INTERGENERATIONAL ECONOMIC MOBILITY IN GERMANY: LEVELS AND TRENDS

Iryna Kyzyma*

Luxembourg Institute of Socio-Economic Research

Olaf Groh-Samberg

University of Bremen

July 12, 2018

Abstract

This paper provides new evidence on intergenerational economic mobility in Germany by analyzing the degree of intergenerational persistence in ranks – positions, which parents and children occupy in their respective income distributions. Using data from the German Socio-Economic Panel, we find that the association of children's ranks with ranks of their parents is about 0.242 for individual labor earnings and 0.214 for household pre-tax income. The evidence points that mobility of earnings across generations is higher for daughters than for sons whereas the opposite applies to the mobility of household pretax income. We also find that intergenerational rank mobility of earnings decreased twice for children born in 1973-1977 as compared to children born in 1968-1972.

JEL codes: D31, J31, J62.

Keywords: intergenerational economic mobility, absolute rank mobility, relative rank mobility, income inequality, changes over time

---

* Corresponding author, Luxembourg Institute of Socio-economic Research, 11 Porte des Sciences, L-4366 Esch-sur-Alzette, G.D. Luxembourg; e-mail: iryna.kyzyma@liser.lu.

1. Introduction

The extent to which economic outcomes of children are associated with economic outcomes of their parents has been widely studied in the literature (for an extensive overview see Solon (2002), Black and Devereux (2011), Jäntti and Jenkins (2015)). The findings from this literature suggest that, regardless of the country studied, there is a significant relationship between economic outcomes of parents and children, although the strength of the relationship varies across countries. In general, countries with higher levels of income inequality experience lower levels of economic mobility across generations and the other way around, the relationship also known as the Great Gatsby curve (Corak, 2013).

Despite relatively large and further growing literature on intergenerational economic mobility, it focuses predominantly on elasticities of children's income with respect to income of their parents whereas much less is known about intergenerational persistence of ranks – positions which parents and children occupy in their respective income distributions. The available studies date back to the late 2000s and cover only a restricted number of countries, such as Canada, Sweden, and the United States (see, among others, Dahl and DeLeire, 2008; Chetty et al., 2014a, b; Corak, 2017; Heidrich, 2017; Nybom and Stuhler, 2017). The evidence from these studies suggests that estimates of intergenerational mobility based on ranks are less susceptible than income-based measures to two major biases typical for studies on intergenerational mobility – the attenuation bias and the life cycle bias. The attenuation bias arises when researchers do not have information on lifelong income of individuals and proxy it with annual observations of income. In his seminal work, Solon (1992) shows that the use of annual income information instead of permanent income results into severe underestimation of the degree of income persistence across generations. The life cycle bias is related to a mismatch in the stages of the life cycle when children's' and parents' incomes are taken into account. Haider and Solon (2006) demonstrate that measuring children's income too early in their life cycle yields a downward bias in the estimates of intergenerational mobility. By comparing the degree of these two biases in various measures of intergenerational income mobility, Nybom and Stuhler (2017) provide convincing evidence that rank-based measures of intergenerational mobility perform much better than conventional measures based on income elasticities.

Apart from being relatively resistant to the attenuation and life cycle biases, there is another important reason why looking at rank rather than income mobility across generations helps to extend our knowledge on intergenerational mobility. By construction, ranks of children and parents follow a uniform distribution with the same variance, the property that makes ordinary least squares (OLS) estimates of intergenerational association in ranks insensitive to the differences in earnings inequality across generations. Due to this property, estimates of intergenerational association in ranks allow capturing the dependence of children's income on income of their parents net of the levels of income inequality present in both generations (Chetty et al., 2014a). This is especially important for tracking trends in intergenerational mobility over time when the interest falls on the identification of the changes in the chances of children to move up and down the income ladder rather than changes in income inequality across generations.

This paper is the first to analyze intergenerational rank mobility in Germany, the most populous country in Europe and the largest European economy in terms of the size of gross domestic product (European Commission, 2015). Due to a decline in long-term unemployment and relatively good economic performance during and after the Great Recession, Germany is characterized as the country, which, within a decade, transformed from the "sick man of Europe" into an "economic superstar" (Dustmann et al., 2014). The employment growth and strengthening of the German economy, however, have been accompanied by a profound increase in income inequality and poverty: both the Gini coefficient and the relative poverty rate were on the rise since 2000 (Figure 1).

< Insert Figure 1 about here >

Many studies analyzed the degree of intergenerational mobility in Germany after reunification (for the summary, see Table A1 in Appendix A), yet the evidence on the topic is scarce and inconclusive. The estimates of the intergenerational earning elasticity (IEE) vary from as low as 0.11 in early studies on intergenerational mobility to as high as 0.32 in the most recent ones. The main reason of such variation in the estimates is different criteria, which researchers apply for the sample specification, especially with respect to the age at which income of children is measured. For example, the average age of sons in Couch and Dunn (1997) is 23 years whereas in Schnitzlein (2016) it is above 37 years.

Apart from yielding heterogeneous estimates of IEE, the available literature focuses exclusively on measuring intergenerational persistence in earnings whereas, to the best of our knowledge, nothing has been done to evaluate the degree of intergenerational persistence in ranks. In addition, little evidence exists on changes in intergenerational mobility in Germany over time. Given that income inequality was on the rise in the 2000s, it might have also reflected on the mobility of income across generations, as suggested by the Great Gatsby curve. Up to our knowledge, only one study, among other things, explored whether the IEE estimates have changed over time. By comparing IEE estimates for children whose fathers' earnings were measured in 1983-1987 with those measured in 1988-1992, Schnitzlein (2009) concludes that there was an increase in income mobility over time. The study, however, does not go beyond 2004 and, hence, does not cover the period of the steepest increase in income inequality throughout the 2000s.

In this paper, we aim to fill in the highlighted gaps in the literature by analyzing the level and trends in intergenerational mobility in Germany after its reunification. Along with the conventional income-based measures of intergenerational mobility (the elasticity of children's income with respect to parental income), we analyze intergenerational persistence in the positions, which children and parents occupy in their respective distributions of income. Using data from the German Socio-Economic Panel (GSOEP) for the period between 1984 and 2014, we measure income of children when they were in their mid-30s and income of parents when children were between 15 and 19 years old. We perform the analysis for both sons and daughters, and consider two types of income – individual gross annual earnings and total household pre-tax income. Finally, we investigate whether intergenerational mobility has changed for the cohort of children born in 1973-1977 as compared to the cohort of children born in 1968-1972.

The paper is structured as follows. Section 2 describes the estimation approach. Section 3 provides details on data and sample construction. Section 4 presents the results from the main analysis and Section 5 complements these results with some sensitivity checks. Section 6 concludes.

2. Rank-based approach to measuring intergenerational economic mobility

2.1. The intergenerational association of ranks

In this paper, we rely on the rank-based approach to measuring intergenerational economic mobility. Let R_i^{child} denote the percentile rank of child *i* (normalized at the unit interval) in the life-long income distribution of children, so that $R_i^{child} \in [0;1]$. Let R_i^{parent} stand for the percentile rank of child's *i* parent in the parental distribution of life-long income, so that $R_i^{parent} \in [0;1]$. Then, the association between child's and parent's percentile ranks can be identified via the ordinary least squares (OLS) procedure as follows:

$$R_i^{child} = \beta_0 + \beta_1 R_i^{parent} + \varepsilon_i, \tag{1}$$

where ε_i is a random uniformly distributed error component capturing factors which might affect distributional positions of children independently from the ranks of their parents.

The estimates β_0 and β_1 from Equation (1) measure the degree of absolute (β_0) and relative (β_1) mobility of ranks across generations. The intercept coefficient, β_0, shows the expected rank that a child can reach if he or she is raised by a parent with income at the very bottom of the distribution. The slope coefficient, β_1, measures the relative association between child's and parent's positions in the respective distributions of income. In particular, it shows the percentile point change in child's rank with respect to a percentile point change in the parent's rank. If β_1 equals to 0, the position of a child in the distribution of income is independent from the distributional position of a parent, and the society can be characterized as absolutely mobile. The larger the value of β_1, the higher is the rank persistence across generations and the lower is mobility. When β_1 takes the value of 1, a child's distributional position is fully determined by the position of the parent. Taken together, the estimates β_0 and β_1 allow us to approximate the expected ranks of children given the location of parents in the parental distribution of income.

2.2.Measurement concerns

The availability of information on life-long ranks for both children and parents is the key prerequisite for obtaining consistent estimates of intergenerational rank mobility in Equation (1). In real life, however, it is challenging to find a dataset, which would contain information on parental and children's income over the entire life cycle and would allow deriving their lifelong positions in the respective income distributions. Researchers typically observe only snapshots of income in both generations, which they use as proxies for unobserved lifetime income and which might generate a severe measurement problem (the problem has been extensively discussed in Björklund, 1993; Angrist and Krueger, 1999; Böhlmark and Lindquist, 2006; Haider and Solon, 2006; and Brenner, 2010). To characterize the relationship between current and lifelong income most studies apply the textbook error-in-variables model, which assumes that current income represent lifelong income plus period-specific transitory fluctuations in it:

$$Y_{i,t} = Y_i + \omega_{i,t}, \tag{2}$$

where $Y_{i,t}$ stands for current income; Y_i stands for true life-long income; and $\omega_{i,t}$ is a transitory component capturing deviations of current incomes from lifelong income.

Specification of Equation (2) suggests that the slope coefficient in the OLS regression of current income on lifelong income equals one. From this follows that the use of current income (or their transformed values) as a dependent variable will not produce biases in the OLS estimates of intergenerational mobility. The estimates will be biased downwards only if current income is used as a proxy for lifelong income in the right-hand side of Equation (1), with the size of the bias dependent on the ratio of true to total variance in parental income, $Var(Y_i)/\left[Var(Y_i)+Var(\omega_{i,t})\right]$.

Recent research argues, however, that the widely used textbook error-in-variables model does not correctly specify the relationship between current and lifelong income. Björklund (1993), Haider and Solon (2006), Böhlmark and Lindquist (2006), and Brenner (2010) have shown that the correlation between current and lifelong income varies over the life cycle and across individuals of different qualifications. Nybom and Stuhler (2017) have further pointed out that errors in ranks are negatively correlated with true ranks because ranks at the top of the distribution cannot be overstated whereas ranks at the bottom of the distribution cannot be understated. To account for this negative correlation in ranks, Nybom and Stuhler (2017) proposed to use the generalized error-in-variables model of Haider and Solon (2006). The model describes the relationship between current and lifelong values of ranks in the form of a regression function:

$$R_{i,t}^{child} = a + \lambda^{child} R_i^{child} + \upsilon_{i,t}^{child} \tag{3}$$

$$R_{i,t}^{parent} = b + \lambda^{parent} R_i^{parent} + \upsilon_{i,t}^{parent}, \tag{4}$$

where $\upsilon_{i,t}^{child}$ and $\upsilon_{i,t}^{parent}$ are random error terms, which are uncorrelated with true ranks by construction, and λ^{child} and λ^{parent} are the slope coefficients in the linear projection of current ranks on lifelong ranks. In line with the definition of ranks, these coefficients may take any value between zero and one, with values close to one signifying little measurement error and the other way around. λ^{child} and λ^{parent}, therefore, can be viewed as discount factors that diminish the values of true ranks to the values of observed ones.

In the presence of measurement errors in both parental and children's ranks and under the assumption that these measurement errors are uncorrelated, the probability limit of β_1 in Equation (1) will be:

$$\operatorname{plim}\hat{\beta}_1 = \frac{\operatorname{cov}(R_{i,t}^{child}, R_{i,t'}^{parent})}{\operatorname{var}(R_{i,t'}^{parent})} = \lambda^{child}\lambda^{parent}\frac{\operatorname{cov}(R_i^{child}, R_i^{parent})}{\operatorname{var}(R_i^{parent})} = \lambda^{child}\theta^{parent}\cdot\beta_1\,, \qquad (5)$$

where λ^{child} is a slope coefficient in the regression of child's current ranks on child's life-long ranks:

$$\lambda^{child} = \frac{\operatorname{cov}(R_{i,t}^{child}, R_i^{child})}{\operatorname{var}(R_i^{child})}\,, \qquad (6)$$

and θ^{parent} is an estimated coefficient from the regression of parent's lifelong ranks on parent's current ranks:

$$\theta^{parent} = \frac{\operatorname{cov}(R_{i,t}^{parent}, R_i^{parent})}{\operatorname{var}(R_{i,t}^{parent})} = \frac{\lambda^{parent} Var(R_i^{parent})}{\lambda^{parent2} Var(R_i^{parent}) + Var(\upsilon_{i,t}^{parent})}\,. \qquad (7)$$

In other words, the estimate of intergenerational association in ranks, $\hat{\beta}_1$, equals the true association, β_1, adjusted for the measurement errors in parental and children's ranks. Given that λ^{child} and $\lambda^{parent} \in [0;1]$, $\hat{\beta}_1$ is biased downwards as soon as there is even a small measurement error in the observed ranks. The size of the bias, however, is smaller in the estimates of intergenerational association of ranks than in the estimates of intergenerational association of income, because ranks are less sensitive to extreme observations at the tails of the distribution (Dahl and DeLeire, 2008; Chetty et al., 2014; Nybom and Stuhler, 2017). Ranks also tend to be less susceptible to the life-cycle bias, which arises when income is measured at the beginning or at the end of one's professional career (Haider and Solon, 2006). Dahl and DeLeire (2008) and Nybom and Stuhler (2017) have shown that rank profiles of individuals stabilize earlier in their life course than log-income profiles, which makes mobility estimates robust to any rank-preserving changes in the spread of income distribution later in life. While estimates of intergenerational income elasticity tend to be downward biased if income observations are taken prior to the age of 35-40 (Haider and Solon, 2006; Chen et al., 2017), rank-based measures stabilize as soon as individuals turn 30 (Dahl and DeLeire, 2008; Corak, 2017; Nybom and Stuhler, 2017).

Due to the lack of information on life-long income, it is typically impossible to estimate λ^{child} and λ^{parent} in a real life setting. To address this problem, the literature on intergenerational rank mobility suggests to eliminate the transitory component from short-run observations of ranks by averaging the values of current earnings over multiple periods before performing ranking of individuals (see, among others, Dahl and DeLeire, 2008; Chetty et al., 2014a,b; Corack, 2017; Nybom and Stuhler, 2017):

$$\overline{Y}_i = \frac{1}{T}\sum_{t=1}^{T} Y_{i,t} = \frac{1}{T}\sum_{t=1}^{T}(Y_i + \omega_{i,t}) = Y_i + \overline{\omega}_i \quad , \tag{8}$$

where $\overline{\omega} \to 0$ as $T \to \infty$.

The major challenge in Equation (8) is to define a sufficient number of years over which income has to be averaged in order to eliminate the measurement error. According to Nybom and Stuhler (2017), the estimate of intergenerational association in ranks falls close to the true value of β_1 when income of parents is averaged over five to ten years covering the middle stage of their life cycles. Similar evidence is also found in Chetty et al. (2014a) and Corak (2017), who show that the estimates are relatively robust to the choice of the number of years, over which parental income is averaged, as soon as this number exceeds five. With respect to children's income, both Chetty et al. (2014a) and Corak (2017) find that there is no significant change in the estimates or rank-rank associations across generations as soon as children's income is averaged at least over two years.

Since averaging income over multiple years helps to reduce but not necessarily to eliminate the error-in-variables bias, $\hat{\beta}_1$ coefficients represent low bound estimates of intergenerational association in ranks. Obtaining upper bound estimates using the instrumental variables approach, as most studies with income-based measures of mobility do, is not straightforward in the context of ranks. As soon as the measurement error is correlated with lifelong ranks, any instrument, which is correlated with lifelong ranks, will also be automatically correlated with the measurement error. This violates the key assumptions of the instrumental variable estimator.

2.3. The relationship between intergenerational association of ranks and intergenerational elasticity of income

The intergenerational association of ranks is a relatively new measure of intergenerational mobility. As mentioned above, the vast majority of studies on intergenerational mobility focuses on estimating the elasticity of children's income with respect to income of their parents:

$$\log Y_i^{child} = \gamma_0 + \gamma_1 \log Y_i^{parent} + \zeta\,, \tag{9}$$

where Y_i^{child} and Y_i^{parent} are income of children and parents respectively; γ_1 is an intergenerational elasticity of income, and ζ is a random error term.

The OLS procedure applied to Equation (9) yields the estimate of γ_1 equal to:

$$\hat{\gamma}_1 = \rho(Y^{child}, Y^{parent}) \cdot \frac{SD(Y^{child})}{SD(Y^{parent})}\,, \tag{10}$$

where $\rho(Y^{child}, Y^{parent})$ is a Pearson correlation between log income of children and parents; and $\sigma(Y^{child})$, $\sigma(Y^{parent})$ are standard deviations of these income variables.

From Equation (10) it follows that beyond the correlation of children's income with parental income, the estimate of intergenerational income elasticity captures the difference in the marginal distributions of income in two generations. A higher dispersion of income in the generation of children than in the generation of parents results into higher estimates of income persistence across generations. And the other way around - if incomes of parents are more unequally distributed than incomes of children, the estimates of intergenerational income persistence will be lower implying more mobility.

In contrast to intergenerational elasticity of income, estimates of intergenerational association of ranks are not sensitive to the differences in income inequality across generations. By construction, ranks of children and parents follow a uniform distribution with the same variance, which eliminates the ratio of standard deviations from the formula and yields the OLS estimate of β_1 equal to:

$$\hat{\beta}_1 = \rho(R^{child}, R^{parent})\,, \tag{11}$$

where $\rho(R^{child}, R^{father})$ is a Spearman coefficient of correlation capturing the dependence structure between ranks of children and parents.

According to Equation (11), the estimate of intergenerational rank association differentiates the true dependence between the positions of parents and children in their respective income distributions from the differences in inequality present in those distributions. This is especially important in the context of studying changes in intergenerational mobility over time when the goal is to capture changes in the chances of children to move up and down the income distribution rather than changes in income inequality. The intergenerational association in ranks as a measure of mobility, however, has its limitations because it tells us nothing about the size of financial resources associated with movements up and down the income ladder. As a consequence, the same degree of rank mobility in different countries (over different time periods) may translate into very different levels of financial resources (Corak et al., 2017).

3. Data and sample construction

To derive an intergenerational sample for our analysis we use data from the GSOEP, a longitudinal survey conducted by the German Institute for Economic Research (DIW). The GSOEP started in 1984 with a representative sample of 5921 private households living in the Federal Republic of Germany and expanded to the territory of the German Democratic Republic in June 1990 (Haisken-DeNew and Frick, 2005). Over time, the survey has undergone several sample refreshments to better capture the ethnical composition of the population, increase the sample size, or collect information on particular socio-economic sub-groups (for a detailed description of the GSOEP samples see Table B1 in Appendix B). This paper covers only individuals, who were included in the initial GSOEP samples because only for them we have enough observations of income in both parents' and children's samples.

The main advantage of the GSOEP for intergenerational mobility research is that it follows individuals over time, even when they move from one household to another (the follow-up, however, stops if individuals move beyond the borders of Germany). To qualify for an annual interview, a person should be at least 16 years old and either be an initial member of the sampled household, or join it later as a result of birth or residential mobility. Although children from eligible households are not interviewed during childhood years, they become full participants in the survey as soon as they reach the age of 16. Thanks to this follow-up principle, we can link children, who have reached adulthood and moved out from parental households, to their parents interviewed in the first waves of the GSOEP.

In this paper, we use GSOEP data for 1984-2014. Our children's sample consists of individuals born between 1968 and 1977, who reached their mid-30s between 2002 and 2013.[i]

We are interested in measuring income at this age because income observations at earlier stages of the life cycle have proved to be noisy measures of life-long income (Solon, 2002; Haiden and Solon, 2006; Chen et al., 2017; Nybom and Stuhler, 2017). To decrease the risk of underestimation of intergenerational association in ranks due to the use of annual rather than life-long information on income, we average children's income over three years, when children were between 34 and 36 years old.

In a similar way, to reduce the error-in-variable problem in parental income and ranks, we followed Chetty et al. (2004a) and Corak (2017) and averaged parents' income over the 5-year period when children were between 15 and 19 years old. This restriction implies that information on parental income refers to the years between 1983 and 1996. Only parents with at least three valid observations of income in the 5-year period are included in the analysis. We also consider only those parent-child pairs where parents were between 15 and 40 years old when the children were born.

We focus on two measures of income - individual gross annual earnings and annual pretax household income. Individual gross annual earnings have been widely used as an income measure in the literature on the intergenerational earnings mobility of sons (for the survey of this literature, see Solon, 2002; Jäntti and Jenkins, 2015). For daughters, the measure is often criticized as problematic because women's labor market participation is lower than that of men (Chadwik and Solon, 2002; Cervini-Plá, 2014). To overcome this problem, Chadwik and Solon (2002) suggest using household income instead of individual earnings while analyzing intergenerational mobility of daughters. Rather than focusing on individual earnings for sons and household income for daughters, in this paper we analyze intergenerational mobility using both measures of income. This choice also allows us to compare the estimates of intergenerational rank mobility in Germany with those available for other countries because most of them focus on annual pretax household income (e.g. Chetty et al., 2004a, b; Corak, 2017; Heidrich, 2017).

In the GSOEP, individual gross annual earnings include wages and salary from all employment including training, primary and secondary jobs, self-employment, income from bonuses, over-time work, and profit sharing. In line with the most studies in the field, we focus on the relationship between children's earnings and earnings of their fathers. For calculation of annual household pretax income, we follow as closely as possible the definitions used by Chetty et al. (2014a, b) and Corak (2017). In particular, we define the total pretax household income as a sum of income from labor earnings of all household members, assert flows, private retirement income, social security pensions, private transfers and public benefits prior to the deduction of social security contributions and taxes. Again, following Chetty et al. (2014a, b) and Corak (2017), in each year we divide the total pretax household income by 2 if both spouses were present in the household.

To make the values of earnings and household income comparable over time, we adjust them for the prices of 2013. In our primary sample, we also exclude observations with zero values of individual earnings or earnings smaller than 1200 Euros per year. We evaluate the impact of this restriction on the estimation results by performing calculations for two alternative samples (the results of this exercise are provided in Section 5). In the first alternative sample, we include all observations with positive annual earnings values. In the second sample, we also include observations with zero earnings but record them to 1 before performing the logarithmic transformation of earnings. For the pre-tax household income, the problem of zero values is less relevant because, if not from labor, household typically obtain incomes from other sources.

We define ranks of children based on their positions in the distribution of individual earnings (pre-tax household income), where the distribution encompasses all children born in the same year. For parents, we define ranks relative to other parents, who have children born in the same year. In order to analyze intergenerational mobility of daughters and sons separately, we then redefine ranks within the respective gender sub-samples.

Our final core sample comprises 447 father-child pairs (246 for sons and 201 for daughters) for individual earnings and 536 parent-child pairs (266 for sons and 270 for daughters) for pre-tax household income. In order to investigate whether the degree of intergenerational mobility has changed over time, we split the entire sample of children into a set of overlapping sub-samples with each sub-sample comprising children born within five consecutive years – i.e. the cohorts born in 1968-1972, 1969-1973 … 1973-1977 (a detailed overview of the birth cohorts is provided in Table C1 in Appendix C). Table 1 below provides summary statistics for the entire sample and gender sub-samples.

< Insert Table 1 around here >

On average, fathers in our sample were around 45.5 years old when children reached the age between 15 and 19. The mean age of children in the sample constitutes 35 years regardless of the gender. While looking at all cohorts together, the average size of fathers' log earnings is the same as the average size of sons' earnings but it is slightly larger than the average size of daughter's earnings. The gender difference, however, disappears for household pretax income: its size is almost identical in the generations of parents and children, regardless of whether the latter are boys or girls. Noticeably, the variance of earnings and pretax household income is larger in the generation of children (especially daughters) than in the generation of parents, implying higher levels of inequality among the former. The estimates also do not differ much across the cohorts.

4. Results

4.1. The level of intergenerational economic mobility in Germany

Table 2 below presents the estimates of intergenerational mobility for the entire sample of children, and separately for sons and daughters. Panel A provides the estimates of the rank mobility whereas Panel B summarizes the estimates of income mobility across generations.

< Insert Table 2 around here >

The estimates in Panel A show that children raised by fathers at the bottom percentile of the earnings distribution, on average, rank at the 38th percentile of the earnings distribution as adults. The absolute mobility at the bottom is higher in the sample of girls than in the sample of boys: girls born to the poorest fathers can expect to find themselves at the 42nd percentile of the earnings distribution as adults whereas boys with similar economic circumstances at birth will end up only in the 31st percentile of the male earnings distribution.[ii]

The estimates of relative mobility of earnings across generations (rank-rank slopes) are also significant for the entire sample of children and for both gender sub-samples implying that distributional positions of children depend on the distributional positions of their parents. On average, a child born to a father at the top of the earnings distribution ranks 24 percentiles higher than a child born to a father at the bottom of the distribution. While looking within the gender sub-samples, distributional positions of boys are much more dependent on the distributional positions of their fathers compared to girls. On average, sons of the top quintile fathers rank 38 percentiles higher than sons of the bottom quintile fathers whereas for daughters the relative advantage is only 15 percentiles. This evidence suggests that intergenerational rank mobility in earnings is higher in the sample of daughters than in the sample of sons.

The estimates of intergenerational rank mobility based on household pretax income are quite similar to the mobility estimates based on individual labor earnings, if we pull all children together. The absolute mobility is almost the same for two income measures whereas the relative mobility is slightly higher for household pretax income than for individual labor earnings (the rank-rank slopes are 0.214 and 0.242 accordingly). The major differences in the estimates for two income measures arise when the models are estimated separately for the sub-sample of daughters and sons. Whereas girls are much more mobile than boys in individual labor earnings, the opposite applies for household pretax income. In particular, daughters born to bottom percentile fathers, on average, rank at the 38^{th} percentile of their own household pretax income distribution whereas sons can reach the 41^{st} percentile. The relative advantage of being a child of a top percentile rather than a bottom percentile parent is also higher for girls than for boys (24 versus 18 percentiles) implying lower intergenerational rank mobility in household pretax income in the sub-sample of daughters.

Panel B in Table 2 provides the conventional estimates of intergenerational mobility, obtained by regressing children's log earnings (incomes) on the respective outcomes of their parents. The estimates for the entire sample of children show that, on average, a 10-percent increase in a father's earnings is associated with a 3.68-percent increase in a child's earnings. For household pretax income, the elasticity is somewhat smaller: a 10-percent increase in parental income is associated with a 2.7-percent increase in a child's income. While looking across the gender sub-samples, the estimates of intergenerational persistence in individual earnings and household pretax income are higher for daughters than for sons. For individual labor earnings, a 1 percent increase in fathers' earnings is associated with a 0.42 percent increase in daughters' earnings and 0.265 percent increase in sons' earnings. For household pretax income, the estimates are 0.353 and 0.185 accordingly.

In general, Table 2 yields an important message – depending on the measure chosen (income-based versus rank-based) one might reach completely different conclusions about the level of intergenerational mobility. For example, while looking at the intergenerational earnings elasticities, we will find that relative mobility is higher for sons than for daughters – a finding which comes along with the previous literature.[iii] However, if we look at intergenerational association in ranks, we will reach the opposite conclusion that relative mobility is higher for daughters than for sons. Two main reasons stand behind these differences. First, rank-based measures of intergenerational mobility capture monotonic relationship between incomes of children and their parents whereas income-based measures approximate linear relationship between the two. Second, income-based measures of mobility also capture the difference in the levels of inequality present in the distributions of those earnings, which is not the case for rank-based measures (see Equations 10 and 11). Given this evidence, rank-based measures of intergenerational mobility might be more appropriate for identifying the true dependence of children's economic outcomes on the outcomes of their parents than income-based measures.

Tables 3 and 4 provide further evidence on the absolute mobility of individual labor earnings and household pretax income by listing quintile transition matrices for the entire sample of father-child pairs (Panel A) and for its gender sub-samples (Panels B and C). Each transition matrix summarizes the probabilities for a child raised by a father from a given quintile of the fathers' earnings distribution to reach various positions in the children's earnings distribution later in life. By providing these probabilities, the transition matrices shed further light on the direction of absolute mobility in the generation of children as compared to the generation of parents.

< Insert Table 3 here >

< Insert Table 4 here >

Panel A in Table 3 shows that there is quite a lot of mobility in individual labor earnings across generations. Children born to fathers from any quintile but the top have relatively equal chances to end up in any quintile of the earnings distribution in their own generation. It is, however, relatively more difficult for children of the fathers from the lowest 40th percentile of the earnings distribution to reach the top quintile in the distribution of their own generation. In contrast, children of the top quintile fathers have a disproportionally high probability of ending up in the top quintile once adult: almost 43 percent of such children can expect to become top earners in their own generation. This evidence implies that although there is a lot of mobility up to the 80th percentile of the earnings distribution, earnings still persist at the top of the fathers' earnings distribution.

In line with the findings from Panel A in Table 2, the estimates in Table 3 reveal that sons tend to experience lower intergenerational mobility of earnings than daughters do. The level of intergenerational mobility for sons, as compared to daughters, is especially low at the bottom of the fathers' earnings distribution. For example, sons born to the fathers at the bottom quintile of the earnings distribution have only a 4-percent probability to reach the top quintile of the earnings distribution as adults whereas for daughters this probability constitutes 17 percent. Sons of the top quintile fathers, in turn, have almost a 37-percent probability to stay in the top quintile of the earnings distribution once they grow up whereas this probability is only 32.5 percent for daughters.

The estimates in Table 4 reveal that intergenerational persistence of household pretax income is higher at the bottom but lower at the top of the parental distribution, as compared to individual labor earnings (Table 3). On average, a child born to a parent at the very bottom of the household income distribution has almost a 30-percent probability of staying at the bottom as an adult whereas for individual labor earnings this probability is only 21 percent. Contrarily, for children of the richest parents, the chances to slide down the income ladder are around 60 percent higher for household pretax income as compared to individual labor earnings. This evidence implies that there is much more stickiness at the bottom and much more fluidity at the top of the household income distribution across generations, as compared to the individual labor earnings distribution. Panels B and C in Table 4 further reveal that intergenerational persistence of household pretax income at the bottom of the distribution is especially high in the sample of daughters, which explains their relatively low estimates of rank mobility in Table 2.

4.2. Trends in intergenerational mobility over time

Figure 4 shows the evolution of the estimates of intergenerational mobility in earnings over time for the entire sample of children. Due to a small sample size, we plot the estimates for a set of overlapping cohorts, where each cohort covers a period of five years – e.g. children born in 1968-1972, 1969-1973, …, 1973-1977.

< Insert Figure 2 around here >

Panel A in Figure 2 shows that the estimates of absolute rank mobility were declining whereas the estimates of rank-rank slopes were increasing over the period of interest. The latter more than doubled for children born in 1973-1977 as compared to children born in 1968-1972. A similar trend is also observed for the earnings-based measures of intergenerational mobility (Panel B). While absolute earnings mobility at the bottom of the distribution has decreased by 1/3 over time, the relative persistence of earnings across generations almost doubled in size. This evidence suggests that a decline in intergenerational mobility took place not only due to changes in the levels of earnings inequality across generations but also due to an increase in the dependence between distributional positions of children and parents.

Figure 3 plots changes over time in the intergenerational mobility estimates based on household pretax income. Although there was a downward trend in both absolute and relative rank mobility of household pretax income, the trend has reversed for the children born in 1977. The income-based measures of intergenerational mobility were also fluctuating a lot over time but remained unchanged for the cohort of children born in 1973-1977 as compared to the cohort born in 1968-1972 (Panel B in Figure 3).

< Insert Figure 3 around here >

In order to test whether the observed trends in intergenerational mobility are statistically significant, for each income measure we estimated two additional models by adding to the initial model (i) a linear trend by the year of a child's birth, and (ii) a cohort trend capturing the change between the two non-overlapping cohorts, i.e. those born in 1968-1972 and 1973-1977. The results of this exercise are summarized in Table 5 below.

< Insert Table 5 around here >

The results in Table 5 indicate that there was a significant decline in absolute and relative intergenerational rank mobility of earnings over time. Both the linear (Model 2) and cohort (Model 3) trends are statistically significant. On average, children born between 1968 and 1972 to fathers with earnings at the very bottom of the distribution could expect to rank at the 43rd percentile as adults whereas their counterparts born between 1973 and 1977 rank only at the 31st percentile. At the same time, the relative advantage of being a child of a top percentile's father rather than a bottom percentile's father has increased by almost 23 percentiles over time.

Although intergenerational rank mobility in earnings has decreased substantially over time, intergenerational rank mobility in household pretax income remained unchanged. None of the trend estimates in Table 5 is sizable or statistically significant. The results also appear to be insignificant for income-based mobility estimates, regardless of whether they refer to individual labor earnings or household pretax income (Panel B in Table 5).

The breakdown of the sample by gender does not reveal substantial differences in the trends between sons and daughters (see Figures D.1 and D.2 in Appendix D and Figures E1 and E2 in Appendix E). The graphical evidence suggests that both genders experienced a decline in absolute and relative mobility, but the decline appears to be statistically insignificant for any measure of intergenerational mobility (Tables F1 and F2 in Appendix F). On the one hand, these findings suggest that there has been no significant decline in intergenerational mobility for both sons and daughters. On the other hand, the lack of statistical significance might also be related to a relatively small sample size, the problem that has been widely discussed by Bratberg et al. (2005) and Aaronson and Mazumder (2008). The results in Table 5 also speak in support of this hypothesis since the decline in intergenerational rank mobility of earnings appears to be significant once all children are pulled together.

5. Robustness checks

In order to test the robustness of our results to the methodological choices made in the main part of the paper, we perform three sets of additional analyses aiming to identify the sensitivity of our estimates to: (1) the treatment of zero values in income variables; (2) the presence of life-cycle bias; and (3) the presence of attenuation bias. The results of these tests are presented below.

5.1. Treatment of zero values in income variables

In our primary analysis, we excluded observations with earnings and household pre-tax income smaller than 1200 Euros per year. To evaluate the impact of this restriction on the estimation results, we performed calculations for two alternative samples. In the first alternative sample, we included all observations with positive values in annual earnings. In the second sample, we also included observations with zero earnings but recorded them to one before the logarithmic transformation of earnings. For the pre-tax household income, the problem of zero values is less relevant because, if not from labor, household typically obtain income from other sources.

In line with other papers in the field (e.g. Dahl and DeLeire, 2008; Chetty et al., 2014a, b; Corak, 2017), the results of the sensitivity analysis indicate that rank-based measures of intergenerational mobility are more robust to the treatment of zero values than income-based measures (Table G.1 of Appendix G). In general, the estimates of both absolute and relative rank mobility remain statistically significant when we include observations with low or zero values in the analysis.

The picture, however, looks differently for income-based measures of mobility. As soon as we include observations with zero values in the sample, the estimates of intergenerational earnings elasticity become indistinguishable from zero. This evidence suggests that in small sample sizes, like ours, rank-based measures perform better than income-based measures of intergenerational mobility. Although inclusion of observations with low or zero values in the analysis results into a decline in the estimates of rank-rank slopes, these estimates remain statistically significant and relatively close to the estimates from the baseline model (for low income values the difference in the estimates is around 5 percent whereas for zero income values it is around 30 percent).

5.2.Life-cycle bias

In order to identify sensitivity of our results to the life-cycle bias, we estimate a number of models with alternative specifications of children's age. In the first model, we consider earnings of children when they were between 30 and 32. In the subsequent models, we measure earnings of children in the second half of their 30s, i.e. when they were 35-37, 36-38, and 37-39 years old. The results of this exercise are summarized in Table G.2 of Appendix G.

The estimates reveal that rank-based measures of intergenerational mobility are much more robust to life-cycle bias than income-based measures, which also comes in line with previous literature in the field. The estimate of relative rank mobility at the age of 30-32 is a bit smaller than the baseline estimate (0.207 versus 0.242) but the difference is negligible compared to the difference in the estimates of intergenerational earnings elasticity (0.252 versus 0.368). Moreover, the estimates of rank persistence across generations stabilize in our sample after children reach 35 whereas the estimates of intergenerational elasticity of earnings keep growing with age, at which income children's income is measured.

5.3. Attenuation bias

In order to test for the presence and the size of attenuation bias in our baseline estimates of intergenerational mobility, we estimate a series of models, where we average earnings of children and parents over different number of years (see Table G.3 in Appendix G). The results signify that rank-based measures of intergenerational mobility are quite robust to the attenuation bias. In particular, decreasing the number of years over which parental earnings are averaged results into a decline in the estimates of relative rank mobility but the size of the decline is relatively small. For example, taking parental earnings for only one year yields the estimate of rank-rank slope of 0.227 whereas our baseline estimate is 0.242. The estimates of relative rank mobility also do not fluctuate much depending on the number of years, over which we average earnings of children. When only one year of children's earnings is taken into account, the estimated association of children's ranks with the ranks of their parents constitute around 0.251.

In contrast, the attenuation bias is very profound in the estimates of intergenerational elasticity of earnings: a decrease in the number of years over which parental earnings are averaged leads to a decrease in the estimates of earnings persistence across generations. For example, if we take only one year of parental earnings into account we will get the elasticity estimate of 0.231, which is 37 percent smaller than the baseline estimate of 0.368.

6. Conclusions

Using GSOEP data, this paper provides estimates of the level of intergenerational economic mobility in Germany and their trends over time in the context of increasing inequality in labor earnings and household income. Apart from the conventional measures of intergenerational mobility (the elasticity of children's income with respect to parental income), we also estimate the association between the positions, which children and parents occupy in the income distributions of their own generations. We do it for two measures of income – individual labor earnings and household pretax income – and perform the analysis for the entire sample of children, and separately for sons and daughters.

We find that children born to fathers at the bottom of the earnings distribution, on average, reach the 38th percentile of the earnings distribution as adults. Being a child of a top rather than a bottom percentile father moves a person up the distribution of individual earnings by 24 additional percentiles. The estimates are quite similar for household pretax income. A child of the poorest parents, on average, can expect to reach the 39th percentile of the household income distribution as an adult. The relative advantage of being born to top percentile rather than to bottom percentile parents constitutes 21 percentiles. These estimates put Germany ahead of the United States but behind Sweden in terms of intergenerational rank mobility: in the United States, the estimate of the relative rank mobility for household pretax income is 0.339 whereas in Sweden it is 0.197 (Chetty et al., 2014 and Heidrich, 2017).

While looking at the gender differences in intergenerational rank mobility, we find that girls are more mobile than boys if one considers individual labor earnings but the opposite applies for household pre-tax income. For individual labor earnings, the estimates of absolute and relative mobility are 0.423 and 0.154 for girls whereas they are 0.310 and 0.380 for boys. For household pretax income, the differences between the gender sub-samples are somewhat smaller: the absolute mobility is only 3 percentiles higher for boys than for girls whereas the relative advantage of being born to reach rather than poor parents is 6 percentiles larger for boys than for boys.

One of the main findings in the paper is that, in most of the cases, the estimates of intergenerational persistence in ranks are lower than the estimates of intergenerational earnings elasticity. The main reason of this mismatch is that the level of inequality is much higher in the generation of children than in the generation of parents in Germany, especially if we consider not only sons but also daughters. We find, for example, that relative rank mobility across generations is higher than relative income mobility for both earnings and household pretax income, if they are derived for all children together. Moreover, if we calculate conventional estimates of intergenerational mobility based on income elasticities, we will find that girls are much less mobile than boys are, but the opposite will take place if we focus on the mobility of ranks across generations. These findings suggest that, in the presence of various degrees of income inequality in the generations of parents and children, rank-based measures of mobility might be more appropriate for making judgements about the level of intergenerational economic mobility than income-based measures. We also find that rank-based measures of intergenerational mobility are much less sensitive than income-based measures to the treatment of zero values, attenuation and life cycle bias even in small samples like ours.

While looking at the changes in intergenerational mobility we find that both absolute and relative mobility of earnings have decreased significantly over time. Whereas children born in 1968-1972 to fathers at the bottom of the earnings distribution could expect to rank at the 43rd percentile as adults, those born between 1969 and 1973 could reach only the 31st percentile, other things being equal. The difference in the distributional positions between children born to top quintile fathers and bottom quintile fathers has also increased from 14.5 percentiles for the 1968-1972 cohort to 37 percentiles for the cohort of 1973-1977. We have not found, however, a significant change in the intergenerational mobility of household pre-tax income over the same period of time.

Acknowledgements

The work on this paper has been partially accomplished when Iryna Kyzyma was as a researcher at the Centre for European Economic Research in Mannheim (ZEW). We would like to thank the participants of the ESPE 2018 conference, ECINEQ 2017 conference, workshop on Labour Economics (University of Trier) as well as research seminars at the Luxembourg Institute of Socio-Economic Research, University of Bremen, and University of Luxembourg (SEMILUX) for helpful comments. Iryna Kyzyma also acknowledges funding from NORFACE (IMCHILD project, 2018-2020) and core funding for Luxembourg Institute of Socio-Economic Research from the Ministry of Higher Education and Research of Luxembourg. The usual disclaimers apply.

References

Angrist, J.M. and Krueger, A.B. (1999). Empirical strategies in Labor Economics. In Ashenfelter, O.C. and Card, D. (Eds.) *Handbook of Labor Economics*, Vol. 3A. Amsterdam: Elsevier Science, North-Holland, pp. 1277-1366.

Björklund, A. (1993). A comparison between actual distributions of annual and lifetime income: Sweden 1951-89. *Review of Income and Wealth*, 39 (4), pp. 377-386.

Black, S.E. and Devereux, P.J. (2011). Recent developments in intergenerational mobility. In O. Ashenfelter and D. Card (Eds.) *Handbook of Labor Economics*, vol. 4, pp. 1487-1541.

Böhlmark, A. and Lindquist, M.J. (2006). Life-cycle variations in the association between current and lifetime income: Replication and extension for Sweden. *Journal of Labor Economics*, 24, pp. 879-896.

Braun, S.T. and Stuhler, J. (2018). The transmission of inequality across multiple generations: Testing recent theories with evidence from Germany. *The Economic Journal*, 128 (609), pp. 576-611.

Brenner, J. (2010). Life-cycle variations in the association between current and lifetime earnings: Evidence for German natives and guest workers. *Labour Economics*, 17, pp. 392-406.

Cervini-Plá, M. (2015). Intergenerational earnings and income mobility in Spain. *Review of Income and Wealth*, 61 (4), pp. 812-828.

Chadwick, L. and Solon, G. (2002). Intergenerational income mobility among daughters. *American Economic Review*, 92(1), pp. 335-344.

Chen, W.-H., Ostrovsky, Y. and Piraino, P. (2017). Lifecycle variation, errors-in-variables bias and nonlinearities in intergenerational income transmission: New Evidence from Canada. *Labour Economics*, 44 (1), pp. 1-12.

Chetty. R., Hendren, N., Kline, P., and Saez, E. (2014a). Where is the land of opportunity? The Geography of intergenerational mobility in the United States. *The Quarterly Journal of Economics*, 129 (4), pp. 1553-1623.

Chetty. R., Hendren, N., Kline, P., Saez, E., and N. Turner (2014b). Ist he United States still a land of opportunity? Recent trends in intergenerational mobility. *American Economic Review: Papers & Proceedings*, 104 (5), pp. 141-147.

Corak, M. (2013). Income inequality, equality of opportunity, and intergenerational mobility. *Journal of Economic Perspectives*, 27 (3), pp. 79-102.

Corak, M. (2017). *Divided landscapes of economic opportunity: The Canadian geography of intergenerational income mobility*. Working papers 2017-043. Human Capital and Economic Opportunity Working Group.

Couch, K.A. and Dunn, T. A. (1997). Intergenerational correlations in labor market status: A comparison of the United States and Germany. *Journal of Human Resources*, 32 (1), pp. 210-232.

Dahl, M. and DeLeire, T. (2008). *The association between children's earnings and fathers' lifetime earnings: Estimates using administrative data*. Institute for Research on Poverty Discussion Paper No 1342-08.

Dustmann, C., Fitzenberger, B., Schönberg, U. and Spitz-Oener, A. (2014). From sick man of Europe to economic superstar: Germany's resurgent Economy. *Journal of Economic Perspectives*, 28 (1), pp. 167-188.

Eisenhauer, P. and Pfeiffer, F. (2008). Assessing intergenerational earnings persistence among German workers. *ZAF*, 2 und 3/2008, pp. 119-137.

Ermisch, J., Francesconi, M. and Siedler, T. (2006). Intergenerational mobility and marital sorting. *The Economic Journal*, 116, pp. 659-679.

European Commission (2015). *Statistical annex of European Economy. Spring 2015*. Brussels: European Commission. Directorate-General for Economic and Financial Affairs.

Haider, S. and Solon, G. (2006). Life-cycle variation in the association between current and lifetime earnings. *American Economic Review*, 96, pp. 1308-1320.

Haisken-DeNew, J.P. and Frick, J. R. (Eds.) (2005) *Desktop Companion to the German Socio-Economic Panel*. DIW: Berlin.

Heidrich, S. (2017). Intergenerational mobility in Sweden: A regional perspective. *Journal of Population Economics*, 30, pp. 1241-1280.

Heineck, G. and Riphahn, R.T. (2009). Intergenerational transmission of educational attainment in Germany: the last five decades. *Journal of Economics and Statistics (Jahrb Nationalökonomie und Statistik)*, 229 (1), pp. 39-60.

Jäntti, M. and Jenkins, S.P. (2015). Income mobility. *Handbook of Income Distribution*, vol. 2, pp. 807-935.

Lillard, D.R. (2001). Cross-national estimates of the intergenerational mobility in earnings. *Vierteljahrshefte zur Wirtschaftsforschung*. 70. Jahrgang, Heft 1/2001, S. 51-58.

Nybom, M. and Stuhler, J. (2017). Biases in standard measures of intergenerational income dependence. *Journal of Human Resources*, 52 (3), pp. 800-825.

Riphahn, R.T. and Schieferdecker, F. (2012). The transition to tertiary education and parental background over time. *Journal of Population Economics*, 25, pp. 635-675.

Schnitzlein, D. D. (2009). Struktur und Ausmaß der intergenerationalen Einkommensmobilität in Deutschland. *Jahrbücher für Nationalökonomie und Statistik*, 229/4, S. 450-466.

Schnitzlein, D. D. (2016). A new look at intergenerational mobility in Germany compared to the U.S. *Review of Income and Wealth*, 62 (4), pp. 650-667.

Solon, G. (1992). Intergenerational income mobility in the United States. *The American Economic Review*, 82 (3), pp. 393-408.

Solon, G. (2002). Cross-country differences in intergenerational earnings mobility. *Journal of Economic Perspectives*, 16 (3), pp. 59-66.

Vogel, T. (2006). Reassessing intergenerational mobility in Germany and the United States: The impact of differences in lifecycle earnings patterns. *SFB 649 Discussion Paper 2006-055*. Berlin: SFB.

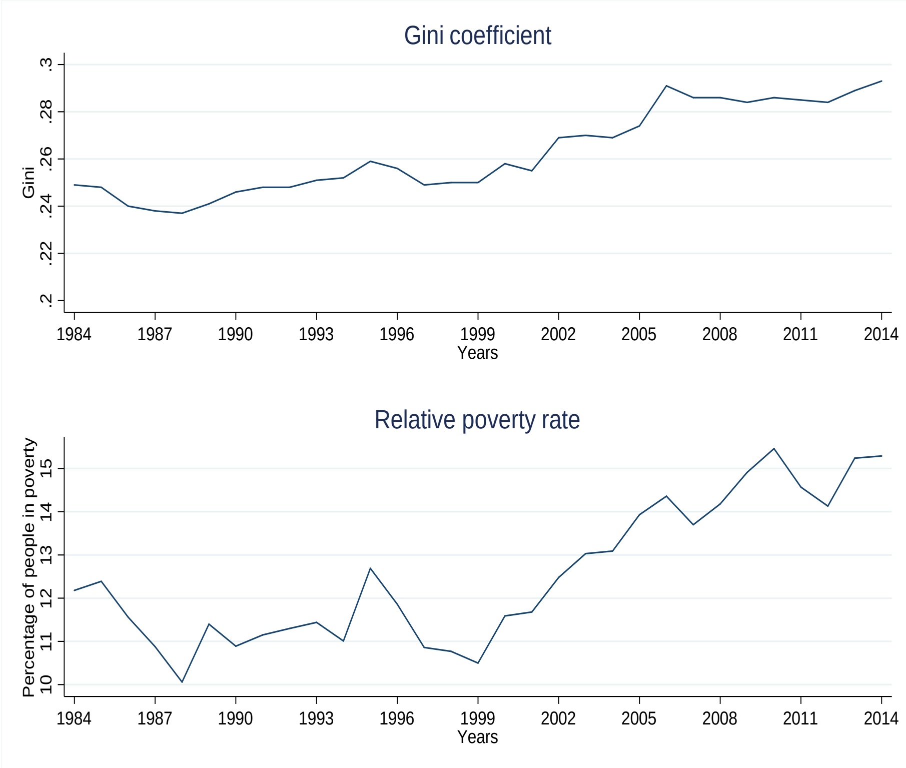

Figure 1. Trends in the Gini coefficient and relative income poverty rate in Germany

Note: Authors' calculations based on the GSOEP data (v31), weighted estimates. The relative poverty rate shows the percentage of people living below the poverty threshold defined as 60 percent of the median household equivalized disposable income in a given year.

Table 1. Summary statistics

Characteristic	All children		Only sons		Only daughters	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
All cohorts						
Father's age	45.4	4.46	45.5	4.50	45.20	4.41
Child's age	35.0	0.20	35.0	0.16	34.9	0.23
Father's log earnings	10.52	0.45	10.54	0.47	10.49	0.42
Child's log earnings	10.21	0.77	10.57	0.52	9.78	0.79
Parents' log household income	11.00	0.37	11.02	0.39	10.98	0.36
Child's log household income	10.93	0.52	10.97	0.49	10.88	0.54
Only those born in 1968-1972						
Father's age	45.5	4.19	45.6	4.29	45.3	4.07
Child's age	35.0	0.20	35.0	0.16	35.0	0.24
Father's log earnings	10.56	0.40	10.55	0.40	10.58	0.39
Child's log earnings	10.28	0.75	10.60	0.55	9.85	0.77
Parents' log household income	11.00	0.35	11.01	0.35	10.99	0.36
Child's log household income	10.95	0.51	10.99	0.49	10.91	0.54
Only those born in 1973-1977						
Father's age	45.2	4.80	45.3	4.82	45.1	4.80
Child's age	34.9	0.21	35.0	0.14	34.9	0.25
Father's log earnings	10.46	0.50	10.52	0.56	10.40	0.44
Child's log earnings	10.12	0.78	10.52	0.48	9.69	0.81
Parents' log household income	11.00	0.40	11.05	0.44	10.96	0.37
Child's log household income	10.90	0.53	10.96	0.50	10.84	0.55

Note: Athours' calculations based on GSOEP data, weighted estimates.

Table 2. Regression estimates of intergenerational economic mobility, all cohorts

Income measure	All children		Only sons		Only daughters	
	Absolute mobility	Relative mobility	Absolute mobility	Relative mobility	Absolute mobility	Relative mobility
Panel A: Intergenerational rank mobility						
Individual labor earnings	0.379***	0.242***	0.310***	0.380***	0.423***	0.154**
	(0.024)	(0.045)	(0.031)	(0.059)	(0.040)	(0.068)
	447		246		201	
Household pre-tax income	0.393***	0.214***	0.410***	0.180**	0.380***	0.241***
	(0.024)	(0.040)	(0.034)	(0.058)	(0.033)	(0.056)
	565		281		284	
Panel B: Intergenerational income mobility						
Individual labor earnings	6.34***	0.368***	7.78***	0.265***	5.36***	0.420***
	(0.734)	(0.070)	(0.743)	(0.071)	(1.368)	(0.130)
	447		246		201	
Household pre-tax income	7.52***	0.274***	8.47***	0.185**	6.66***	0.353***
	(0.520)	(0.050)	(0.650)	(0.063)	(0.818)	(0.080)
	565		281		284	

Note: Authors' calculations based on the GSOEP data, all cohorts pulled together. For each specification of the sample, the first line provides the estimated coefficients from the OLS regression model, where children's economic outcomes are regressed on respective economic outcomes of their parents, the second line lists robust standard errors of these estimates, and the third line indicates the sample size. * means significant at 0.05 level, ** means significant at 0.01 level, and *** means significant at 0.001 level.

Table 3. Transition matrices for individual gross labor earnings

Child's quintile	Father's quintile				
	Bottom	Second	Third	Fourth	Top
Panel A: All children					
Bottom	21.11	21.35	22.22	21.35	14.61
Second	25.56	24.72	16.67	17.98	14.61
Third	27.78	24.72	20.00	17.98	10.11
Fourth	14.44	21.35	25.56	20.22	17.98
Top	11.11	7.87	15.56	22.47	42.70
Panel B: Only sons					
Bottom	26.00	30.61	14.29	18.37	12.24
Second	34.00	30.61	18.37	10.20	6.12
Third	22.00	26.53	24.49	16.33	10.20
Fourth	14.00	8.16	20.41	22.45	34.69
Top	4.00	4.08	22.45	32.65	36.73
Panel C: Only daughters					
Bottom	26.19	20.51	32.50	17.50	7.50
Second	14.29	30.77	15.00	22.50	15.00
Third	21.43	20.51	20.00	25.00	12.50
Fourth	21.43	10.26	15.00	20.00	32.50
Top	16.67	17.95	17.50	15.00	32.50

Source: GSOEP data, authors calculations.
Note: The quantiles in Panels B and C are defined separately for each gender.

Table 4. Transition matrices for household pretax income

Child's quintile	Parents' quintile Bottom	Second	Third	Fourth	Top
Panel A: All children					
Bottom	29.20	30.09	13.27	14.16	13.27
Second	20.35	25.66	20.35	17.70	15.93
Third	22.12	15.93	19.47	23.89	18.58
Fourth	14.16	15.04	24.78	20.35	25.66
Top	14.16	13.27	22.12	23.89	26.55
Panel B: Only sons					
Bottom	24.56	28.57	23.21	14.29	10.71
Second	24.56	19.64	16.07	17.86	21.43
Third	22.81	16.07	17.86	25.00	17.86
Fourth	17.54	17.86	16.07	28.57	19.64
Top	10.53	17.86	26.79	14.29	30.36
Panel C: Only daughters					
Bottom	31.03	23.21	18.97	16.07	12.50
Second	24.14	16.07	24.14	21.43	12.50
Third	15.52	28.57	15.52	19.64	23.21
Fourth	15.52	19.64	22.41	17.86	23.21
Top	13.79	12.50	18.97	25.00	28.57

Source: GSOEP data, authors calculations.
Note: The quantiles in Panels B and C are defined separately for each gender.

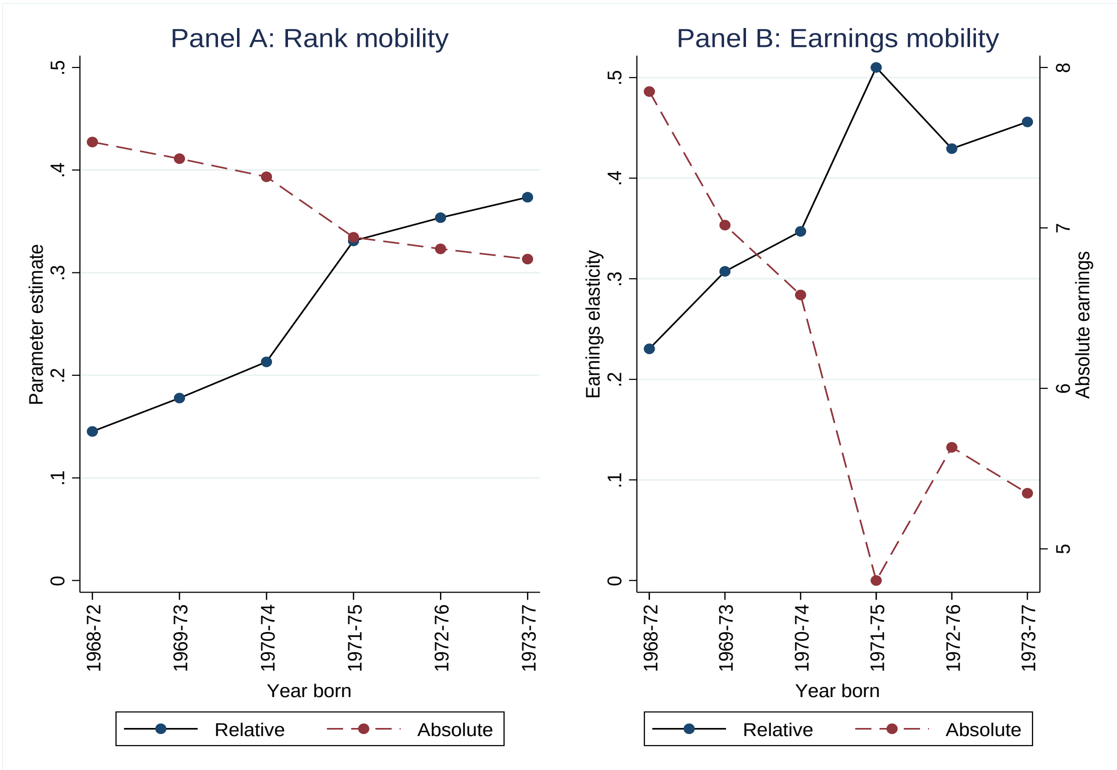

Figure 3. Estimates of intergenerational mobility for individual earnings, by rolling cohorts

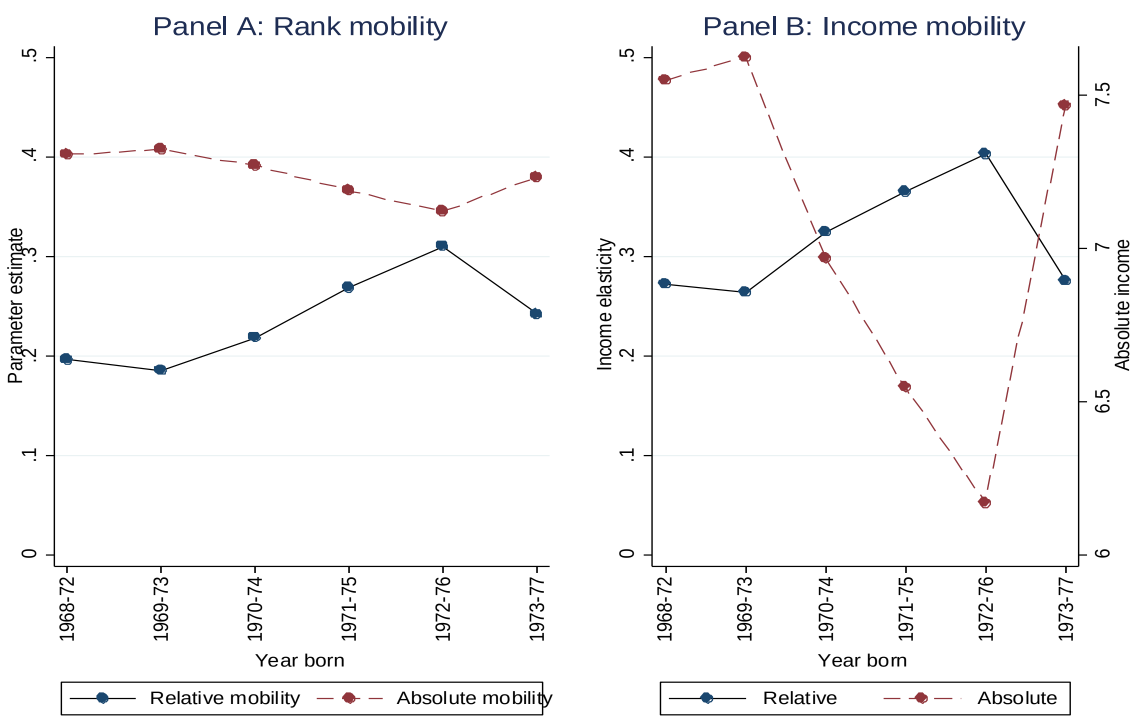

Figure 4. Estimates of intergenerational mobility for household pretax income, by rolling cohorts

Table 5. Changes in the estimates of intergenerational economic mobility over time, entire sample

	Individual labor earnings			Household pre-tax income		
Estimates	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Panel A: Intergenerational rank mobility						
Constant	0.379***	0.477***	0.427***	0.393***	0.438***	0.402***
	(0.024)	(0.051)	(0.033)	(0.023)	(0.047)	(0.031)
Father's rank	0.242***	0.045	0.145*	0.214***	0.123	0.195***
	(0.045)	(0.096)	(0.063)	(0.040)	(0.081)	(0.052)
Year born		-0.019*			-0.009	
		(0.008)			(0.008)	
Cohort			-0.114*			-0.023
			(0.048)			(0.047)
Father's rank*year		0.038*			0.019	
		(0.015)			(0.014)	
Father's rank*cohort			0.228*			0.045
			(0.089)			(0.083)
Panel B: Intergenerational income mobility						
Constant	6.34***	8.82***	7.85***	7.52***	8.45***	7.55***
	(0.0734)	(1.748)	(1.235)	(0.520)	(0.936)	(0.712)
Father's log earnings	0.368***	0.147	0.230*	0.274***	0.189*	0.272***
	(0.070)	(0.166)	(0.117)	(0.050)	(0.091)	(0.069)
Year born		-0.413			-0.188	
		(0.263)			(0.162)	
Cohort			-2.50			-0.084
			(1.540)			(1.037)
Father's log earnings*year		0.036			0.017	
		(0.025)			(0.016)	
Father's log earnings*cohort			0.225			0.003
			(0.146)			(0.101)

Note: Model 1 provides baseline estimates from Table 2. Model 2 tests for the presence of a linear trend in the estimates of intergenerational mobility by year of child's birth. Model 3 tests for the significance of the change in the estimates of intergenerational mobility between two cohorts of children – those born in 1968-1972 and those born in 1973-1977. Standard errors in the parentheses. * means significant at 0.05 level, ** means significant at 0.01 level, and *** means significant at 0.001 level.

Appendix A

Table 1. Summary of the studies on intergenerational income mobility in Germany[1]

Study	The period used for income measurement	Age when child's income is measured	Age when father's income is measured	Elasticity estimate
Father-son pairs				
Couch and Dunn (1997)	1984 - 1989	Annual earnings, multiyear average (up to six years) when sons were 18 years old and more (the period between 1984 - 1989)	Annual earnings, multiyear average (up to six years) for the period 1984 - 1989	0.112
Lillard (2001)	1984 - 1998	Annual earnings, multiyear average (up to six years) when sons were 18 years old and more (the period between 1984 - 1998)	Annual earnings, multiyear average (up to six years) when fathers were up to 65 years old (the period 1984 – 1998)	0.109
Vogel (2006)	1984 - 2005	Annual earnings, multiyear average (at least over five years) when sons were 25 years and older	Annual earnings, multiyear average (at least over five years) when fathers were up to 60 years old	0.235
Eisenhauer and Pfeiffer (2008)	1984 - 2006	Monthly earnings when sons were between 30 and 50 years old	Monthly earnings, multiyear average (at least over five years) when fathers were between 30 and 50 years old	0.282 0.205 (without multiyear average of fathers' earnings)
Schnitzlein (2009)	1984 – 2004	Annual earning,s multiyear average over the period between 2000 and 2004, when sons were 30-40 years old	Annual earnings, multiyear average (at least over five years between 1984-2004) when fathers were 30-55 years old	0.263
Schnitzlein (2016)	1984 - 2011	Annual earnings, multiyear average over the period between 1997 and 2011, when sons were 35-42 years old	Annual earnings, multiyear average (at least over five years between 1984-1993) when fathers were 30-55 years old	0.318
Father-daughter pairs				
Schnitzlein (2009)	1984 – 2004	Annual earnings, multiyear average over the period between 2000 and 2004, when daughters were 30-40 years old	Annual earnings, multiyear average (at least over five years) when fathers were 30-55 years old	0.361

Note: All estimates listed in the table are based on data from the German Socio-economic panel.

[1] In this paper, we consider only intergenerational mobility of income-related outcomes. For the evidence on intergenerational mobility of educational and occupational outcomes see, among others, Ermisch et al. (2006), Heineck and Riphahn (2009), Riphahn and Schiederdecker (2012), and Braun and Stuhler (forthcoming).

Appendix B

Table 1: The description of the GSOEP sub-samples

Name of the sample	Year of collection	Description	Size
Sample A "Residents in the FRG"	1984	Includes people living in private households in the Federal Republic of Germany (FRG), where the head of the household does not belong to one of the main groups of foreigners (Turkish, Greek, Yugoslavian, Spanish or Italian)	4528
Sample B "Foreigners in the FRG"	1984	Includes people living in private households in the FRG, where the head of the household is of Turkish, Greek, Yugoslavian, Spanish or Italian origin	1393
Sample C "German residents in the GDR"	1990	Includes people living in private households where the head of the household is a citizen of the German Democratic Republic (GDR)	2179
Sample D "Immigrants"	1994/1995	Includes households in West Germany, in which at least one household member has moved from abroad after 1984.	531
Sample E "Refreshment"	1998	Includes people living in private households in Germany without any restrictions to their origin	1060
Sample F "Refreshment"	2000	Includes people living in private households in Germany without any restrictions to their origin but with a slightly higher selection probability for households with a non-German than with a German head	6043
Sample G "High income"	2002	Includes private households with a monthly income of at least 3835 Euros	1224
Sample H "Refreshment"	2006	Includes people living in private households in Germany without any restrictions to their origin	1506
Sample I "Incentive sample"	2009	Includes people living in private households in Germany without any restrictions to their origin	1531
Sample J "Refreshment sample"	2011	Includes people living in private households in Germany without any restrictions to their origin	3136
Sample K "Refreshment sample"	2012	Includes people living in private households in Germany without any restrictions to their origin	1526
Migration sample	2013	Includes immigrants using register information of the German Federal Employment Agency	2700

Source: Composed by the authors using Haisken-DeNew and Frick (2005) and on-line SOEP Desktop Compendium (http://about.paneldata.org/soep/dtc/sample.html).

Appendix C

Table 1: Definition of the cohorts by birth year

Born in	Reached the age of 15-19 in													
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1968														
1969														
1970														
1971														
1972														
1973														
1974														
1975														
1976														
1977														
	Turned 34-36 in													
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013		
1968														
1969														
1970														
1971														
1972														
1973														
1974														
1975														
1976														
1977														

Appendix D

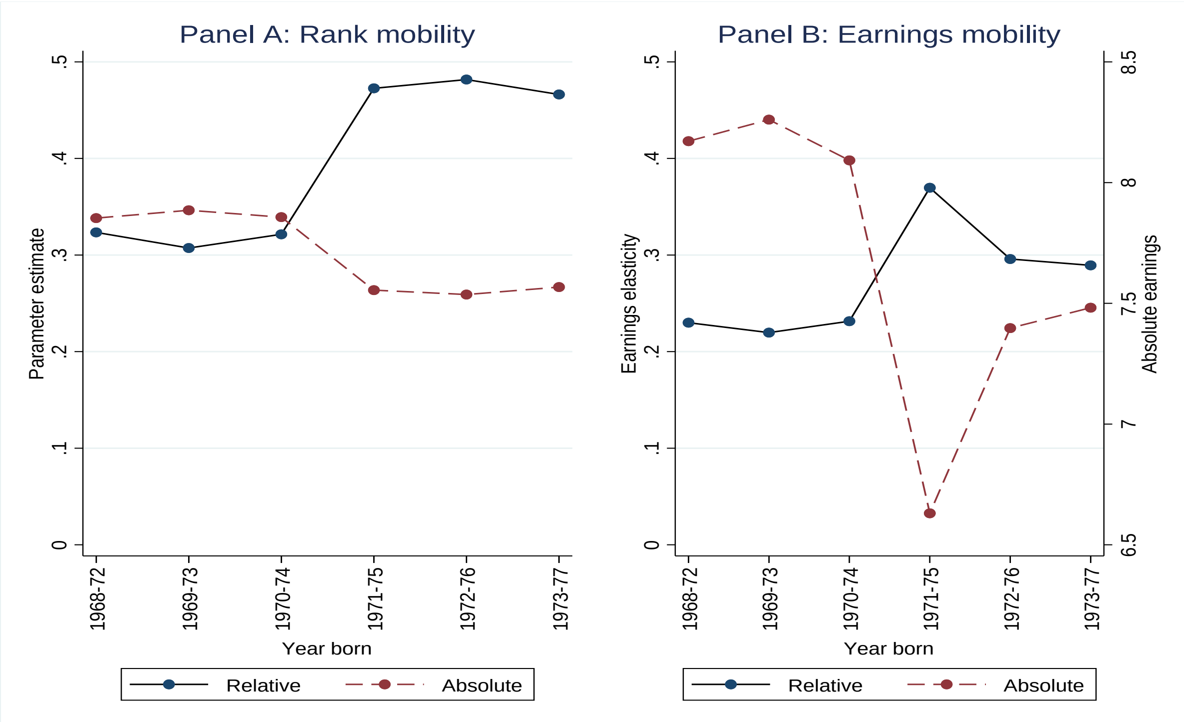

Figure D.1. Estimates of intergenerational mobility for individual earnings by rolling cohorts, only sons

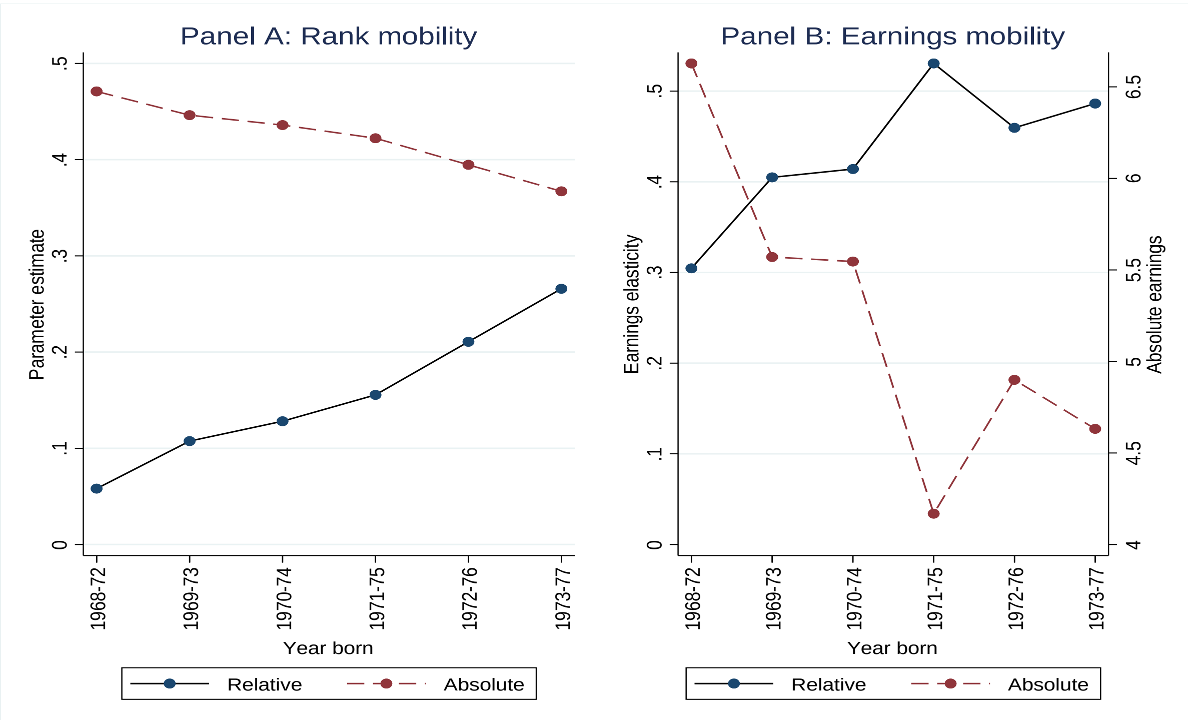

Figure D.2. Estimates of intergenerational mobility for individual earnings by rolling cohorts, only daughters

Appendix E

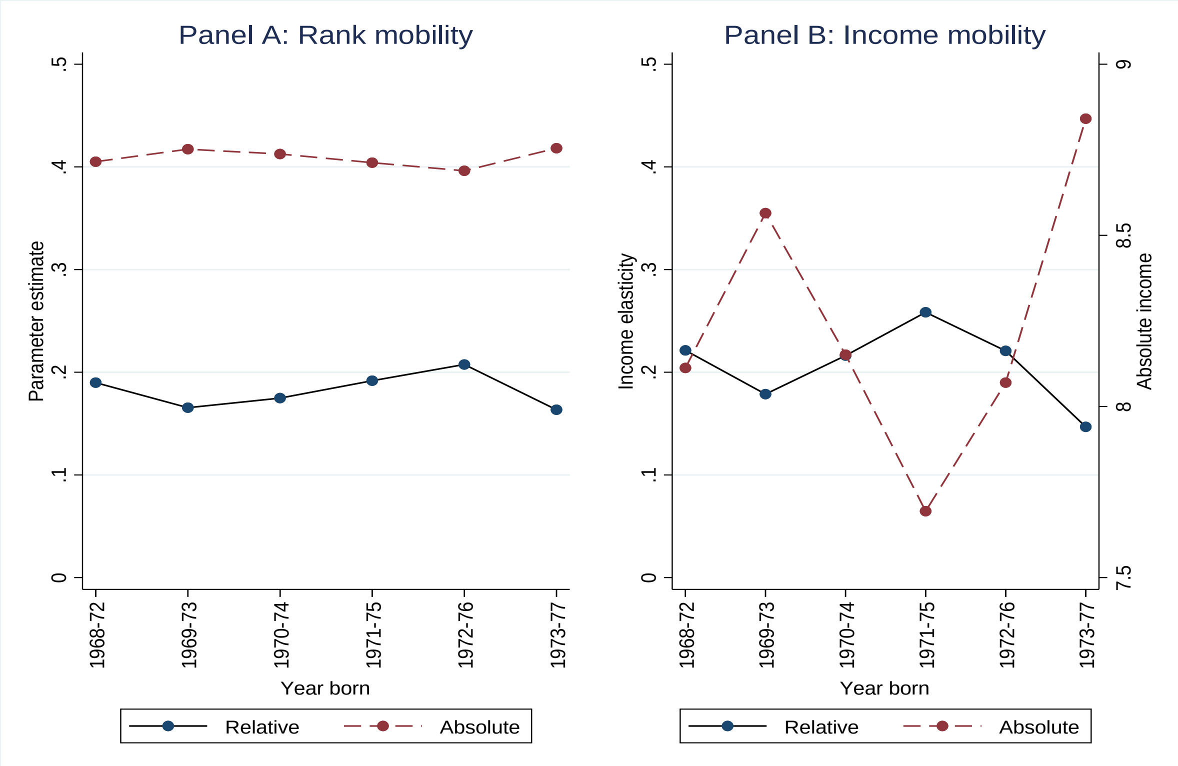

Figure E.1. Estimates of intergenerational mobility of household pretax income by rolling cohorts, only sons

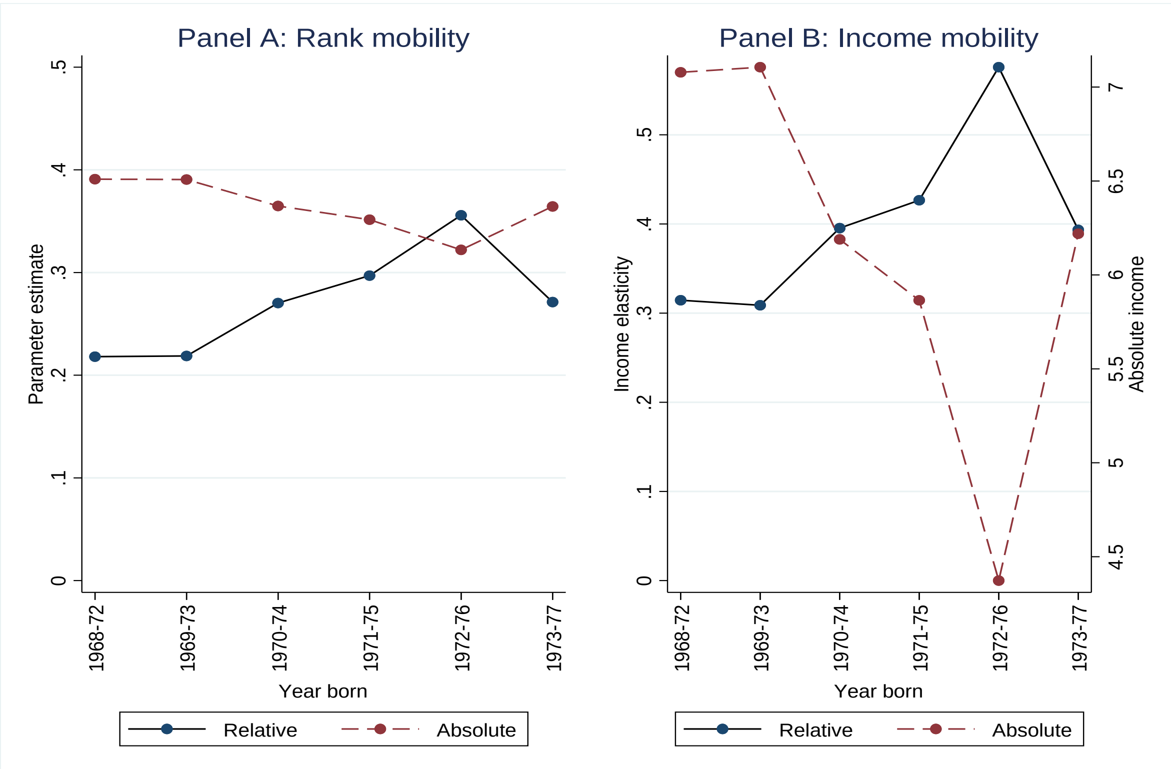

Figure E.2. Estimates of the intergenerational mobility of household pretax income by rolling cohorts, only daughters

Appendix F

Table F.1. Changes in intergenerational mobility of individual labor earnings, by gender sub-groups

Estimate	Only sons			Only daughters		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Constant	0.310***	0.361***	0.338***	0.423***	0.546***	0.471***
	(0.031)	(0.064)	(0.041)	(0.040)	(0.088)	(0.059)
Father's rank	0.380***	0.277*	0.324***	0.154**	-0.092	0.058
	(0.059)	(0.119)	(0.079)	(0.068)	(0.149)	(0.100)
Year born		-0.011			-0.023	
		(0.011)			(0.013)	
Cohort			-0.071			-0.104
			(0.063)			(0.078)
Father's rank*year		0.021			0.045*	
		(0.021)			(0.022)	
Father's rank*cohort			0.143			0.208
			(0.119)			(0.136)
Constant	7.78***	7.97***	8.17***	5.36***	9.24**	6.63**
	(0.743)	(1.580)	(1.225)	(1.368)	(3.142)	(2.081)
Father's log earnings	0.265***	0.255	0.230*	0.420***	0.057	0.305
	(0.071)	(0.152)	(0.118)	(0.130)	(0.297)	(0.196)
Year born		-0.036			-0.634	
		(0.240)			(0.520)	
Cohort			-0.690			-1.996
			(0.521)			(2.958)
Father's log earnings *year		0.001			0.060	
		(0.023)			(0.049)	
Father's log earnings *cohort			0.059			0.182
			(0.146)			(0.282)
Number of obervations	246	246	246	201	201	201

Source: SOEP data, authors' calculations.

Note: Model 1 provides baseline estimates from Table 4.1. Model 2 tests for the presence of a linear upward trend in the estimates of intergenerational mobility by year of child's birth. Model 3 tests for the presence of a linear upward trend in the estimates of intergenerational mobility between two cohorts of children – those born in 1968-1972 and those born in 1973-1977. * means significant at 0.05 level, ** means significant at 0.01 level, and *** means significant at 0.001 level.

Table F.2. Changes in intergenerational mobility of pretax household income, by gender sub-groups

Estimate	Only sons			Only daughters		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Constant	0.410***	0.428***	0.405***	0.380***	0.439***	0.391***
	(0.034)	(0.067)	(0.044)	(0.033)	(0.069)	(0.045)
Parental rank	0.180***	0.143	0.189*	0.241***	0.123	0.218**
	(0.058)	(0.111)	(0.073)	(0.056)	(0.117)	(0.076)
Year born		-0.004			-0.011	
		(0.012)			(0.011)	
Cohort			0.013			-0.027
			(0.068)			(0.065)
Parental rank*year		0.008			0.023	
		(0.021)			(0.020)	
Parental rank*cohort			-0.026			0.053
			(0.121)			(0.113)
Constant	8.47***	8.29***	8.11***	6.66**	8.91***	7.08***
	(0.650)	(1.159)	(0.943)	(0.818)	(1.534)	(1.087)
Parental log earnings	0.185**	0.207	0.221*	0.353***	0.141	0.314**
	(0.063)	(0.112)	(0.091)	(0.080)	(0.150)	(0.106)
Year born		0.027			-0.417	
		(0.174)			(0.274)	
Cohort			0.728			-0.859
			(1.276)			(1.646)
Parental log income *year		-0.004			0.039	
		(0.017)			(0.026)	
Parental log income *cohort			-0.074			0.079
			(0.123)			(0.161)
Number of obervations						

Source: SOEP data, authors' calculations.

Note: Model 1 provides baseline estimates from Table 4.1. Model 2 tests for the presence of a linear upward trend in the estimates of intergenerational mobility by year of child's birth. Model 3 tests for the presence of a linear upward trend in the estimates of intergenerational mobility between two cohorts of children – those born in 1968-1972 and those born in 1973-1977. * means significant at 0.05 level, ** means significant at 0.01 level, and *** means significant at 0.001 level.

Appendix G

Table G.1. Sensitivity analysis for the treatment of zero values in earnings, all cohorts

Sample specification	All children	
	Absolute mobility	Relative mobility
Excluding observations with earnings below 1200 Euros *(Main sample)*	0.379***	0.242***
	(0.024)	(0.045)
	447	
Excluding observations with zero earnings	0.385***	0.230***
	(0.024)	(0.045)
	455	
Including observations with zero values	0.416***	0.167***
	(0.023)	(0.043)
	536	
Excluding observations with earnings below 1200 Euros *(Main sample)*	6.34***	0.368***
	(0.734)	(0.070)
	447	
Excluding observations with zero earnings	6.45***	0.354***
	(0.777)	(0.074)
	455	
Recording zero earnings to 1 Euro	8.39***	0.093
	(0.931)	(0.089)
	536	

Note: Authors' calculations based on the GSOEP data, all cohorts pulled together. For each specification of the sample, the first line provides the estimated coefficients from the OLS regression model, where children's economic outcomes are regressed on respective economic outcomes of their parents, the second line lists standard errors of these estimates, and the third line indicates the sample size. * means significant at 0.05 level, ** means significant at 0.01 level, and *** means significant at 0.001 level.

Table G.2. Sensitivity analysis for the life-cycle bias

Age of children used for earnings measurement	All children		
	Absolute mobility	Relative mobility	Number of observations
Panel A: Intergenerational rank mobility			
30-32	0.396***	0.207***	557
	(0.023)	(0.042)	
34-36 (the main sample)	**0.379*****	**0.242*****	**447**
	(0.024)	**(0.045)**	
35-37	0.371***	0.258***	402
	(0.026)	(0.048)	
36-38	0.378***	0.244***	351
	(0.028)	(0.051)	
37-39	0.385***	0.230***	297
	(0.031)	(0.057)	
Panel B: Intergenerational earnings mobility			
30-32	7.51***	0.252***	557
	(0.642)	(0.061)	
34-36 (the main sample)	**6.34*****	**0.368*****	**447**
	(0.734)	**(0.070)**	
35-37	6.27***	0.380***	402
	(0.772)	(0.073)	
36-38	6.16***	0.387***	351
	(0.869)	(0.082)	
37-39	5.51	0.448***	297
	(1.064)	(0.101)	

Note: Authors' calculations based on the GSOEP data, all cohorts pulled together. For each specification of the sample, the first line provides the estimated coefficients from the OLS regression model, where children's economic outcomes are regressed on respective economic outcomes of their parents and the second line lists standard errors of these estimates. * means significant at 0.05 level, ** means significant at 0.01 level, and *** means significant at 0.001 level. The results from the baseline model are in bold.

Table G.3. Sensitivity analysis for the attenuation bias

Number of observations used for averaging of earnings	All children		
	Absolute mobility	Relative mobility	Number of observations
Panel A: Intergenerational rank mobility			
3 observations for children and 5 for fathers	**0.379*** (0.024)**	**0.242*** (0.045)**	**447**
1 observation for children and 5 for fathers	0.374*** (0.025)	0.251*** (0.047)	432
2 observations for children and 5 for fathers	0.382*** (0.024)	0.234*** (0.044)	464
3 observations for children and 1 for fathers	0.386*** (0.026)	0.227*** (0.047)	424
3 observations for children and 3 for fathers	0.390*** (0.024)	0.218*** (0.044)	477
Panel B: Intergenerational earnings mobility			
3 observations for children and 5 for fathers	**6.34*** (0.734)**	**0.368*** (0.070)**	**447**
1 observation for children and 5 for fathers	5.81*** (0.835)	0.415*** (0.079)	432
2 observations for children and 5 for fathers	5.76*** (0.857)	0.414*** (0.070)	464
3 observations for children and 1 for fathers	7.83*** (0.754)	0.231*** (0.072)	424
3 observations for children and 3 for fathers	7.28*** (0.679)	0.280*** (0.065)	477

Note: Authors' calculations based on the GSOEP data, all cohorts pulled together. For each specification of the sample, the first line provides the estimated coefficients from the OLS regression model, where children's economic outcomes are regressed on respective economic outcomes of their parents, the second line lists standard errors of these estimates, and the third line indicates the sample size. * means significant at 0.05 level, ** means significant at 0.01 level, and *** means significant at 0.001 level. The results from the baseline model are in bold.

Endnotes

[i] Because in the SOEP a reference year for income measurement is always the previous year, we have moved all income variables by one year to eliminate the time mismatch between the age and reported incomes. Hence, income reported in 2014 was linked to the age reported in 2013.
[ii] These findings, however, do not imply that absolute outcomes of girls are better than absolute outcomes of boys because the ranks are defined within the gender-specific distributions of income.
[iii] In his study on intergenerational mobility in Germany Schnitzlein (2009) find that the intergenerational elasticity of earnings constitutes 0.26 for sons and 0.36 for daughters. Higher estimates of intergenerational earnings persistence for daughters than for sons were also found in Bratberg et al. (2005).