Lifetime Earnings Inequality in Germany

by

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Abstract: German social security records show that intra-generational lifetime earnings inequality is about two-thirds of the corresponding inequality of annual earnings. Within cohorts, mobility in the distribution of yearly earnings is substantial at the beginning of the life cycle, decreases afterwards and virtually vanishes after age forty. We detect a striking secular rise of intra-generational inequality in lifetime earnings: West-German men born in the early 1960s are likely to experience about 85 % more lifetime inequality than their fathers. In contrast, both short-term and long-term intra-generational mobility are stable. Longer unemployment spells of workers at the bottom of the distribution of younger cohorts contribute to explain 20 to 40 % of the overall increase in lifetime earnings inequality.

Keywords: Earnings Distribution, Lifetime Inequality, Intra-generational Mobility.
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1 Introduction

Labor income inequality is usually described in terms of a distribution of yearly earnings and such earnings distributions have become more unequal in many advanced economies during the last three decades.[1] However, labor markets also generate a heterogeneous dynamics of individual earnings, so that the evolution of inequality of long-term earnings might considerably differ from the evolution of inequality of yearly earnings. A life-cycle perspective recognizes that some levels of earnings are transient and not representative of an individual's position in the long-term distribution, e.g. low earnings during college years and when unemployed, or high earnings thanks to temporarily skyrocketing bonuses. In that perspective, it is the inequality of lifetime earnings that is crucial in order to assess how much inequality is generated by the labor market.

In this paper, we exploit a sample of high-quality administrative data to study actual lifetime earnings, their dispersion, and the mobility of individuals in the earnings distribution. We take a cohort perspective and investigate the earnings of people born in the same year. Intra-generational inequality of lifetime earnings is important because it portrays permanent disparities in labor-market incomes. Generational welfare depends on it - both because earnings are the largest income component and because individuals often compare their earnings with those of people of similar age.[2] Furthermore, a cohorts-based analysis of the mobility experienced by individuals over their life cycle can help us to better understand the drivers of growing cross-sectional inequality and the ways in which labor markets have changed during the last decades.

We examine the largest European economy, Germany, and, for the first time, investigate the magnitude, structure and evolution of intra-generational lifetime earnings inequality there.

[1] See e.g. Atkinson and Piketty (2010), Autor et al. (2006), Card and DiNardo (2002), Goos et al. (2009), Lemieux (2007).

[2] See e.g. Pérez-Asenjo (2011).

We exploit data on earnings biographies from social security administrative records to shed light on the following issues: What is the magnitude of lifetime earnings inequality and how does it compare to measures of inequality of annual earnings? How do cohort-specific inequality and mobility evolve over the life cycle? Is lifetime inequality for individuals who currently are in working age going to be larger or smaller than the one experienced by their parents?

In order to answer those questions we analyze the earnings histories of thirty-five birth cohorts in Germany, ranging from individuals who were born in 1935 to those born in 1969, separately for men and women. The dataset we scrutinize is a highly representative sample of the employee population of West Germany. We define lifetime earnings as the present value of an individual's earnings until the individual reaches age sixty. For the fifteen oldest birth cohorts in our dataset we observe all annual earnings until they reach age sixty, so that we can compute their lifetime inequality as well as their mobility in the intra-generational distribution of annual earnings during their entire active life cycle. We observe younger cohorts' earnings only for an initial part of their life cycle and can compute measures of earnings inequality and mobility up to some age. Using both the information about cohorts that have completed their labor-market life cycle and the information about the still active cohorts, we attempt to gauge how lifetime inequality is evolving across generations in Germany.

We find that the Gini coefficient of the intra-generational distribution of lifetime earnings is about two-thirds of the Gini coefficient of annual earnings. Age-specific annual earnings inequality follows a U-shaped pattern over the life cycle, with a minimum reached around age thirty-five. Even controlling for age, measures of inequality of annual earnings substantially overestimate the inequality of lifetime earnings, the difference between the two measures being due to individuals' mobility in the distribution over time. Within cohorts, mobility in the distribution of yearly earnings is substantial at the beginning of the life cycle, decreases afterwards and virtually vanishes after age forty. Age-earnings profiles are concave and steeper for better educated individuals.

Our main finding concerns the evolution of lifetime inequality across cohorts. We detect striking evidence of a dramatic secular rise of intra-generational inequality in lifetime earnings: West-German men born in the early 1960s are likely to experience about 85 % more lifetime inequality than their fathers. We find an increase of intra-generational inequality in lifetime earnings also for women but of a smaller magnitude. We also find that across cohorts both short-term and long-term intra-generational mobility are rather stable, for both men and women.

In the final part of the paper we shed light on the proximate causes of the rise of lifetime earnings inequality in the case of men. We find that intra-generational lifetime earnings inequality has increased both at the bottom half of the distribution and at the top half of the distribution, but the rise has been stronger at the bottom. We find that some 20 to 40 % of the rise of lifetime inequality in Germany can be attributed to an increase in the duration of unemployment for individuals at the bottom of the earnings distribution. The rest is due to an increase of intra-generational wage inequality.

This paper is related to various strands of literature. Firstly, it relates to the literature on the long-run evolution of earnings inequality. Our finding of a secular rise of intra-generational lifetime earnings is, to the best of our knowledge, a novel one. There seem to be no other studies that attempt to pin down the evolution of the inequality of lifetime earnings. Closest to the current paper is probably the article by Kopczuk et al. (2010) about earnings inequality in the United States. Using social security data, they compute Gini coefficients of cohort-specific long-term earnings distributions since 1937. Long-term earnings are defined as earnings over a twelve-year period and three benchmark periods are considered: from age twenty-five to age thirty-six, from age thirty-seven to age forty-eight, and from age forty-nine to age sixty. For cohorts born after the late 1930s, all three measures of long-term earnings exhibit a clear upward trend of cohort-specific inequality. Our finding that intra-generational inequality of lifetime earnings has increased in Germany points to a remarkable common trend in the two countries.

Secondly, this paper complements various analyses of how wage inequality has evolved in Germany over the last three decades. The literature has mainly focused on the cross-sectional distribution of wages and discussed when inequality began to increase. Using social security records, Dustmann et al. (2009) find that men's inequality of daily wages has increased in West Germany in the 1980s, but only at the top half of the distribution; in the early 1990s, inequality started to rise for the entire distribution. They argue that skill-biased technological change drove the widening of the wage distribution at the top, while changes in labor market institutions and immigration shocks were responsible for the increasing inequality at the bottom. Card et al. (2013) stress the role played by increasing plant-level heterogeneity and rising assortativeness in the assignment of workers to establishments. Using data from the German Socio-Economic Panel (SOEP) and the German Income and Expenditure Survey (EVS), Fuchs-Schündeln et al. (2010) confirm the rise of earnings inequality in West Germany after reunification, the upward trend of inequality being mainly driven by an increase in earnings inequality after the year 2000. By contrast, they find that inequality has not noticeably increased during the 1980s. They find that the experience premium has increased over time. Also using the SOEP data, Gernandt and Pfeiffer (2007) find that inequality of hourly wages for prime-age male employees was stable in West Germany between 1984 and 1994 and increased thereafter. In the period of increasing inequality they find a significant positive gap between high-tenure and low-tenure workers in terms of wage growth rates. They suggest that the adjustment of wages to worsening labor market conditions mainly concerned the entrants in the labor market.[3]

Our paper adds to the overall picture of the evolution of inequality in Germany by establishing how lifetime earnings inequality has changed across cohorts, which is necessary in order to assess how increases in cross-sectional wage inequality translate into inequality experienced over the life cycle. Our investigation of age-earnings profiles confirms the importance of controlling for the age composition of the workforce when evaluating long-run

[3] Dell (2005) and Bach et al. (2009) investigate the evolution of top salaries in Germany using tax returns data, as earners at the very top of the distribution are not represented well in social security and SOEP data. Consistently with results from other countries, they document an increase of top salary inequality after reunification. However, that inequality increase is much less accentuated than in the US.

changes in cross-sectional distributions. Moreover, we show that at a common age German cohorts markedly differ from each other in terms of annual earnings inequality.[4]

Thirdly, our work is related to the literature on the relationship between annual and lifetime income inequality and the extent of intra-generational mobility. We contribute to that literature by offering findings based on high-quality data drawn from a sample that is significantly larger than those analyzed in earlier work. The main previous study of complete income biographies is Björklund (1993), who exploits Swedish tax registers to compute the lifetime income before taxes of cohorts of men born between 1924 and 1936. He finds that the Gini coefficient of the distribution of lifetime earnings is around 35-40 percent lower than the one for cross-sections of annual incomes and that there is substantial intra-generational mobility during the early stages of the life cycle.[5] Björklund (1993) finds that age-specific annual income inequality follows an L-shaped pattern over the life cycle, i.e. the Gini coefficient of the distribution of annual income does not increase when individuals approach age sixty, as we find for Germany. This difference appears to be mainly due to the role of pensions - that are included in Björklund's (1993) income concept whereas they do not count as earnings in our investigation.

Fourthly, our paper adds to the literature on the life cycle variation in the association between annual and lifetime earnings by assessing that association over completed life cycles for the case of Germany.[6] We confirm Björklund's (1993) result that the correlation between

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[4] OECD (2008) gives an overview of the impact of demographic change on the income distribution. Almas et al. (2011) provide evidence that changes in the age structure of the workforce had a significant impact on the Gini coefficient of annual earnings in Norway in the period 1967-2000.

[5] Burkhauser and Poupore (1997) compare the distribution of annual earnings with the one of earnings over a six-year period from 1983 to 1988. Using the SOEP, they find that when the Gini coefficient is computed over six years, its level falls by less than ten percent. See also Maasoumi and Trede (2001). Trede (1998) analyzes short-run earnings mobility between 1983 and 1993 using the SOEP. He finds that mobility declines with age until age thirty-five and does not change thereafter.

[6] Implications of that variation for regression models are discussed by Jenkins (1987) and further worked out by Haider and Solon (2006). Böhlmark and Lindquist (2006) apply Haider and Solon's model to high-quality Swedish data. An application of their methodology to correct for the life-cycle bias that uses German earnings data is Brenner (2010).

annual income and lifetime income is quite high and stable after age thirty-five while it is low before. With respect to age-earnings profiles, our finding that they are much steeper for university graduates than for uneducated workers is in line with standard models of human capital investment. It also accords well with recent findings by Bhuller et al. (2011) based on Norwegian earnings biographies for cohorts born in the 1948-1950 period.

The rest of the paper is organized as follows. In the next Section, we describe our dataset and define the variables of interest. Section 3 quantifies lifetime earnings inequality and compares it with annual earnings inequality. Section 4 is devoted to the pattern of earnings mobility during the entire active life cycle. The core of the paper is Section 5 where we analyze the evolution of intra-generational lifetime inequality and dissect its main driving forces. Section 6 concludes.

2 Data and Methodology

Our analysis is based on administrative data of the German social security. Virtually all employees in Germany mandatorily participate in its national pay-as-you-go pension system which, being of the Bismarckian variety, carefully records all contributors' earnings biographies. The dataset we analyze is based on the Insurance Account Sample (*Versicherungskontenstichprobe*).[7] That is a stratified random sample of individuals who live in Germany, have at least one entry in their social security record and are aged between thirty and sixty-seven in the reference year of the sample. Insurance Account Samples exist for the reference years 2002 and 2004 to 2009.[8] Each sample contains the earnings biographies of the observed individuals up to the reference year. The data are collected following individuals over

[7] The final dataset we work with (*FDZ-RV − VSKT2002, 2004-2009_Bönke*) is provided to researchers by the Data Research Centre of the German Federal Pension Insurance. It is accessible through controlled remote computing.

[8] A detailed description of the data is given by Himmelreicher and Stegmann (2008). We use all seven samples in our analysis. Information on birth cohorts 1935 and 1936 is picked from the 2002 sample; cohort 1937 stems from the 2004 sample, cohort 1938 from the 2005 sample, cohort 1939 from the 2006 sample, cohort 1940 from the 2007 sample and cohort 1941 from the 2008 sample. Later birth cohorts are covered using the 2009 sample.

time so as to form a panel. For each individual, a monthly history of employment, unemployment, sickness, and contributions to the pension system is recorded. It starts when the individual reaches age fourteen and it ends when the individual turned sixty-seven in case of complete biographies. Information about the contributions made to the pension system allows one to recover the earnings received by that individual in each month.

The current investigation focuses on German citizens and excludes ethnic Germans that immigrated to Germany after having worked in their country of origin. Because of insufficient comparability of earnings information and wage levels in the FRG and the GDR, we restrict the attention to individuals who have only been working in West Germany. Furthermore, we exclude contributors for whom a consistent earnings biography cannot be reconstructed.[9] In this way we exclude contributors who worked also as self-employed or civil servants, or who emigrated abroad at some point in time, and who may thus have substantial earnings that are not recorded in the Federal Pension Register. After elimination of those observations, we are left with a number of individuals for each cohort that oscillates between 1,000 and 1,600 in the case of men and about half as much in the case of women; the exact numbers are reported in Appendix B, Tables B1 and B3.

While the dataset we use is virtually free from measurement errors, three adjustments were necessary in order to prepare the earnings data for the analysis. The first one concerns the imputation of one-time payments. Those payments were not included in the social security data before 1984 while they are included from that year onwards. In order to obtain a time invariant definition of earnings, we exploit the panel structure of our data and estimate each individual's earnings path so as to identify spurious growth between 1983 and 1984. Conditional on an

[9] More precisely, we only allow for an average of one month of missing information per year after the age of thirty.

individual's age and position in the earnings distribution we then adjust the earnings before 1984.[10]

Our second adjustment is the addition of the employers' social contributions (to unemployment, health, pension and nursing care public insurances) to the individuals' gross earnings. Adding those elements of pay is warranted in order to take into account the changes of contribution rates and assessment ceilings that have occurred over the years across various branches of the social insurance system and across various subgroups of the working population.[11] Thus, the earnings measure we employ is a measure of the market value of labor. As a major robustness check, we have repeated the entire analysis when the employer contributions are excluded. As shown in the Online Appendix to this paper, all findings remain qualitatively unaltered - in particular the rise of lifetime earnings inequality retains the same order of magnitude when employer contributions are excluded.

Third, we deal with the issue of top-coded earnings. In Germany, employees contribute a share of their gross wage to the mandatory pension system up to a wage ceiling. As a result, our social security data is right-censored as individuals whose wages exceed that ceiling are recorded as if their wages were equal to the ceiling. On average over all years and cohorts, censoring concerns about seven percent of the recorded earnings of men and about 0.5 percent of the earnings of women.[12] In order to better approximate the true distribution of top earnings, we impute them to the individuals affected by top coding. Our imputation method rests on the assumption that the upper tail of the earnings distribution behaves according to the Pareto law. We posit that the top ten percent of individual earnings below the contribution ceiling are

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[10] See the Online Appendix for details. Our method to correct for the 1984 break extends the one proposed by Fitzenberger (1999) and used by Dustmann et al. (2009) and Card et al. (2013) in a cross-sectional setting so as to make it suitable for a longitudinal analysis. While also those papers investigate social security records, their datasets stem from the Employment Register of the Federal Labor Office.

[11] Otherwise, it would be highly problematic to include some categories of employees like miners, sailors and distinctive employees of the federal railways that have special social security arrangements and the incidence of which has changed a lot across cohorts. The Online Appendix describes the evolution of the various contribution rates and contribution limits.

[12] Further information about how censoring affects our sample is provided in the Online Appendix.

Pareto-distributed. Then, we estimate the corresponding Pareto-coefficient by OLS. The estimation is conducted separately for all years, birth cohorts, and separately for men and women. The estimated Pareto-coefficients are then used to determine the distribution of the unobserved earnings above the contribution ceiling. The assignment of estimated earnings to individuals is done so as to preserve the individual rankings in the distribution of annual earnings. Thereby, the rank of an individual is based on the last observable rank in relation to all individuals at or above the contribution ceiling in the cohort-specific earnings distribution. We also explore the implications of two alternative imputation methods: an imputation of the estimated mean income above the ceiling to all individuals with top-coded earnings and a maximum mobility scenario where the ranking order is reversed every year. Results from those alternative imputations are reported in the Online Appendix. They do not differ much from those obtained under our preferred rank-preserving assumption.[13]

In order to validate the earnings data we finally work with, we have compared it with corresponding earnings data from the German SOEP. The latter is based on an annual survey of private households and is constructed so as to be highly representative of the population living in Germany in a given year. SOEP earnings data goes back to 1984. For the years from 1984 to 2009, we have used the cross-sectional earnings distribution revealed by the SOEP in order to assess the representativeness of our data. As shown in Appendix A, the cross-sectional earnings distributions obtained from our data reproduce remarkably well those obtained from the SOEP and the two are statistically undistinguishable. In terms of representativeness, the comparison with the SOEP reveals that our sample represents about 80% of the total workforce in West Germany (see also Appendix A).

[13] In the Online Appendix we also present a robustness check concerning the bottom of the distribution. Legislated exemptions from social security contributions may lead to an underrepresentation of very low earnings in some years. As it turns out, simulating a constant exemption regime over time generates qualitatively the same results as the ones reported here.

3 Inequality of Lifetime Earnings

A key objective of this paper is to determine the extent of lifetime earnings inequality within annual birth cohorts. Lifetime earnings are computed from the earnings an individual has received from age seventeen to age sixty. Given that age limit, we can determine the complete lifetime earnings of fifteen cohorts, born between 1935 and 1949. When computing lifetime earnings, we discount yearly earnings to the year the individual turned seventeen and then determine the corresponding present value of earnings. We set the discounting rates equal to the average nominal returns on German government bonds, obtained from an official time series provided by the German central bank.[14] As a robustness check, we discount earnings using the consumer price index.

Results about the Gini coefficient of the cohort-specific distribution of lifetime earnings for men and women are displayed in Figure 1. The lowest curve represents the Gini coefficient of lifetime earnings when annual earnings are discounted using the rate of returns of German federal bonds. The Gini coefficient for men reaches a minimum of 0.156 for the oldest cohort of those born in 1935 and peaks at 0.212 for those born in 1949. The curve in the middle of Figure 1 obtains when annual earnings are discounted using the consumer price index. The discounting method affects the level of lifetime inequality but not its evolution. A lower discount rate increases intra-generational inequality because of the steeper rising age-profile of earnings for better educated workers, who are also those with the higher lifetime earnings. We display age-earning profiles in the next section.

Because of earnings mobility, inequality in lifetime earnings is smaller than inequality in annual earnings. The curve in the upper part of Figure 1 helps to compare yearly inequality with lifetime inequality. It depicts the average of the Gini coefficients of the distribution of yearly

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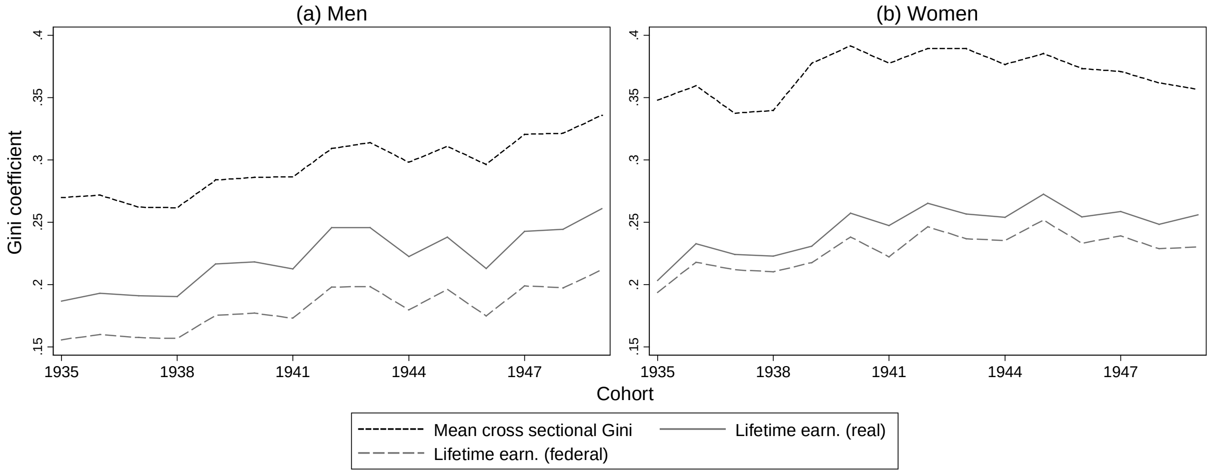
[14] Details on the methodology used to compute the time series are available at http://www.bundesbank.de/statistik/statistik_zeitreihen.php?lang=de&open=zinsen&func=row&tr=WU0004.

earnings for each cohort. For men, that average Gini coefficient ranges from a minimum of 0.262 for the 1938 cohort to a maximum of 0.336 for the 1949 cohort. Hence, Gini coefficients of lifetime earnings distributions are somewhat less than two-thirds of the corresponding average Gini coefficients of annual earnings distributions. Thus, inequality measured from annual earnings substantially overestimates the inequality of lifetime earnings, but the latter is by no means negligible.

As compared to men, women's earnings tend to be distributed less evenly. This may be driven by part-time work being more common among women than among men – something which cannot be scrutinized using our data but is well known from other sources. Women also display a larger difference between annual inequality and lifetime inequality than men. This is consistent with the view that part-time work comes along with a substantial mobility in the distribution of yearly earnings, possibly mirroring the evolution of family needs in terms of childcare. Furthermore, discounting has a smaller impact on measured lifetime earnings inequality in the case of women. This is consistent with the fact to be shown shortly that highly educated women have a less steep age-earnings profile than highly educated men.

Figure 1: Means of annual Gini coefficients and Gini coefficients of lifetime earnings for cohorts 1935 - 1949, men and women

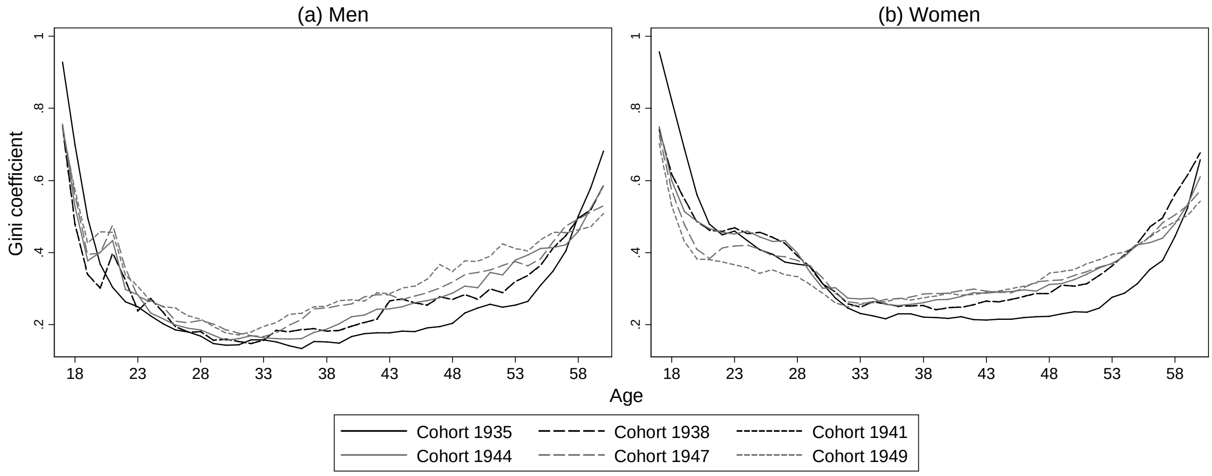


Note: real denotes CPI discounting, federal denotes federal bond discounting.
Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using weighted data.

4 Inequality and Mobility over the Life Cycle

We are now in a position to assess how intra-generational inequality develops along the whole life cycle and how it relates to lifetime inequality. Figure 2 shows for selected cohorts the evolution of the Gini coefficient of annual earnings as a cohort grows older. A U-shaped pattern clearly emerges from the data. Inequality is maximal when the cohort is below twenty because many individuals have not yet entered the labour market and thus have zero earnings. Inequality then declines and reaches a minimum when the cohort is in its mid-thirties. After that, a period of rising inequality of annual earnings sets in.[15] At the time individuals are sixty-years old the distribution of their annual earnings exhibits about the same Gini coefficient as the distribution that prevailed when they were twenty-years old. This pattern is consistent with the presumption that better educated workers have a steeper age-earnings profile, something to which we return below. The sudden and short-lived rise of annual inequality for men in their early twenties born in 1938 and thereafter can be attributed to mandatory military and civil service which entail a temporary lack of earnings.[16]

Figure 2: Annual Gini coefficients from age 17 to age 60 for cohorts 1935 - 1949, men and women



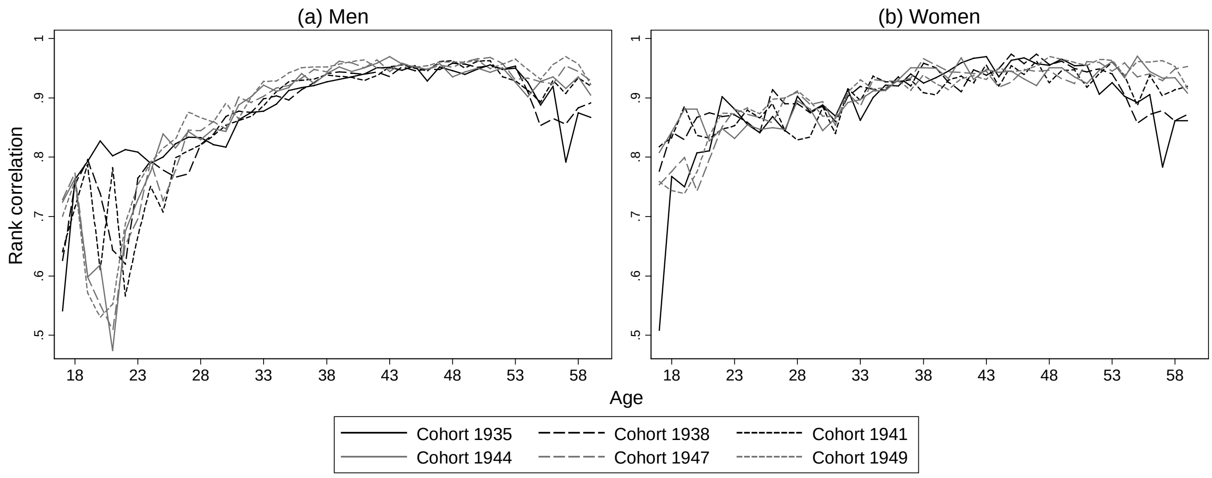
Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using weighted data.

[15] Familiar models of stochastic earnings dynamics focus on employed individuals and predict that, for any cohort, earnings inequality should grow with age. See e.g. Deaton and Paxson (1994) and Huggett et al. (2011).

[16] The first three cohorts in our sample were not affected by drafting. The effect on subsequent cohorts is heterogeneous because of changes in the mandatory serving time.

Figure 3 shows for selected cohorts the correlation of individuals' ranks in the earnings distributions of two consecutive years. The displayed correlation coefficients are inversely related to the short-run mobility of individuals in the cohort-specific earnings distribution: the lower is that coefficient, the higher is their mobility. As shown by Figure 3, some intra-generational mobility always exists during the life cycle and that mobility decreases with age.[17] While there is significant mobility when the cohort is in its twenties, mobility virtually vanishes when the cohort enters its forties.

Figure 3: Earnings rank correlations between consecutive years for cohorts 1935-1949, men and women



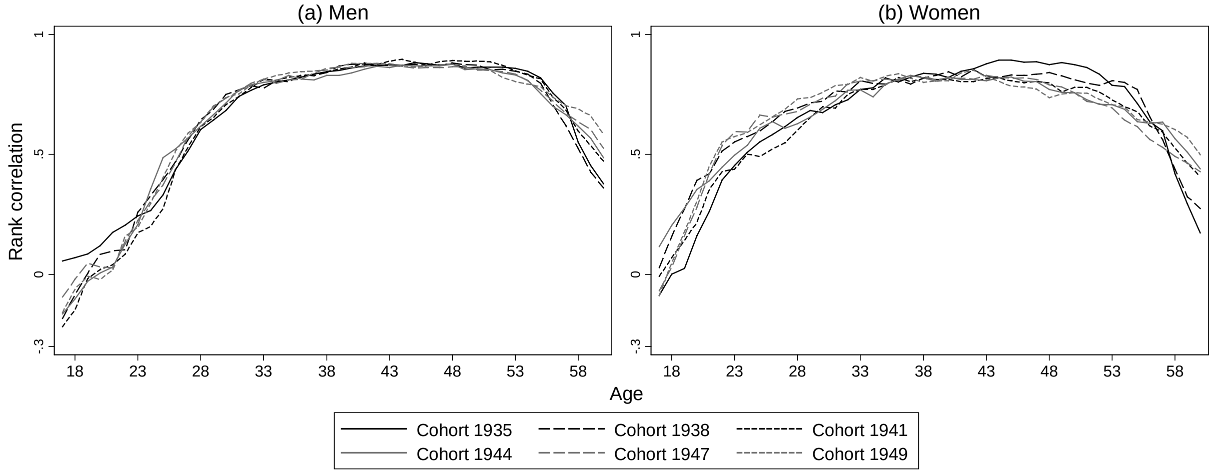
Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using weighted data.

Further details on mobility are provided by the rank correlation between annual and lifetime earnings. For both men and women that correlation exhibits a distinctive age pattern - see Figure 4. When adulthood begins, annual earnings contain virtually no information about lifetime earnings as their mutual correlation is close to zero. The correlation between annual and lifetime earnings then rapidly increases with age. A correlation coefficient of 0.9 is reached when the cohort is at the end of its thirties and such a high level persists until the mid-fifties. In

[17] The drop of the rank correlation for the 1935 cohort when it reaches age fifty-five is due to early-retirement. Changes in legislation and workforce composition entailed a reduced incidence of early retirement for subsequent cohorts.

that period of the life cycle the level of individuals' annual earnings can be considered as a good proxy of their respective lifetime earnings.[18]

Figure 4: Rank correlation of annual and lifetime earnings for cohorts 1935-1949, men and women



Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using weighted data.

The role of mobility in shaping long-term inequality can be assessed by computing the effect of rank changes in the earnings distribution over a small number of years on the inequality of the present value of earnings received up to certain a age. For that purpose, we employ the concept of "up-to-age-X" earnings, UAX for short. For a given individual, UAX is the present value of all his earnings before the individual becomes X-years old. The higher X, the closer that earnings measure to lifetime earnings, and the two concepts coincide if $X = 60$.

In order to measure the impact of mobility on the UAX distribution, we decompose the change in the Gini coefficient of the UAX distribution into two components, one that mirrors the growth of earnings in different parts of the distribution, and one that mirrors the re-ranking of individuals in the UAX distribution. Our decomposition method follows the one developed by Jenkins and Van Kerm (2006) in a related framework.

[18] Unless stated otherwise, we shall always present the findings obtained when using the German federal bond rate as the discount rate. The Online Appendix contains the corresponding findings obtained when using the CPI.

Let $G_{X,c}$ denote the Gini coefficient of the UAX distribution for a cohort c. We are interested in decomposing the change $\Delta_{X,c} = G_{X+5,c} - G_{X,c}$, i.e. the change in the Gini coefficient of the present value of earnings at a given age and five years later. From the covariance definition of the Gini coefficient (Lerman and Yitzhaki, 1985), we have:

$$G_{X,c} = \frac{2\,\mathrm{cov}\left(W_{X,c}, F\left(W_{X,c}\right)\right)}{E\left[W_{X,c}\right]} \tag{1}$$

where $W_{X,c}$ represents the present value of earnings that members of cohort c have received between age 17 and age X. Furthermore, $E\left[W_{X,c}\right] = \mu_{X,c}$ denotes the mean of those earnings and $F(W_{X,c})$ their cumulative density function.

If one keeps the ranking of individuals in the original UAX distribution when computing the Gini coefficient of the UAX distribution five years later, the following concentration coefficient obtains:

$$C_{X+5}^{(X)} = \frac{2\,\mathrm{cov}\left(W_{X+5}, F(W_X)\right)}{\mu_{X+5}} \tag{2}$$

where we have suppressed the cohort index for notational simplicity. Hence, the difference between G_{X+5} and $C_{X+5}^{(X)}$ captures the re-ranking effect, while the remaining portion of the change in the Gini coefficient of the UAX distribution is due to heterogeneous earnings growth at the various ranks. This invites one to partition the change in the Gini coefficient as

$$\Delta_X = \underbrace{\left[G_{X+5} - C_{X+5}^{(X)}\right]}_{\equiv R_X} - \underbrace{\left[G_X - C_{X+5}^{(X)}\right]}_{\equiv P_X} \tag{3}$$

where

$$R_X = \frac{2}{\mu_{X+5}}\left[\mathrm{cov}\left(W_{X+5}, F(W_{X+5})\right) - \mathrm{cov}\left(W_{X+5}, F(W_X)\right)\right] \tag{4}$$

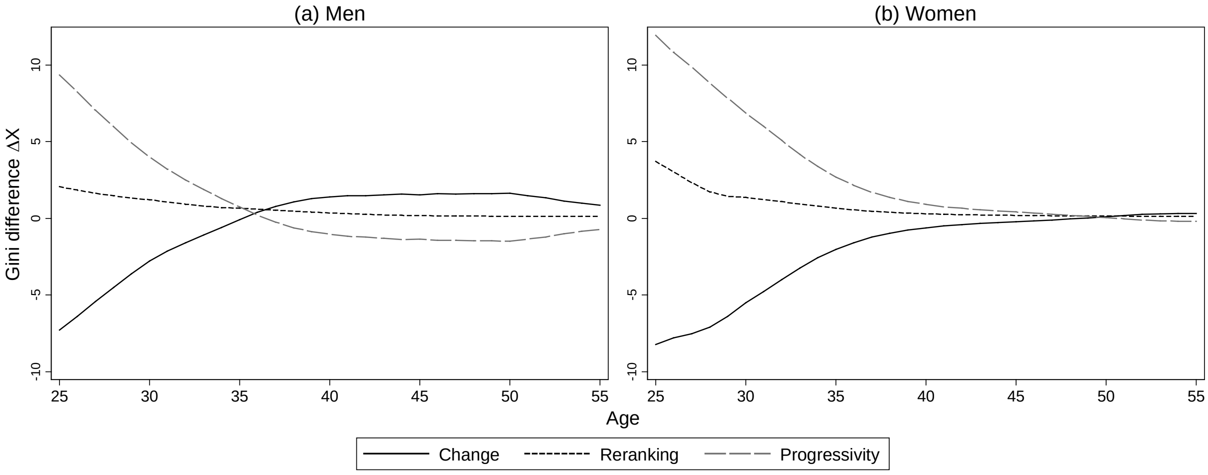
is the re-ranking effect and $R_X = 0$ if no re-ranking occurs. Furthermore,

$$P_X = \frac{2}{\mu_X \mu_{X+5}} \left[\mathrm{cov}\big(W_X, F(W_X)\big)\, \mu_{X+5} - \mathrm{cov}\big(W_{X+5}, F(W_X)\big) \mu_X \right] \tag{5}$$

captures the relative average earnings growth between the two periods, where the growth is weighted by the earnings hierarchy in the initial distribution. Following Jenkins and Van Kerm (2006), P_X measures the progressivity of earnings growth: $P_X > 0$ ($P_X < 0$) indicates that earnings growth is concentrated at the lower (upper) end of the distribution, which leads to decreasing (increasing) inequality over time.

We now employ the above framework to decompose the changes in the inequality of UAX measured between the age of 20 and 25, 21 and 26, and so on, up to age 55 and 60. Figure 5 plots our decomposition results for the cohort of 1944. The continuous line, indicating the change in the Gini coefficient, shows that the UAX distribution becomes more equal during the initial part of the life cycle and that inequality starts increasing when the cohort enters its forties. The two dashed lines describe the progressivity effect and the re-ranking effect. Most of the change in UAX inequality is caused by progressivity. The progressivity index shows that in the case of men earnings growth is pro-poor until the late thirties and switches to pro-rich thereafter. In the case of women, earnings growth becomes pro-rich about ten years later. The effect from re-ranking peaks at the beginning of the life cycle and decreases afterwards. Its influence on the development of UAX inequality becomes negligible in the second half of the life cycle, which means that five-year mobility in that earnings ladder is nearly non-existing during the second half of the life cycle. As shown in the Online Appendix, the pattern revealed by Figure 5 carries over to the remaining cohorts, although with some variation in the case of women.

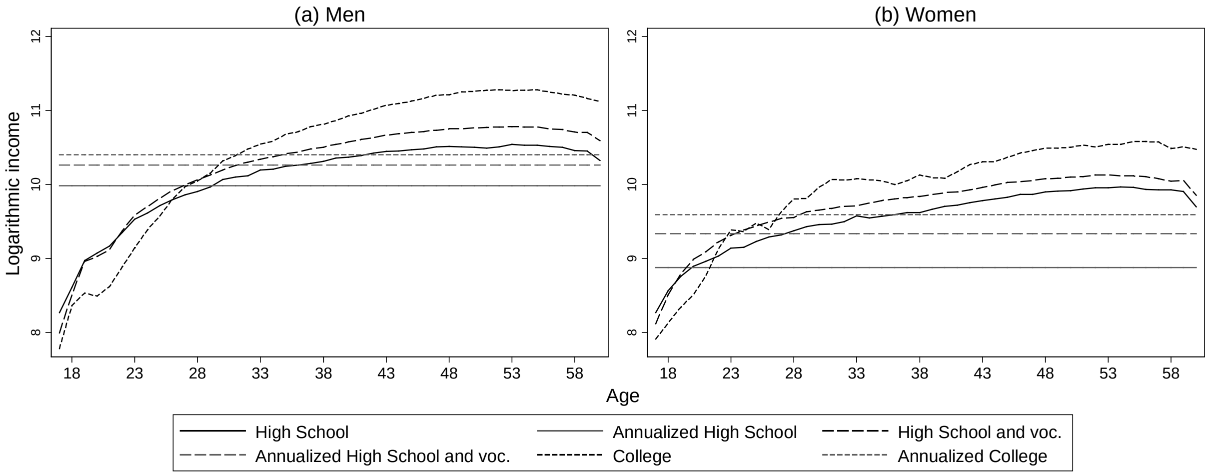
Figure 5: Decomposition of changes in inequality as of Eq. (3) for cohort 1944, men and women



Note: Accumulated discounted earnings refer to the age in the abscissa as compared to accumulated earnings five years later, as in Eq. (3). Coefficients are multiplied by 100.
Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using weighted data.

It is interesting to relate the various mobility patterns detected above to the age-earnings profiles of individuals with different educational attainments. In Figure 6 we plot those profiles for three levels of education for the pooled cohorts from 1935 to 1949. The horizontal lines depict the annualized value of the corresponding present value of lifetime earnings. All earnings are in real terms, on the basis of prices in 2000, and expressed in logs. For each educational group, its profile has a mainly rising, concave shape. However, the higher educated individuals experience more rapid earnings growth through the entire life cycle. This is consistent with the kind of earnings dynamics suggested by standard human-capital theory. Women, especially the highly-educated ones, display a less steep age-earnings profile than their male counterparts.

Figure 6: Age-earning-profiles by highest educational attainment for pooled cohorts 1935-1949, men and women



Note: voc. abbreviates vocational training.
Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using weighted data.

5 Evolution of Lifetime Inequality

Are cohorts in Germany becoming more or less equal in terms of their lifetime earnings? This question cannot be satisfactorily answered by examining just the cohorts born between 1935 and 1949 for which lifetime earnings can be computed. We now exploit also the data available for younger cohorts in order to uncover patterns of the long-run evolution of lifetime earnings inequality.

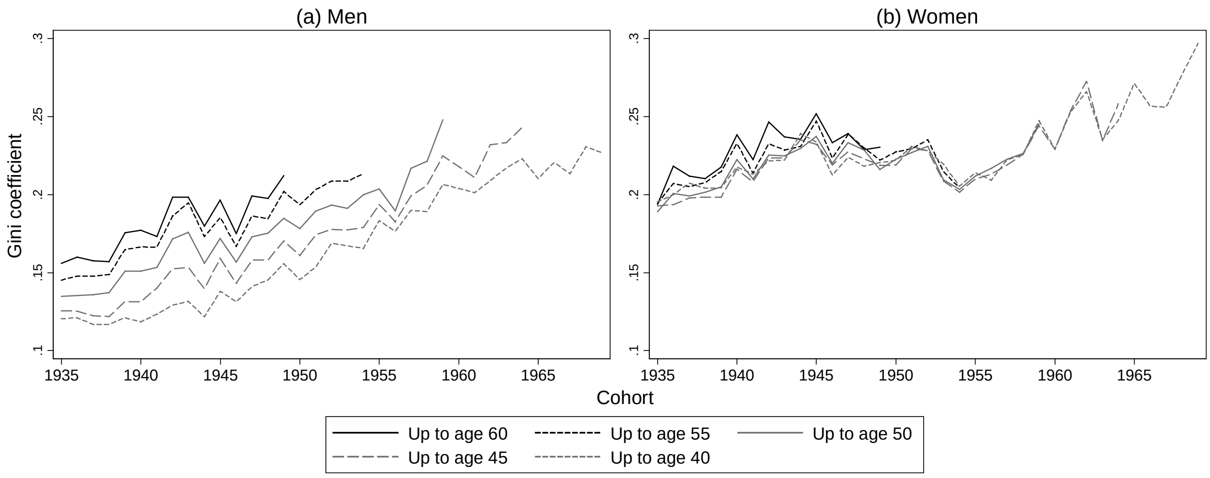
5.1 Main finding

We resort to the concept of “up-to-age-X earnings", UAX for short. As already mentioned, UAX is the present value of an individual’s earnings before the individual becomes X-years old, and lifetime earnings correspond to $X = 60$. For each cohort, the Gini coefficient of the distribution of UAX can be computed for different values of X. Establishing how the Gini coefficient of the distribution of UAX has evolved over successive cohorts can provide valuable hints about the underlying evolution of lifetime earnings inequality. If younger cohorts display higher Gini coefficients for the same X and if this applies to all X, that would strongly suggest that there is a trend of increasing lifetime earnings inequality. The opposite conclusion would be drawn from observing lower Gini coefficients for younger cohorts; in that case one would argue that younger cohorts are characterized by less inequality and are likely to experience more equal lifetime earnings.

The results in the previous section indicate that mobility in the earnings distribution is significant until about age forty. Therefore, we focus on the distribution of UAX for $X \geq 40$. The data allows us to compute UAX for $X \geq 40$ for all thirty-five cohorts born between 1935 and 1969. For each cohort and each definition of X, we then compute the Gini coefficient of the distribution of UAX. Representative results are displayed in Figure 7 for earnings up to the ages of 40, 45, 50, 55, and 60 (lifetime earnings).

Results for men are very clear: Gini coefficients trend upwards for each value of X. This strongly suggests that younger generations of men are likely to experience more intra-generational lifetime economic disparity than their statistical fathers. Results for women are less clear-cut but point in the same direction: intra-cohort inequality tended to increase for the older cohorts, slightly declined for the cohorts in between, and sharply increased for the cohorts born after 1955. [19]

Figure 7: Gini coefficients of UAX for cohorts 1935-1969, men and women



Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using weighted data.

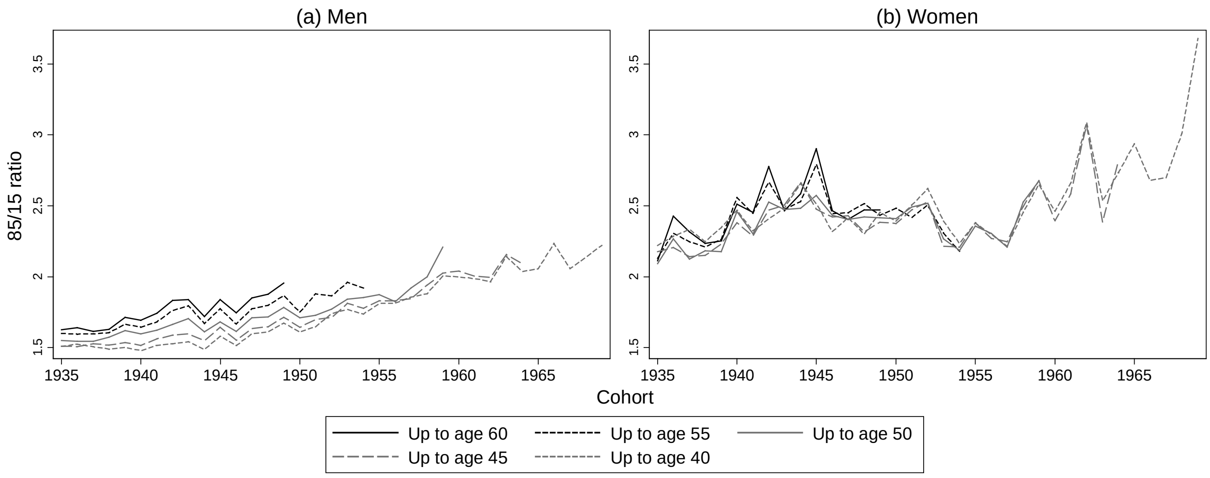
The overall increase in intra-generational earnings inequality is remarkable. To illustrate, compare the cohort of men born in 1935 with the cohort born in 1963, which may respectively be seen as “fathers” and “sons”. When they reached age forty-five, the fathers’ generation was characterized by a distribution of accumulated earnings with a Gini coefficient of about 0.126. At the same age, their sons’ generation was characterized by a distribution of accumulated earnings with a Gini coefficient of about 0.233, an increase of inequality by roughly 85 %.

[19] Statistical inference shows that the observed trend of increasing inequality is significant for both men and women. Confidence intervals for UAX Ginis are provided in the Online Appendix.

A similar finding obtains if we replace the Gini coefficient with an interquantile ratio. Figure 8 plots the evolution of the ratio between the UAX at the 85^{th} quantile and the one at the 15^{th} quantile.

In the case of men, Figures 7 and 8 show that the finding that inequality of accumulated earnings increases with age after age forty holds true for all cohorts. As indicated by the decomposition analysis in Section 4, cohort members who by age forty have received larger earnings tend to experience a stronger earnings growth at a later age. Furthermore, inequality comparisons across cohorts tend to be rather unaffected by the age at which they are made. By way of an example, relative to its neighbouring cohorts, the cohorts of 1942 and 1943 are characterized by a large inequality of UAX and that is true for all $X > 40$. This suggests that the evolution of inequality of lifetime earnings is likely to mirror the evolution of inequality of earnings up to age forty.

Figure 8: 85^{th} / 15^{th} ratio of UAX- earnings for cohorts 1935-1969, men and women



Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using weighted data.

Our finding of a rising intra-generational inequality does not hinge on the fact that younger generations enter the labor market at a later age. The same pattern as in Figure 7 obtains if UAX are computed starting with a higher age so that virtually all individuals in the sample participate in the labor market in all years when their earnings are taken into account.[20]

The dramatic rise of intra-generational inequality manifests itself also in the distributions of annual earnings received by the various cohorts at a common age. Figure 9 is based on the earnings distributions at ages 40, 45, 50 and 55 as earnings at those ages are good proxies of lifetime earnings. The figure shows that at any given age the Gini coefficient of annual earnings tends to be higher for the younger cohorts.

Figure 9: Gini coefficients of annual earnings at various ages for cohorts 1935-1969, men and women

Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using weighted data.

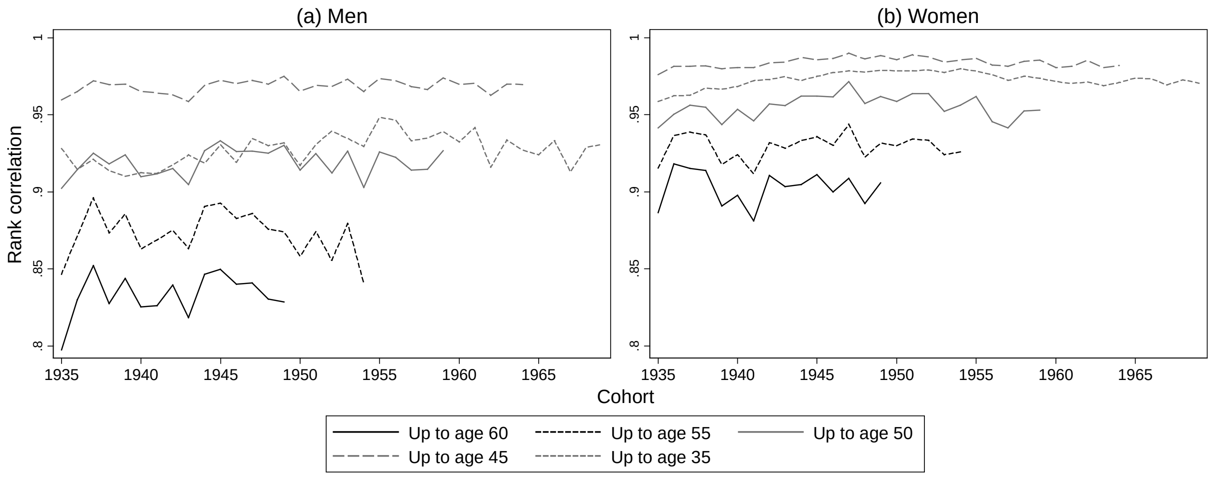
The rise of intra-generational inequality concerns all education groups that can be identified within our dataset. As shown in Appendix C, within-group inequality of the UAX distribution is systematically higher for the younger cohorts, and this applies to both men and women. This suggests that the increase in lifetime inequality is not simply driven by the expansion of tertiary education. However, this finding should be taken with caution since the VSKT fails to report the educational attainment of about 40% of the sample and the share of missing information is especially high in the case of older cohorts.

[20] See the Online Appendix.

Further insights into the evolution of intra-generational inequality come from an analysis of the evolution of mobility after age forty. For each cohort, we compute the correlation between the individuals' ranks in the distribution of UAX for $X = 40$ with their ranks in the distribution of UAX for $40 < X \leq 60$. Representative findings for $X = 45, 50, 55$, and 60 are plotted in Figure 10. No major change in mobility across generations can be detected. By way of an example, the rank correlations observed for the cohort born in 1935 are virtually undistinguishable from those observed for the 1963 cohort for the same X.

In Figure 10 we also plot the rank correlation of UA-35 with UA-40, which is distinctively affected by the dynamics of earnings in that period of the life cycle in which most individuals settle into stable employment. Also that correlation varies little across cohorts.

Figure 10: Rank correlation of UA-40 with selected UAX for cohorts 1935-1969, men and women.



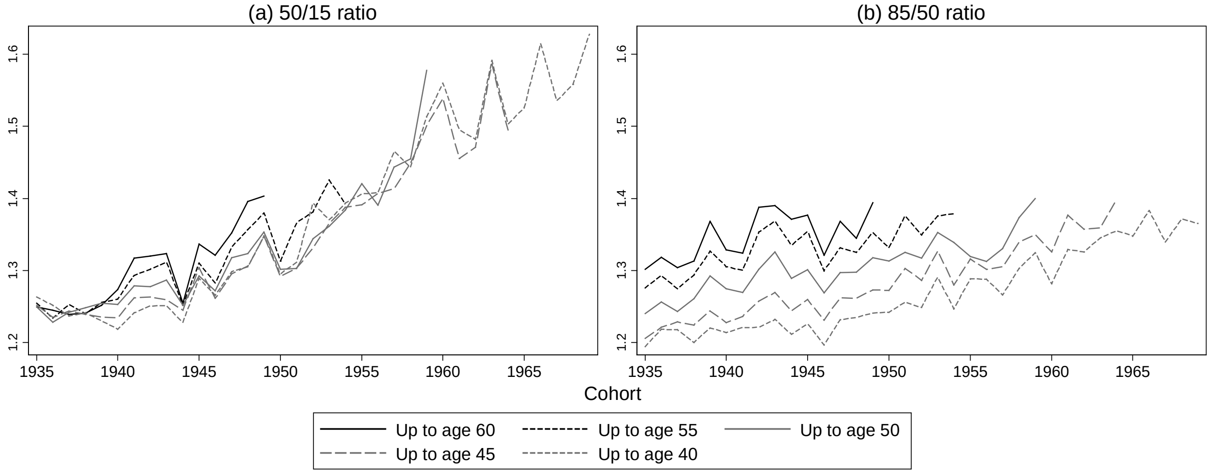
Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using weighted data.

5.2 Proximate causes

The aim of the remaining part of our paper is to get some insight into the proximate causes of the rise of lifetime earnings inequality in Germany. We focus on men because only in their case we can be confident that for all cohorts the overwhelming majority of the earnings we observe were received from full-time jobs. In contrast, the evolution of women's lifetime earnings inequality is likely to be affected by substantial variation across cohorts in terms of their labor supply.[21] We defer its in-depth analysis to future work.

As a first step, we are interested in how lifetime earnings inequality for men has evolved at various parts of the distribution. This can be assessed by means of generalized entropy inequality indices that are more sensitive to distinctive parts of the distribution. Results for the Theil index, the mean logarithmic deviation and half the squared coefficient of variation are reported in the Online Appendix. They suggest that intra-generational lifetime inequality has significantly increased both at the bottom and at the top of the distribution. Here, we merely present the evolution of two interquantile ratios of the UAX distribution that respectively capture inequality at the bottom and at the top of the distribution. In Figure 11, the left panel plots the 50th / 15th ratio while the right panel plots the 85th / 50th ratio. They show that while lifetime earnings inequality has increased both at the bottom and at the top of the distribution, the increase has been stronger at the bottom of the distribution.

Figure 11: 50th / 15th and 85th / 50th ratio of selected UAX for cohorts 1935-1969, men



Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using weighted data.

The second step of our analysis it a decomposition of the inequality increase into a part due to increasing wage dispersion and one due to longer unemployment spells for the low-

[21] Part-time participation has substantially increased over time in Germany and nowadays about two-thirds of all working women work part-time. See e.g. Fuchs-Schündeln et al. (2010).

skilled. This is motivated by the distinctive temporal pattern exhibited by the unemployment rate in West Germany. Until the first oil shock, when only the older cohorts of our sample were active, almost full employment prevailed. Then, a strong stepwise increase of the unemployment rate set in which lasted about three decades. Individuals with a low educational attainment were severely hit.[22]

Figure 12 plots for each cohort the average number of months spent in employment, unemployment, and other ways during the life span that goes from age seventeen to age forty. The residual category "Other" includes all remaining categories: civil and military service, education, sick-pay, periods of occupational disability, nursing care and months of missing information. Within each cohort, individuals have been ranked into quartiles according to their lifetime earnings up to age forty.

Over time, there has been a substantial increase in the number of months of unemployment for the bottom quartile, a moderate increase for the next quartile, and virtual stability for the upper half of the distribution. Individuals in the bottom quartile of the earnings distributions of cohorts born in the mid-1930s spent on average about 5 months in unemployment before reaching age forty. By contrast, their statistical children born in the early 1960s spent about 41 months in unemployment before reaching age forty. For individuals in the upper half of the distribution, no comparable rise of unemployment incidence for the younger cohorts can be observed.[23] Those findings fit well with the fact that the rise of unemployment after the first oil shock severely hit the low-skilled and lend support to the notion that hiring and firing costs entail a higher unemployment risk for the entrants in the labor market than for the incumbents.

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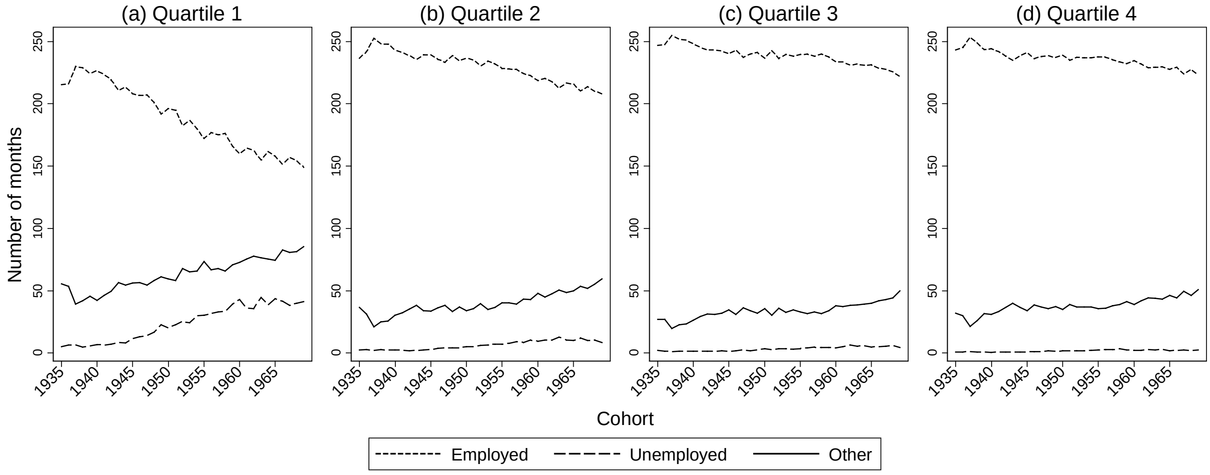
[22] Their unemployment rate is usually at least twice the average unemployment rate – see Reinberg and Hummel (2007). Both unemployment rates have been declining since 2006.

[23] The same striking difference obtains if one only considers the spells of unemployment after age twenty-five. See the Online Appendix.

Figure 12: Months of employment status up to age forty by quartile of UA-40 for cohorts 1935-1969, men



Note: Earnings quartiles based on UA-40 with federal bond discounting.
Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using weighted data.

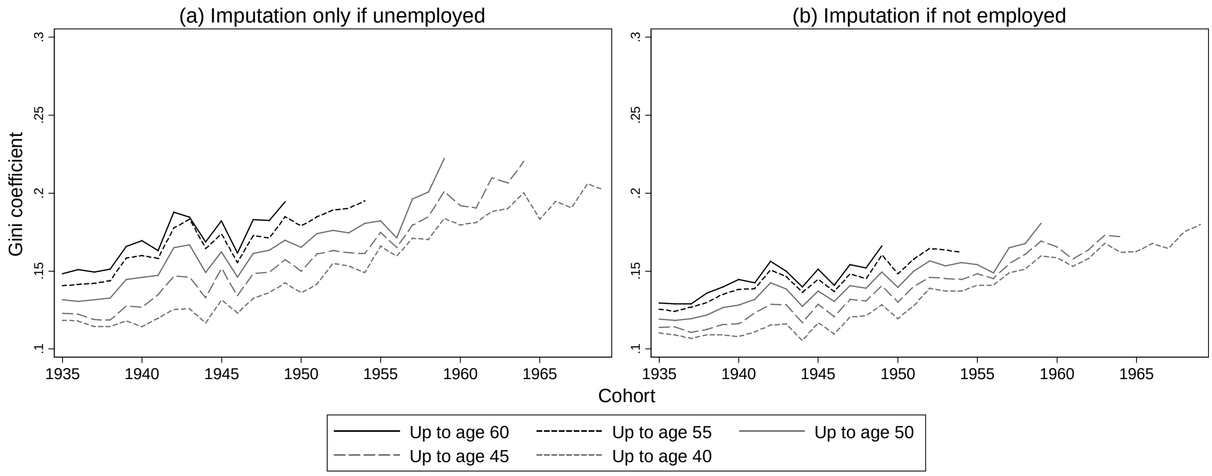
In order to disentangle the effect on lifetime earnings inequality due to changes in the distribution of unemployment spells from the one due to changes in the wage structure, we simulate the evolution of lifetime inequality under the counterfactual of full employment. In this way, we estimate the intergenerational change of lifetime inequality that had occurred in a hypothetical labor market without unemployment. In a first approximation, a situation of full employment characterized the oldest cohorts in our sample. Hence, the rise of lifetime inequality computed under the counterfactual of full employment is a first approximation of the rise of lifetime inequality due to changes in the wage structure, while the difference between actual and hypothetical inequality rise captures the effect from changes in unemployment spells.

Based on the actual earnings distribution, we construct a full-employment scenario by imputing earnings when individuals are recorded as unemployed. The imputed value for an individual is the last monthly earning observed for that individual.[24] Results for the hypothetical distributions of UAX are plotted in Figure 13 in the case of two different full-employment scenarios. In the left panel, earnings have been imputed only for the months in which an

[24] In cases where no previous individual earnings are observed, we impute retrospectively the first level of earnings observed for that individual. In an additional scenario, we reversed our imputation procedure and imputed the level of earnings observed when the individual exits unemployment. Results were similar to those based on our preferred imputation and can be obtained upon request.

individual was registered as unemployed. In the right panel, earnings have been imputed for all months in which an individual was not in employment. This is based on the notion that for some individuals protracted periods of education, in the military etc. mirror their inability to find a job.

Figure 13: Gini coefficients of UAX with earnings imputation if individual is not employed for cohorts 1935-1969, men



Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using weighted data.

Comparing Figure 13 with panel (a) of Figure 7 reveals that the unequal evolution of unemployment spells goes some way in explaining the rise of lifetime earnings inequality. While imputing earnings in case of unemployment has a small impact on the Gini coefficients of UAX for the older generations, it clearly lowers them for the younger generations. To illustrate, consider again the cohort born in 1935 and the one of their statistical children born in 1963. Under the counterfactual of no unemployment underlying panel (a) of Figure 13, at the time parents reached age forty-five their accumulated earnings were distributed with a Gini coefficient of about 0.123. At the same age, their children's generation was characterized by a distribution of accumulated earnings with a Gini coefficient of about .207 - an increase of inequality by about 68 %. In the scenario covered by panel (b), the same comparison yields an increase of the Gini coefficient by about 52 %. In both cases, the Gini coefficient increases by much less than 85 %, the growth rate of actual lifetime inequality for those two cohorts. This suggests that the unequal evolution of unemployment spells for individuals at different points of the earnings distribution contributes to explain some 20 to 40 percent of the secular rise of lifetime earnings inequality.[25]

Using the same imputation method to compute interquantile ratios of UAX distributions under the counterfactual of full employment gives some insight into the effect of unemployment on lifetime inequality at bottom versus top of the distribution. As we report in Appendix D, imputation has little impact on the 85^{th} / 50^{th} ratio while it substantially decreases the 50^{th} / 15^{th} ratio. By way of an example, the 50^{th} / 15^{th} ratio of the UA-45 for the two cohorts considered above increases from 1.25 to 1.59 without imputation while it goes from 1.24 to 1.45 in the case of imputation for registered unemployment. Thus, the rise of unemployment contributes to explain increasing lifetime inequality at the bottom of the distribution but not at the top.[26]

The remaining 60 to 80 percent of the secular rise of intra-generational lifetime earnings inequality can therefore be attributed to the evolution of the wage structure. Unfortunately, our dataset does not contain information about working time. Hence, we cannot distinguish between the role played by the inequality in hourly wages and the one played by the inequality in hours worked. Cross-sectional evidence from other sources suggests that both types of inequality increased during the last decades but it remains to be seen to what extent this holds true for cohort-specific distributions. As reported by Fuchs-Schündeln et al. (2010), per-capita hours worked by male employees have been rather stable since 1984, while the correlation between hours and wages has slightly increased, from about -0.2 to approximately zero. As we discussed in the Introduction, several studies find that cross-sectional wage rates have become more unequal in West Germany during the last decades. According to Dustmann et al. (2009), skill-biased technological change is the best explanation for the widening of the dispersion of wage rates at the top of the distribution. Changes in labor market institutions – related in particular to

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[25] In the case of full employment described by panel (a) the share of the inequality increase approximately attributed to the rise of unemployment is (85-68)/85 = 0.2. In the case of panel (b) we have (85-52)/85 = 0.39. The Online Appendix shows that this approximation is exact if a plausible symmetry assumption is made.

[26] Further evidence is provided in the Online Appendix. There, we show that the bulk of the inequality-reducing effect from our imputation exercise stems from imputation in the lowest quartile.

declining union power – and labor supply shocks – in particular, immigration waves – are instead key drivers of growing wage inequality at the bottom.

6 Conclusion

We have documented, for the first time, the magnitude, pattern, and evolution of lifetime earnings inequality in Germany. Based on a large sample of earnings biographies from social security records, we have shown that the intra-generational distribution of lifetime earnings has a Gini coefficient that amounts to about two-thirds of the value of the Gini coefficient of annual earnings. Within cohorts, mobility in the distribution of yearly earnings is substantial at the beginning of the life cycle, decreases afterwards and virtually vanishes after age forty.

A comparison of earnings mobility across cohorts has not revealed noticeable differences. The pattern of mobility within a cohort's earning distribution is similar across all the cohorts we have scrutinized, from the one born in 1935 to the one born in 1969. Hence, changes in intra-generational mobility cannot be held responsible for the increase of cross-sectional earnings inequality in the German labor market.

The main novel finding from our investigation is the secular rise of intra-generational inequality in lifetime earnings: West-German men born in the early 1960s are likely to experience about 85 % more lifetime inequality than their fathers. Our findings for women are less clear-cut but also point to rising lifetime inequality. In particular, inequality tended to increase for the older cohorts, slightly declined for the cohorts in between, and increased again for the cohorts born after 1955. In the case of men, intra-generational inequality shows instead an almost linear upwards trend over all cohorts.

During the last three and a half decades, cohorts in West Germany have become substantially more heterogeneous in terms of their labor-market performance. This holds true even when focusing on German citizens born in the country, i.e. neglecting the role of immigration. Ceteris paribus, the increased inequality generated by the labor market is bound to decrease the social welfare of cohorts and is likely to make them socially less cohesive.

Our analysis has begun to shed some light on the proximate causes of the rise of intra-generational inequality in lifetime earnings among men. We have shown that longer unemployment spells, mainly affecting workers at the bottom of the distribution of younger cohorts, contribute to explain some 20 to 40 percent of the overall increase in lifetime earnings inequality. The remaining 60 to 80 percent is due to increasing wage dispersion.

The increase in lifetime earnings inequality that separates the baby boomers of the 1960s from their parents' generations is large and unlikely to be offset by more progressive taxes and transfers. From a policy perspective, our main finding raises the issue of how inequality-reducing measures could be tailored to the distinctive needs of the current worker generation and their heirs - rather than on the current elderly. Using the proceeds from higher bequest taxes to promote programs of life-long learning for the low-skilled is the kind of policy approach our main finding seems to call for.

References

Almas, I., Havnes, T. and M. Mogstad (2011): Baby booming inequality? Demographic change and earnings inequality in Norway, 1967-2000, Journal of Economic Inequality 9, 629-650.

Atkinson. A. and T. Piketty (2010): Top Incomes – A Global Perspective, Oxford: OUP.

Autor, D., L. Katz and M. Kearny (2006): The polarization of the U.S. labor market, American Economic Review (Papers & Proceedings) 96, 189-194.

Bach, S., Corneo, G. and V. Steiner (2009): From bottom to top: The entire income distribution in Germany, 1992-2003, Review of Income and Wealth 55, 303- 330.

Bhuller, M., Mogstad, M. and K. Salvanes (2011): Life-cycle bias and the returns to schooling in current and lifetime earnings, IZA DP N°. 5788.

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

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

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

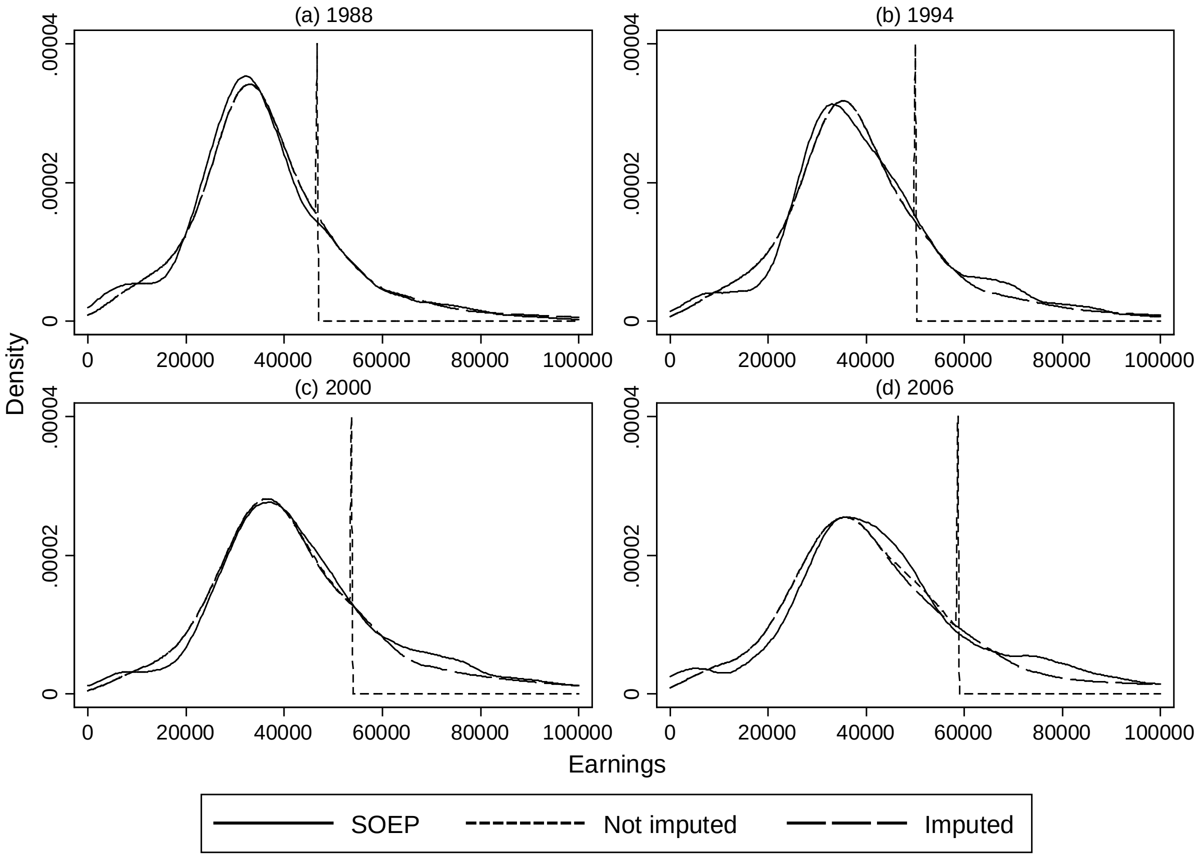
Burkhauser, R. and J. Poupore (1997): A cross-national comparison of permanent inequality in the United States and Germany, Review of Economics and Statistics 79, 10-17.

Card, D. and J. DiNardo (2002): Skill-biased technological change and rising wage inequality: Some problems and puzzles, Journal of Labor Economics 20, 733-83.
Card, D., J. Heining and P. Kline (2013): Workplace heterogeneity and the rise of West German wage inequality, Quarterly Journal of Economics, forthcoming.
Dell, F. (2005): Top income in Germany and Switzerland over the twentieth century, Journal of the European Economic Association 3, 1-10.
Deaton, A. and C. Paxson (1994): Intertemporal choice and inequality, Journal of Political Economy 102, 437-467.
Dustmann, C., J. Ludsteck and U. Schönberg (2009): Revisiting the German wage structure, Quarterly Journal of Economics 124, 843-881.
Fitzenberger, B. (1999): Wages and employment across skill groups: An analysis for West Germany, ZEW Economic Studies, Physika-Verlag: Heidelberg, New York.
Fuchs-Schündeln, N., Krueger, D. and M. Sommer (2010): Inequality trends for Germany in the last two decades: A tale of two countries, Review of Economic Dynamics 13, 103-132.
Gernandt, J. and F. Pfeiffer (2007): Rising wage inequality in Germany, Journal of Economics and Statistics 227, 358-380.
Goos, M., Manning A. and A. Salomons (2009): Job polarization in Europe, American Economic Review (Papers & Proceedings) 99, 58-63.
Haider, S. and G. Solon (2006): Life-cycle variation in the association between current and lifetime earnings, American Economic Review 96, 1308-1320.
Himmelreicher, R. and M. Stegmann (2008): New possibilities for socio-economic research through longitudinal data from the Research Data Centre of the German Federal Pension Insurance, Journal of Applied Social Science Studies 128, 647 - 660.
Hugget, M., G. Ventura and A. Yaron (2011): Sources of lifetime inequality, American Economic Review 101, 2923-2954.
Jenkins, S. (1987): Snapshots versus movies: “Lifecycle biases” and the estimation of intergenerational earnings inheritance, European Economic Review 31, 1149-1158.
Jenkins, S. and P. Van Kerm (2006): Trends in income inequality, pro-poor income growth, and income mobility, Oxford Economic Papers 58, 531-548.
Kopczuk, W., Saez, E. and J. Song (2010): Earnings inequality and mobility in the United States: Evidence from social security data since 1937, Quarterly Journal of Economics 125, 91-128.
Lemieux, T. (2007): The changing nature of wage inequality, NBER WP 13523.
Lerman, R. and S. Yitzhaki (1985): Income inequality effects by income Source: A new approach and applications to the United States, Review of Economics and Statistics 67, 151-156.
Maasoumi, E. and M. Trede (2001): Comparing income mobility in Germany and the United States using generalized entropy mobility measures, Review of Economics and Statistics 83, 551-559.
OECD (2008): Growing Unequal? Income Distribution and Poverty in OECD Countries, Paris: OECD.
Pérez-Asenjo, E. (2011): If happiness is relative, against whom do we compare ourselves? Implications for labour supply, Journal of Population Economics 24, 1411-1442.
Reinberg, A. and M. Hummel (2007): Der Trend bleibt – Geringqualifizierte sind häufiger arbeitslos, IAB Kurzbericht Nr. 18.
Trede, M. (1998): The age profile of mobility measures: An application to earnings in West Germany, Journal of Applied Econometrics 13, 397-409.

Appendix

A. Representativeness as compared to the SOEP

Figure A1. Comparison of Kernel density estimates for annual earnings distributions, men



Note: “Not imputed” denotes estimates based on original VSKT data, “imputed” estimates based on the VSKT after applying our imputation method, all earnings include employer's social security contributions. Population composition of the SOEP mirrors those of the VSKT in age composition, region of residence, gender and employment status; see Table A1 for further details.
Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, SOEP v28, own calculation using weighted data.

Table A1: West-German workforce for selected years according to the SOEP, men

Year[A]	1988		1994		2000		2006	
Age range of sample[B]	20-53		25-59		31-59		37-59	
Labor force status	Observations	%	Observations	%	Observations	%	Observations	%
Employed[C]	10,078,221	70.07	11,343,612	70.35	9,871,416	72.87	7,733,104	71.4
Apprentice[C]	462,953	3.22	76,840	0.48	22,960	0.17	3,727	0.03
Miners[C]	84,576	0.59	101,913	0.63	90,558	0.67	19,925	0.18
Civil servant	1,592,497	11.07	1,778,165	11.03	1,125,649	8.31	876,367	8.09
Self-employed	1,143,363	7.95	1,661,736	10.31	1,703,570	12.58	1,388,851	12.82
Unemployed[C]	716,579	4.98	1,145,635	7.1	732,898	5.41	808,084	7.46
Com./Military service[C]	304,337	2.12	17,443	0.11	1,125,649	8.31	0	
Covered in VSKT	11,646,666	80.99	12,685,443	78.67	10,717,832	79.12	8,564,840	79.08

Note: Sample selection mirrors the respective birth cohorts in our deployed FDZ-RV − VSKT2002, 2004-2009_Bönke data. [A]year of cross section; [B]age range of observations present in our VSKT sample for the respective cross section; [C]workforce covered in our VSKT sample.
Source: SOEP v28, own calculations using weighted data.

Table A2: West-German workforce for selected years according to the SOEP, women

Year[A]	1988		1994		2000		2006	
Age range of sample[B]	20-53		25-59		31-59		37-59	
Labor force status	Observations	%	Observations	%	Observations	%	Observations	%
Employed[C]	7,688,808	76.48	8,571,636	78.89	7,935,596	80.88	7,112,982	77.5
Apprentice[C]	448,453	4.46	71,369	0.66	9,951	0.1	16,838	0.18
Miners[C,D]	0	0	0	0	30,991	0.32	796	0.01
Civil servant	484,884	4.82	621,621	5.72	520,966	5.31	465,570	5.07
Self-employed	697,280	6.94	741,731	6.83	760,714	7.75	694,739	7.57
Unemployed[C]	733,902	7.3	859,543	7.91	550,099	5.61	887,568	9.67
Com./Military service[C,D]	0	0	0	0	3,547	0.04		
Covered in VSKT	8,871,163	88.24	9,502,548	87.45	7,980,085	81.33	8,018,184	87.36

Note: Sample selection mirrors the respective birth cohorts in our deployed FDZ-RV − VSKT2002, 2004-2009_Bönke data. [A]year of cross section; [B]age range of observations present in our VSKT sample for the respective cross section; [C]workforce covered in our VSKT sample; [D]unweighted cell size is <5.
Source: SOEP v28, own calculations using weighted data.

B. Numbers of observations

Table B1: Unweighted number of observations with valid UAX-biograhpies, men

Cohort	Up to 40	Up to 45	Up to 50	Up to 55	Up to 60
1935	1,114	1,091	1,073	1,022	1,000
1936	1,067	1,042	1,019	974	955
1937	1,081	1,079	1,061	1,021	981
1938	1,104	1,099	1,090	1,053	1,023
1939	1,207	1,165	1,140	1,081	1,049
1940	1,095	1,084	1,080	1,046	1,022
1941	1,121	1,118	1,116	1,084	1,070
1942	1,109	1,087	1,082	1,042	1,032
1943	1,107	1,101	1,084	1,048	1,025
1944	1,087	1,067	1,054	1,005	978
1945	1,154	1,143	1,140	1,113	1,090
1946	1,172	1,143	1,133	1,094	1,057
1947	1,175	1,154	1,137	1,089	1,051
1948	1,189	1,167	1,151	1,106	1,056
1949	1,163	1,132	1,110	1,062	1,016
1950	1,202	1,175	1,152	1,101	
1951	1,228	1,206	1,175	1,127	
1952	1,212	1,168	1,145	1,101	
1953	1,223	1,195	1,171	1,120	
1954	1,271	1,230	1,202	1,144	
1955	1,293	1,261	1,230		
1956	1,311	1,268	1,236		
1957	1,295	1,255	1,236		
1958	1,322	1,292	1,256		
1959	1,345	1,316	1,277		
1960	1,377	1,336			
1961	1,417	1,389			
1962	1,481	1,435			
1963	1,494	1,444			
1964	1,437	1,411			
1965	1,493				
1966	1,507				
1967	1,511				
1968	1,531				
1969	1,622				
	44,517	36,053	28,550	21,433	15,405

Note: Number of observations for a cohort changes because of the selection criterion for valid biographies (see details in the Online Appendix).
Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using unweighted data.

Table B2: Weighted number of observations with valid UAX-biograhpies, men

Birth cohort	Up to 40	Up to 45	Up to 50	Up to 55	Up to 60
1935	214,783	210,073	206,947	197,408	193,415
1936	217,551	212,263	207,186	196,663	191,881
1937	207,309	206,856	203,374	195,114	186,527
1938	221,022	218,897	217,169	211,985	209,564
1939	245,519	236,111	231,068	223,601	219,909
1940	233,767	230,358	228,571	227,105	224,172
1941	216,453	214,801	213,377	210,465	209,591
1942	172,882	169,064	168,109	164,225	164,017
1943	175,621	174,271	171,203	168,750	166,712
1944	173,017	168,663	166,300	161,142	159,641
1945	126,931	125,355	124,422	123,337	122,304
1946	162,292	157,618	155,222	152,719	149,049
1947	178,106	174,483	171,523	167,621	164,812
1948	188,304	183,558	180,554	177,935	173,946
1949	201,483	194,494	189,937	186,256	182,587
1950	210,781	205,003	200,438	197,303	
1951	202,075	198,195	192,300	188,904	
1952	207,547	198,705	194,186	191,816	
1953	198,846	193,264	188,495	185,667	
1954	218,223	210,309	204,987	199,045	
1955	218,160	212,973	207,454	205,115	
1956	232,274	223,581	217,471		
1957	237,176	229,484	225,704		
1958	242,756	236,871	228,939		
1959	258,979	252,939	245,655		
1960	267,044	258,361			
1961	267,736	261,133			
1962	279,379	270,243			
1963	276,530	267,379			
1964	280,680	275,448			
1965	282,497				
1966	283,604				
1967	288,091				
1968	277,011				
1969	261,663				
	7,926,092	6,370,753	4,940,591	3,932,176	2,718,127

Note: Number of observations for a cohort changes because of the selection criterion for valid biographies (see details in the Online Appendix).
Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using weighted data.

Table B3: Unweighted number of observations with valid UAX-biograhpies, women

Birth cohort	Up to 40	Up to 45	Up to 50	Up to 55	Up to 60
1935	344	332	318	311	313
1936	354	349	349	329	336
1937	381	366	348	336	346
1938	407	403	387	360	362
1939	373	360	361	356	346
1940	425	420	419	432	440
1941	433	420	422	440	438
1942	468	463	472	479	476
1943	519	506	496	500	505
1944	479	481	481	478	472
1945	531	544	537	528	519
1946	525	502	492	496	500
1947	539	521	517	527	517
1948	508	501	512	514	500
1949	521	526	531	523	514
1950	504	515	507	512	
1951	522	535	538	539	
1952	551	539	533	528	
1953	528	523	526	522	
1954	499	503	514	511	
1955	558	569	565		
1956	503	527	550		
1957	567	567	581		
1958	501	526	541		
1959	552	567	578		
1960	545	553			
1961	565	561			
1962	654	654			
1963	647	646			
1964	657	661			
1965	692				
1966	657				
1967	700				
1968	698				
1969	888				
	18,795	15,140	12,075	9,221	6,584

Note: Number of observations for a cohort changes because of the selection criterion for valid biographies (see details in the Online Appendix).
Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using unweighted data.

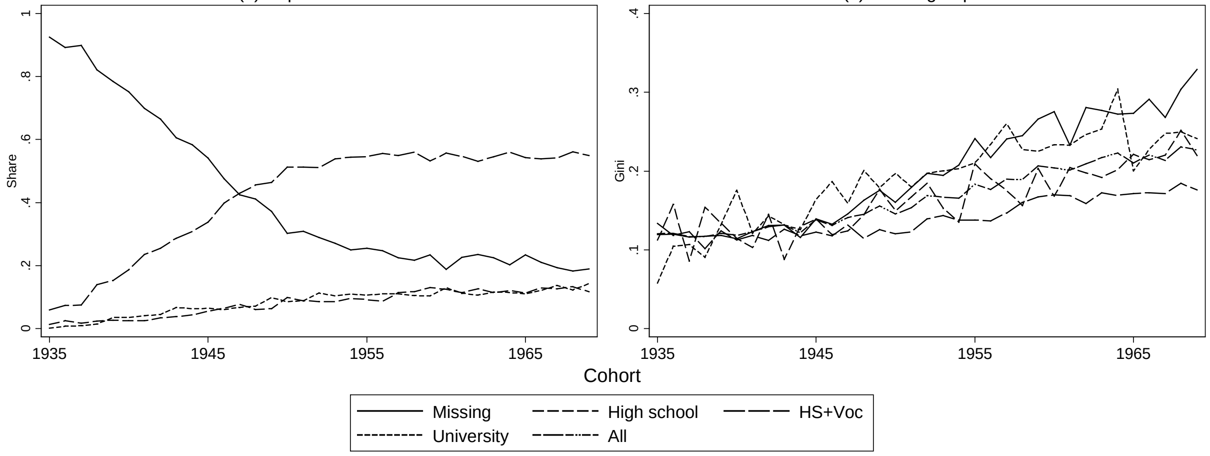
Table B4: Weighted number of observations with valid UAX-biograhpies, women

Birth cohort	Up to 40	Up to 45	Up to 50	Up to 55	Up to 60
1935	52,622	50,353	48,384	47,316	48,175
1936	53,356	52,572	53,091	49,557	51,276
1937	50,362	47,803	45,417	43,887	45,512
1938	61,887	61,498	58,893	55,125	55,975
1939	60,105	58,912	58,727	57,776	57,050
1940	64,653	64,182	64,474	66,696	69,552
1941	71,620	68,661	69,313	72,244	70,475
1942	60,512	60,087	60,867	61,635	62,068
1943	73,109	71,529	69,801	70,128	71,327
1944	69,795	70,204	70,192	69,223	68,046
1945	55,662	56,701	54,976	54,022	53,185
1946	74,109	70,441	68,875	68,793	70,248
1947	82,645	79,152	79,550	80,563	79,427
1948	83,779	83,093	83,629	83,924	83,742
1949	99,915	99,882	100,330	97,999	96,264
1950	93,323	95,009	95,676	95,400	
1951	90,938	93,035	93,411	93,860	
1952	98,684	97,226	96,700	96,101	
1953	96,190	95,506	95,110	95,126	
1954	92,391	93,927	96,216	94,149	
1955	100,683	103,887	103,634		
1956	97,569	101,439	105,649		
1957	105,207	107,349	109,690		
1958	97,649	99,741	101,691		
1959	109,672	111,108	113,736		
1960	103,066	103,457			
1961	108,367	107,331			
1962	115,887	116,899			
1963	116,896	116,696			
1964	118,184	117,276			
1965	129,950				
1966	121,063				
1967	127,507				
1968	119,226				
1969	143,057				
	3,199,640	2,554,956	1,998,032	1,453,524	982,322

Note: Number of observations for a cohort changes because of the selection criterion for valid biographies (see details in the Online Appendix).
Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using weighted data.

C. Inequality within education groups and interquantile ratios under imputation

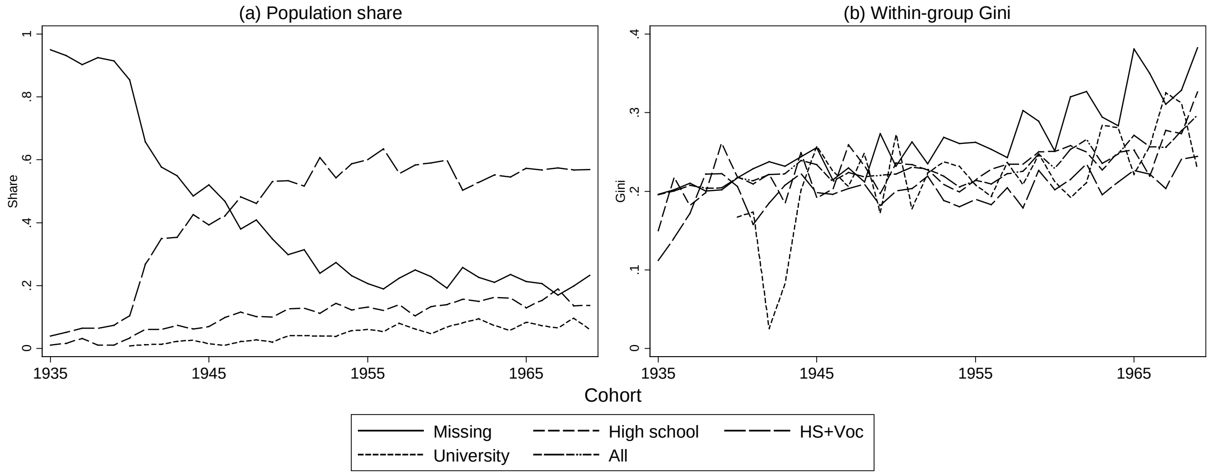
Figure C1: Population shares and inequality by education groups for cohorts 1935-1969, men



Note: Within-group Gini coefficients refer to the distributions of UA-40 with federal bond discounting.

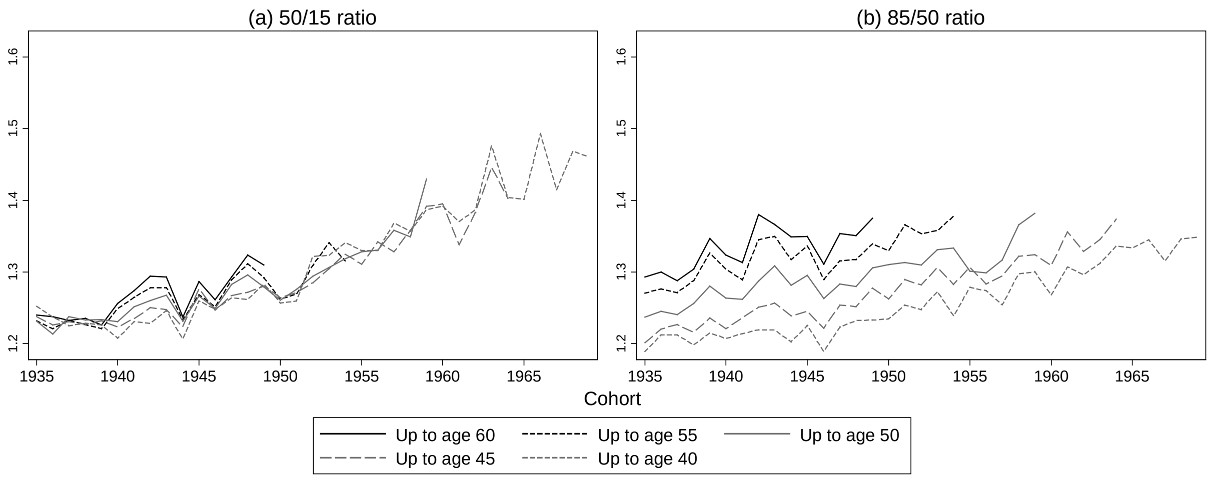
Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using weighted data.

Figure C2: Population shares and inequality by education groups for cohorts 1935-1969, women



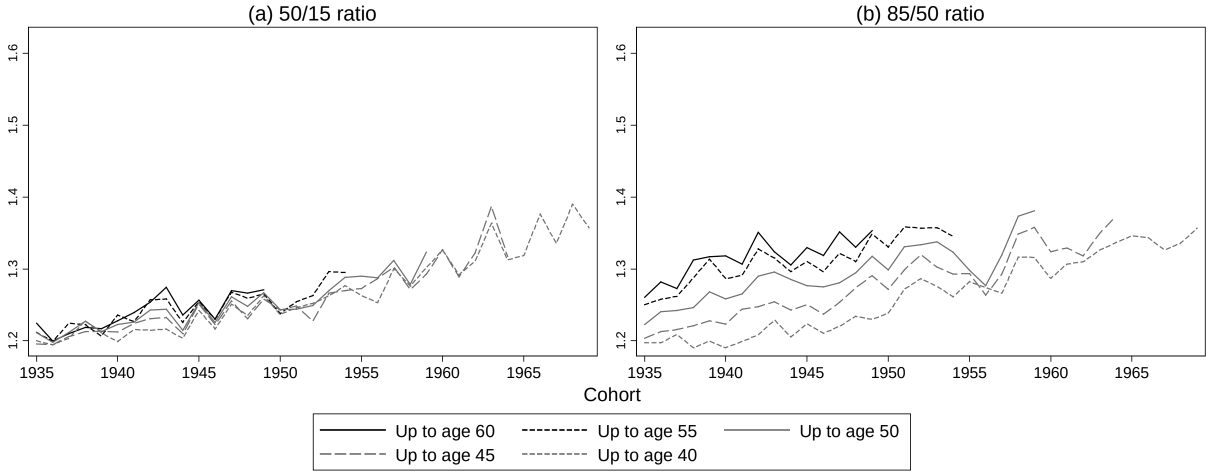
Note: Within-group Gini coefficients refer to the distributions of UA-40 with federal bond discounting.
Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using weighted data.

Figure C3: 50^{th} / 15^{th} and 85^{th} / 50^{th} ratio of UAX with imputation for registered unemployment for cohorts 1935-1969, men



Note: UAX based on federal bond discounting.
Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using weighted data.

Figure C4: 50th / 15th and 85th / 50th ratio of UAX with imputation if not employed for cohorts 1935-1969, men



Note: UAX based on federal bond discounting.
Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using weighted data.