censuses; and (d) using data from either the Census or CPS to measure the incomes of both parents and children from a single dataset.

Heterogeneity. Next, we examine how trends in absolute mobility vary across subgroups. We begin by examining heterogeneity across states. We define parents' states as based on where they live when we measure their incomes (between ages 25-35). We define children's state as their state of birth to account for the possibility that children who grow up in a given state may move elsewhere as adults. Since children's state of birth is not observed in the CPS, we use the Census for both parents and children.[21]

Figure 4 presents the results by state. Panel A shows absolute mobility by cohort for selected states (see Table S2 for estimates for all states). Panel B presents a heat map of the change in absolute mobility from 1940 to 1980 by state, with darker colors representing areas with larger declines. Absolute mobility fell substantially in all 50 states between the 1940 and 1980 birth cohorts. Absolute mobility fell particularly sharply in the industrial Midwest, where rates of absolute mobility fell by 48 percentage points in Michigan and approximately 45 percentage points in Indiana,

[21] To increase precision, our state-level analysis includes all children aged 25-35 and uses the 100% Census in 1940 and 5% IPUMS sample in 1980. Measuring children's incomes from ages 25-35 rather than just at age 30 creates small differences in levels of absolute mobility. To adjust for these differences, we calculate the difference between the baseline national estimates and population-weighted national means of our state-level estimates for each cohort, and add these differences to the state-level estimates.

Illinois, and Ohio. The smallest declines occurred in states such as Massachusetts, New York, and Montana, where absolute mobility fell by approximately 35 percentage points.

Next, we examine heterogeneity by gender. When comparing children's family incomes to their parents' family incomes as in our baseline analysis, we find similar declines in absolute mobility for sons and daughters (Figure S10). However, the patterns differ by gender when we focus on *individual* earnings. As noted above, sons' chances of earning more than their fathers fell steeply, from 95% in 1940 to 41% in 1984, underscoring the sharp decline in the economic prospects of American men. In contrast, the fraction of daughters earning more than their fathers fell from 43% for the 1940 birth cohort to 22% in 1960, and then rose slightly to 26% in 1984. The pattern for women's individual earnings differs because of the rise in female labor force participation rates and earnings over the period we study (Figure S11).

In sum, the subgroup analysis shows that declines in absolute mobility have been a systematic, widespread phenomenon throughout the United States since 1940.

V. Counterfactual Scenarios

Why have rates of absolute income mobility fallen so sharply over the last half century, and what policies can restore absolute mobility to earlier levels? We use counterfactual simulations to evaluate the effects of two key trends over the past half century: declining rates of GDP growth and greater inequality in the distribution of GDP (Piketty and Saez 2003, Goldin and Katz 2008).

We consider two counterfactual scenarios. The first, a "higher GDP growth" scenario, asks what would have happened to absolute mobility for the 1980 cohort if the economy had grown as quickly during their lifetimes as it did in the mid-twentieth century, but with GDP distributed across households as it is today. The second "more broadly shared growth" scenario asks the converse: what if total GDP grew at the rate observed in recent decades, but GDP was allocated across households as it was for the 1940 birth cohort? The first scenario expands the size of the economic pie, dividing it in the proportions by which it is divided today. The second keeps the size of the pie fixed, but divides it more evenly as in the past.

We calculate children's counterfactual incomes under the "higher GDP growth" scenario as follows. Let G_t^O denote the observed GDP per working-age family in year t.[22] We first define the

[22] We define "working-age families" as families with at least one member between the ages of 18 and 64. We normalize GDP by the number of working-age families to control for changes in GDP due to changes in the number of working-age adults.

share of GDP that goes to children at percentile q of the 1980 cohort in 2010 as $\pi^k_{q,1980} = y^k_{q,1980}/G^O_{2010}$, where $y^k_{q,1980}$ is the q^{th} percentile of the income distribution in 2010 for children in the 1980 cohort. We then construct a counterfactual level of GDP per working-age family in 2010, $G^C_{2010} = G^O_{1980} \times 1.025^{30}$, under the assumption that real GDP per family grew at a rate of 2.5% per year from 1980 to 2010. This 2.5% growth rate is comparable to the real growth rate per working-age family from 1940-1970, and is one percentage point per year higher than the actual annualized growth rate from 1980-2010 of 1.5%.[23] Finally, we define a counterfactual marginal income distribution for children in the 1980 cohort as

$$y^{k,C1}_{q,1980} = \pi^k_{q,1980} \times G^C_{2010} \qquad (4)$$

The counterfactual income for children at percentile q is given by the share of GDP going to 30 year olds at percentile q in 2010 multiplied by the level of GDP that would have prevailed in 2010 had children in the 1980 cohort experienced GDP growth from birth to age 30 comparable to that experienced by children born in the 1940s.

For the "more broadly shared growth" scenario, we follow the same approach as above to calculate the share of GDP that goes to children at percentile q of the 1940 cohort in 1970, $\pi^k_{q,1940} = y^k_{q,1940}/G^O_{1970}$. We then apply these shares to the observed level of 2010 GDP to construct a counterfactual income distribution for the 1980 birth cohort:

$$y^{k,C2}_{q,1980} = \pi^k_{q,1940} \times G^O_{2010} \qquad (5)$$

This counterfactual represents the incomes 30 year olds would have had in 2010 if GDP in 2010 were allocated across households in the same proportions as in 1970.

After calculating the counterfactual income distributions for children in the 1980 cohort, $\{y^{k,C1}_{q,1980}\}^{100}_{q=1}$ and $\{y^{k,C2}_{q,1980}\}^{100}_{q=1}$, we use the same copula and parent marginal income distributions as above to compute counterfactual rates of absolute mobility by parent income percentile. Figure 5A presents the results. The top and bottom curves in the figure reproduce the empirical series for the 1940 and 1980 cohorts from Figure 1A. The dotted and dashed series show absolute mobility rates that would have been observed for the 1980 cohort under the counterfactuals in (4) and (5).

Under the higher growth counterfactual, the mean rate of absolute mobility is 62%. This rate is 12 percentage points higher than the empirically observed value of 50% in 1980, but closes only 29% of the decline relative to the 92% rate of absolute mobility in the 1940 cohort. The increase in absolute mobility is especially modest given the magnitude of the change in the aggregate economy:

[23] The 1.5% growth rate of GDP per working-age family corresponds to total real GDP growth of 2.8% per year, while the 2.5% growth rate of GDP per working-age family corresponds to total real GDP growth of 3.8% per year.

a growth rate of 2.5% per working-age family from 1980 to 2010 would have led to GDP of $20 trillion in 2010, $5 trillion (35%) higher than the actual level.

The more broadly shared growth scenario increases the average rate of absolute mobility to 80%, closing 71% of the gap in absolute mobility between the 1940 and 1980 cohorts. The broadly shared growth counterfactual has larger effects on absolute mobility at the bottom of the income distribution, whereas the higher growth counterfactual has larger effects at higher income levels. Since income shares of GDP are larger for high-income individuals, higher growth rates benefit those with higher incomes the most, while a more equal distribution benefits those at the bottom the most.

The results in Figure 5A imply that much of the decline in absolute mobility is due to changes in the distribution of growth rather than reductions in aggregate growth rates. In Figure 5B, we ask what rates of GDP growth would be necessary to return to mid-century rates of absolute mobility under today's income distribution. We plot mean rates of upward mobility under real GDP per family growth rates from 1% to 10%, recalculating G_{2010}^{C} and applying (4) to generate counterfactual income distributions. Achieving rates of absolute mobility above 80% under today's income distribution would require sustained real per-family growth greater than 5% per year (or total real GDP growth above 6.4%), well above the historical experience of the United States since World War II.

To see why absolute mobility is not very responsive to the growth rate when growth is distributed unequally, consider the extreme case in which one child obtains all of the increase in GDP. In this case, higher GDP growth rates would have no effect on absolute mobility. More generally, GDP growth has larger effects on absolute mobility when growth is spread more broadly, allowing more children to achieve higher living standards than their parents. Higher GDP growth and a broader distribution of growth have a multiplicative effect on absolute mobility: absolute mobility is highest when GDP growth rates are high *and* growth is spread broadly across the distribution.

In the Supplementary Appendix, we show that similar results are obtained when using counterfactuals for the change in incomes from 1980 to 2010 based on shares of GDP growth over that period rather than counterfactuals for the level of incomes in 2010. Measuring incomes at age 40 instead of 30 also yields similar results (Figure S12).

In sum, the counterfactuals show that higher growth rates alone are insufficient to restore absolute mobility to the levels observed in mid-century America. A broader distribution of income

growth is necessary to revive absolute mobility, and can itself be sufficient to reverse much of the decline since 1940 even if growth were to remain at current levels.[24]

VI. Conclusion

The analysis in this paper yields two main results. First, children's prospects of earning more than their parents have faded over the past half century in the U.S. The fraction of children earning more than their parents fell from approximately 90% for children born in 1940 to around 50% for children entering the labor market today. Absolute income mobility has fallen across the entire income distribution, with the largest declines for families in the middle class. These findings contrast with prior research showing that *relative* mobility – measured, for instance, by the correlation between parents' and children's incomes – remained stable in recent decades (e.g., Lee and Solon 2009, Chetty et al. 2014b). The measures of absolute mobility we focus on in this study differ from relative mobility because they compare levels of earnings across generations by bringing in data on the marginal income distributions of parents and children. Absolute mobility has fallen over time while relative mobility has remained stable because income growth has stagnated across much of the income distribution in recent decades.

Second, most of the decline in absolute mobility is driven by the more unequal *distribution* of economic growth in recent decades rather than the slowdown in GDP growth rates. In this sense, the rise in inequality and the decline in absolute mobility are closely linked. Growth is an important driver of absolute mobility, but high levels of absolute mobility require broad-based growth across the income distribution. With the current distribution of income, higher GDP growth rates alone are insufficient to restore absolute mobility to the levels experienced by children in the 1940s and 1950s. If one wants to revive the "American Dream" of high rates of absolute mobility, then one must have an interest in growth that is spread more broadly across the income distribution.

[24] Plausible changes in relative mobility (the copula) also have modest effects on average rates of absolute mobility. For example, a uniform copula – where children's ranks are independent of their parents' ranks – would still produce absolute upward mobility for the 1980 cohort of 50%. Greater relative mobility produces higher rates of absolute mobility for children with low-income parents while reducing rates of absolute mobility for children with high-income parents, leaving average absolute mobility essentially unchanged.

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Supplementary Appendix

This appendix contains three sections. Section I describes how we construct our samples and define the key variables used in the baseline specifications and sensitivity analyses. Section II presents a set of supplementary robustness checks that address various limitations of our data. Section III presents further detail on the methods underlying the counterfactual simulations and supplementary counterfactual results. Stata and Matlab code to reproduce all of the results in the paper from publicly available data can be downloaded from www.equality-of-opportunity.org.

Section I: Sample Construction and Variable Definitions

We construct estimates of absolute mobility by combining three sets of data. First, we construct a series of marginal income distributions for parents using the decadal Census data. Second, we construct a series of marginal income distributions for children using CPS data. Third, we construct the joint distribution of parent and child rank (the copula) using de-identified data from federal income tax returns.

In this section, we describe how we construct each of these three elements. We then discuss how we combine them to estimate absolute mobility in our baseline specification. Finally, we summarize supplementary data used for sensitivity analyses, such as alternative price deflators and data on taxes and transfers.

A. Parents' Income Distributions

Sample Construction

We obtain data on parents' incomes from the 1940 to 2000 U.S. Censuses, retrieved via the University of Minnesota's Integrated Public Use Microdata Series (IPUMS). We use the 1% national random samples provided by IPUMS (except for the state-level analysis in Figure 4, where we use the 100% sample for 1940 and the 5% sample for 1980). We use the Form 1 Metro sample in 1970 and the Metro sample in 1980 (which are, contrary to their labels, full population samples) and the unweighted samples in 1990 and 2000.

To construct a sample that can be used without weights, we restrict the 1940 and 1950 Censuses to self-weighting sample-line persons and their families. Since the CPS data that we use to estimate children's incomes does not sample institutional group quarters, we render the Census and CPS samples comparable by excluding from the Census individuals residing in institutional group quarters (i.e., correctional and mental institutions, as well as institutions for the elderly and the handicapped) and residents of the military non-institutional group quarters. For every birth cohort from 1940 to 1984, we restrict our sample to parents who had children between the ages of 16 and 45 (inclusive). In two-parent households, we define the "representative parent" as the spouse with the higher total personal income, and use this parent's age when restricting the sample.

We follow the rules established by IPUMS to determine parent-child relationships, as well as whether and to whom a respondent is married.[25] Children for whom no parent-child link can be made

[25] We determine marital status and partner using both the SPLOC and MARST variables. For more detail, see https://usa.ipums.org/usa/chapter5/chapter5.shtml.

– that is, for whom both mother's and father's location in the household are not recorded – are dropped from the sample.

Baseline Income Definitions

Our baseline definition of family income varies across Census years because the income variables change across the Censuses. A complete list of the underlying IPUMS-USA variables used to construct our measures of parental income in each Census year is given in Table S3.

In the 1970 to 2000 Census years, we define parents' family income as the sum of spouses' pre-tax total personal income, minus income derived from Aid to Families with Dependent Children, General Assistance, and Supplemental Security Income.

Prior to 1970, data on income from public assistance programs is unavailable in the Census. Therefore, in the 1960 Census, parental income is defined simply as the sum of spouses' total personal income. In 1950, where personal income is only available for sample-line household heads, the sum of spouses' income cannot be computed. Here, we define parents' family income as the sum of the sample-line household head's total income, plus any income from other members of the primary family (including business, farm, and wage income, as well as from other, unspecified sources).

In the 1940 Census, only data on wages and salaries is available, as well as an indicator of whether respondents had more than $50 in non-wage, non-salary income. For 1940, we therefore impute average non-wage, non-salary income from the 1950 Census (adjusted for inflation) for each combination of occupation (using the detailed 1950 Census Bureau occupational classification), self-employed status, race (black, white, other), and the indicator for non-wage income above $50. Parents' family income in 1940 thus comprises the sum of spouses' wages, as well as their imputed non-wage income.

Inflation Adjustment

In our baseline specifications, we adjust for inflation using the Consumer Price Index Research Series (CPI-U-RS), available from the Bureau of Labor Statistics from 1977 onward. For all prior years, we follow the Census Bureau in applying the 1977 CPI-U-RS-to-CPI-U ratio to the CPI-U of previous years. Since income in Census and CPS refers to income earned in the previous calendar year, inflation adjustments are also applied to that calendar year. For instance, in the 1960 Census, income refers to income earned in 1959; our inflation adjustment thus pertains to 1959 U.S. dollars.

Construction of Marginal Distributions

As described in Section I of the text, we combine several Censuses to measure income between ages 25-35 (inclusive) for parents who had children in a given birth cohort *c*. In particular, we pool all individuals between the ages of 25 and 35 (at the time of the survey) in the available Census samples who had a child in cohort *c*. However, when drawing records from Censuses before year *c* (i.e., for parents who had children after age 35), we measure the incomes of *all* adults between ages 25-35 and

assign them weight equivalent to the fraction of adults who have children in cohort *c* after age 35. This is because we naturally cannot observe who will have children in the future.[26]

For children born in 1940, we cannot secure income measurements from prior Censuses because income data were not collected prior to the 1940 Census. We therefore use income measurements from the 1940 Census itself for these older parents, pooling parents up to age 45.[27] Likewise, because we can only reach back to the 1940 Census for the 1941-1949 birth cohorts, the income measurements for parents who had children in these earlier birth cohorts are also taken at slightly older ages on average relative to the measurements for parents who had children more recently. These age differences make it slightly more difficult for children of these early cohorts to exceed the income of their parents, reducing our estimate of the decline in absolute mobility.

We compute marginal income distributions for parents of children in each birth cohort by first estimating the cutoff values for the 100 percentile ranks and then calculating mean incomes within each percentile. We exclude parents with zero income when estimating the parental marginal income distribution. Parents with zero income are reintroduced in the final step of our absolute mobility calculations, described in Subsection D below.

B. Children's Income Distributions

Sample Construction

We obtain data on children's incomes from the 1970-2014 Annual Social and Economic Supplements of the Current Population Surveys (CPS-ASEC). We include only respondents who are 30 years old. We exclude all respondents who reported a birthplace outside of the United States starting in 1994 (information on birthplace is unavailable prior to 1994).

Baseline Income Definitions

Children's income is defined analogously to parents' family income, namely as the sum of spouses' total personal income minus income from welfare and Supplemental Security Income. Table S4 lists the variables in the IPUMS-CPS that we use to construct our measures of children's income.

To account for the different thresholds used to top code income across different years of the CPS-ASEC, we use the Census Bureau's income component rank proximity swap values for 1976-2010 (which are constructed using restricted CPS data that are not top-coded).[28] We apply this procedure to all income components separately (such as wages and business income), and then sum them to obtain total personal income.

Construction of Marginal Distributions

[26] Our approach double counts the incomes of individuals who have children at exactly age 25 or 35. We adopt this approach to obtain a symmetric window around age 30. Measuring incomes when parents are between ages 25 and 34 or 26 and 35 to avoid double counting yields estimates of absolute mobility that bracket the estimates we report.
[27] Because we do not use data on parents' incomes from earlier Censuses, the number of observations used to construct parents' income distributions for the 1940 birth cohort is lower than for subsequent cohorts (Table S1).
[28] For further detail on this procedure, see https://cps.ipums.org/cps/income_cell_means.shtml

To construct marginal income distributions for each birth cohort, we again estimate the cutoff values for every percentile and then calculate mean incomes within each percentile. We account for the CPS's stratified sampling scheme by using person-level sampling weights provided for use with ASEC when estimating the percentile cutoff values.

Our income estimates from our CPS-ASEC samples closely match the trends in median individual income by gender published in Table P-8 of the Census Bureau's Historical Income Tables based on CPS data (see Figure S11). For purposes of this comparison, we extend our sample to include all individuals aged 25-34 and exclude individuals with no reported individual income.

C. Copula

The copula we use is the 100 x 100 percentile transition matrix constructed by Chetty et al. (2014a, Online Data Table 1).[29] We briefly summarize the methodology used to construct this copula below; see Chetty et al. (2014a, Appendix A) for further information.

Sample Construction

The sample consists of the set of children in Social Security Administration population records who are born between 1980-1982 and are U.S. citizens as of 2013. For each child, we then define the parent(s) as the first person(s) who claim the child as a dependent on a 1040 tax form. Ninety percent of children born between 1980 and 1982 can be linked to parents based on dependent claiming. We limit the sample to children who can be linked to parents.

Income Definitions

We define both parents' and children's family income in the tax data as follows. In years where the individual files a tax return, we define family income as Adjusted Gross Income (as reported on the 1040 tax return) plus tax-exempt interest income and the non-taxable portion of Social Security and Disability benefits. In years where the individual does not file a tax return, we define family income as the sum of wage earnings (reported on form W-2), unemployment benefits (reported on form 1099-G), and gross social security and disability benefits (reported on form SSA-1099). In years where the individual has no tax return and no information returns, family income is coded as zero.

We average parents' family income over the five years from 1996 to 2000 (the earliest years available in the sample) to obtain a proxy for parent lifetime income that is less affected by transitory fluctuations. We define child family income as mean income over the last two years in the data (2011 and 2012), when children in the 1980-82 cohorts are in their early thirties.

Construction of Copula

We exclude parents with zero or negative income when constructing the copula because parents with no earnings typically do not file a tax return and hence cannot be linked to their children based on dependent claiming. After excluding parents with zero income, we assign parents percentile ranks based on their incomes relative to other parents in the sample. Children are assigned percentile ranks based on their incomes relative to other children in the same birth cohort. We estimate the copula

[29] This table can be downloaded from http://www.equality-of-opportunity.org/index.php/data.

non-parametrically as a 100×100 matrix that gives the joint probability of each child and parent percentile rank pair.

For simplicity, we use the same copula when analyzing subgroups (by gender and state). Using gender-specific or state-specific copulas yields very similar estimates of mean absolute mobility by cohort (not reported). We also use the same copula when measuring income at age 40, motivated by evidence that distribution of income ranks is stable between the ages of 30 and 60 (Chetty et al. 2014a).

D. Constructing Absolute Mobility

We combine the copula and the marginal income distributions for each birth cohort to calculate the fraction of children who earn as much or more than their parents at each parental income percentile. The mean absolute mobility for a given cohort is simply the average of the rates of absolute mobility across all parental income levels. We include parents with zero income when computing these cohort-level averages, noting that children whose parents have zero income always earn at least as much as their parents. Formally, we calculate mean absolute mobility in cohort c as

$$A_c = z_c + (1 - z_c)A_{c \mid Par\_Inc > 0}, \quad (1)$$

where z_c is the fraction of parents with zero income in cohort c and $A_{c \mid Par\_Inc > 0}$ is mean absolute mobility for positive parental income (computed as an unweighted mean of absolute mobility across percentiles).

E. Variable Definitions for Sensitivity and Heterogeneity Analysis

This subsection defines the variables used for the sensitivity and heterogeneity analysis in Section IV of the paper.

Alternative Price Deflators

We obtain additional deflators (PCEPI, PPI, GDP Deflator, CPI-U) from the Federal Reserve Economic Data (FRED) database from the Federal Reserve Bank of St. Louis.

Taxes and Transfers

We estimate taxes using the NBER TAXSIM model (Feenberg et al. 1993). TAXSIM provides federal tax estimates starting in 1960. We use it to estimate federal tax liability after credits for children in all cohorts and for parents in 1960 and thereafter. To estimate taxes for parents prior to 1960, we use data on federal marginal tax rates and exemptions from Wilson (2002).

We compute taxes in TAXSIM using the following variables: year, marital status, age of the primary and secondary taxpayers, wages and salary income (replicating the definitions in our baseline income specification), and number of dependents. We use the output variable FIITAX, the federal income tax liability after credits. When using marginal tax rates (prior to 1960), we determine exemptions based on marital status and the number of dependents.

We use two sources of data to measure transfers. First, we use the CPS and Census to measure the value of cash transfers from welfare programs and Supplemental Security Income. In particular, we

add in the variables incwelfr and incssi in IPUMS-CPS, and incwelfr and incsupp in IPUMS-USA. We are able to measure these transfers for children in all years and for parents from 1970 onward.

Second, we include estimates of in-kind transfers from Fox et al. (2015), which cover SNAP, WIC, housing assistance, the School Lunch Program, and LIHEAP. Data on in-kind transfers are only available from 1967 onward. Prior to 1967, these transfers are set to zero. Fox et al. (2015) use CPS and administrative data to estimate mean transfers (with and without tax credits) by marital status, number of children, age categories, and family income decile for each year. We use these four criteria to bin our observations and then assign everyone in each bin the corresponding average transfer amount. Families with positive income are assigned the mean transfer *excluding* tax credits, and families with incomes of zero or less are assigned mean transfer *including* tax credits. This is because families with positive incomes have already had their tax-credits accounted for by TAXSIM.[30]

Alternative Income Measures

We use the following alternative income definitions for sensitivity analyses (Figure S6):

Total family income is defined as the sum of personal incomes of all co-residing members of the same primary family (e.g., siblings, parents, or any other relatives). In our baseline analysis, we use the sum of spouses' total personal income minus income from welfare after 1950; however, we rely on total family income to measure parents' income in the 1950 Census as spouses' total personal income is not reported. The total family income definition is consistent across all years starting with the 1950 Census.

Wage and salary income is defined as the sum of spouses' income from wages and salaries. In our baseline analysis, we use wage and salary income to measure incomes in the 1940 Census (supplemented by imputed non-wage, non-salary income) because measures of total family income and spousal income are not available. The wage and salary income measure is consistent across all years starting with the 1940 Census.

Section II: Additional Robustness Checks

In this section, we present a set of supplementary robustness checks that address various limitations of the data we use.

First, our baseline analysis measures parents' family income as the sum of spouses' total personal income in the 1960-1980 Censuses. However, the 1950 Census only reports total family income, while the 1940 Census includes only wages and salaries, forcing us to use different income definitions in these earlier years as discussed above. Figure S6 shows that the trend in absolute mobility is very similar if we use alternative income definitions that do not change across Censuses: the sum of the spouses' wage and salary income only or total family income, defined as the sum of income earned by all co-residing members of the primary family.

[30] The estimates on credits provided by TAXSIM are frequently higher than Fox et al. (2015), consistent with under-reporting of credits in the survey data (Meyer, Mok, and Sullivan 2015). To check whether such under-reporting affects our results, we implement specifications doubling the transfers reported by Fox et al. (2015). Our baseline estimates of absolute mobility are not affected appreciably by such a correction.

Second, the CPS data does not record individuals' birthplace before 1994. As a result, our baseline series excludes immigrants starting with the 1964 cohort. To verify that this change in the treatment of immigrants does not affect our results, Figure S7 includes immigrants in the calculation of children's marginal income distributions for all cohorts. Absolute mobility is slightly lower when immigrants are included because immigrants tend to have lower earnings than natives on average, but the trends are similar to our baseline results.

Third, in our baseline analysis, we pool data across multiple Censuses to measure the incomes of all parents between the ages of 25 and 35. This procedure provides an imperfect measure of parents' incomes because it relies on the assumption that the income distribution of those who have children after age 35 is representative of the income distribution of the general population and because it does not account for mortality or changes in parents' marital status across Censuses. To assess the robustness of our findings to these concerns, we replicate our analysis using only a single Census to measure parents' incomes, restricting parents' age at childbirth to be between 25 and 35. Figure S8 shows that we obtain very similar results when we focus on this subsample of parents.

Finally, the baseline results combine data for parents from the Census with data from the CPS for children. The use of the CPS for children permits measurement of children's income in each birth cohort at exactly age 30, while the use of the Census for parents allows us to obtain data on parents' incomes back to 1940 (as the CPS began collecting comprehensive income data only in 1967). To ensure that mixing income information from two different datasets does not produce bias, we estimate marginal income distributions using either the Census or the CPS for *both* parents and children. Figure S9 shows that we obtain very similar estimates of absolute mobility when we use data from only the Census or only the CPS for both parents and children for the cohorts where data are available.[31]

Section III: Counterfactuals

This section provides further detail on the methodology used to construct the counterfactuals discussed in Section V of the text and presents an additional set of counterfactuals to assess the robustness of our conclusions.

A. Methods for Baseline Counterfactuals

Higher GDP Growth Scenario

To construct the higher growth counterfactual, we first calculate the ratio of income at each percentile q of the income distribution at age 30 for children in the 1980 birth cohort ($y^k_{q,1980}$) to GDP per working-age family in 2010 (G^O_{2010}). We measure G^O_{2010} using annualized real GDP data from FRED (https://fred.stlouisfed.org/series/GDPCA). The number of working-age families is

[31] For simplicity, when we measure parents' incomes in the CPS, we only include parents between the ages of 25 and 35 who have a child less than one year old at the time of the survey. Unlike in our baseline analysis, we do not pool earlier or later surveys to include parents who have children before age 25 or after age 35 when estimating parents' incomes using the CPS. This is why the levels of absolute mobility in this series are closer to those in Figure S8, which shows comparable estimates from our baseline Census-CPS specification. When we estimate children's incomes using the Census, we include individuals born in the U.S. who are 30 years old.

calculated by summing the household weights of all "famunits" that contain at least one person aged 18-64 in the Census, excluding those living in group quarters (GQ = 3 or 4).

We then compute counterfactual GDP per working-age family in 2010 (G^C_{2010}) by applying 30 years of a 2.5% annual growth to the 1980 GDP per working-age family of \$87,908. This gives a counterfactual GDP per family of G^C_{2010} =\$184,393= \$87,908×1.025^{30} in 2010, compared to the observed value of G^O_{2010} = \$136,198. Finally we create the counterfactual incomes by multiplying the observed income-to-GDP ratios ($\pi^k_{q,1980} = y^k_{q,1980}/G^O_{2010}$) by the counterfactual GDP G^C_{2010}.

We use analogous methods to calculate absolute mobility under the alternative annual growth rates of 1-10% presented in Figure 5B.

More Broadly Shared Growth Scenario

To construct the more broadly shared growth counterfactual, we first calculate the ratio of income at each percentile of the income distribution at age 30 for children in the 1940 birth cohort ($y^k_{q,1940}$) to GDP per working-age family in 1970 (G^O_{1970}). We then multiply this ratio by the observed 2010 GDP per working-age family of G^O_{2010} = \$136,198 to obtain a counterfactual income distribution for children in the 1980 birth cohort.

B. Robustness to Alternative Counterfactuals

Measuring Income at Older Ages

Our more broadly shared growth counterfactual reallocates income not just across different income groups but also across individuals of different ages. In this subsection, we assess whether this reallocation across ages affects our conclusion that a broader distribution of growth across income groups would substantially increase absolute mobility.

To motivate the issue, note that by using the ratio of child incomes at age 30 to GDP per working-age family to characterize the income distribution, our counterfactuals combine three channels through which the allocation of GDP affects children's marginal income distributions. First, within the set of 30 year olds in our sample, the allocation of income has become more unequal over time. In 1970, the difference between the 90th and 10th percentile of the income distribution of 30 year olds was \$70,011; this difference grew to \$118,347 in 2010. Second, the total amount of GDP per working-age family that accrues to 30 year olds has declined. The average income of 30 year olds in our sample fell from 69% of GDP per working-age family in 1970 to 44% in 2010. Finally, the total amount of national income captured in the CPS and Census has declined with the rise of profits and the increase in top income shares, which are not fully recorded in surveys (Bollinger et al. 2015, Piketty, Saez, Zucman 2016). The ratio of total income in the CPS to total GDP declined from 73% in 1970 to 60% in 2010.

To understand the contributions of these three components to our counterfactuals under the broadly shared growth scenario, we first consider a counterfactual that uses the total income in the CPS (per working-age family) instead of GDP to measure G^O_{2010}. This lowers the estimated rate of absolute mobility from the baseline value of 80% to 72%. As expected, a broadly shared growth scenario that does not fully account for the rise of incomes not captured in the CPS generates a lower rate of absolute upward mobility.

Second, we consider a counterfactual that replaces GDP (G^O_{2010}) with the total amount of income that accrues to 30 year olds in the CPS. In this scenario, absolute mobility would be 57%. This result shows that a significant portion of the increase in absolute mobility in our baseline more broadly shared growth counterfactual is driven by the fact that 30 year olds today earn a smaller fraction of GDP than in the past. This finding raises the potential concern that the effects of distributing income more equally on absolute mobility might differ if we measure incomes at older ages.

We evaluate this concern by repeating our counterfactuals, measuring incomes at age 40 instead of age 30. We construct counterfactuals for the 1970 cohort, the most recent decadal birth cohort for whom we can measure income at age 40. For the higher growth scenario, we use the same counterfactual level of GDP per working-age family in 2010 used for the age 30 counterfactuals, G^C_{2010} =$184,393.[32] However, we multiply the observed income-to-GDP ratios for 40 year olds in 2010 ($\pi^k_{q,1970} = y^k_{q,1970}/G^O_{2010}$) by G^C_{2010} to create the counterfactual income distribution at age 40 for the 1970 cohort under higher GDP growth. For the more broadly shared growth scenario, we calculate income-to-GDP ratios using incomes and GDP in 1980, when the 1940 cohort was 40 years old. We then multiply these ratios by observed GDP per working-age family in 2010 (G^O_{2010}) to construct estimates of what the 1970 cohort would have earned at age 40 if GDP in 2010 were allocated more evenly.

Panel A of Figure S12 presents the results of these counterfactuals, along with the actual levels of absolute mobility observed at age 40 for the 1940 and 1970 birth cohorts. In the data, mean absolute mobility at age 40 fell from 86% for the 1940 cohort to 56% for the 1970 cohort. Our counterfactual analysis shows that mean absolute mobility for the 1970 cohort would be 68% under the higher growth counterfactual, closing 39% of the gap between the two cohorts. Mean absolute mobility would rise to 74% for the 1970 cohort under the more broadly shared growth counterfactual, closing 59% of the observed gap between the two cohorts. Hence, the qualitative conclusion that more broadly shared growth would have a substantial effect on absolute mobility is unaffected by measuring income at later ages. Intuitively, the effect of the changing age distribution of growth noted above is partly offset by the greater degree of inequality in incomes at older ages, which increases the impact of changing the income distribution.

Using Shares of GDP Growth Instead of Levels

In our baseline analysis, we construct counterfactual incomes by allocating GDP based on individuals' observed shares of the *level* of GDP at age 30. An equally reasonable alternative is to construct counterfactuals based on individuals' observed shares of GDP *growth* from birth to age 30. In this subsection, we assess whether using growth shares would affect our conclusions.

To construct counterfactual incomes under the higher growth scenario using growth shares, we first calculate the *difference* in income between children and parents at each percentile q for the 1980 cohort ($y^k_{q,1980} - y^P_{q,1980}$). We then calculate the change in GDP per working-age family from 1980 to 2010 ($G^O_{2010} - G^O_{1980}$). Dividing the difference in income at a given percentile by the change in GDP gives us the ratio of income to GDP growth at each percentile for the 1980 cohort. We then

[32] We use the same counterfactual GDP – applying 30 years of a 2.5% annual growth rate to GDP in 1980 – even though children are 40 years old when we measure their incomes because children's incomes are still measured approximately 30 years after their parents' incomes.

multiply these ratios by the counterfactual GDP per family growth of $96,485 – the counterfactual GDP per working-age family of G^C_{2010} =$184,393 minus observed 1980 GDP of $87,908 – and add them to the 1980 parent incomes at each percentile to obtain counterfactual incomes for children.

To construct counterfactual incomes under the more broadly shared growth scenario using growth shares, we first calculate the difference in parent versus child incomes at each percentile of the income distribution for the 1940 cohort ($y^k_{q,1940} - y^P_{q,1940}$). We then divide these differences by the increase in GDP per working-age family from 1940 to 1970 ($G^O_{1970} - G^O_{1940}$) to obtain the ratio of income to GDP growth at each percentile for the 1940 cohort. We then multiply these ratios by the observed change in GDP per working-age family from 1980-2010 of $48,291 ($136,198 in 2010 minus $87,908 in 1980) and add them to the 1980 parent incomes at each percentile to obtain counterfactual incomes for children.

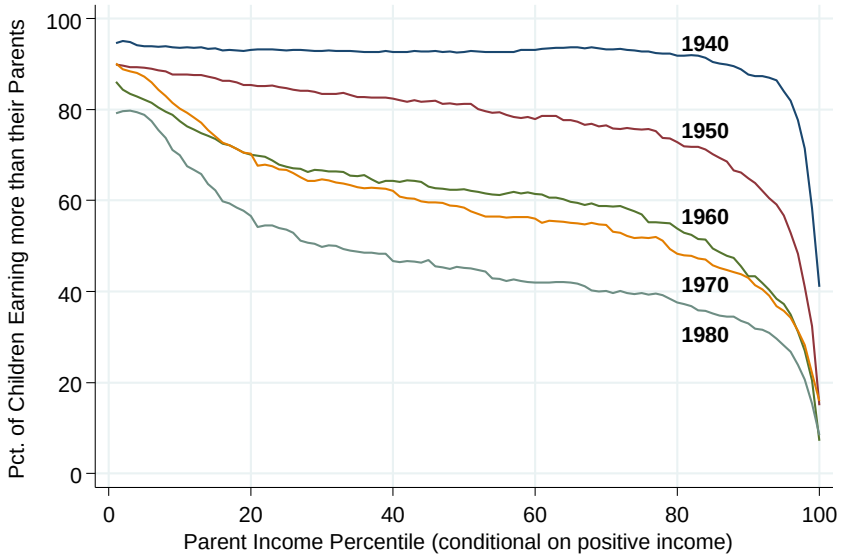
The results of this alternative approach are presented in Panel B of Figure S12. We find an even larger impact of the broadly shared growth counterfactual relative to the high growth counterfactual than in our baseline counterfactuals. Under the broadly shared growth counterfactual, mean absolute mobility rises to 80%; under the higher growth counterfactual, mean absolute mobility *falls* to 47%. This is because many percentiles of the children's income distribution have fallen relative to their parents for the 1980 birth cohort. For these groups, allocating growth in accord with how it has been allocated between 1980-2010 (i.e., using negative growth shares) decreases their incomes further. Conversely, changing the distribution to the more equal shares of growth experienced by the 1940 cohort has very large effects.

In Panel C of Figure S12, we replicate the growth shares counterfactuals in Panel B, measuring incomes at age 40 for the 1970 cohort. These counterfactuals are constructed in the same way as above, except that they use income growth to GDP growth ratios for the years 1950-1980 rather than 1940-1970 in the more broadly shared growth counterfactual. The results at age 40 are very similar to those at age 30.

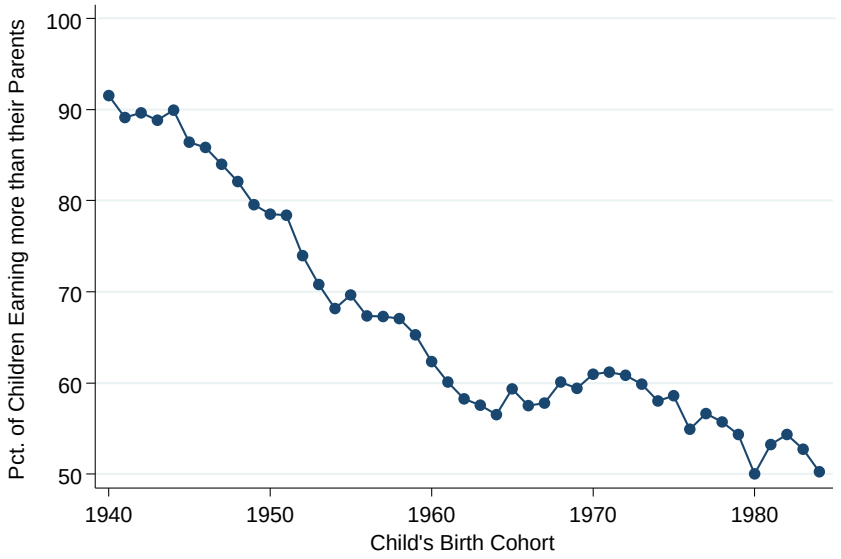
In sum, these alternative counterfactuals reinforce the conclusion that higher GDP growth itself cannot increase absolute mobility unless it is more broadly distributed.

Figure 1. Baseline Estimates of Absolute Mobility by Birth Cohort

A. Selected Cohorts by Parent Income Percentile



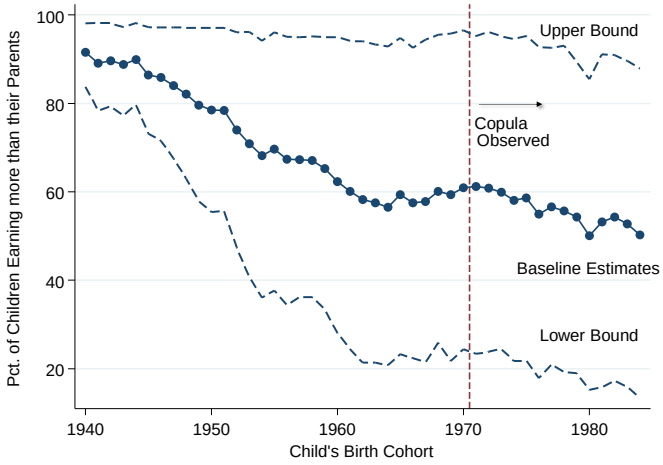
B. Mean Rate of Absolute Mobility by Cohort



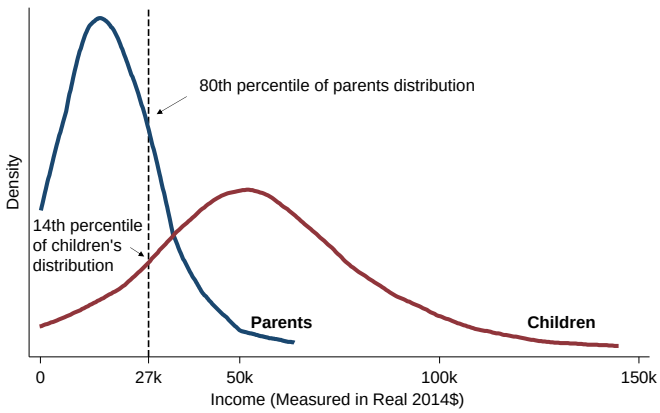
Notes: This figure plots the fraction of children earning more than their parents ("absolute mobility") by parental income percentile for selected child birth cohorts (Panel A) and on average by child birth cohort (Panel B). Panel A includes only parents with positive income; within this group, parents' income percentiles are constructed based on their ranks in the distribution of parents' incomes within each child cohort. Panel B includes parents with 0 income, defining absolute mobility as 100% for that subgroup when computing the mean rate of absolute mobility by cohort. Children's income is measured at age 30 in the CPS-ASEC as the sum of individual and spousal income, excluding immigrants after 1994. Parental income is measured in the Census as the sum of the spouses' incomes for families in which the highest earner is between age 25-35. Children's and parents' incomes are measured in real 2014 dollars using the CPI-U-RS. Absolute mobility is calculated by combining these income distributions with the copula estimated for the 1980-82 cohorts in tax data by Chetty et al. (2014a)

Figure 2. Effects of Copula on Absolute Mobility by Cohort

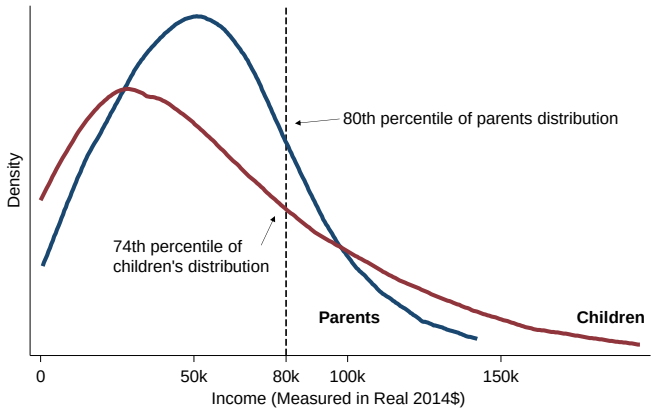
A. Bounds on Absolute Mobility Across All Copulas



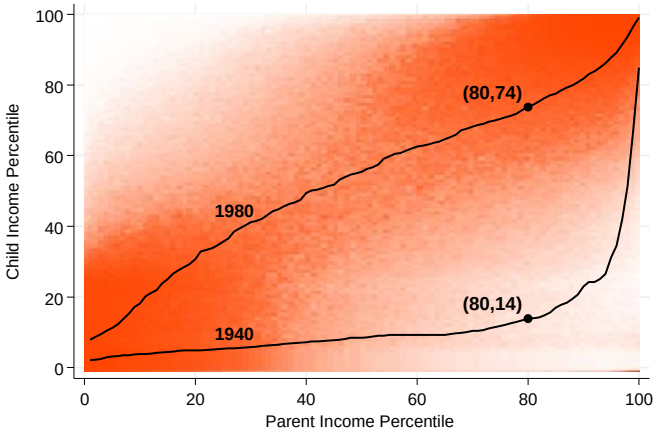
B. Family Income Distributions: 1940 Birth Cohort



C. Family Income Distributions: 1980 Birth Cohort

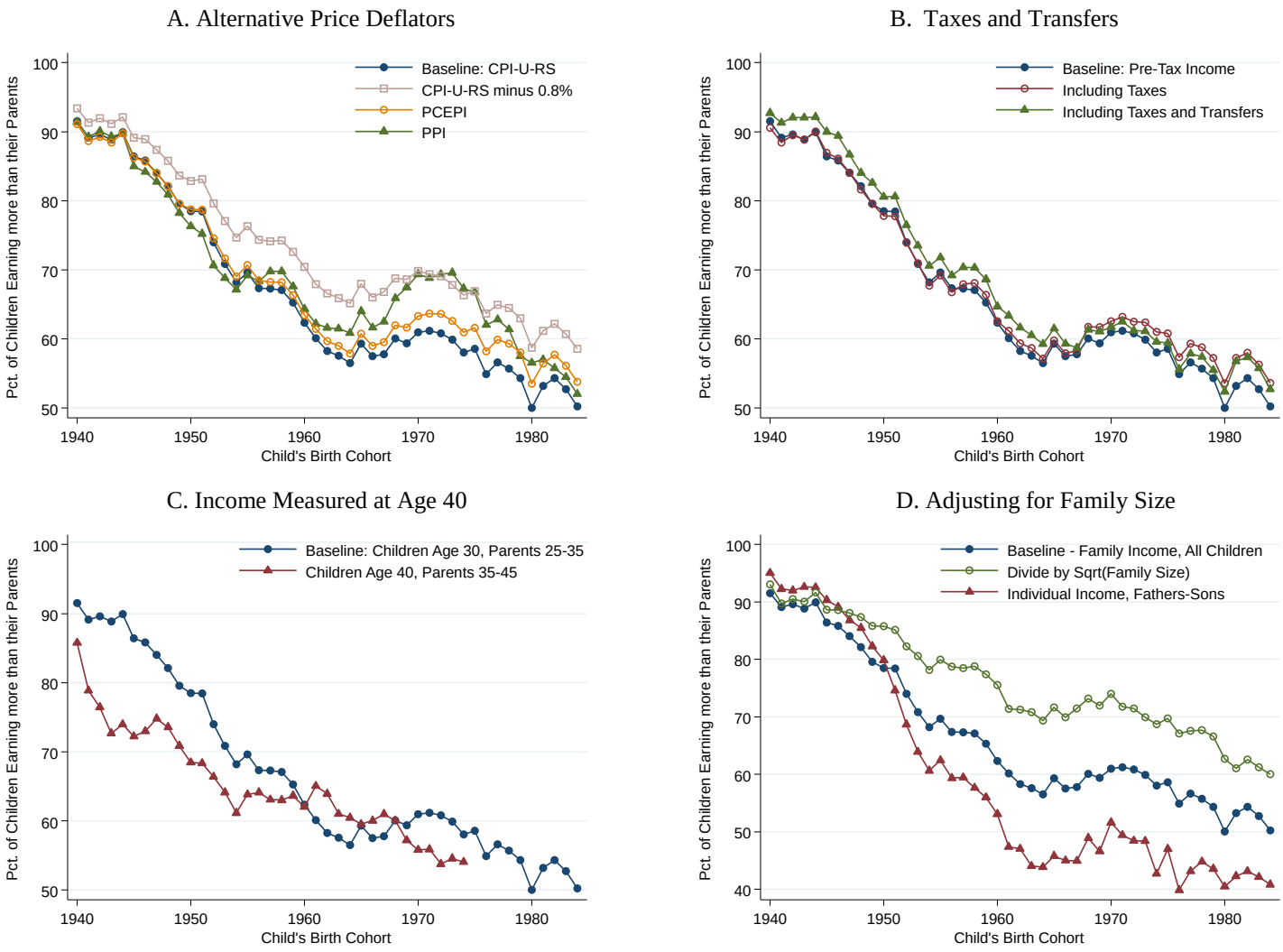


D. Child Rank Needed to Beat Parents and 1980-82 Copula



Notes: These figures show how the copula affects estimates of absolute mobility by birth cohort. Panel A plots bounds on absolute mobility for each cohort over all copulas satisfying first-order stochastic dominance of children's income distributions as parent income rises. The bounds are estimated separately by cohort. The solid circles in Panel A replicate the baseline estimates shown in Figure 1B, with the section to the right of the dashed vertical line corresponding to the cohorts (1971-1984) for which Chetty et al. (2014b) document copula stability. Panel B plots the marginal family income distributions of children in the 1940 birth cohort and their parents, measured at approximately age 30. Corresponding to the analysis in Figure 1A, parents with zero income are excluded, but children with zero income are included when estimating these kernel densities. For scaling purposes, incomes above $200,000 are excluded. Panel C plots analogous income distributions for children in the 1980 birth cohort and their parents. Panel D plots the income percentile that a child must reach in order to earn more than his or her parents for the 1940 and 1980 cohorts, with labels corresponding to the examples shown by the dashed vertical lines in Panels B and C. Panel D also shows a heat map of the baseline copula for the 1980-82 birth cohorts. The copula is a 100x100 matrix where each cell *(x,y)* gives the probability of a child being in income percentile *y* and having parents in income percentile *x* (conditional on parents having positive income). Darker colors represent areas with higher density in the copula.

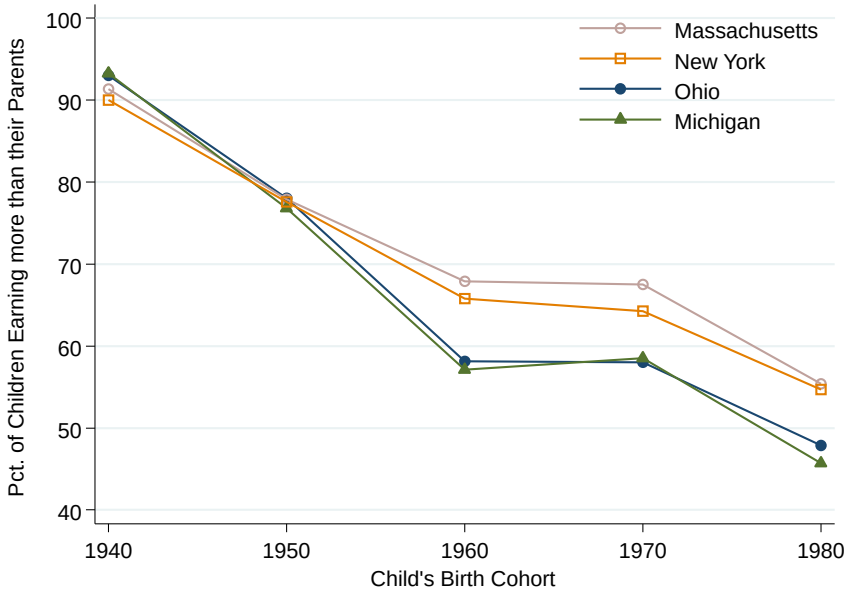
Figure 3. Trends in Absolute Mobility: Sensitivity Analysis



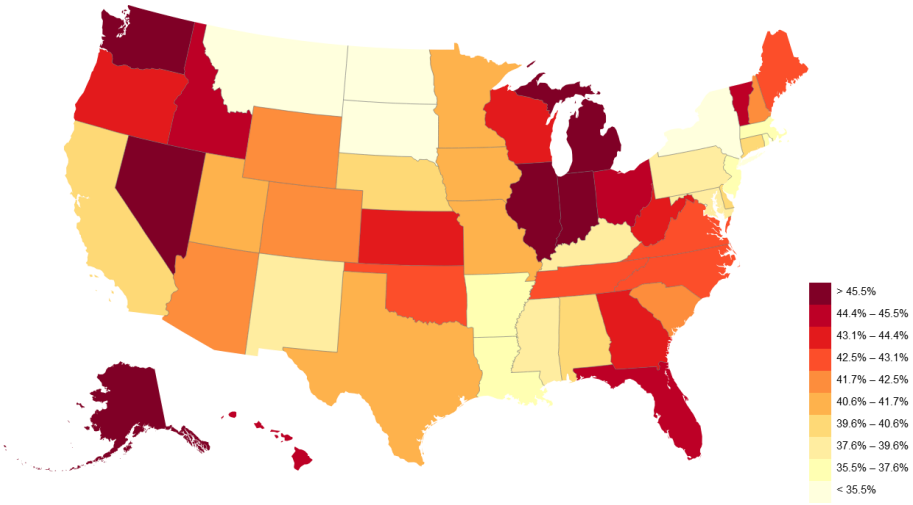
Notes: This figure plots absolute mobility by child birth cohort using a set of alternative income definitions. Panel A presents estimates that use alternative price deflators to adjust for inflation, including the producer price index (PPI) and the personal consumption expenditure price index (PCEPI). We also consider a price index that adjusts for bias in the CPI-U-RS due to new and higher quality products by subtracting 0.8% from the annual inflation rate implied by the CPI-U-RS (Meyer & Sullivan 2009, Broda and Weinstein 2010). Panel B presents estimates using income after including federal taxes and transfers. Taxes are estimated using the NBER TAXSIM model (Feenberg 1993) for years after 1960, and historical marginal tax rates before 1960. Transfers include cash and in-kind transfers. Cash transfers are obtained from Census and CPS data. In-kind transfers are obtained from calculations by Fox et al. (2015) using CPS data from calendar year 1967 onward; prior to 1967, in-kind transfers are set to zero. Panel C plots absolute mobility when children's income is measured at age 40 and parental income is measured between ages 35-45. Note that the last year of income data in our sample is 2014, so absolute mobility can only be measured at age 40 until the 1974 birth cohort. Panel D presents estimates that adjust income for family size and number of earners. In the series in open circles, we divide the baseline measures of family income by the square root of family size (defined as the number of dependent children plus the number of adults) for both parents and children. In the series in triangles, we estimate the fraction of sons whose individual incomes are greater than or equal to their fathers' individual incomes. Individual income is defined in the same way as the baseline family income measure, but does not include spousal income.

Figure 4. Trends in Absolute Mobility by State

A. Absolute Mobility by Birth Cohort for Selected States



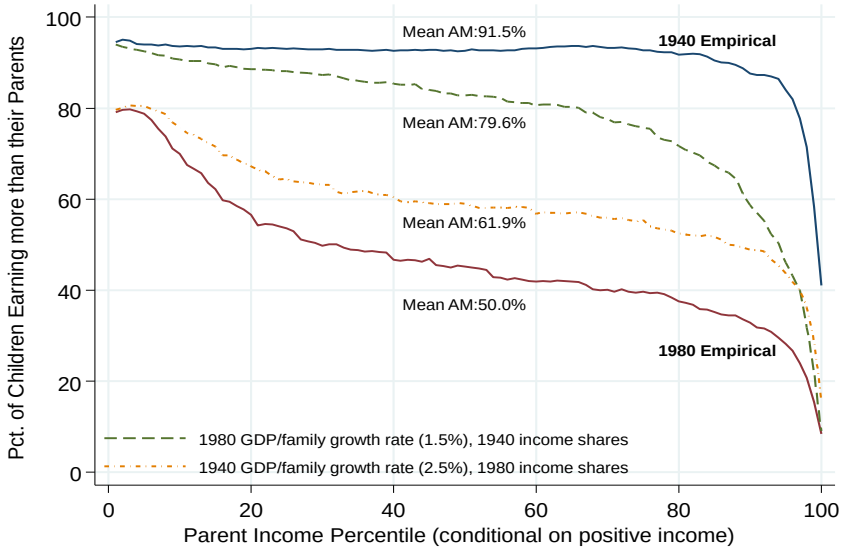
B. Decline in Absolute Mobility from 1940 to 1980 Cohort by State



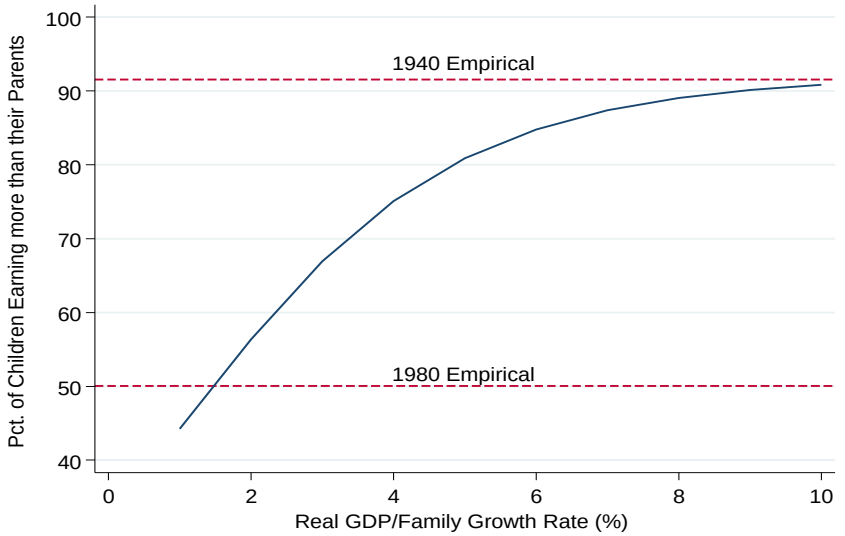
Notes: This figure shows trends in absolute mobility by state. Panel A shows estimates for decadal birth cohorts for selected states; data by cohort for all other states is reported in Table S2. Panel B shows a heat map of the magnitude of the decline in absolute mobility from the 1940 to 1980 cohorts, with darker colors representing states with larger declines. For parents, state refers to location at the time incomes are measured (between ages 25-35); for children, state refers to location at birth. Since children's state of birth is not observed in the CPS, we use the Census for both parents and children. To increase precision, we include all children aged 25-35 and use the 100% Census in 1940 and 5% IPUMS sample in 1980. Measuring children's incomes from ages 25-35 rather than just at age 30 creates small differences in levels of absolute mobility. To adjust for these differences, we calculate the difference between the baseline national estimates and population-weighted national means of our state-level estimates for each cohort, and add these differences to the state-level estimates.

Figure 5. Absolute Mobility for 1980 Birth Cohort: Counterfactual Scenarios

A. Counterfactual Rates of Absolute Mobility by Parent Income Percentile

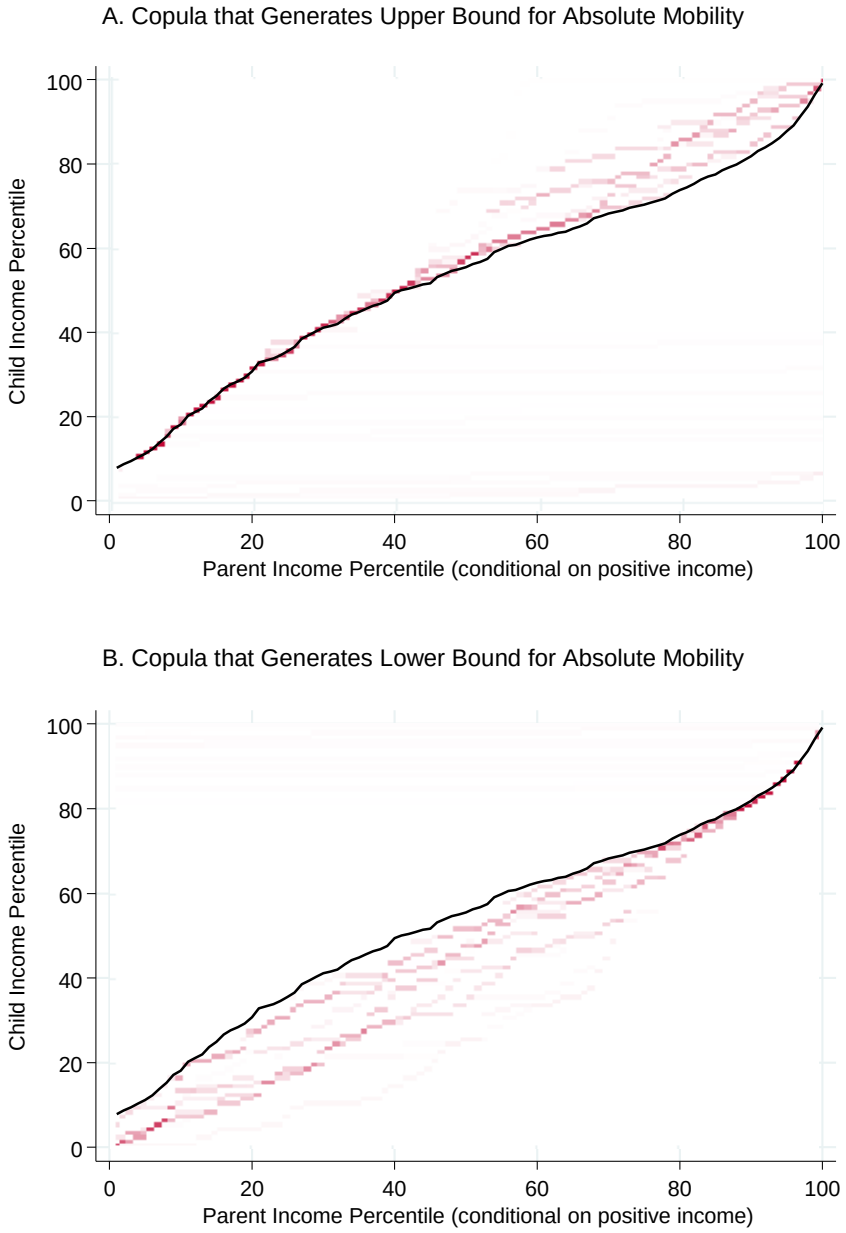


B. Counterfactual Absolute Mobility for 1980 Cohort vs. GDP Growth Rate



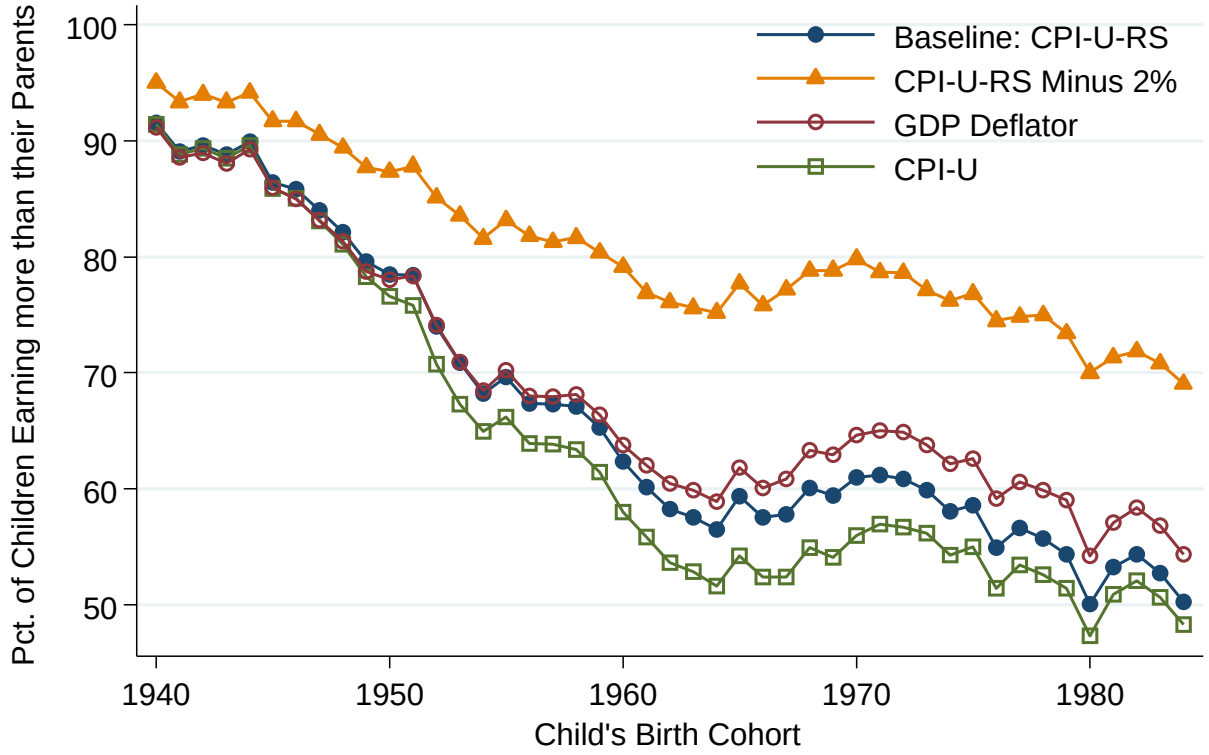
Notes: This figure shows how absolute mobility for the 1980 cohort would change under counterfactual scenarios varying GDP growth rates or the distribution of income. Panel A plots absolute mobility by parent income percentile. The solid curves replicate the baseline estimates of observed absolute mobility by parent income percentile from Figure 1A for the 1940 and 1980 birth cohorts. The dashed series, "1940 GDP/family growth rate (2.5%), 1980 income shares," plots the rates of absolute mobility that the 1980 cohort would have experienced had GDP per working-age family grown at 2.5% annually from 1980-2010 instead of the actual rate of 1.5%. The resulting higher level of GDP in 2010 is allocated to households based on the ratio of income to GDP per working family at each percentile of the family income distribution for 30 year olds in 2010. The dotted series, "1980 GDP/family growth rate (1.5%), 1940 income shares" plots the rates of absolute mobility that the 1980 cohort would have experienced had GDP in 2010 been allocated in the same manner across households as it was for the 1940 cohort. In this counterfactual, GDP remains at the observed level in 2010, but income is allocated to households based on the ratio of income to GDP per working family at each percentile in the 1940 cohort. For each series, we also report the mean level of absolute mobility (AM), averaging across all income percentiles (including parents with zero incomes, whose children mechanically have absolute mobility of 100% and are not shown in the figure). In Panel B, the solid line plots mean absolute mobility for the 1980 cohort had they experienced alternative GDP growth rates. These estimates are constructed in the same way as the estimate of AM for the "1940 GDP/family growth rate (2.5%), 1980 income shares" series in Panel A, using growth rates ranging from 1% to 10%. The dashed horizontal lines show the actual levels of AM for the 1940 and 1980 birth cohorts. See Section III of the Supplementary Appendix for further details on these counterfactuals.

Figure S1. Copulas that Maximize and Minimize Absolute Mobility for 1980 Cohort



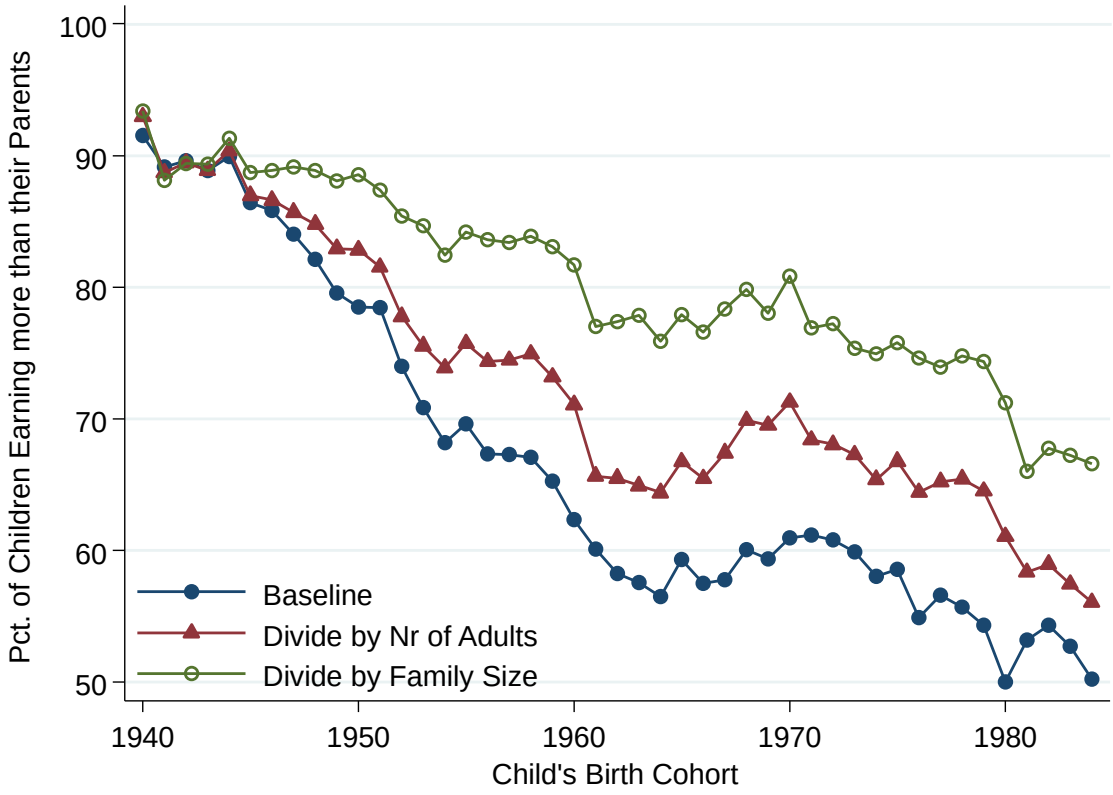
Notes: This figure depicts the copulas that generate the bounds on absolute mobility for the 1980 cohort in Figure 2A. Panel A presents the copula that generates the upper bound on absolute mobility, while Panel B presents the copula that generates the lower bound on absolute mobility. Darker shades represent cells with greater mass in the copula. The solid curve in both panels shows the rank that a child must reach in order to surpass the income of their parents by parental income percentile in the 1980 birth cohort, as in Figure 2D.

Figure S2. Alternative Price Deflators



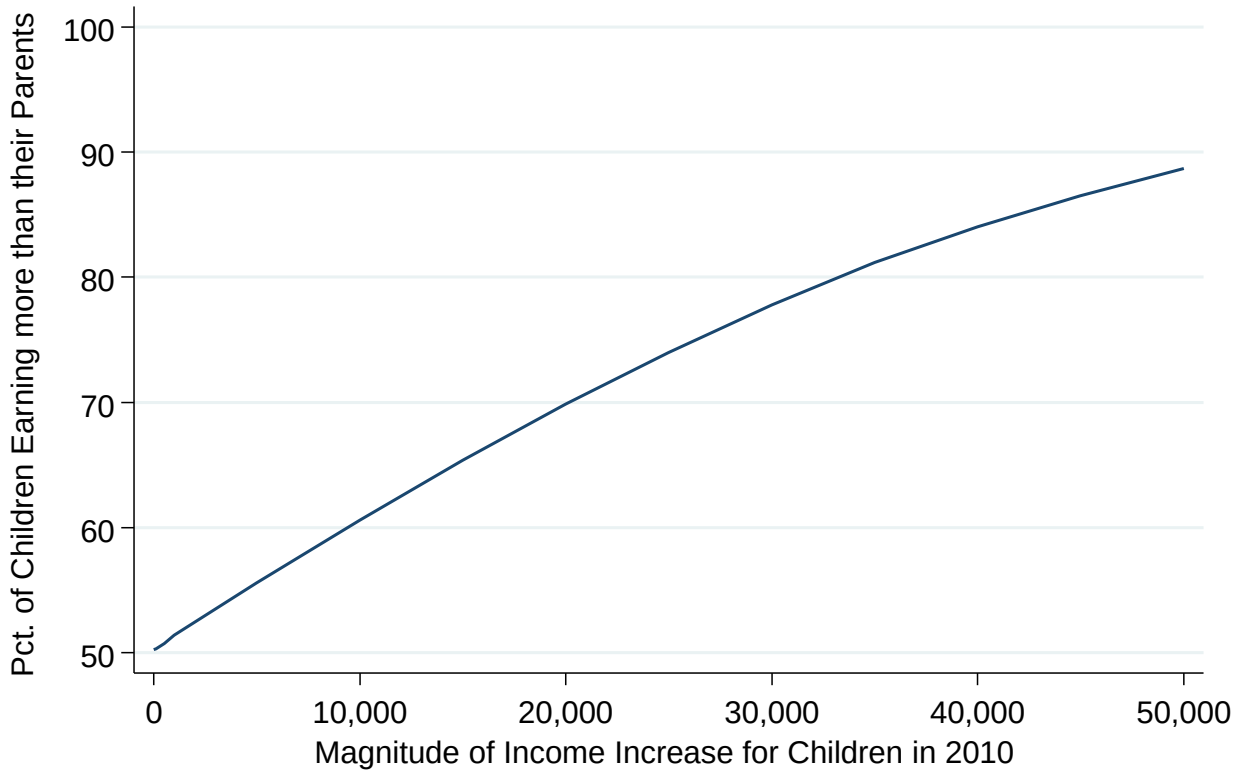
Notes: This figure plots absolute mobility by birth cohort, replicating Figure 3A with alternatives to our baseline price deflator (the CPI-U-RS): the GDP deflator, the CPI-U, and a price index that subtracts 2% from the annual inflation rate implied by the CPI-U-RS.

Figure S3. Alternative Adjustments for Family Size



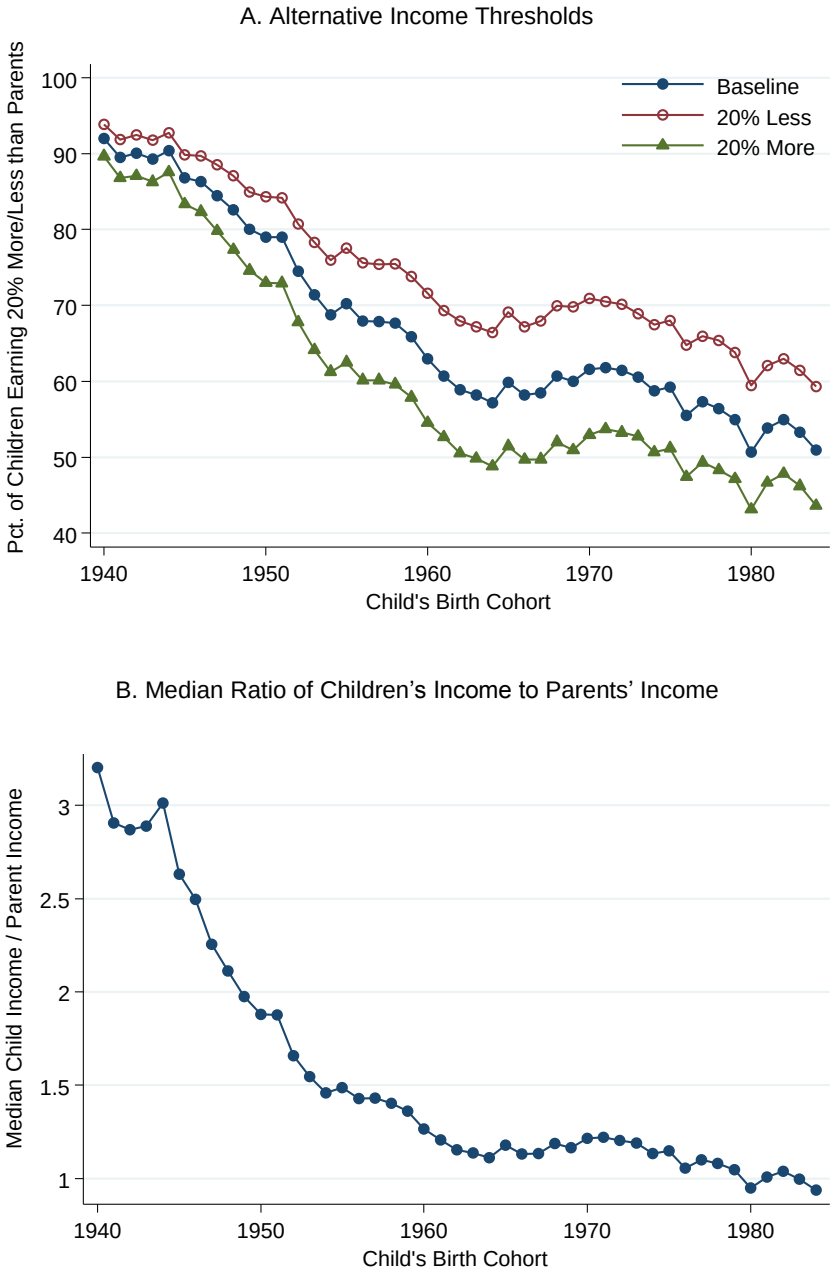
Notes: This figure plots absolute mobility by cohort, replicating Figure 3D using alternative adjustments for family size. We divide the baseline family income measures for both parents and children by either the total number of adults in the household (triangles) or by family size (open circles). The number of adults is defined as one plus an indicator for being married. In the CPS, family size is defined as the number of own children plus the number of spouses. In the Census, family size is defined as the number of own family members residing with each individual.

Figure S4. Effects of Increasing Child Income on Absolute Mobility for 1984 Cohort



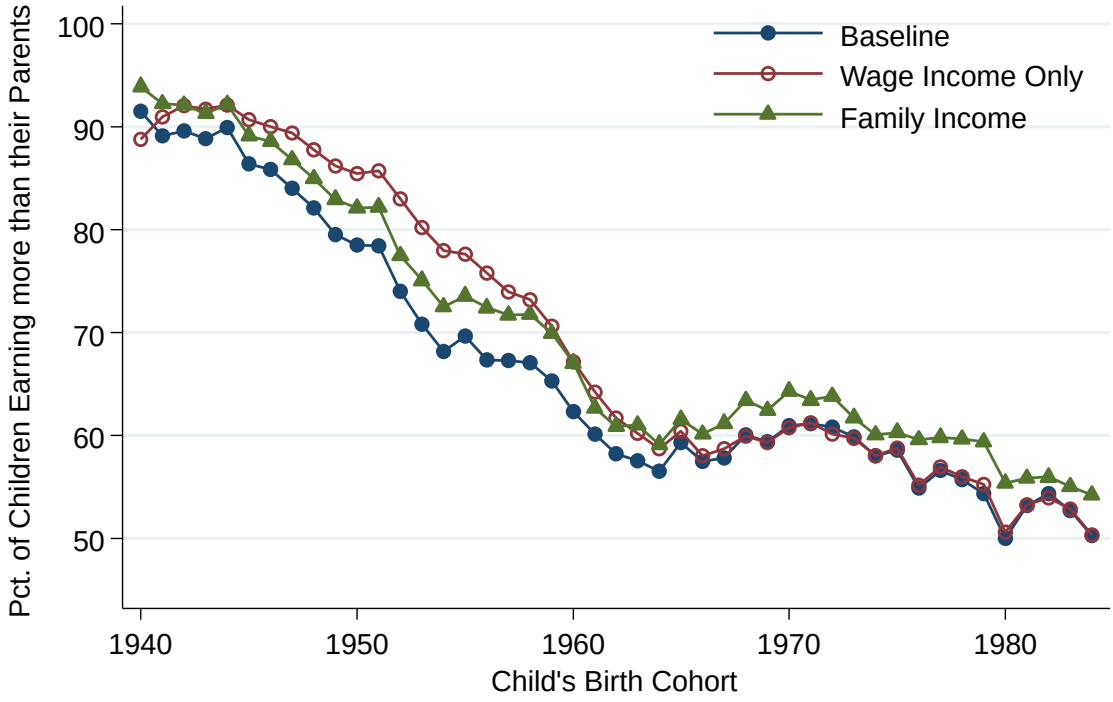
Notes: This figure recalculates absolute mobility for the 1984 birth after increasing each child's income in 2010 by fixed dollar amounts ranging from 0 to $50,000 (measured in real 2014 dollars). Aside from these increments to children's incomes, all other aspects of the specification are identical to the baseline.

Figure S5. Alternative Measures of Absolute Mobility



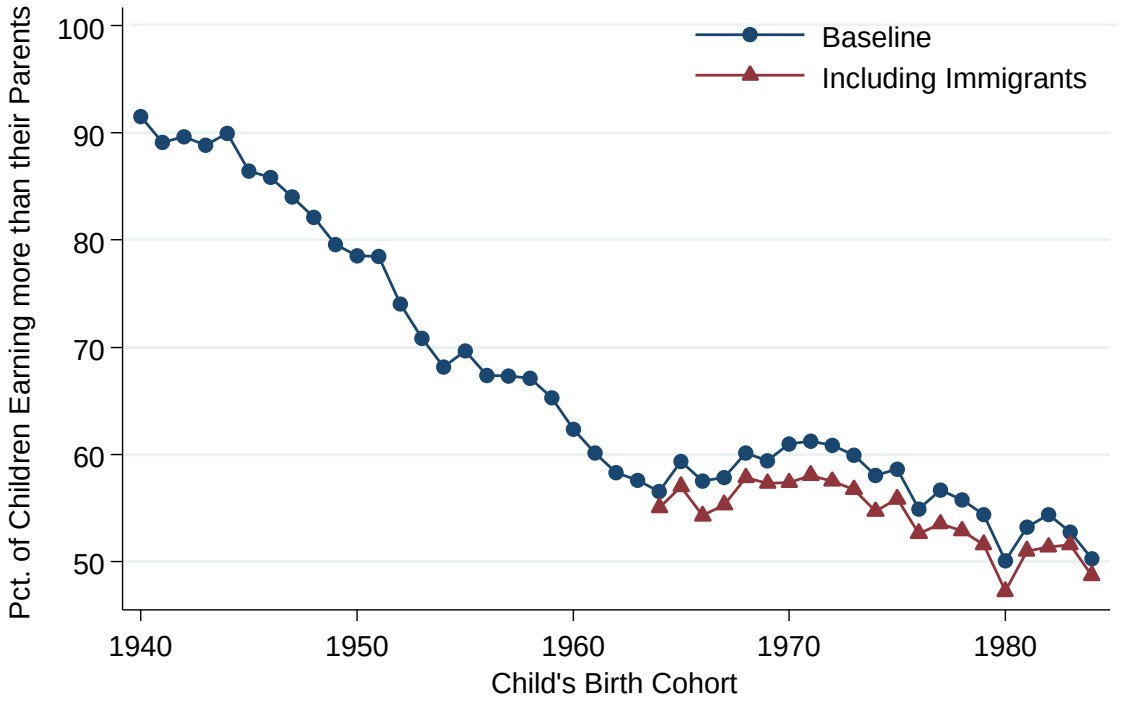
Notes: This figure shows estimates of absolute mobility by birth cohort using alternative measures of mobility. Panel A shows the fraction of children earning 20% more than their parents or 20% less than their parents. Panel B plots the median ratio of child to parent income. All other aspects of the absolute mobility calculations are identical to those used in the baseline specification.

Figure S6. Alternative Income Definitions



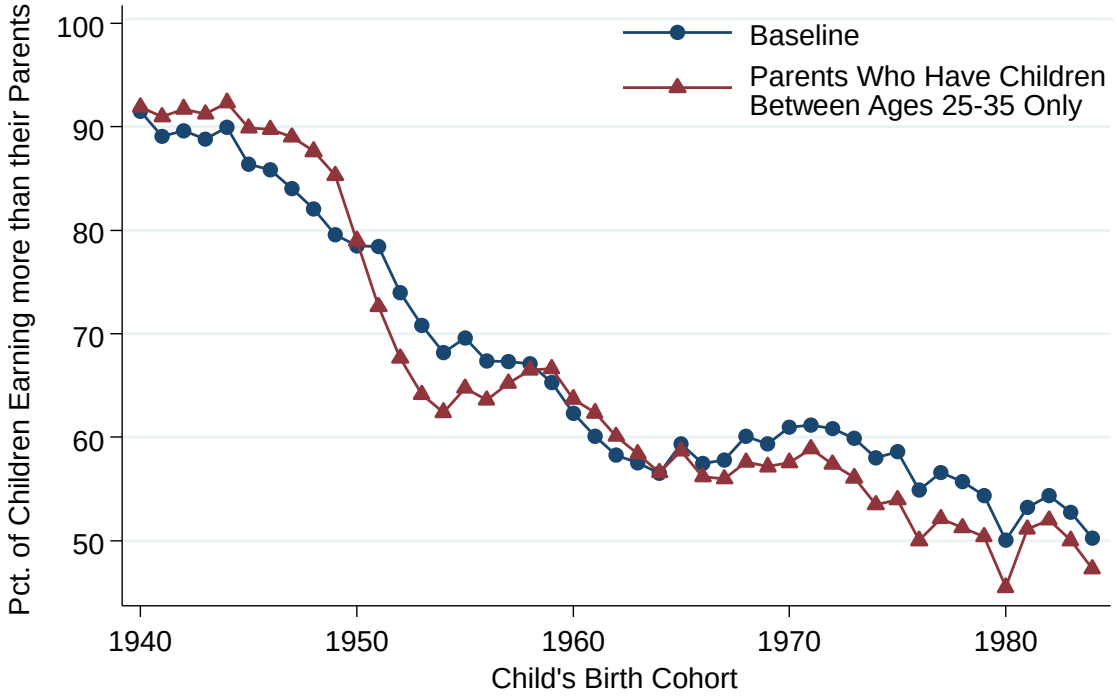
Notes: This figure plots absolute mobility by cohort, replicating Figure 1B using alternative income definitions for parents and children. Wage Income is computed as the sum of wage and salary income of the individual and spouse (if applicable). Family income is total income from all co-residing members of the primary family. The Supplemental Appendix provides further details on how these measures are defined. Aside from these changes to the income definition, all other aspects of the specification are identical to the baseline.

Figure S7. Effect of Including Immigrants



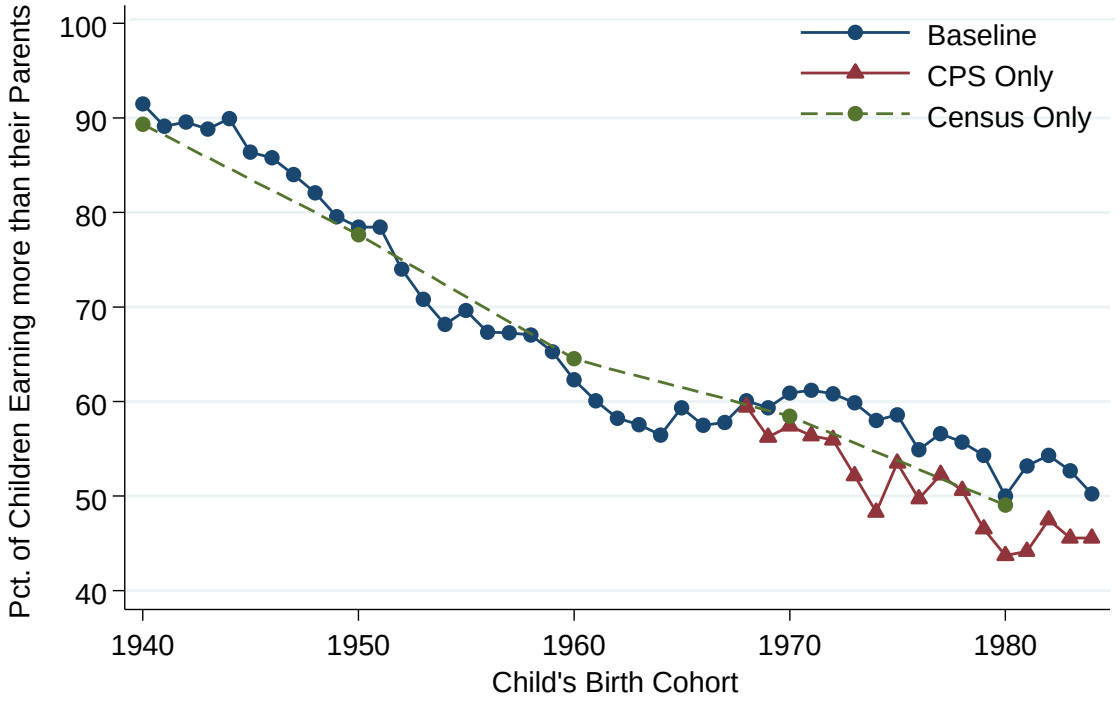
Notes: This figure plots absolute mobility by cohort, replicating Figure 1B including immigrants in the sample of children. The CPS-ASEC did not collect data on birthplace prior to 1994, so the 1964 cohort is the first cohort for which immigrants are excluded from our baseline sample.

Figure S8. Sensitivity to Parent Age at Child Birth



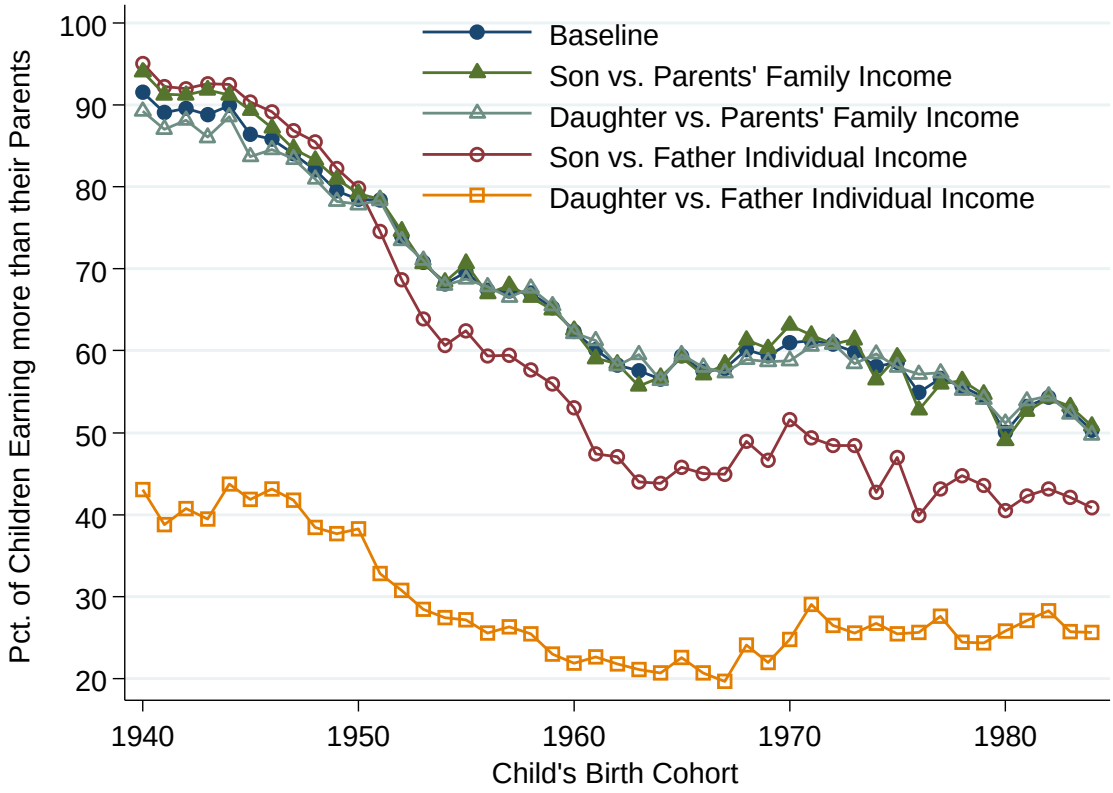
Notes: This figure replicates Figure 1B after restricting the sample to parents who have a child between ages 25-35, the ages at which we measure parents' incomes. All other aspects of the specification are identical to the baseline. The baseline estimates include all parents who have a child between ages 16-45 by pooling data across multiple Censuses.

Figure S9. Alternative Data Sources for Marginal Income Distributions



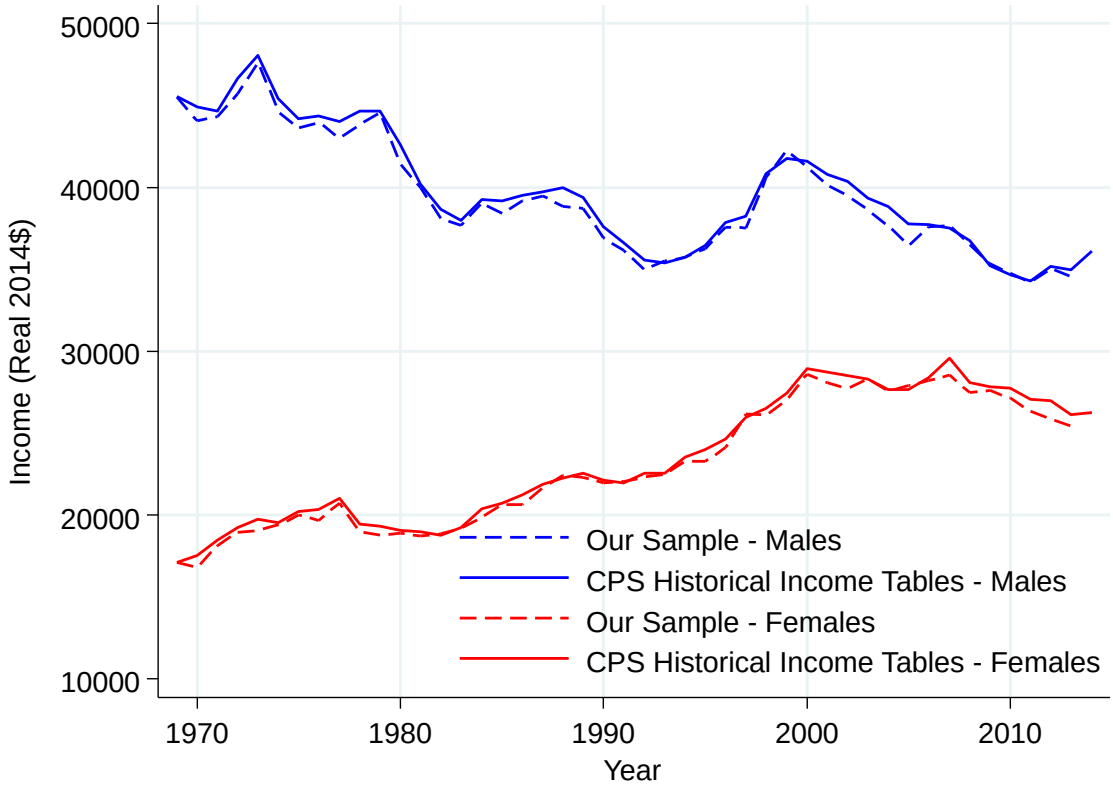
Notes: This figure plots absolute mobility by cohort, measuring both parents' and children's incomes using the same dataset rather than using annual CPS data for children and decadal Census data for parents as in our baseline specification. In the Census only series, parents' incomes are identical to the baseline, while children's income distributions are defined using total family income among all 30-year olds. In the CPS only series, children's incomes are identical to the baseline, while parents' income distributions are calculated using total family income for parents of newborns in families where the higher-earning parent is aged 25-35. The CPS only series therefore excludes parents who have children after age 35 or before age 25, as in Figure S8. The CPS only series begins in 1968 because consistent income definitions for parents are not readily available in prior years. All other aspects of the specifications in both series are identical to the baseline.

Figure S10. Heterogeneity by Gender



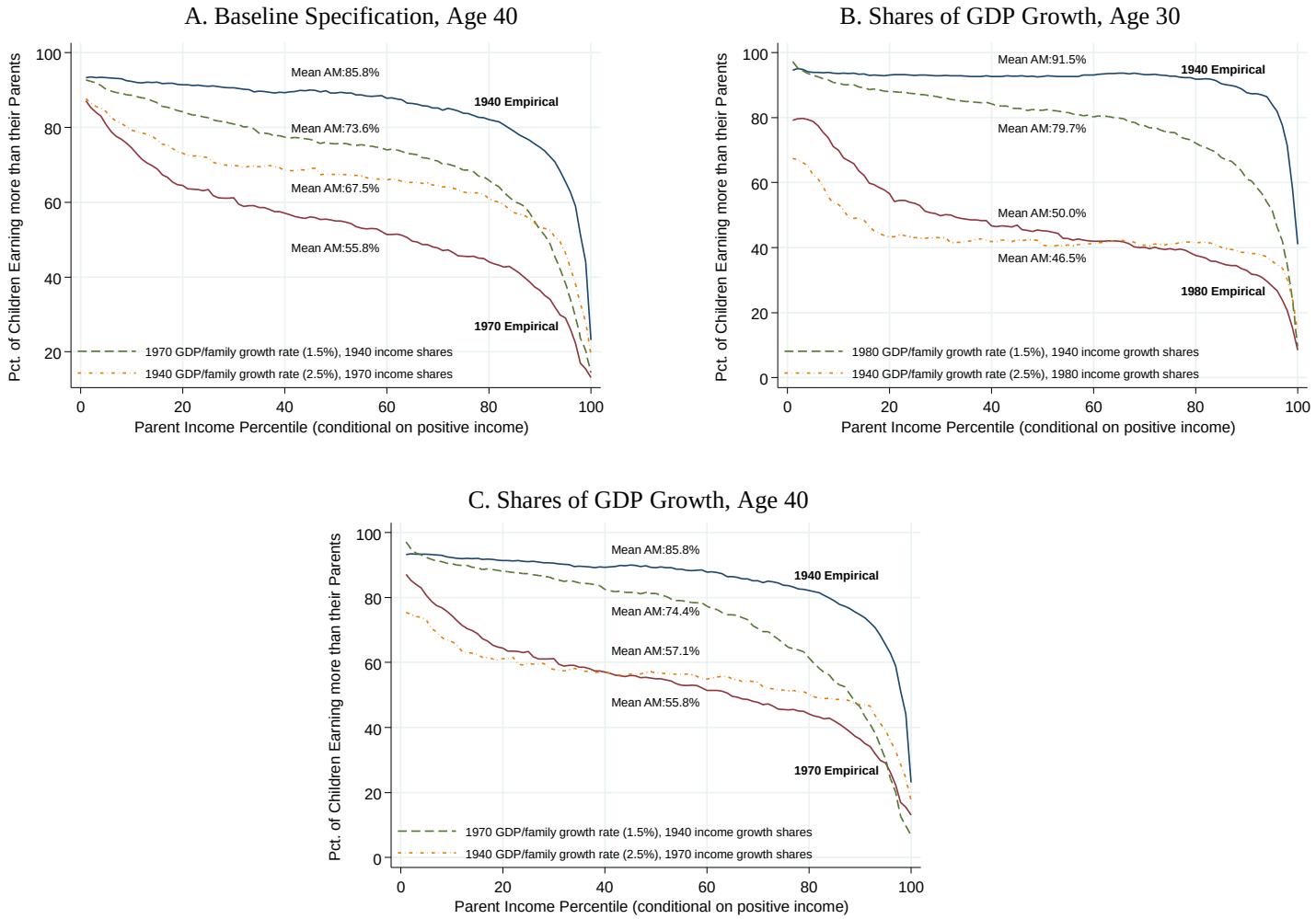
Notes: This figure plots absolute mobility by cohort for sons and daughters using individual income and family income (including spousal income). The series in solid triangles plots the fraction of sons whose family income exceeds their parents' family income, replicating Figure 1B for sons. Similarly, the series in hollow triangles plots the fraction of daughters whose family income exceeds their parents' family income. The series in circles plots the fraction of sons whose individual income exceeds their fathers' individual income, replicating the series in Figure 3D. The series in squares plots the fraction of daughters whose individual income exceeds their fathers' individual income.

Figure S11. Median Incomes by Year, Individuals Aged 25-34



Notes: This figure plots the median income of individuals aged 25-34 in the CPS as published by the Census Bureau (Historical Income Tables: People P-8) alongside our own estimates, constructed from the CPS-ASEC. Both series use total personal (individual) income, adjusting for inflation using CPI-U-RS. In contrast to our baseline marginal income distributions, we pool individuals from ages 25-34 and drop individuals with zero income for comparability with the published Census tables.

Figure S12. Alternative Counterfactuals



Notes: This figure presents the alternative counterfactual scenarios described in Section III of the Supplemental Appendix. Panel A replicates the counterfactuals in Figure 5A, measuring incomes at age 40 instead of age 30. We use the 1970 cohort instead of the 1980 cohort for the age 40 analyses as it is the most recent decadal cohort for which income at age 40 can be observed. Panel B reports results from GDP growth shares counterfactuals, in which counterfactual incomes for children in the 1980 cohort are constructed based on observed shares of GDP *growth* from birth to age 30 (1980-2010) rather than shares of GDP *levels* in 2010. Panel C replicates Panel B, measuring incomes at age 40 instead of age 30. In all panels, the dotted lines present the higher GDP growth counterfactuals, while the dashed lines present the more equal growth counterfactuals.

Table S1. Summary Statistics for Child and Parent Samples

Child's Birth Cohort	Children (CPS)				Parents (Census)		
	No. of Children	Weighted Count	Income at Age 30 ($)		No. of Families	Income Ages 25-35 ($)	
			Mean	Median		Mean	Median
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1940	1,614	2,256,476	57,159	53,512	9,990	18,835	17,836
1941	1,680	2,371,403	55,473	53,259	20,186	20,642	18,694
1942	1,745	2,652,364	56,587	53,708	21,106	21,280	19,322
1943	1,899	2,903,434	59,352	55,689	22,847	22,295	19,857
1944	1,843	2,901,957	62,069	57,792	23,252	22,651	19,857
1945	1,718	2,809,649	56,839	55,440	23,203	23,723	19,857
1946	1,706	2,718,989	56,448	52,430	23,562	24,614	20,065
1947	2,687	3,606,320	58,853	55,311	30,276	27,836	23,781
1948	2,560	3,583,373	58,909	54,886	31,256	29,448	25,961
1949	2,500	3,566,347	58,642	55,645	29,699	31,124	27,383
1950	2,990	3,590,742	59,857	55,605	28,767	32,968	29,517
1951	2,953	3,674,309	57,163	54,729	20,952	32,051	28,259
1952	2,703	3,860,927	54,891	51,845	22,888	34,244	30,867
1953	2,730	3,970,066	53,765	49,012	24,561	35,363	32,606
1954	2,650	3,901,364	52,739	48,136	26,423	36,536	34,345
1955	2,817	4,153,580	55,118	50,759	28,574	37,610	35,562
1956	2,827	4,373,260	56,333	49,882	29,868	39,065	35,918
1957	2,805	4,432,183	59,033	51,644	31,813	39,776	36,629
1958	2,825	4,517,124	58,266	52,226	33,631	41,304	38,052
1959	2,528	4,412,732	58,809	51,170	34,691	42,177	38,407
1960	2,680	4,481,928	56,694	49,976	35,564	43,920	40,185
1961	2,726	4,510,418	55,700	47,638	36,524	44,595	40,263
1962	2,757	4,602,943	54,836	46,972	36,866	46,175	42,319
1963	2,713	4,610,697	55,496	47,538	36,868	46,904	43,030
1964	2,025	3,730,913	57,175	45,674	37,765	47,545	43,566
1965	1,953	3,644,244	58,793	50,614	36,470	48,320	44,809
1966	1,561	3,357,382	59,394	49,377	34,243	49,116	45,520
1967	1,580	3,396,908	58,872	49,600	33,126	50,358	46,259
1968	1,552	3,292,186	65,263	53,759	32,301	51,129	46,942
1969	1,577	3,281,357	63,261	52,431	33,312	51,675	47,972
1970	1,447	3,089,620	69,381	56,853	33,917	53,437	49,282
1971	2,599	3,422,277	71,011	55,037	36,921	52,504	48,258
1972	2,393	3,191,262	68,175	53,934	33,459	52,714	48,659
1973	2,140	2,910,392	67,448	54,105	32,359	52,928	48,829
1974	2,179	3,031,181	68,171	52,155	30,718	53,864	49,787
1975	2,040	2,825,818	65,862	52,659	31,351	54,185	50,257
1976	2,009	3,017,329	62,741	49,029	31,286	54,770	51,060
1977	2,085	3,062,028	69,692	52,857	31,426	55,238	51,699
1978	2,041	3,092,305	66,815	51,513	32,222	55,956	51,699
1979	2,132	3,175,792	64,679	49,814	32,488	55,333	51,685
1980	2,153	3,153,461	60,650	46,373	34,928	57,028	52,930
1981	2,242	3,328,443	58,088	43,448	35,819	52,548	46,204
1982	2,086	3,225,419	60,189	47,384	34,326	53,202	46,841
1983	2,156	3,381,167	57,644	43,350	35,916	53,542	47,062
1984	2,005	3,212,377	53,435	42,687	35,375	54,586	47,947

Notes: The table presents summary statistics for the samples used to estimate parents' and children's marginal income distributions in our baseline analysis. Columns 1-4 report statistics for children from the CPS, while columns 5-7 report statistics for parents from the Census. Column 1 reports the total number of children observed at age 30 in each birth cohort in the CPS; for example, the 1940 cohort is observed at age 30 in the 1970 CPS. Column 2 reports the sum of the sampling weights for each birth cohort in the CPS, i.e. the weighted cohort size. Columns 3 and 4 report the mean and median incomes of these children at age 30 using our baseline family income measure, which sums income across spouses. Column 5 presents the number of families who have children in each birth cohort, drawing on data from multiple Census years as described in the text. Columns 6 and 7 present the mean and median family incomes of these parents. Incomes are expressed in 2014 dollars, adjusting for inflation using the CPI-U-RS.

Table S2. Absolute Mobility by State and Birth Cohort

State	Absolute Mobility Rate by Birth Cohort (%)					Change from
	1940	1950	1960	1970	1980	1940-80
Alabama	92.0	81.8	64.5	63.9	51.9	40.1
Alaska	87.3		57.2	45.0	37.9	49.4
Arizona	88.5	73.9	57.7	57.5	46.2	42.3
Arkansas	92.1	83.3	70.7	66.0	56.0	36.1
California	89.1	71.2	58.0	57.2	48.8	40.3
Colorado	92.0	77.5	54.9	62.8	49.9	42.1
Connecticut	92.3	79.0	66.8	64.1	51.8	40.5
Delaware	91.6	81.9	70.8		51.4	40.2
District of Columbia	86.3	77.4	71.7	68.9	66.2	20.1
Florida	90.5	77.2	62.3	61.4	45.8	44.7
Georgia	92.1	82.6	63.0	59.5	48.2	43.9
Hawaii	94.4		59.7	54.6	50.0	44.4
Idaho	94.6	81.2	68.4		49.2	45.3
Illinois	92.4	78.2	59.5	58.3	47.0	45.5
Indiana	94.3	79.0	59.7	58.6	48.4	45.9
Iowa	94.8	82.9	65.7	65.7	54.0	40.8
Kansas	93.6	82.1	66.4	63.1	49.7	43.9
Kentucky	91.9	83.3	64.5	70.1	53.4	38.5
Louisiana	88.7	80.1	58.6	59.5	53.2	35.5
Maine	93.2	77.5	74.3	66.8	50.1	43.1
Maryland	90.8	75.3	59.8	59.6	51.2	39.5
Massachusetts	91.4	77.9	67.9	67.5	55.4	36.0
Michigan	93.3	76.8	57.1	58.5	45.7	47.6
Minnesota	94.3	84.1	64.4	63.2	52.9	41.4
Mississippi	90.7	82.8	66.0	66.4	53.1	37.6
Missouri	93.8	80.8	63.0	61.8	52.4	41.4
Montana	91.5	80.1	64.9		58.6	33.0
Nebraska	94.5	83.3	65.4	66.9	54.9	39.6
Nevada	89.1	69.5	51.9	49.2	39.5	49.7
New Hampshire	93.0	78.5	62.8	61.5	51.0	42.1
New Jersey	89.9	77.3	66.7	64.4	52.5	37.4
New Mexico	89.5	80.1	57.3	60.6	50.9	38.7
New York	90.0	77.6	65.8	64.2	54.7	35.3
North Carolina	92.8	83.5	69.0	65.0	49.8	43.0
North Dakota	93.7	84.2	73.6		59.4	34.3
Ohio	93.0	78.0	58.1	58.0	47.9	45.2
Oklahoma	93.8	81.7	64.9	57.1	51.2	42.5
Oregon	92.0	76.5	55.4	60.2	47.7	44.3
Pennsylvania	92.6	81.5	65.9	65.0	53.9	38.7
Rhode Island	90.8	80.1	70.5	66.8	54.4	36.4
South Carolina	91.1	82.8	67.4	63.3	49.4	41.7
South Dakota	92.9	81.3	76.0		62.3	30.6
Tennessee	92.3	81.5	62.2	64.6	49.6	42.7
Texas	91.3	80.5	61.3	58.8	50.5	40.7
Utah	93.7	78.3	64.3	61.1	53.1	40.6
Vermont	91.8	81.5	73.8		47.4	44.4
Virginia	90.6	82.1	65.3	59.9	47.9	42.7
Washington	91.9	76.7	59.4	57.5	45.8	46.1
West Virginia	93.0	82.4	66.2	58.3	49.9	43.1
Wisconsin	94.4	81.0	62.9	63.7	50.6	43.8
Wyoming	91.4	75.1	62.8		49.0	42.4

Notes: This table presents rates of absolute mobility by state for decadal cohorts from 1940-80; the final column shows the magnitude of the change from 1940 to 1980. Since children's state of birth is not observed in the CPS, we use the Census for both parents and children. To increase precision, we include all children aged 25-35 and use the 100% Census in 1940 and 5% IPUMS sample in 1980. Measuring children's incomes from ages 25-35 rather than just at age 30 creates small differences in levels of absolute mobility. To adjust for these differences, we calculate the difference between the baseline national estimates and population-weighted national means of our state-level estimates for each cohort, and add these differences to the state-level estimates. State-cohort cells with insufficient data are blank.

Table S3. Income Variables Used to Measure Parents' Incomes, by Census Year

1940	1950	1960	1970	1980	1990	2000
INCWAGE	FTOTINC	INCWAGE	INCWAGE	INCWAGE	INCWAGE	INCWAGE
INCNONWG		INCBUSFM	INCBUS	INCBUS	INCBUS	INCBUS
		INCOTHER	INCFARM	INCFARM	INCFARM	INCSS
			INCSS	INCSS	INCSS	INCINVST
			INCOTHER	INCINVST	INCINVST	INCRETIR
				INCOTHER	INCRETIR	INCOTHER
					INCOTHER	

Notes: This table lists the income variables in the IPUMS-USA that are used to construct the baseline measures of parental family income by Census year.

Table S4. Income Variables Used to Measure Children's Incomes, by CPS Year

1970-1975	1976-1987	1988-2014
INCWAGE	INCWAGE	INCWAGE
INCBUS	INCBUS	INCBUS
INCFARM	INCFARM	INCFARM
INCSS	INCSS	INCSS
INCGOV	INCGOV	INCRETIR
INCIDR	INCRETIR	INCINT
INCALOTH	INCDRT	INCUNEMP
	INCINT	INCWKCOM
	INCALOTH	INCVET
		INCSURV
		INCDISAB
		INCDIVID
		INCRENT
		INCEDUC
		INCCHILD
		INCALIM
		INCASIST
		INCOTHER

Notes: This table lists the income variables in the IPUMS-CPS that are used to construct the baseline measures of children's family income by CPS year.