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The Broken Elevator: Declining Absolute Mobility of Living Standards in Germany*

Timm Bönke, Astrid Harnack-Eber, Holger Lüthen

January 10, 2024

Abstract. This study provides the first absolute income mobility estimates for postwar Germany. Using various micro data sources, we uncover a steep decline in absolute mobility rates from 81 percent to 59 percent for children's birth cohorts 1962 through 1988. This trend is robust across different ages, family sizes, measurement methods, copulas, and data sources. Across the parental income distribution, we find that children from middle class families experienced the largest percentage point drop in absolute income mobility (-31pp). Our counterfactual analysis shows that lower economic growth rates and higher income inequality contributed similarly to these trends.

Keywords: Absolute mobility, Intergenerational mobility, Income distributions, Consumption, Inequality.
JEL Classification: D31, H0, J62

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1 Introduction

Throughout history parents have sought upward mobility for their children and until recently, this goal seemed within reach. But today, achieving this is arguably harder than ever before. Empirical evidence shows that the fraction of children earning more than their parents declined severely in the U.S. and some other industrial countries (Berman 2022; Chetty et al. 2017); the "elevator" to higher living standards for next generations might be broken.

We adopt a concept which allows us to estimate absolute income mobility by combining different data sources where no direct link between parents and their children is required. Absolute income mobility is measured as the fraction of children who earn more than their parents did. Using various German micro data sources, we first estimate detailed cross-sectional income and consumption distributions for children born 1962 through 1988 and their parents. Using transition probabilities from non-parametric copulas, we then create an intergenerational link between the distributions that allows us to estimate absolute income and consumption mobility in postwar Germany for the first time.

We find that the share of children earning more than their parents declined for cohorts 1962 through 1988 from 81 percent to 59 percent. While the decrease was steep for older cohorts with an all-time low of 49 percent for children born in 1978, mean rates of absolute mobility stabilized around 50 percent for cohorts born in the early 1980s and finally increased slightly for the youngest birth cohorts 1986 through 1988. These trends are robust with regard to age, correction for family size, measurement method, copula and data source. Further, we show that this downward trend is similar to the decline in absolute consumption mobility once we exclude the consumption categories of shelter and food.

Across the parental income distribution, children from middle class families were hit hardest with absolute mobility rates declining from 80 to 49 percent. This percentage point drop is higher than for children from all other parts of the income distribution. This adds to the empirical evidence documenting the erosion of the German middle class over time and gives another possible explanation for their fear of falling down the social ladder (e.g., Grabka et al. 2016; OECD 2021).

A counterfactual analysis reveals that both lower economic growth rates and higher income inequality have driven the strong decline in absolute income mobility. Additionally, there are several long-term societal developments that underlie this shift; these include a trend toward smaller households, particularly among younger generations who are more likely to be living alone, as well as a movement away from the traditional male breadwinner household model. Thus, although younger households may have lower total income than their parents did, resources have to support less household members and therefore the reduction per capita is comparatively less significant.

This paper is linked to several strands of literature. First, it relates to the extensive research on relative intergenerational mobility. These studies investigate how children's outcomes depend on parental ranks, rather than looking at living standards across generations. Studies show that for the US, Germany and many other industrial countries children's outcomes highly depend on their parental background (e.g., Bratberg et al. 2017; Chetty et al. 2014; Schnitzlein 2009). Most studies place Germany between the US and Scandinavian countries in terms of relative intergenerational mobility (Black and Devereux 2011; Corak 2013).

Second, this paper contributes to the scarce literature on absolute mobility. So far only a few studies on this topic have been published due to high data requirements, even though research has shown that people tend to think in absolute rather than in relative terms (Amiel and Cowell 1999; Ravallion et al. 2018). The most seminal work in this space is from Chetty et al. (2017) which combines U.S. census and CPS data with de-identified tax records and finds that absolute income mobility decreased from 90 percent for children born in 1940 to 50 percent for children born in the 1980s. A study by Berman (2022) finds that absolute income mobility decreased in eight other advanced economies in the second half of the twentieth century. For Germany, only one study exists that measures absolute social mobility by comparing parents' incomes and children's highest educational attainment

(Dodin et al. 2021). The authors find an average five percentage point increase in the share of children obtaining the A-Level with every decile increase in parental income rank for children's birth cohorts 1980 through 1996.

Our paper adds to this literature in several ways. First, this study is the first to compare both parents' and children's incomes in Germany, therefore providing the first true measure of absolute income mobility for Germany. Even though the A-Level completion of children is a first important indication of young adults' labor market opportunities since it is needed to gain college access, there is still a high variation in earnings among college graduates by study field and college performance. Second, our data are more granular than those used in previous studies and allow us to assess measurement methods commonly used in absolute mobility research. Third, we are the first study to also investigate consumption mobility. This is of special interest since consumption is less volatile and better reflects long-term living standards (e.g. Attanasio and Pistaferri 2016).

The remainder of the paper is structured as follows. Section 2 describes the data and the methodology used to estimate absolute mobility. Section 3 presents our results on income and consumption mobility. Section 4 concludes.

2 Data and Methodology

Absolute income mobility is measured as the fraction of children who earn weakly more than their parents. We measure it as the sum of the dichotomous comparison between parent and child income, divided by the number of children N_c in each birth cohort:

$$A_c = \frac{1}{N_c} \sum_i 1\{y_{ic}^k \geq y_{ic}^p\} \tag{1}$$

with y_{ic}^k being the income of child i in birth cohort c and y_{ic}^p being the income of its parents.

Ideally, empirical data on intergenerational mobility includes both true family ties as well as income data for parents and their children at the same age. Measuring absolute income mobility would then be straightforward, but such data is rarely available and only exists for a handful of birth cohorts in Germany. Since this paper aims to investigate German long term trends in absolute mobility for the first time, we use a theorem by Sklar (1959) to overcome this hurdle. The theorem shows that any multivariate cumulative distribution can also be obtained from the corresponding copula and its marginals, allowing us to connect various data sources to estimate rates of absolute mobility.

Following Chetty et al. (2017), we therefore connect parents' and children's marginal income distributions with a copula. In this context, the copula is a $100x100$ transition matrix that captures the probability of a parent in quantile y of the parent income distribution to have a child in quantile x of the child income distribution (e.g., the likelihood of parents in the 50th quantile to have a child in quantile $1, 2, ..., 100$).

We then estimate A_c as the product of the marginal distributions and the copula of parent and child ranks $C_c(r^k, r^p)$. Here, we denote $Q_c^k(r^k)$ and $Q_c^p(r^p)$ as the $r^t h$ quantile of child and parent income distributions. Intuitively, Equation (2) now shows the dichotomous comparison of child and parent income quantiles, weighed by the likelihood of occurence of the respective intergenerational quantile combination:

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

The first part of Equation (2) then yields 1 if a child of rank r^k earns weakly more than their parent with rank r^p. Afterwards, the copula weights the pairs by probability of their occurrence leading to an absolute income mobility estimate between 0 (all children earn less than their parents) and 1 (all children earn weakly more than their parents) for children's birth cohort c.

2.1 Copula

Empirical data on parent-child links are hard to come by - survey data often suffers from low numbers of observations, while administrative data rarely includes intergenerational links at all. We draw our data on parent-child pairs and their incomes from the German Socio-Economic Panel (SOEP), the only available data source in Germany with information on household incomes of both parents and their children. The SOEP is a highly representative German panel dataset, which follows individuals and their children since 1984 (Goebel et al. 2019). We then take the real average per adult household income to obtain a robust measure for relative income ranks and adjust for household size (Mazumder 2005). Following Chetty et al. (2017), we use parents' incomes between ages 30 and 60 to obtain their rank within the parental income distribution.[1] For children, we include their incomes between ages 30 and 34.[2] This leaves us with 3,456 parent-child pairs that we use to identify the most likely copula fit. Appendix B provides a detailed description of our copula methodology and includes further robustness checks.

2.2 Marginal income distributions

We use the German Mikrozensus (MZ) to construct marginal income distributions for both parents and their statistical children. Starting in 1957, the MZ is the longest German micro data series and due to its mandatory participation the most reliable source of information on households' socio-economic situation.[3] It represents one percent of the entire German

[1]To obtain the rank in the lifetime earnings distribution, using an income measure between mid-thirties and mid-fifties is preferable. At this time in life, correlation between annual and lifetime earnings is highest with around 0.9 (e.g., Björklund 1993; Bönke et al. 2015).

[2]We apply the same approach to obtain a copula to estimate absolute consumption mobility. Since SOEP data does not include information on consumption but only expenditure, we construct an expenditure copula to estimate absolute consumption mobility. This approach is possible for two main reasons: First, expenditures and consumption are very close in their concepts and should lead to similar copulas. And second, the shape of the copula does hardly influence the estimation process, while the marginal distributions largely determine the rates of absolute mobility (Berman 2022). To avoid any confusion, we will refer to this copula as the consumption copula going forward.

[3]The first available data for research purposes starts only with 1962. Hence, our study focuses on birth cohorts 1962 and younger. In addition, data for single years are occasionally missing throughout the past 60 years. Please find a detailed overview of all data sources and data waves we used in this study in Table

population, with 810,000 individuals in 370,000 households reporting information about their household context, education, labor market situation and disposable income. Disposable income is defined as household income after taxes and benefits and therefore best describes the income that a household truly has available for their consumption. Since this income concept offers a closer approximation of households' living standards than other income concepts such as pre-tax or post-tax incomes, it is best suited for our study to evaluate absolute mobility trends.

The MZ does not provide income as a continuous variable but as tabulated data, including the number of households in each of the up to 24 income categories. To obtain continuous income distributions from the binned data, we use a generalized Pareto estimation (Blanchet et al. 2022). Appendix A.2 provides a comprehensive overview of the methodology and its robustness. Still, we cannot eliminate all risk of introducing some measurement noise. Therefore, we also investigate absolute income mobility in Germany using another well-known data source - the Income and Expenditure Survey (Einkommens- und Verbraucherstichprobe, EVS), a representative household sample covering 0.1% of the German population.[4] It has been collected in five year intervals by the German Federal Statistical Office since 1962.[5] Despite covering a smaller sample of the German population and relying on voluntary participation, it reports continuous incomes for its participants and provides the opportunity to test the robustness of our results even further. We find that using both the MZ and the EVS yield similar absolute income mobility trends, confirming one more time the reliability of the generalized Pareto estimation in retrieving continuous income distributions.

We construct the marginal income distribution for both parents and children by measuring their real disposable family incomes at age 30. We obtain marginal income distributions

1, Appendix A.1.

[4]Please see Bönke et al. (2013) for a detailed overview of EVS data and how to harmonize data waves over time.

[5]The EVS lacks waves for 1968 and 1973. Using corresponding MZ waves and the EVS wave 1978, we were able to reconstruct the relevant measures for these years. Our estimates for absolute income mobility using the MZ or EVS yield similar results (see Figure 3B), showing that this approach is successful.

for children born 1962 through 1986 directly from each MZ wave since every child in a given cohort turns 30 in the same year. Obtaining the parent's income distribution is not that straightforward. Parents' age at childbirth varies widely and children of the same birth cohort can have very differently aged parents. Still, for comparability we also want to measure the living standard in the parent's household at age 30. Hence, we need to pool observations from several MZ waves to derive parents' marginal income distributions at age thirty for each child birth cohort.

For example, we construct the parental marginal income distributions for children born in 1982 as follows: First, we use waves 1982 to 1996 and select all parents aged 30 who had a child that was born in 1982. That way we include all income observations at age 30 if the parent had a child of this birth cohort at age 30 or younger. For older parents, we turn to waves 1968 to 1980 and select all individuals aged 30 in each survey year.[6] We assign this group a weight equal to the fraction of individuals aged 31 to 45 in 1982 who gave birth to a child that year. Because it is not possible to identify future parents in waves before 1982, we follow Chetty et al. (2017) and assume that the income distribution of older parents is representative of the general income distribution.

The MZ only includes information on disposable incomes but the EVS also includes data on households' expenditures and consumption. Hence, in addition to testing the robustness of our results on absolute income mobility with a different data source, the EVS also provides the unique opportunity to assess whether income is a sufficient proxy for households' consumption. This is of particular interest as consumption is less volatile than income and therefore reflects long-term living standards better (e.g., Attanasio and Pistaferri 2016). To construct both parents' and children's marginal income distributions using the EVS, we follow the same procedure as described above for the MZ data with one exception: Since EVS data is not annual but only quinquennial, we compare parents' and children's incomes at a

[6]We set the age limit to 45, assuming that no children are born to parents after age 45. This assumption is not only realistic for mothers. In 2020, only six percent of fathers were 44 or older at the birth of their children (Pötzsch et al. 2020).

wider age window, namely at ages 30 to 34.

3 Results

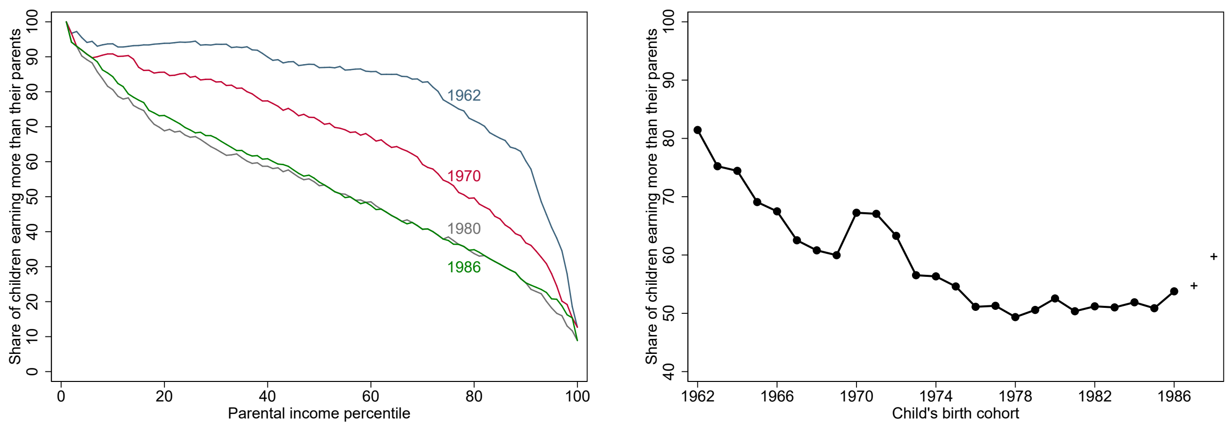
After combining the marginal income distributions of children and their statistical parents via the copula, we are now able to assess the German trend in absolute income mobility for the first time. We will show that our results are robust across ages, family sizes, data sources, measurement methods and units. Appendix B also shows the robustness of our results regarding the copula. Further, we investigate the main drivers of the steep drop in absolute income mobility over time: declining economic growth rates, rising inequality, and demographic changes. Lastly, this is the first study to show results on absolute consumption mobility, evaluating if income as a measurement unit leads to credible results on absolute mobility of living standards.

3.1 Absolute income mobility

Figure 1a shows the fraction of children earning more than their parents at age 30 by parental income percentile for children born in 1962, 1970, 1980 and 1986. In the 1962 cohort, almost all children had more disposable income than their parents did. Rates of absolute mobility naturally declined with higher parental income percentiles since it became harder for children to earn more than their already well off parents.

Afterwards, absolute income mobility rates declined gradually for younger cohorts regardless of their parental income. For example, at the 20th percentile of the parental income distribution, children born in 1962 still had a 94 percent chance to be better off than their parents. For the 1986 cohort, the same likelihood decreased to only 73 percent. At the 80th parental income percentile, the drop for younger cohorts was even more severe with a difference of 37 percentage points between the 1962 and 1986 cohort.

Figure 1: The evolution of absolute income mobility



(a) By parental income

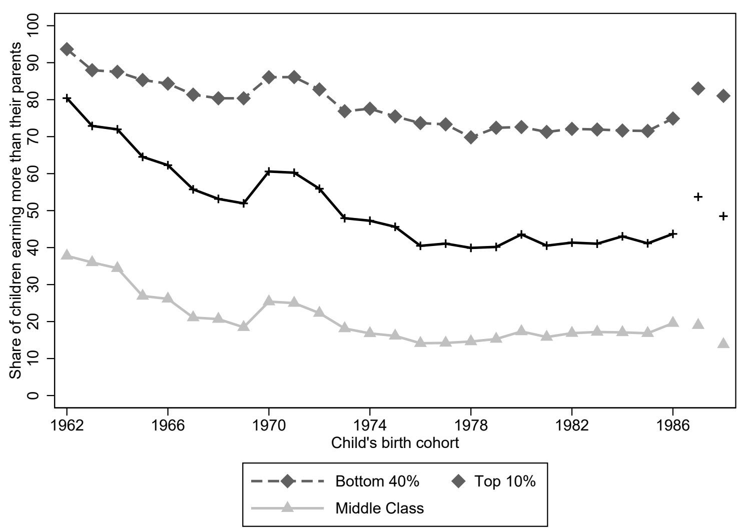
(b) Mean rates

Note: We only have Mikrozensus data until 1986. To show the overall trend in Germany to its fullest extent, we added EVS estimates for children's birth cohorts 1987 and 1988 using plus symbols.
Source: Mikrozensus 1962-2016, EVS 1978-2018, SOEP v38, own calculations.

Aggregating absolute mobility rates across all parental incomes then yields the mean rates of absolute mobility for each birth cohort (see Figure 1b). Overall, absolute income mobility declined sharply for younger birth cohorts. Children born in 1962 still had a chance of 81 percent to grow up earning more than their parents did. This probability decreased steeply through the 1970s cohorts, with an all-time low of 49 percent for children born in 1978, only 15 years after the oldest cohort of our study was born. Afterwards, mean rates of absolute mobility stabilized around 50 percent for cohorts 1979 through 1985, followed by a slight increase for the younger cohorts. The youngest children born in 1988 experienced a mean rate of absolute income mobility of 59 percent. Overall, absolute income mobility fell by 23 percentage points for children's birth cohorts 1962 through 1988. This result holds also true if we measure parents' and children's incomes at age 35 (see Appendix C, Figure 14).

Noticeably, the short-term bump in absolute mobility rates for children born in the early 1970s stands out from the overall decline. This short-lived uptick has two key drivers: On one hand, parents of the early 1970s cohorts were in the middle of the first oil crisis when we measured their incomes. The first oil crisis caused one of the steepest economic recessions leading to the first rise in mass unemployment in the German postwar era. Hence, average incomes during this period were temporary lower than usual. On the other hand, children's incomes thirty years later in the early 2000s are measured during the last lag of the economic boom after the reunification crisis, leading to higher incomes on average. These two extremes yield the temporary bump in absolute income mobility, showing the importance of economic growth in shaping absolute mobility patterns. However, even with mean rates oscillating through boom and bust periods, the overall decline in absolute income mobility remains steep.

Figure 2: Absolute income mobility of different income groups



Note: We only have Mikrozensus data until 1986. To show the overall trend in Germany to its fullest extent, we added EVS estimates for children's birth cohorts 1987 and 1988 using plus symbols. All subsequent estimations using the Mikrozensus sample will focus on children born from 1962 through 1986 and their parents.
Source: Mikrozensus 1962-2016, EVS 1978-2018, SOEP v38, own calculations.

Our results in Figure 1a have already hinted at which parts of the income distribution are driving this overall decline in absolute mobility. Figure 2 extends this analysis and confirms that children from middle class families were hit hardest.[7] Their absolute mobility declined

[7]We define the middle class as families from the $41^{s}t$ through $90^{t}h$ percentile.

by 31 percentage points from 80 to 49 percent. This percentage point drop is higher than for children from all other parts of the income distribution. Absolute income mobility in the bottom 40 percent dropped from 94 to 81 percent and in the top 10 percent from 38 to 14.[8]

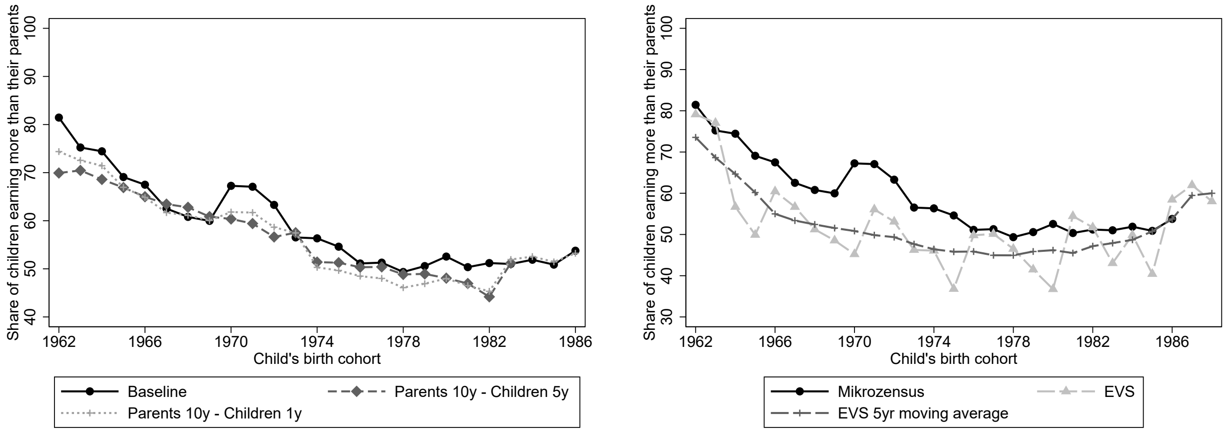
3.2 Sensitivity analysis: Measurement method and data source

Next, we investigate how sensitive our findings are with regard to the data source, measurement method and measurement unit. For our baseline results, we measure parents and children with MZ data which is collected annually. This is different from other studies on absolute income mobility which only had access to decennial data for parents' incomes (e.g., Chetty et al. 2017). Since our data allows a more precise measurement, it provides us the opportunity to test the influence of the measurement window length on absolute income mobility estimates for the first time. Figure 3a depicts our baseline results, as well as the estimates using decennial data for parents' incomes and quinquennial data or annual data for children. Clearly, all three measurement windows lead to very similar results, illustrating that the drop in absolute income mobility is also robust regarding the measurement method.

Since 3a also confirms that decennial data for parents and quinquennial data for children are sufficient to measure absolute income mobility trends reliably, we can use the EVS data with confidence for another robustness check of our baseline results. Figure 3b shows the mean rates of absolute income mobility for both data sources, the MZ and the EVS. Despite small deviations, both data sources yield the same conclusion: Absolute income mobility has indeed declined strongly for younger birth cohorts.

[8]Again, overall mobility rates are smaller for children from higher-income families since it's naturally harder to earn more than their parents did.

Figure 3: Sensitivity of absolute income mobility estimates



(a) Different measurement methods

(b) Different data sources

Note: We use the Mikrozensus waves 1962, 1973, 1982, 1992 and 2002 to construct parents' marginal income distributions from decennial data. To obtain children's marginal income distributions from quinquennial data, we use the Mikrozensus waves 1993, 1998, 2003, 2008 and 2013. Hence, the estimates using quinquennial data for children end with the child birth cohort 1983.
Source: Mikrozensus 1962-2016, EVS 1963-2018, SOEP v38, own calculations.

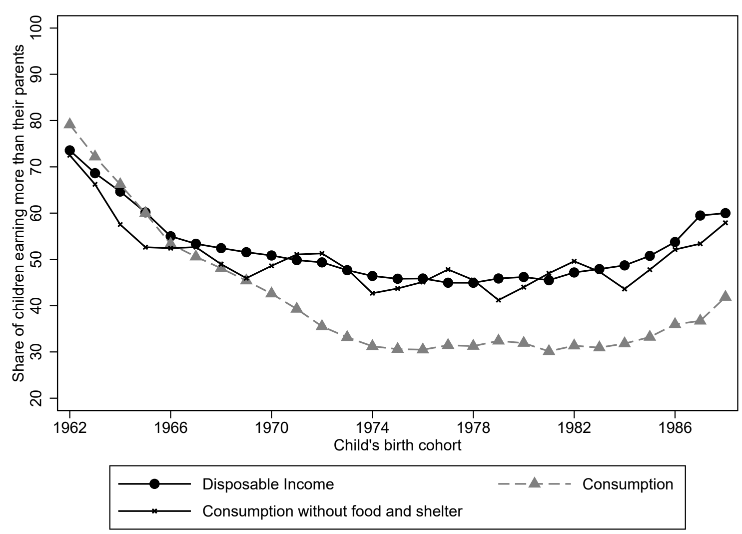
3.3 Absolute consumption mobility

Showing that the MZ and EVS both show the same trend in absolute income mobility does not only serve the purpose of another robustness check for our baseline results. It also confirms that the EVS is a reliable data source to assess absolute mobility trends in general. This is of particular interest since the EVS does not only record households' incomes, but also their expenditures and consumption. Consumption is less volatile than income and reflects long-term living standards better (e.g., Attanasio and Pistaferri 2016). Since good consumption data is scarce, income is usually the second best proxy to compare the intergenerational mobility of living standards. The EVS provides us with the unique opportunity to compare absolute mobility rates in income and consumption and to assess for the first time whether income really is a reliable proxy for living standards when investigating absolute mobility trends.

Figure 4 compares absolute income and consumption mobility trends in Germany using

EVS data. Notably, analyzing absolute consumption mobility reveals an even steeper drop in absolute mobility than when using incomes. While both, absolute income and consumption mobility, were still high for the oldest child cohort and dropped steeply for the 1960s and early 1970s child cohorts, starting with children born in 1975 differences in the two absolute mobility trends arise. While absolute income mobility stabilizes around a low level of 45 percent, absolute consumption mobility continues to fall to 30 percent for child cohort 1983. For the youngest cohorts, both measures suggest a small uptick in absolute mobility – however, these increases are not able to offset the previous severe declines in living standards. Though while absolute mobility in income has fallen by 14 percentage points according to the EVS, the decline in consumption mobility is with 38 percentage points more than twice the rate. [9]

Figure 4: Absolute income and consumption mobility



Note: We used five year moving averages to account for the quinquennial EVS data.
Source: EVS 1963-2018, SOEP v38, own calculations.

However, the steeper decline in absolute consumption mobility is mainly driven by lower absolute mobility rates for shelter and food. If we exclude these two consumption categories,

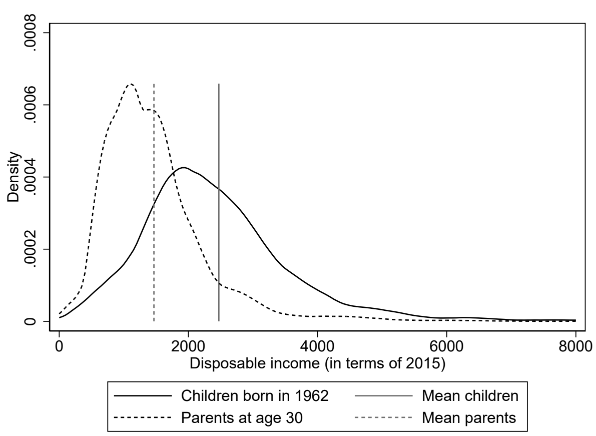
[9] The shape of the decline in absolute consumption mobility by parental income percentile is very similar to our findings for absolute income mobility (see Figure 1).

we find that mobility rates of all other consumption categories paint a very similar picture than income. We therefore conclude that disposable income is indeed a reliable proxy for consumption that captures differences in living standards across generations well.

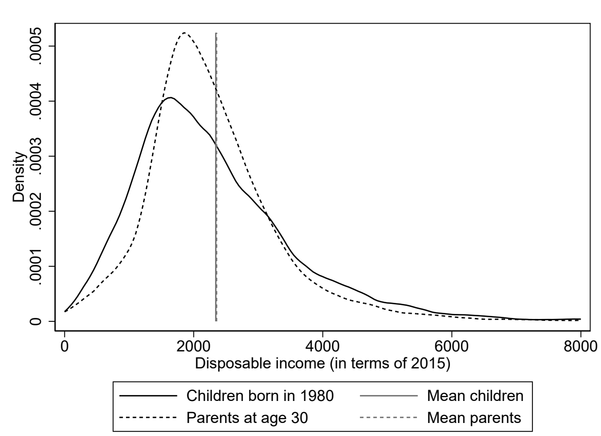
3.4 The roles of growth and inequality

Economic growth plays not only a role in short-term oscillations but is also a possible main driver of the overall downward trend in absolute income mobility. GDP growth declined steeply from the heights of the postwar years until 2018. At the same time, cohort-specific lifetime earnings inequality increased strongly by 85 percent (Bönke et al. 2015). Since we know from other countries that a rise in inequality can also contribute to a drop in absolute income mobility, we will also investigate inequality as a possible source of the decline (Berman 2022; Chetty et al. 2017).

Figure 5: Marginal income distributions of children and their statistical parents



(a) Child birth cohort 1962



(b) Child birth cohort 1980

Source: Mikrozensus 1962-2016, own calculations.

Figure 5 illustrates why changes in economic growth and inequality likely influence the evolution of absolute mobility over time. It shows the marginal income distributions of (a) children born in 1962, (b) children born in 1980 and their respective parents. For the oldest child cohort, we see that their average real income at age 30 is noticeably higher than that of their parents, hinting at the high income growth this child cohort still experienced. In stark contrast, the mean incomes of the 1980 child cohort and their parents are even hard to tell apart by eye, underlining that the declining GDP growth has made it significantly harder for younger cohorts to earn more than their parents did. However, this is not the only difference between the income distributions. We also observe that both child income distributions are less centralized and reveal a greater spread compared to their respective parents, showing that inequality has increased over time as well.

But how would absolute mobility look like for younger cohorts if they still experienced high GDP growth rates? And what would it look like if income inequality had not risen so steeply? To investigate these questions, we follow Chetty et al. (2017) and simulate two counterfactual scenarios: The higher GDP growth scenario and the more inclusive GDP growth scenario.

The first counterfactual scenario analyzes what would have happened if the 1980 child cohort had experienced the same high GDP growth rates as the oldest child cohort 1962 (blue line). To do so, we first estimate the counterfactual 2010 GDP per working-age family

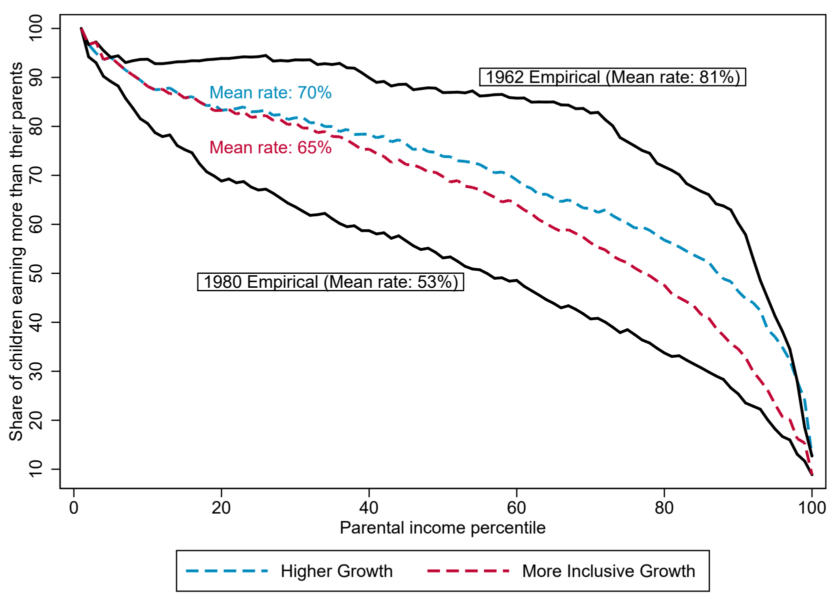
$$G^C_{2010} = G^0_{1980} \text{ x } 1.023^{30}$$

G^C_{2010} is the GDP we would have observed if family incomes had grown 2.3 percent between 1980 and 2010, instead of the truly observed growth rate of 1.7 percent during this time (World Bank national accounts data, and OECD National Accounts data files). This 2.3 percent growth is the same average GDP growth rate the oldest child cohort 1962 experienced between 1962 to 1992, when we measured their incomes at age 30. Next, we calculate the income share $\pi^k_{q,1980}$ for every income percentile q in the marginal income distribution of the 1980 children k. With those two ingredients at hand, we can now estimate the counterfactual income $y^{k,C1}_{q,1980}$ of the 1980 children for each income percentile q as

$$y_{q,1980}^{k,C1} = \pi_{q,1980}^{k} \text{ x } G_{2010}^{C}$$

The blue line in Figure 6 shows that absolute mobility for the 1980 child cohort would have risen significantly across the entire income distribution if they had experienced the same GDP growth as the 1962 child cohort. The higher GDP growth scenario would have led to a mean rate of absolute mobility of 70 percent, notably higher than the truly observed 53 percent. However, even the higher growth rate would not have been sufficient to avoid the decline in absolute mobility over time. In fact, it would have needed a GDP growth rate of 3.2 percent to offset the entire decline (see Appendix C, Figure 15). This confirms that slower economic growth rates alone do not fully explain the steep downward trend in absolute mobility that we find for younger cohorts.

Figure 6: Counterfactual analysis



Note: Aggregating absolute mobility rates across all parental incomes yields the mean rates of absolute mobility. The empirical mean rates for birth cohorts 1962 and 1980 are also shown in Figure 1b.
Source: Mikrozensus 1962-2016, SOEP v38, own calculations.

The second counterfactual analysis investigates how absolute mobility for the 1980 cohort would have evolved if they had still experienced the more inclusive income growth of the 1962 cohort (red line). This time, we do not alter the size of the pie, just how it is distributed. Hence, we redistribute the income shares of the 1980 cohort to match the more equal income distribution of the 1962 cohort without changing the 2010 GDP itself. The more inclusive growth scenario can then be written as

$$y_{q,1980}^{k,C2} = \pi_{q,1962}^{k} \text{x} G_{2010}^{0}$$

leading to a counterfactual income distribution for the 1980 child cohort.

In the more inclusive GDP growth scenario, we also find that many more children would have earned more than their parents did if incomes were as equally distributed as for the oldest child cohort. Hence, the counterfactual mean rate of absolute mobility amounts to 65 percent. Again, the increase in absolute mobility is visible across the entire income distribution, even though it is - as expected - more pronounced in the bottom 40 percent of the distribution.

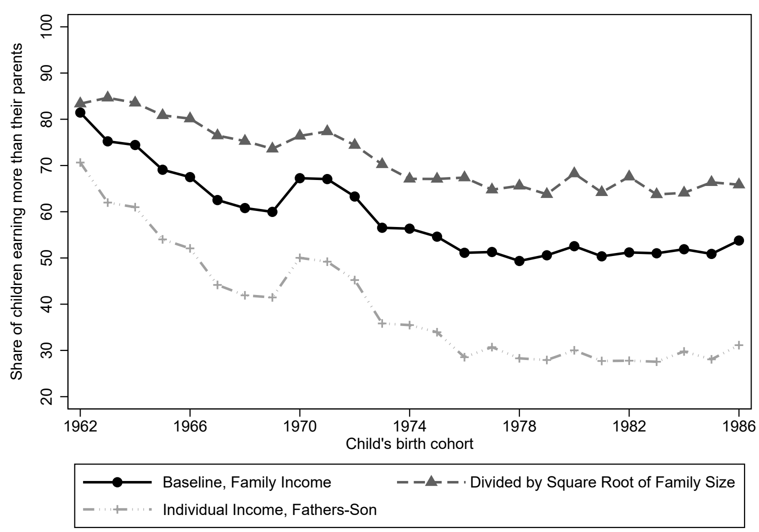
Overall, our counterfactual analysis reveals that both lower economic growth rates and higher income inequality had strong negative effects on absolute income mobility in Germany. We also find that the decline in GDP growth had a slightly stronger negative effect. That said, GDP growth rates were extraordinarily high in the 1960s which is why this postwar period is often referred to as the *economic miracle years*. Hence, it will be interesting to repeat this counterfactual analysis with future cohorts to see how the influence of these two main drivers change with more time.

3.5 The role of societal changes

We have identified lower economic growth and rising inequality as main drivers of the decline in absolute income mobility. But the evolution of absolute income mobility in Germany is also rooted in several societal long-term developments: younger cohorts live in smaller households and are more often singles, a general shift away from the male breadwinner model, and changes in family policies regarding parental leave and childcare.

Figure 7 depicts the mean rates of absolute mobility when we adjust for family size and the number of earners. The mechanical effect of measuring absolute mobility of family income instead of equivalent income is shown when comparing the black line and the dark grey line, respectively.[10] If family size at age 30 would have been ceteris paribus constant over time, the two lines would coincide. However, since the average family size has shrunk over the past decades, absolute mobility declined less for equivalent income than for unadjusted family income. In addition, younger child cohorts are more likely to (still) be single at age 30 (see Figure 8a). So, while households have less total income nowadays than their parents did, the decline in resources per family member is less severe. Hence, absolute mobility of equivalent income is still at 66 percent for the youngest child cohort 1986, 12 percentage points higher than for family income.

Figure 7: Mean rates of absolute mobility by income concept



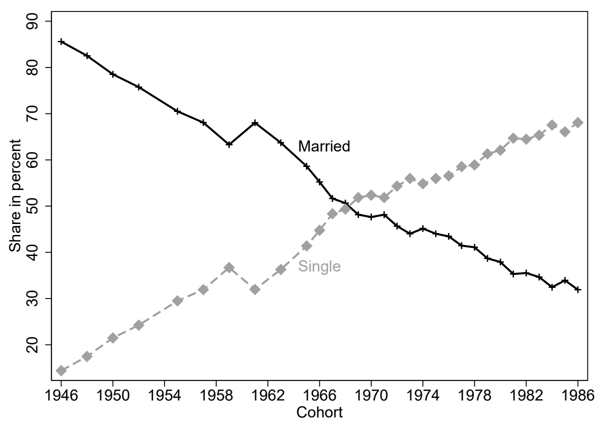
Source: Mikrozensus 1962-2016, SOEP v38, own calculations.

Next, we also want to adjust for the for the number of earners. Over the past decades, we have seen a shift away from the male breadwinner model, with more and more women

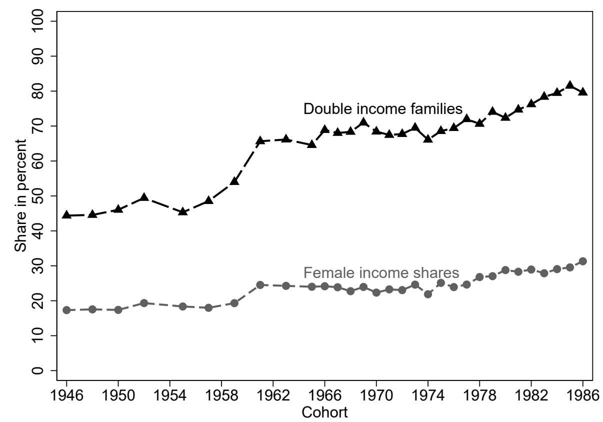
[10]We calculated the equivalent income by dividing the family income by the square root of family members.

working and contributing to the family income. When only looking at individual absolute mobility between fathers and sons, we find that the drop in absolute mobility is significantly steeper than for families as the measurement unit. This finding mirrors the general decline in economic opportunities after the economic miracle years in the 1960s and the gradual decline of the industrial sector, which to this day still predominantly employs men.

Figure 8: Changes in household structures over time



(a) Men's marital status



(b) Double income households

Note: Men's marital status, the share of double income household and the female income shares are all measured at age 30.
Source: Mikrozensus 1962-2016, own calculations.

However, we do not see the severeness of this evolution in the absolute mobility rates of family income. While in the 1960s, the difference between the individual and household perspective is still small, the gap gradually increases with younger cohorts, largely driven by the fact that married women are much more likely to be employed than back in the days (see Figure 8b). In the 1962 cohort, 65 percent of married women were active on the labor market, contributing 24 percent to the entire income of both partners. In the 1986 cohort, the share of working wives rose to 80 percent with an average income share of 31 percent, weathering part of the sons' income losses at the household level. This increase in female labor market activity is not only due to changes in social norms, but also due to the decline in paid parental leave duration, the introduction of incentives for both parents to take some time off, while introducing publicly subsidized childcare for children aged one and older in 2013, reducing mother's opportunity costs to return to their jobs. All these policy changes led to the declined importance of the male breadwinner model.[11]

4 Conclusion

We provide novel evidence on magnitude, pattern, and evolution of absolute income and consumption mobility in postwar Germany. Our analysis yields three main results for children born between 1962 and 1988 and their parents.

First, we find that the share of children earning more than their parents did steeply declined for cohorts born from 1962 through 1988, dropping from 81 percent to 59 percent. The time trend follows an inverse u-shape: While absolute mobility declined for children's birth cohorts 1962 through the early 1980s, it saw an uptick for the youngest birth cohorts 1986 through 1988. This result is robust across different ages, family sizes, measurement methods, copulas, and data sources. In addition, we show that this trend is very similar to the decline in absolute consumption mobility once we exclude the consumption categories of shelter and food.

Second, when looking at the parental income distribution, we document that children from middle-class families experienced the most significant declines in absolute income mobility, with a drop of 31 percentage points. This decrease is larger than for children from the lower and upper parental income distribution.

Third, our counterfactual analysis revealed that lower economic growth rates and higher income inequality have contributed in similar capacities to the steep decline in absolute income mobility. Hence, the German social market economy was not able to buffer the decline in absolute mobility rates seen in other countries like the United States. In addi-

[11] We forgo a counterfactual analysis of formation of partnership and families here since the latter is driven by its socioeconomic environment which has changed in many areas over time. Furthermore, those changes have been intertwined in partially unobservable ways. Hence, any reweighting procedures would not be sufficient and introduce more bias than explanation.

tion to economic factors, societal factors also played a role in shaping absolute mobility. Smaller households, especially among younger generations who are more likely to live alone, intensified the decline in absolute mobility, while the departure from the traditional male breadwinner household model prevented an even more severe decline due to women's higher income contributions for younger birth cohorts.

Even though this study documented a strong decline in absolute income mobility over decades, we do not fully observe the intergenerational mobility of wealth. While incomes from wealth are included in disposable incomes, inheritances and gifts usually transfer much later in life from parents to children than at age 30. However, those intergenerational transfers could offset the steep declines that we see for children from middle- and higher-income families, while children from lower income families might not have access to such resources. Hence, the decline in absolute income mobility along the distribution could have very different real-life impacts on children depending on their parental background. Hence, future research in this field should expand its focus beyond income alone and incorporate a more comprehensive analysis that considers wealth and intergenerational transfers. This approach can offer a more nuanced understanding of the complex nature of intergenerational mobility.

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Appendix

A. Marginal Income Distributions

The following sections give an overview of all data sources used for each year and provide more information on the generalized Pareto estimation that was used to construct continuous income distributions from tabulated MZ income data.

A.1 Data sources

Table 1: Data sources for this study

Year	**Data sources**
1962	Income and Expenditure Survey (EVS; SUF), Mikrozensus (MZ; on site, full sample)
1963	Mikrozensus (MZ; on site, full sample)
1964	Mikrozensus (MZ; on site, full sample)
1965	Mikrozensus (MZ; on site, full sample)
1966	Mikrozensus (MZ; on site, full sample)
1967	Mikrozensus (MZ; on site, full sample)
1968	Mikrozensus (MZ; on site, full sample)
1969	Mikrozensus (MZ; on site, full sample)
1970	Census (VZ; SUF)
1973	Mikrozensus (MZ; SUF)
1976	Mikrozensus (MZ; SUF)
1978	Income and Expenditure Survey (EVS; SUF), Mikrozensus (MZ; SUF)
1980	Mikrozensus (MZ; SUF)
1982	Mikrozensus (MZ; SUF)
1983	Income and Expenditure Survey (EVS; SUF)
1985	Mikrozensus (MZ; SUF)

1987	Mikrozensus (MZ; SUF)
1988	Income and Expenditure Survey (EVS; SUF)
1989	Mikrozensus (MZ; SUF)
1991	Mikrozensus (MZ; SUF)
1993	Income and Expenditure Survey (EVS; SUF), Mikrozensus (MZ; SUF)
1995	Mikrozensus (MZ; SUF)
1996	Mikrozensus (MZ; SUF)
1997	Mikrozensus (MZ; SUF)
1998	Income and Expenditure Survey (EVS; SUF), Mikrozensus (MZ; SUF)
1999	Mikrozensus (MZ; SUF)
2000	Mikrozensus (MZ; SUF)
2001	Mikrozensus (MZ; SUF)
2002	Mikrozensus (MZ; SUF)
2003	Income and Expenditure Survey (EVS; SUF), Mikrozensus (MZ; SUF)
2004	Mikrozensus (MZ; SUF)
2005	Mikrozensus (MZ; SUF)
2006	Mikrozensus (MZ; SUF)
2007	Mikrozensus (MZ; SUF)
2008	Income and Expenditure Survey (EVS; SUF), Mikrozensus (MZ; SUF)
2009	Mikrozensus (MZ; SUF)
2010	Mikrozensus (MZ; SUF)
2011	Mikrozensus (MZ; SUF)
2012	Mikrozensus (MZ; SUF)
2013	Income and Expenditure Survey (EVS; SUF), Mikrozensus (MZ; SUF)
2014	Mikrozensus (MZ; SUF)
2015	Mikrozensus (MZ; SUF)

2016	Mikrozensus (MZ; SUF)
2018	Income and Expenditure Survey (EVS; SUF)

A.2 Generalized Pareto Estimation

Most income distributions share similar statistical characteristics. Following a seminal methodological approach by Blanchet et al. (2022), implemented through their R-package *gpinter* (http://wid.world/gpinter), we take advantage of these similarities and use the generalized Pareto estimation to recover continuous income distributions from tabulated MZ income data. Using this intermediate step, we are able to construct marginal income distributions from MZ data.

Generalized Pareto curves estimate the inverted Pareto coefficients $b(p)$ for each income percentile p included in the tabulated income.[12] Considering a sample of $(X_1, ..., X_n)$ of n independent and identically distributed realizations of X, the empirical estimator of the inverted Pareto coefficient $\widehat{b_n}(p)$ for each income percentile p can be expressed as follows:

$$\widehat{b_n}(p) = \frac{1}{(n - \lfloor np \rfloor) X_{(\lfloor np \rfloor + 1)}} \sum_{k=\lfloor np \rfloor + 1}^{n} X_{(k)} \tag{3}$$

with $\lfloor np \rfloor$ denoting the floor function of x.

After computing $b(p_1), ..., b(p_k)$, the next step consists of the interpolation of the entire generalized Pareto curve $b(p)$. To guarantee that the resulting function will be consistent with the input data, a transformation of the Lorenz curve with its direct relation to the lognormal distribution is used. Afterwards, the methodology by Blanchet et al. (2022) relies on piecewise polynomials of degree five over each income bracket, allowing a flexible interpolation within reasonable boundaries for income distributions. This interpolation method is used for fractiles $p_1, ..., p_k$. To estimate the distribution outside of this range, extrapolation

[12]The MZ provides us with the number of households in each income category. Hence, we can calculate which income percentiles correspond with each income bracket.

for fractiles where $p > pk$ is then applied.

Using extensive tax data, Blanchet et al. (2022) are able to show that these findings offer greater precision than all other estimation methods. In addition, Bönke et al. (2023) are able to match the continuous income distributions provided by the SOEP when they apply this approach to artificially tabulated SOEP data, confirming the high reliability of this methodology.

B. Copula

B.1 Copula Estimation

To obtain our copula to connect parents' and their statistical children's marginal income distributions, we proceed in four steps. First, we obtain truly observed parent and child incomes from the SOEP. We follow Chetty et al. (2017) and take the average income for children between ages 30 to 34, and between 30 and 59 for parents. The range of parental income is larger to maximize the number of observations. We are left with 3,465 observations for which we observe both parent and their children's incomes.

Second, we estimate a wide range of maximum-likelihood-based copula models to identify the model best representing the dependency structure of the joint sample. We choose the copula that minimizes both the Akaike information criterion (AIC) and Bayes information criterion (BIC). We find that for income, the survival BB1 copula best resembles the truly observed bivariate distribution (see Table 2).[13] A BB1 copula is characterized by the higher dependence at the margins of the distribution and also allows for asymmetric tail dependence (Nikoloulopoulos et al. 2012).

[13] We provide the first ten results in Table 2. Other results are available from the authors upon request.

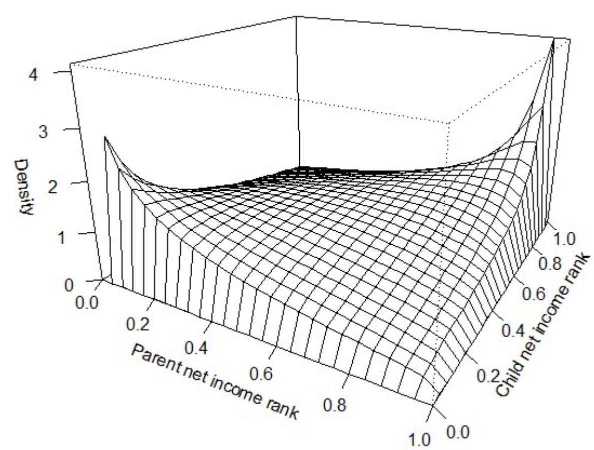
Table 2: Comparing copula fits

Rank	**Family**	**Log likelihood**	**AIC**	**BIC**
1	Rotated BB1 copula (180 degrees; "survival BB1")	486	-969	-957
2	Rotated BB7 copula (180 degrees; "survival BB7")	484	-964	-952
3	BB1 copula	483	-963	-951
4	Student t copula (t-copula)	483	-961	-949
5	BB7 copula	481	-959	-946
6	Rotated Gumbel copula (180 degrees; "survival Gumbel")	460	-918	-912
7	Rotated BB6 copula (180 degrees; "survival BB6")	460	-916	-903
7	Rotated BB6 copula (180 degrees; "survival BB6")	460	-916	-903
8	Gaussian copula	446	-891	-885
9	Rotated Tawn type 1 copula (180 degrees)	423	-842	-830
10	Gumbel copula	418	-834	-828

Third, after fitting the shape of the bivariate distribution in step 2, we now estimate the best fit for the underlying marginal distributions – separately for both parents' and children's income. Fourth, applying Sklar's theorem (Sklar 1959), we retrieve the fitted bivariate distribution by combining the survival BB1 copula with the chosen marginals. We then simulate ten million parent-child-pairs, which enables us to calculate a stable 100x100 rank-rank-matrix.

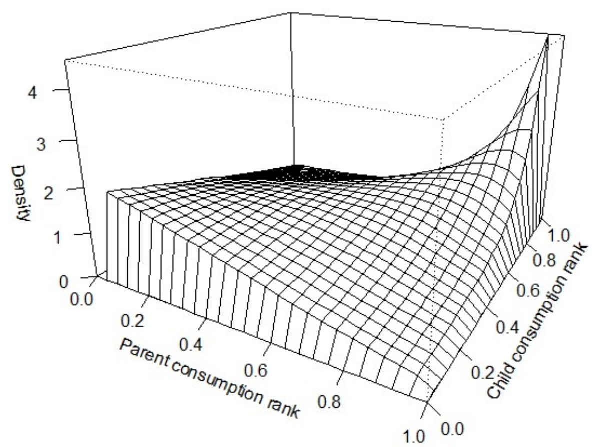
Since we analyze absolute mobility in disposable income and consumption, we cannot assume that we can use the same copula for both concepts. Proceeding as described above, we identify a survival BB8 copula as most likely to resemble the truly observed bivariate distribution for consumption. Compared to a BB1 copula that captures lower and upper tail dependence, a BB8 copula captures upper tail and central dependence (Sriboonchitta et al. 2013). Figure 9 and 10 show our copulas for income and consumption. When comparing both copulas, the differences between the lower tails of the copulas are most notable, as expected. The intergenerational persistence at the bottom is smaller for consumption than income, the persistence at the top is higher for consumption. Overall, the copulas are quite similar and testing differences using the Hellinger distance underline this finding. These results are in line with Berman (2022), who shows that marginal distributions are far more important than copulas in shaping absolute intergenerational mobility trends.

Figure 9: Income copula



Note: This figure displays a survival BB1 copula with ML parameters $\theta = 0.137$ and $\delta = 1.315$. For BB1 copulas, the ML parameters are restricted to $\theta > 0$ and $\delta \geq 1$.
Source: SOEP v38, own calculations.

Figure 10: Consumption copula



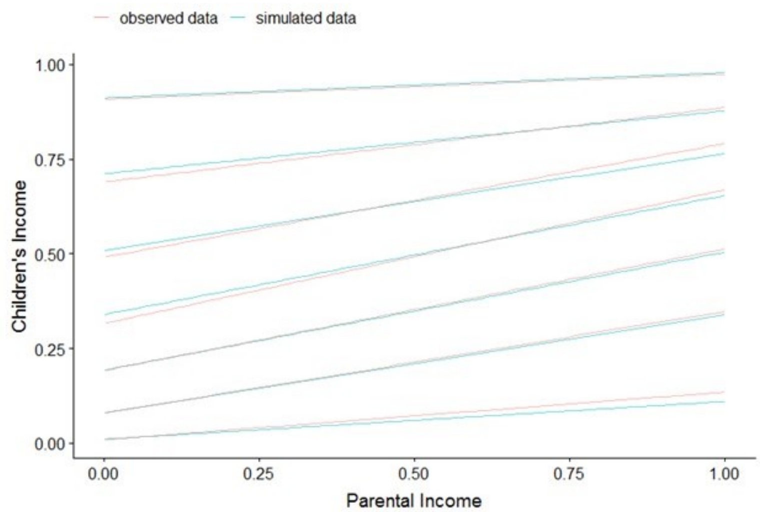
Note: This figure displays a survival BB8 copula with ML parameters $\theta = 2.227$ and $\delta = 0.905$. For BB8 copulas, the ML parameters are restricted to $\theta \geq 1$ and $\delta \in [0, 1]$. Please note that the parameter restrictions are different than for the BB1 copula shown in Figure 9, so their values are not directly comparable.
Source: SOEP v38, own calculations.

B.2 Robustness

Next, we perform several robustness checks to ensure that our identified copula fits our data well. We start with visualizing the rank fit of our copula to the data using conditional quantile regressions. Figure 11 reveals virtually no differences between the simulated and observed rank structure.

Next, we analyze subgroup consistency among cohorts. As mentioned in Chetty et al. (2017), the structure of parent-child-ties is not necessarily stable across generations and might be subject to underlying changes. Due to lack of sufficient information on parent-child-links for children born before the 1980s, we assume copula stability over time (e.g., Chetty et al. 2017). This assumes that one copula model holds true for all cohorts born since the 1960s. In various robustness checks, the authors show that this is not a problematic assumption (see Chetty et al. 2017, 2014). Still, ideally, this assumption is challenged empirically.

Figure 11: Conditional quantile regression for simulated and observed data

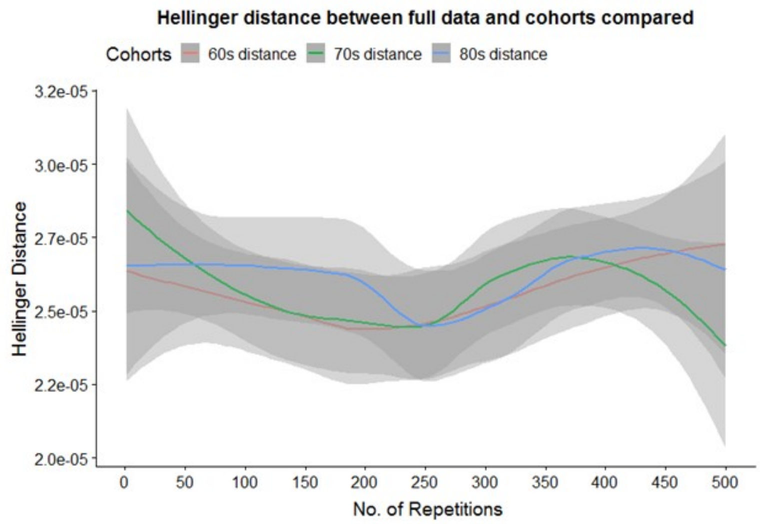


Source: SOEP v38, own calculations.

We compare the simulated copula distributions among cohort groups and the joint sample. To measure the relative distance between probability distributions, we use the Hellinger distance (Hellinger 1909), which is not affected by data limitations. Its value range lies in the unit interval, where 0 depicts perfect similarity between the distributions and the value 1 total discrepancy. Although there is no statistically sound threshold, the literature proposes a rule of thumb value of 0.05 or smaller in order for two distributions to be considered equal (e.g., Leulescu and Agafitei 2013).

Figure 12 shows that there is virtually no differences in the dependency structures among the 1960s, 1970s, 1980s cohorts. After repeatedly drawing random samples from the respective copula models, none of the reported differences exhibit any values even close to the proposed threshold of 0.05. These results support the assumption of copula stability over time.

Figure 12: Hellinger distance between pooled sample and cohort groups compared

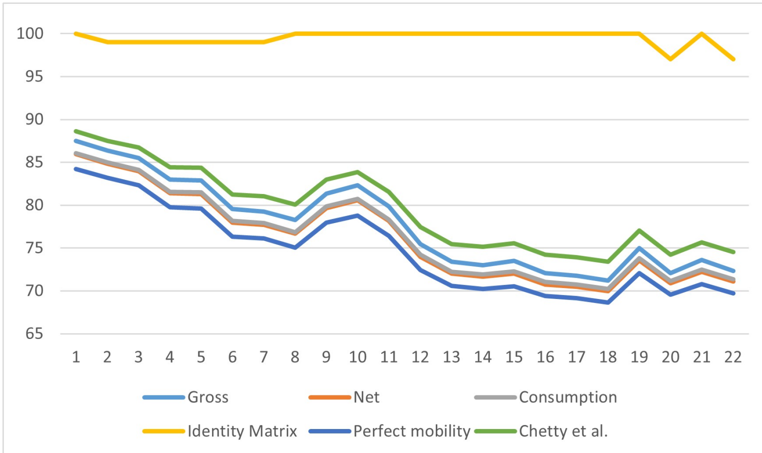


Source: SOEP v38, own calculations.

B.3 Effects of Different Copulae

We showed that assuming a stable copula over time is rather unproblematic. Still, there are some additional robustness checks we can apply. First, we can see how our results change if we used a different copula. In figure 13 we combine our marginal income distributions with different copulae: The copulae we calculated for pre-tax and disposable incomes and consumption from SOEP data, but also the copula from US data provided by Chetty et al. (2017), the identity matrix for an upper bound (no mobility) and last, the matrix of perfect mobility, where each of the 100x100 cells has a value of 0.01. Figure 13 shows that all of these different copulae, except for the identity matrix, would have led to similar results for absolute mobility. Between post-tax and disposable incomes, differences are minor and range from 1 to 2 percentage points. Since the identity matrix proposes perfect immobility - which we know describes a theoretical exercise rather than empirical reality - and all other copulae would have led to similar absolute mobility trends, we are safe to assume that even if relative mobility would have been lower than in the US, we would still have observed a similar decline in absolute income mobility.

Figure 13: Comparing the effects of using different copulae on mean rates of absolute income mobility



For further confirmation, we also provide a 5x5- transition matrix based on SOEP data of gross incomes. This matrix compares well to the matrices provided by Jäntti et al. (2006) for Nordic countries, the UK and the US. Our matrix can be easily placed between the US and the Nordic countries, with the US being the most immobile society in terms of income. This implies that even with other countries' copulae, we are very likely to yield similar results on the trends of absolute mobility. The level, however, might vary, but the trend would stay the same. This is also in line with Berman (2022), who proposes that previously documented empirical copulae have rather limited effects on the evolution of absolute mobility.

Table 3: Transition matrix for gross income

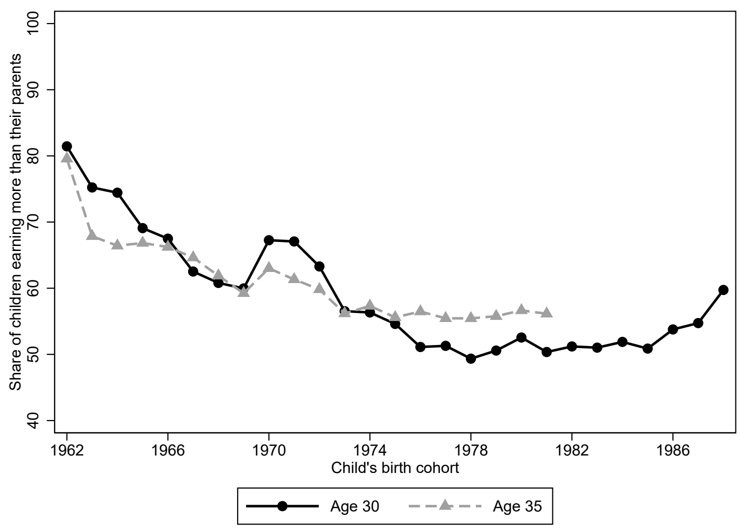
	Children: P1-P20	**Children: P21- P40**	**Children: P41-P60**	**Children: P61-80**	**Children: P81-100**
Parents: P1-P20	0.3743	0.1968	0.1954	0.1288	0.1056
Parents: P21-P40	0.2095	0.2243	0.1867	0.1852	0.1939
Parents: P41-P60	0.1662	0.2041	0.2243	0.2069	0.1983
Parents: P61-P80	0.1272	0.2012	0.2098	0.2402	0.2214
Parents: P81-P100	0.1228	0.1737	0.1838	0.2388	0.2808

Source: SOEP v38, own calculations.

C. Absolute income mobility

One can argue that measuring parents' and children's incomes at age 30 is too early in life. Incomes at such young age might not reflect the living standards of families properly since the correlation between annual earnings and lifetime earnings only becomes sufficiently strong starting in the mid-thirties (Bönke et al. 2015). However, Figure 14 shows that the steep drop in absolute income mobility holds also true if we measure both parents' and children's income at age 35. This confirms that the decline in absolute mobility is robust across age.

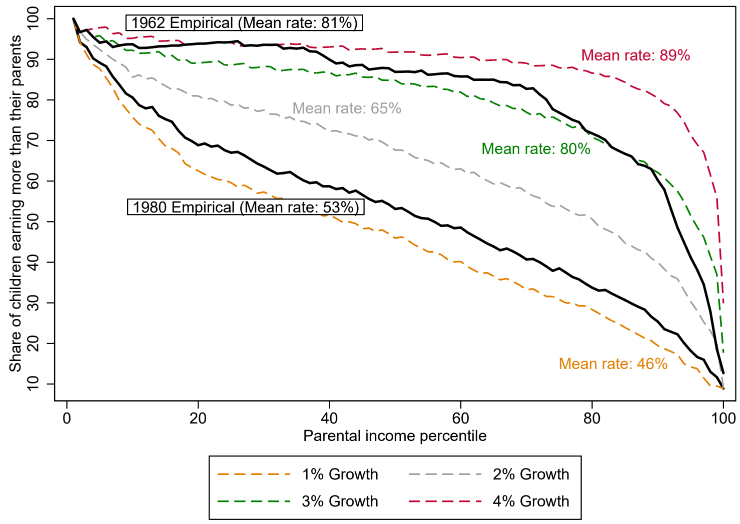
Figure 14: Mean rates of absolute income mobility by age



Source: Mikrozensus 1962-2016, EVS 1978-2018, SOEP v38, own calculations.

Figure 15 shows how absolute income mobility for the 1980 child cohort would have risen if they had experienced GDP growth rates between one and four percent. We find that it would have needed a GDP growth rate of 3.2 percent for the 1980 child cohort to achieve the high absolute income mobility rates that we observe for the 1962 child cohort.

Figure 15: Counterfactual analysis: GDP growth rates



Note: Aggregating absolute mobility rates across all parental incomes yields the mean rates of absolute mobility. The empirical mean rates for birth cohorts 1962 and 1980 stem from our main analysis (see Figure 1b).
Source: Mikrozensus 1962-2016, SOEP v38, own calculations.