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.

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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, the labor market generates patterns of earnings dynamics that vary across individuals, so that the evolution of inequality of long-term earnings might differ considerably 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.

This paper uses 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 distributions of earnings of individuals who were born in the same year. Intra-generational inequality of lifetime earnings is important not only because it mirrors long-term disparities in labor-market outcomes. Given the prominence of earnings as a determinant of the lifetime resources available to agents, intra-generational inequality of lifetime earnings is suggestive of inequality of permanent incomes. In turn, inequality of permanent incomes speaks of consumption inequality and is closely related to the social welfare of generations. Intra-generational inequality also matters because individuals tend to compare their earnings with those of people of similar age.[2] Finally, a cohort-based analysis of the mobility experienced over the 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.

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

[2] Pérez-Asenjo (2011).

Our empirical investigation targets the largest European economy, Germany. We exploit data on earnings biographies from social security 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? How is lifetime inequality for individuals who are currently in the middle of their career going to compare with 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. The dataset we scrutinize is a highly representative sample of the employee population in 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 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. In stark contrast, both short-term and long-term intra-generational mobility are rather stable.[3]

The rise of intra-generational lifetime earnings inequality has affected both the bottom and the top 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 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.

Our 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 mid-1930s, all three measures of long-term earnings exhibit an 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.

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[3] Lifetime earnings inequality appears to be on the rise also for women. However, their labor-market behavior tremendously changed in Germany during the last sixty years. As a consequence, our sample of women born in the 1930s is quite different from the one of women born in the 1960s and sample representativeness varies across cohorts. Therefore, we present here only an analysis of men's earnings distributions. Our findings for women are presented in the Online Appendix II of this paper. The aforementioned changes in sample composition are documented in Online Appendix I.6.

Secondly, this paper complements various analyses of how inequality has evolved in Germany over the last three decades. That literature has mainly focused on the cross-sectional distribution of wages and found that it has become more unequal over time [Gernandt and Pfeiffer (2007), Dustmann et al. (2009), Bach et al. (2009), Card et al. (2013)]. As shown by Fuchs-Schündeln et al. (2010), similar trends can also be observed for the cross-sectional distributions of household income and consumption, although they find the trend of consumption inequality to be rather flat.

Our paper adds to that literature 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 findings suggest that the burden of adjusting the German labor market to changing conditions was mainly carried by the low-skilled of the younger cohorts. They also suggest that measures of cross-sectional consumption inequality might underestimate the increase of consumption inequality in Germany. Furthermore, our investigation of age-earnings profiles confirms the importance of controlling for the age composition of the workforce when evaluating long-run changes in cross-sectional distributions.[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 much larger than those analyzed in earlier work. The main previous study 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

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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.

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]

Fourthly, our paper adds to the literature on the life-cycle variation in the association between annual and lifetime earnings.[6] We confirm Björklund's (1993) result that the correlation between annual income and lifetime income is high after age thirty-five. 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.

The next Section describes our dataset and defines 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 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. Most 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

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[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 Swedish data. An application of their methodology to correct for the life-cycle bias that uses German earnings data is Brenner (2010).

(*Versicherungskontenstichprobe*, VSKT for short) of the Federal Pension Register.[7] The VSKT 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. VSKT waves of reference years 2002 and 2004 to 2009 form the basis of our study.[8] Each sample contains the earnings biographies of the observed individuals up to the reference year. The data are collected following individuals over 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 – including naturalized immigrants with complete earnings biographies in Germany and excluding 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.[9] Furthermore, we exclude contributors for whom a consistent earnings biography cannot be reconstructed.[10] 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

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[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.

[9] West-East migration was almost inexistent before reunification; after reunification it affected a tiny share of the labor force from West Germany, see Fuchs-Schündeln and Schündeln (2009).

[10] More precisely, we only allow for an average of one month of missing information per year after the age of thirty. For further details see Online Appendix I.4.

number of individuals for each cohort that oscillates between 1,000 and 1,600 - see Appendix B, Table B1.[11]

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 individual's age and position in the earnings distribution we then adjust his earnings before 1984.[12]

Our second adjustment is the addition of the employers' social security contributions (to pension, unemployment, health, and nursing care public insurances) to the individuals' gross earnings. In first approximation, those contributions represent the value of insurance that the employees would have purchased if it had not been provided by the government. Adding those elements of pay is warranted in order to take into account the heterogeneity of insurance protection offered to the various subgroups of the working population - subgroups whose relative weights in the working population have substantially changed across cohorts.[13] 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 Online Appendix III.2, all findings remain qualitatively unaltered - in

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[11] In Online Appendix I.5.we document how many individuals are originally included in the dataset and how many remain after eliminating individuals that do not satisfy our selection criteria.

[12] See Online Appendix I.3 for further details and a robustness check. 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.

[13] Otherwise, it would be highly problematic to include in the analysis some categories of employees like miners, sailors and distinctive employees of the federal railways that have special social security arrangements. In Online Appendix I.1 we relate the evolution of contribution rates and contribution ceilings.

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.[14] 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 Pareto-distributed. Then, we estimate the corresponding Pareto-coefficient by OLS. The estimation is conducted separately for all years and birth cohorts. 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 Online Appendix III.3. They do not differ much from those obtained under our preferred rank-preserving assumption.[15]

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[14] Further information about how censoring affects our sample is provided in Online Appendix I.2. There we also provide additional information on our imputation procedure.

[15] In Online Appendix III.7 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.

In order to validate the earnings data we work with, we have compared it with the corresponding earnings data from the SOEP, i.e. earnings data that concern the same population in terms of gender, age, region, and employment status as the one we investigate. The SOEP is based on an annual survey of private households and is constructed so as to be highly representative of the total population in Germany. As shown in Appendix A, the cross-sectional earnings distributions obtained from the VSKT reproduce remarkably well those obtained from the SOEP for the same years and the two are statistically undistinguishable. Furthermore, the SOEP data reveal that the VSKT represents about 80% of the total male labor force in West Germany.

3   Inequality of Lifetime Earnings

We compute lifetime earnings from the monthly earnings an individual has received from age seventeen to age sixty.[16] 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.[17] 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 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 on German federal bonds. The Gini coefficient reaches a minimum of 0.156 for the cohort born in 1935 and peaks

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[16] For months during which no earnings are recorded (e.g. in case of unemployment or schooling) individuals are assigned zero earnings; see Online Appendix I.4 for further details.

[17] 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.

at 0.212 for the one 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 earnings for each cohort. 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. Inequality measured from annual earnings substantially overestimates the inequality of lifetime earnings, but the latter is by no means negligible.

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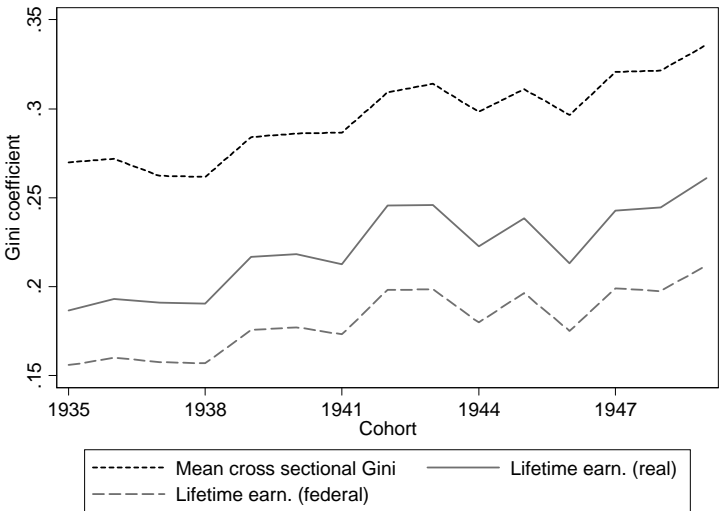

Note: "real" denotes CPI discounting, "federal" denotes federal bond discounting.
Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using weighted data.

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.[18] 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.[19]

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

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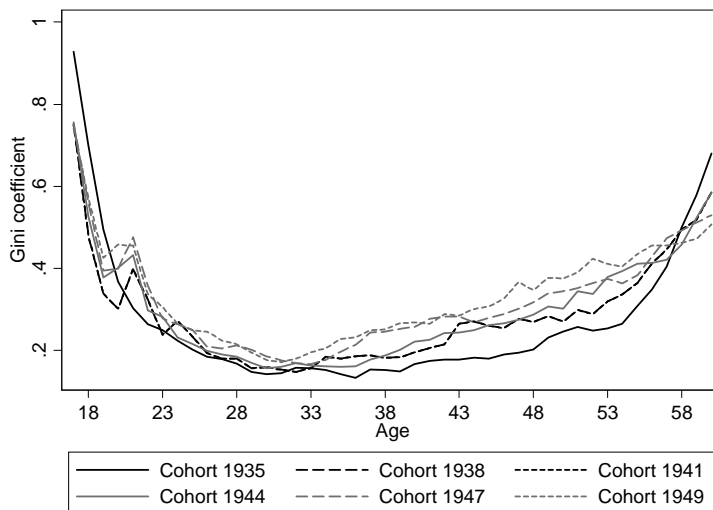
[18] Models of stochastic earnings dynamics focus on employed individuals and predict that, for any cohort, earnings inequality grows with age. See e.g. Deaton and Paxson (1994) and Huggett et al. (2011).

[19] Individuals in our sample who were born before Juli 1937 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.[20] 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
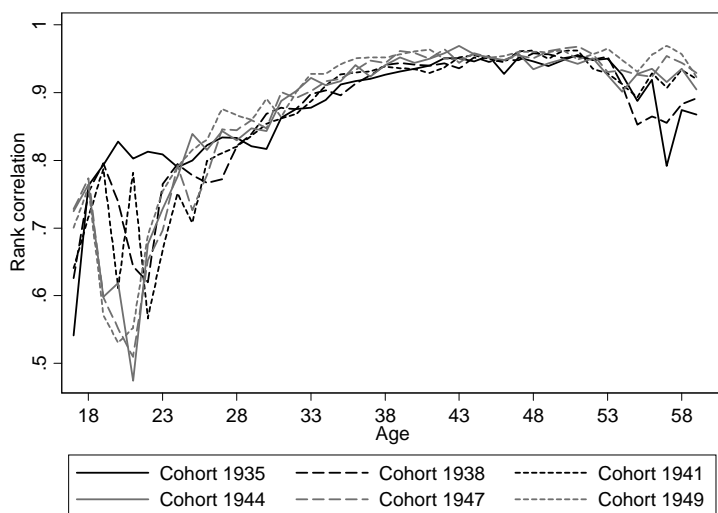
Further details on mobility are provided by the rank correlation between annual and lifetime earnings. As shown by Figure 4, there is a distinctive age pattern. When adulthood begins, annual earnings contain virtually no information about lifetime earnings as their mutual correlation is close to zero. 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 that period of the life cycle the

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[20] 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.

level of individuals' annual earnings can be considered as a good proxy of their respective lifetime earnings.[21]

Figure 4: Rank correlation of annual and lifetime earnings for cohorts 1935-1949
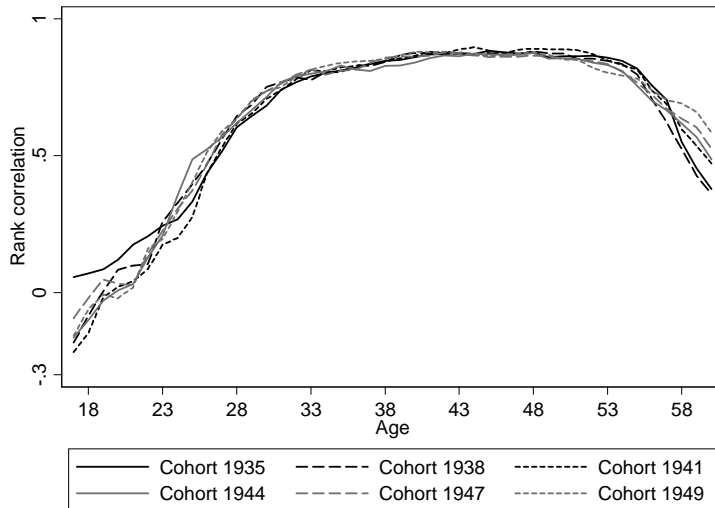
Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using weighted data.

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.

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[21] Unless stated otherwise, we shall always present the findings obtained when using the German federal bond rate as the discount rate. Online Appendix III.4 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:

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

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:

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

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

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

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

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

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 25 and 30, 26 and 31, 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 of the Gini coefficient in each five-year interval, 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, as of Eq. (3). Figure 5 shows that the change in UAX inequality as the cohort grows older is mainly driven by the progressivity effect: earnings growth is markedly pro-poor before the cohort enters its forties and switches to pro-rich thereafter. The effect from re-ranking peaks at the beginning of the life cycle and declines 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 Online Appendix III.5, the pattern revealed by Figure 5 carries over to the remaining cohorts.

Figure 5: Decomposition of changes in inequality as of Eq. (3) for cohort 1944
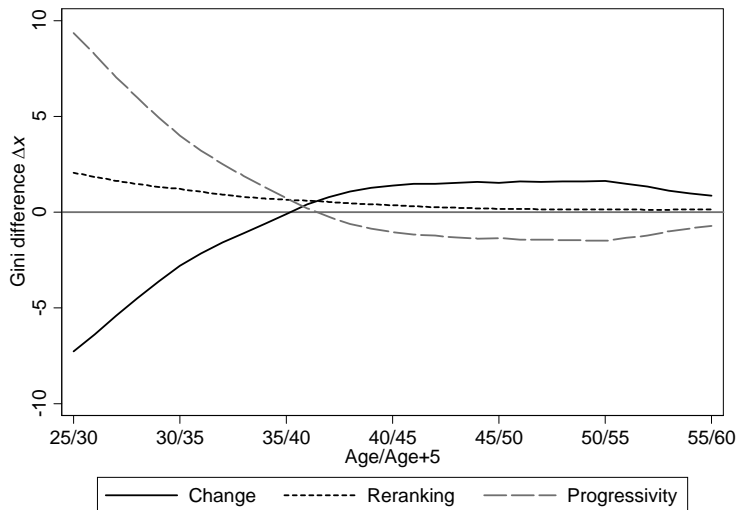
It is interesting to relate the various mobility patterns detected above to the age-earnings profiles of individuals with different educational attainments. In Figure 6 we plot those profiles for three levels of education for the pooled cohorts from 1935 to 1949. The horizontal lines depict the annualized 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.

Figure 6: Age-earning-profiles by highest educational attainment for pooled cohorts 1935-1949
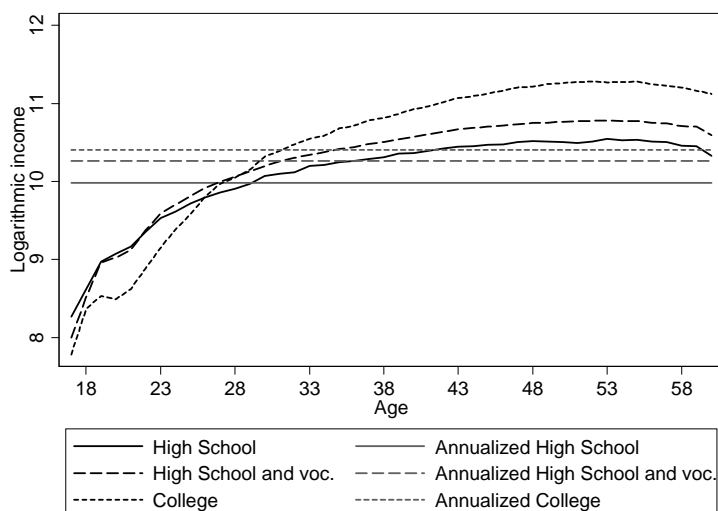
5   Evolution of Lifetime Inequality

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. 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 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). They show that Gini coefficients trend upwards for each value of

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X. This indicates that younger generations are likely to experience more intra-generational lifetime economic disparity than their statistical parents. [22]

Figure 7: Gini coefficients of UAX for cohorts 1935-1969
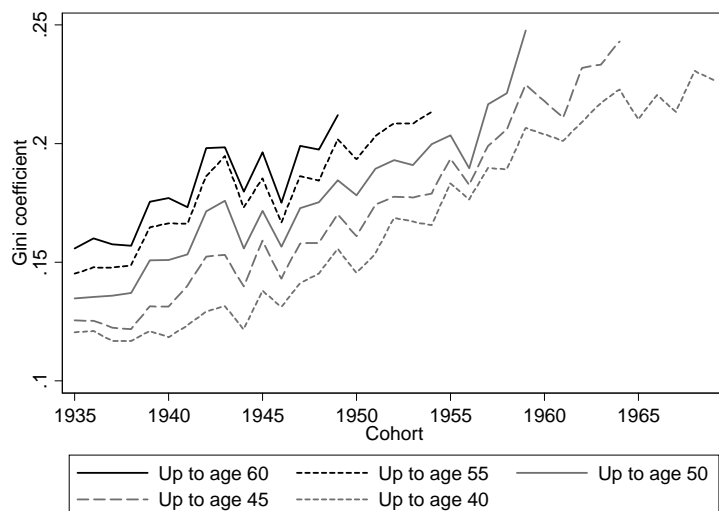
Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using weighted data.

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 %.

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 85th quantile and the one at the 15th quantile.

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

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[22] Statistical inference shows that the observed trend of increasing inequality is significant. Confidence intervals for UAX Ginis are provided in Online Appendix III.1.

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 $X \geq 40$. 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: 85th / 15th ratio of UAX- earnings for cohorts 1935-1969
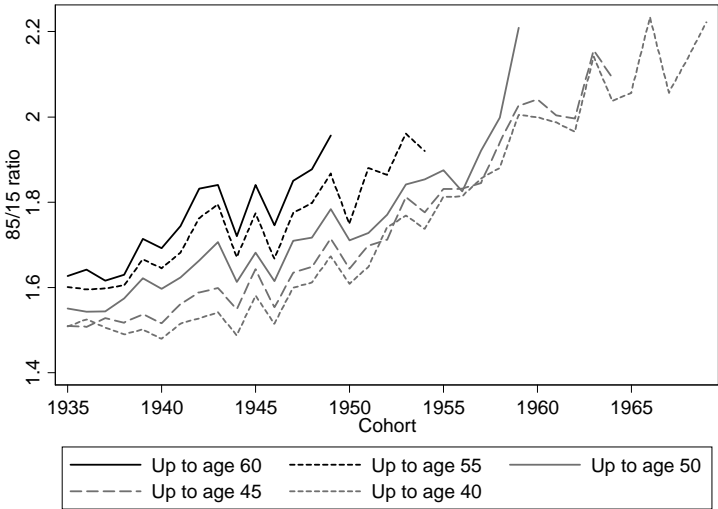
Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using weighted data.

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.[23]

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.

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[23] See Online Appendix III.6.

Figure 9: Gini coefficients of annual earnings at various ages for cohorts 1935-1969
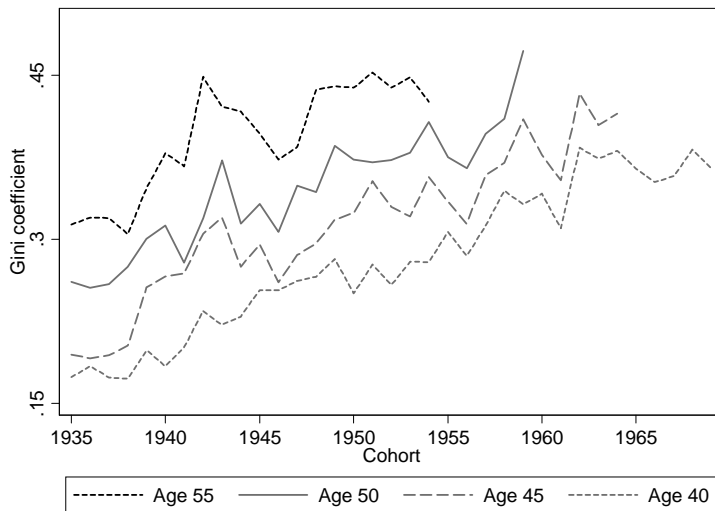
The rise of intra-generational inequality concerns all education groups that can be identified within our dataset. As shown in Appendix D, within-group inequality of the UAX distribution is systematically higher for the younger cohorts. This suggests that the increase in lifetime inequality is not simply driven by the expansion of tertiary education.[24]

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.

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[24] This finding should be taken with some caution as 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.

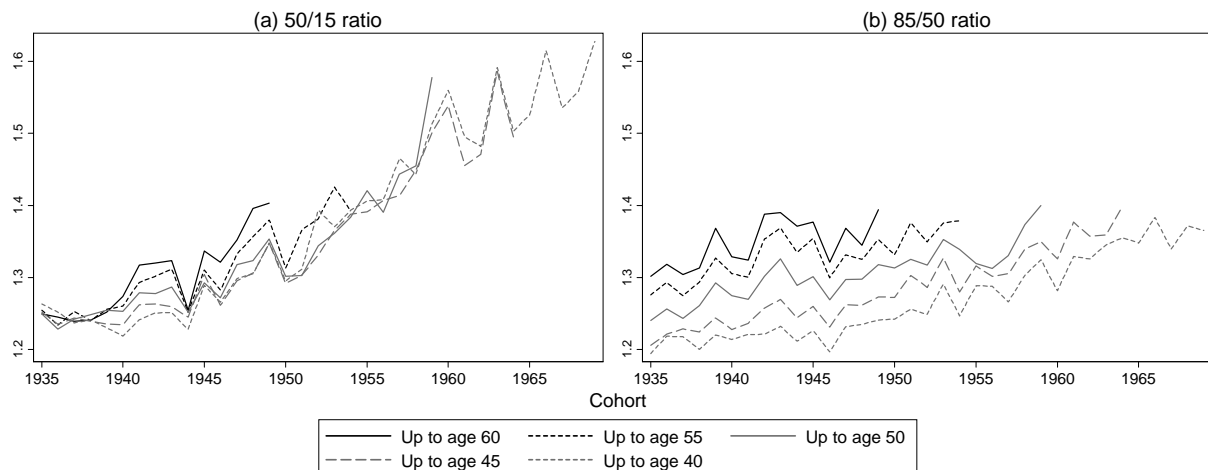Figure 10: Rank correlation of UA-40 with selected UAX for cohorts 1935-1969
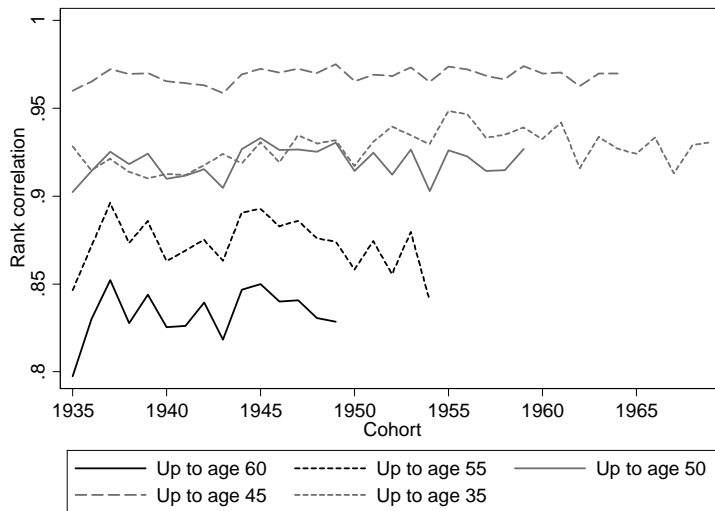
5.2 Proximate causes

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. 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 Online Appendix III.5. 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

(a) 50/15 ratio | (b) 85/50 ratio

Up to age 60 — Up to age 55 — Up to age 50
Up to age 45 — Up to age 40

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

The second step of our analysis is a decomposition of the inequality increase into a part due to increased wage dispersion and one due to longer unemployment spells. The first part refers to months with strictly positive earnings while the second one refers to months with zero earnings. The interest of this decomposition lies in the distinctive temporal pattern exhibited by the unemployment rate in West Germany. Until the first oil shock, 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 by the rise of unemployment.[25]

Figure 12 plots for each cohort the average number of months spent in employment, registered unemployment, and other ways during the life span that goes from age seventeen to age forty. The residual category "Other" mainly includes periods of education and of community or military service as well as periods 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

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[25] During the last three decades, the unemployment rate of individuals with a low educational attainment has usually been at least twice the average unemployment rate [Reinberg and Hummel (2007)].

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.[26]

The findings shown in Figure 12 fit well with the notion that the rise of unemployment after the first oil shock severely hit workers with low skills. Moreover, the Figure reveals that low-skilled unemployment was very unevenly distributed across cohorts, with the younger generations carrying most of the burden. This is consistent with the view that hiring and firing costs entail a higher unemployment risk for the entrants in the labor market than for the incumbents.

Figure 12: Months of employment status up to age forty by quartile of UA-40 for cohorts 1935-1969
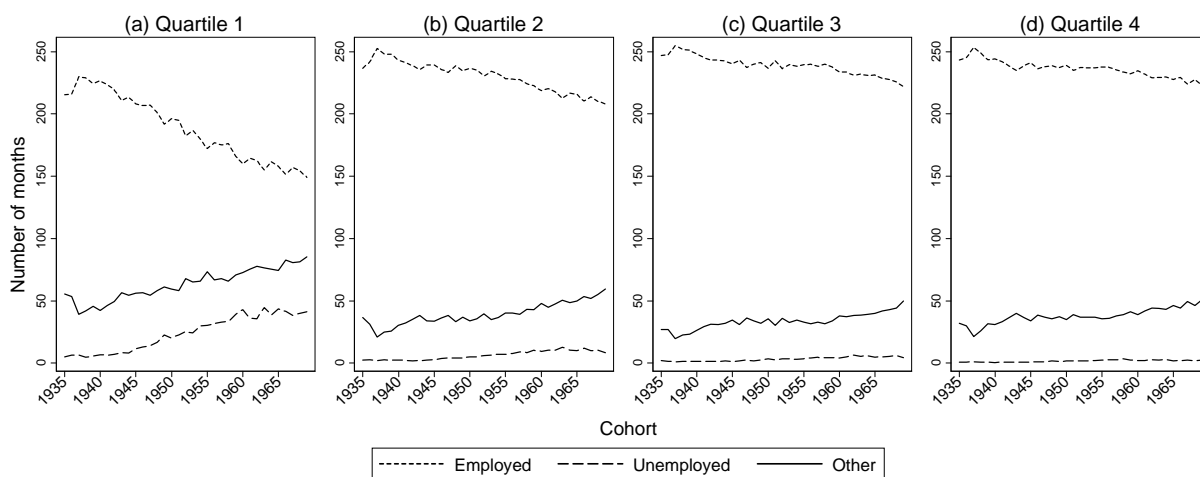
Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using weighted data.

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

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[26] The same striking difference obtains if one only considers the spells of unemployment after age twenty-five. See Online Appendix III.6.

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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 full-employment scenarios by imputing earnings when individuals have none in the original data. The imputed value for an individual is the last level of strictly positive monthly earnings that is observed for that individual.[27] Two full-employment scenarios are considered. In one, earnings are imputed only for the months during which an individual was registered as unemployed. In the other, earnings are imputed for all months in which an individual was not in employment. This is based on the notion that protracted periods of education and in the military and periods of missing information may mirror the inability to find a job.

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[27] In cases where no previous strictly positive individual earnings are observed, we impute retrospectively the first level of strictly positive 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.

Figure 13: Gini coefficients of UA-40 and UA-60 with and without earnings imputation in case of unemployment
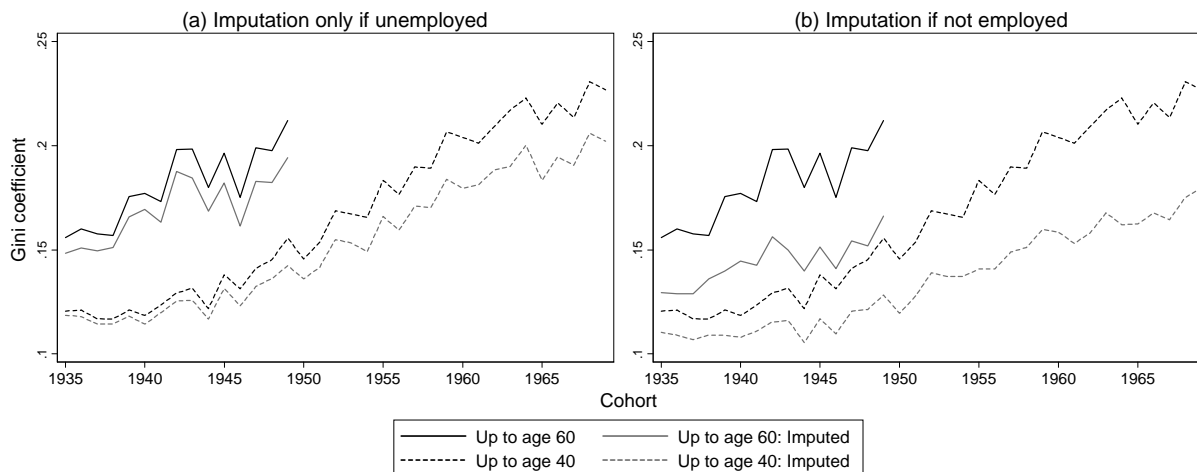
Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using weighted data.

Figure 13 compares the inequality of lifetime earnings and UA-40 for the various cohorts with the corresponding inequality under the counterfactual of full employment.[28] It shows 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 relatively small impact on the Gini coefficients of UAX for the older generations, it substantially lowers them for the younger generations.

To illustrate our results, one may again consider 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 actual growth rate of UA-45 inequality between the two cohorts. This suggests that the unequal evolution of unemployment spells for

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[28] The results for the inequality of UA-45, UA-50 and UA-55 are presented in Appendix C, Figure C1.

individuals at different points of the earnings distribution contributes to explain some 20 to 40 percent of the secular rise of lifetime earnings inequality.[29]

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 C, imputation has little impact on the 85th / 50th ratio while it substantially decreases the 50th / 15th ratio. By way of an example, the 50th / 15th 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.[30]

The remaining 60 to 80 percent of the secular rise of intra-generational lifetime earnings inequality can be attributed to the evolution of the cohort-specific wage structure, i.e. the distribution of strictly positive monthly earnings received by a cohort. Unfortunately, our dataset does not contain information about working time, so that 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.[31]

Cohort-specific unemployment and wage structure may be related to their cross-sectional counterparts. As mentioned in the Introduction, several studies have found that cross-sectional wage rates have become more unequal in West Germany during the last decades. According to

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[29] 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. Online Appendix IV shows that this approximation is exact if a plausible symmetry assumption is made.

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

[31] 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.

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 – in particular, declining union power – and labor supply shocks – in particular, immigration waves – are seen as key drivers of the growth of wage inequality at the bottom. Labor market institutions are also frequently blamed for the rise of unemployment in West Germany since the mid-1970s, although views differ on the relative importance of shifts in unemployment compensation, employment protection and union power [Hunt (1995), Nickell et al. (2005)].

The way in which those factors may enter an explanation of the rise of intra-generational lifetime earnings inequality is a priori unclear and merits an in-depth investigation that is beyond the scope of this paper. For instance, it remains to be seen whether skill-biased technological change significantly increased cohort-specific inequality in spite of the expansion of education. As we document in Appendix D, West German baby boomers have benefitted from substantially more schooling than their parents' cohorts.

Cohort size is another dimension with respect to which the cohorts in our sample substantially differ, which makes it a natural candidate for explaining the rise of cohort-specific inequality. In Appendix B we show that cohort size in the year the cohort turns forty displays a non-monotonic pattern. It displays a local maximum for the 1940-cohort, a global minimum for the 1945-cohort, and a global maximum for the 1964-cohort. There is no one-to-one relationship between cohort size and cohort-specific inequality. The Gini coefficient of UA-40 strongly increases both during the years 1940-1945, when cohort size shrinks, and during the years 1945-1964, when cohort size grows. It does not change much neither during the years 1935-1940 (of growing cohort size) nor during the years 1964-1969 (of shrinking cohort size).

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 analysis has begun to shed some light on the proximate causes of the rise of intra-generational inequality in lifetime earnings. Longer unemployment spells, mainly affecting workers at the bottom of the distribution of younger cohorts, account for some 20 to 40 percent of the overall increase in lifetime earnings inequality. The remaining 60 to 80 percent is due to an increase in cohort-specific wage dispersion. While our decomposition of the rise of intra-generational inequality is just a first pass, we believe that the results of this paper convincingly demonstrate the benefits in terms of insights into the workings of the labor market that can be gained from following a cohort-based approach.

From the generation born immediately before World War II to the baby boomers of the 1960s, the German labor market has generated much more lifetime earnings inequality. The potential implications of this fact are far-reaching. By itself, such an increased heterogeneity in

terms of labor-market outcomes might have a significant impact on cultural and political attitudes by weakening people's feeling of sharing a common fate. Through its effect on the distribution of lifetime consumption, the increase in lifetime earnings inequality might substantially affect the social welfare of generations. Examining those potential implications in detail is an important task of future research.

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Appendix

A. Representativeness of VSKT as assessed through the SOEP

Figure A1. Comparison of Kernel density estimates for annual earnings distributions of men
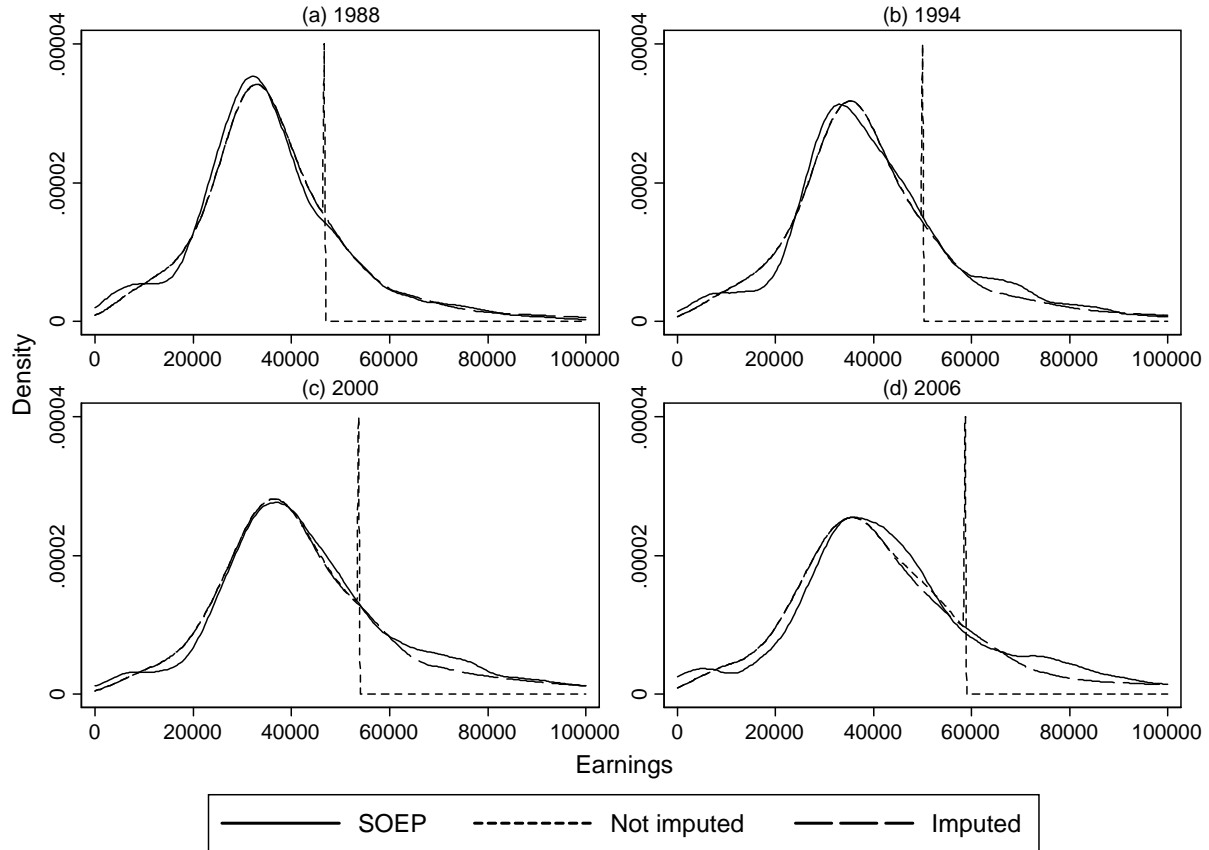
Note: "Not imputed" denotes estimates based on original VSKT data, "imputed" denotes estimates based on the VSKT after applying our imputation method; all earnings include employer's social security contributions. Population composition of the SOEP mirrors the one of the VSKT with respect to age, gender, region of residence, citizenship, 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: Male labor force in West Germany for selected years, SOEP

Year	1988		1994		2000		2006	
Age range	20-53		25-59		31-59		37-59	
Labor force status	Observations	%	Observations	%	Observations	%	Observations	%
Employed[A]	10,078,221	70.07	11,343,612	70.35	9,871,416	72.87	7,733,104	71.4
Unemployed[A]	716,579	4.98	1,145,635	7.1	732,898	5.41	808,084	7.46
Apprentice[A]	462,953	3.22	76,840	0.48	22,960	0.17	3,727	0.03
Miner[A]	84,576	0.59	101,913	0.63	90,558	0.67	19,925	0.18
Com./Military service[A]	304,337	2.12	17,443	0.11	0	0	0	0
Sum of items above[A]	11,646,666	80.99	12,685,443	78.67	10,717,832	79.12	8,564,840	79.08
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
Total	14,382,526	100.00	16,125,344	100.00	13,547,051	100.01	10,830,058	100.00

Note: Sample selection mirrors the respective birth cohorts in our deployed FDZ-RV − VSKT2002, 2004-2009_Bönke data.
[A]Labor force covered in the VSKT.
Source: SOEP v28, own calculations using weighted data.

B. Number of observations in our sample

Table B1: Number of observed men with valid UAX-biographies

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 with age because of the selection criterion for valid biographies (see details in Online Appendix I.5).
Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using unweighted data.

Table B2: Weighted number of observations with valid UA-40 biographies, men

| Birth cohort	Observations with valid UA40-biographies (weighted)	Actual cohort size at age 40			
		without foreigners		including foreigners	
		size	coverage[A]	size	coverage[A]
1935	214,783	431,149	0.4982	474,200	0.4529
1936	217,551	436,191	0.4988	481,363	0.4519
1937	207,309	438,432	0.4728	484,576	0.4278
1938	221,022	463,038	0.4773	512,694	0.4311
1939	245,519	489,539	0.5015	541,907	0.4531
1940	233,767	491,013	0.4761	548,271	0.4264
1941	216,453	454,854	0.4759	505,586	0.4281
1942	172,882	366,390	0.4719	419,750	0.4119
1943	175,621	374,491	0.4690	423,065	0.4151
1944	173,017	361,344	0.4788	405,798	0.4264
1945	126,931	263,183	0.4823	308,797	0.4110
1946	162,292	308,837	0.5255	358,143	0.4531
1947	178,106	348,759	0.5107	400,945	0.4442
1948	188,304	372,573	0.5054	425,099	0.4430
1949	201,483	398,952	0.5050	450,614	0.4471
1950	210,781	.	.	455,050	0.4632
1951	202,075	.	.	453,496	0.4456
1952	207,547	.	.	466,666	0.4447
1953	198,846	.	.	462,634	0.4298
1954	218,223	.	.	480,666	0.4540
1955	218,160	.	.	491,565	0.4438
1956	232,274	.	.	512,988	0.4528
1957	237,176	.	.	526,243	0.4507
1958	242,756	.	.	535,051	0.4537
1959	258,979	.	.	559,580	0.4628
1960	267,044	.	.	578,547	0.4616
1961	267,736	.	.	593,879	0.4508
1962	279,379	.	.	607,311	0.4600
1963	276,530	.	.	629,334	0.4394
1964	280,680	.	.	636,891	0.4407
1965	282,497	.	.	628,727	0.4493
1966	283,604	.	.	624,951	0.4538
1967	288,091	.	.	608,938	0.4731
1968	277,011	.	.	593,330	0.4669
1969	261,663	.	.	562,571	0.4651

Note: Cohorts 1935 – 1949: West Germany includes West Berlin; cohorts 1950 – 1969: West Germany includes Berlin.
[A]Coverage equals the number of observations with valid UA-40 biographies (weighted) divided by actual cohort size at 40.
Source: FDZ-RV − VSKT2002, 2004-2009_Bönke. Actual cohort size at age 40 according to Federal Statistical Office, own calculations using weighted data.
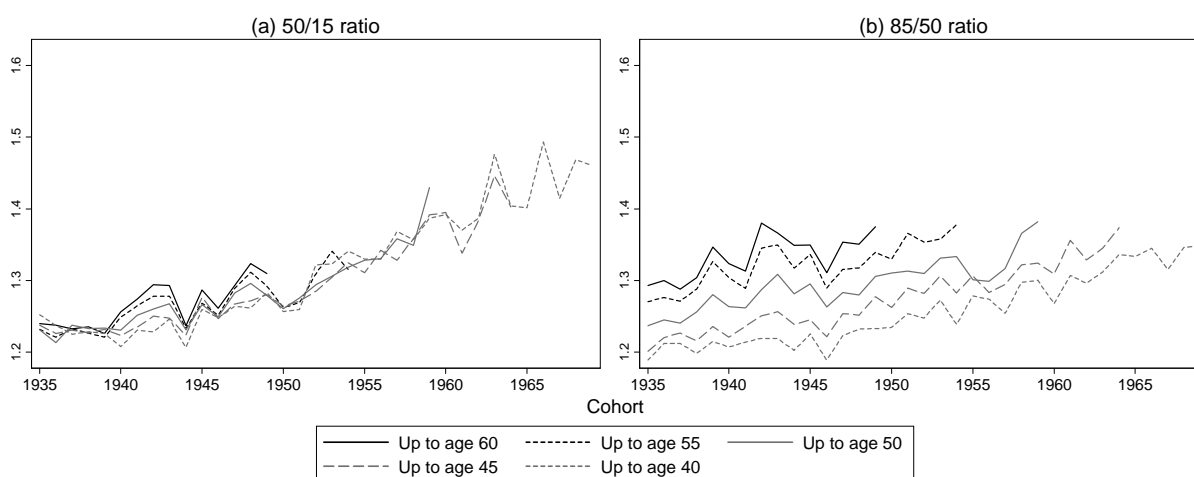
C. Effects of earnings imputation in case of unemployment

Figure C1: Gini coefficients of various UAX with earnings imputation if individual is not employed
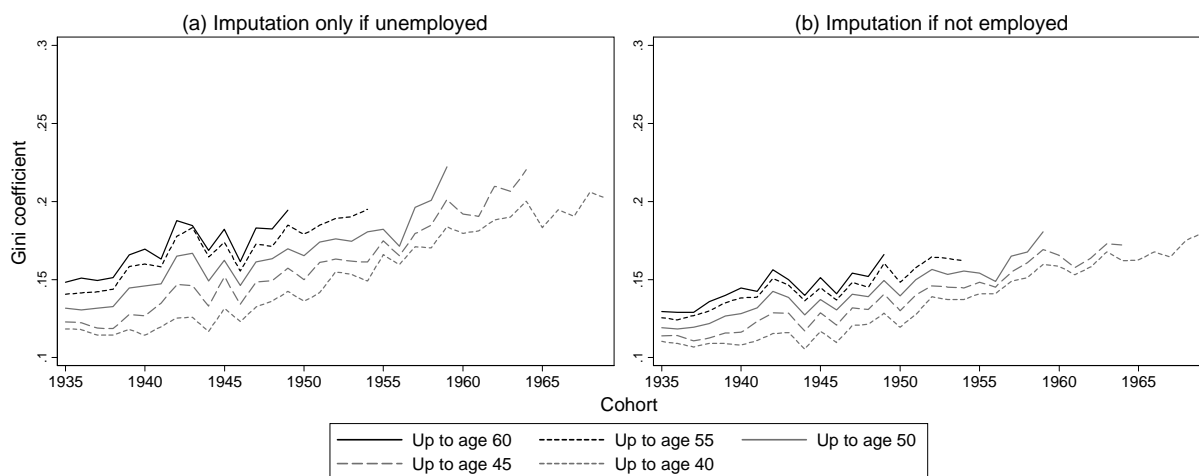
Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using weighted data.
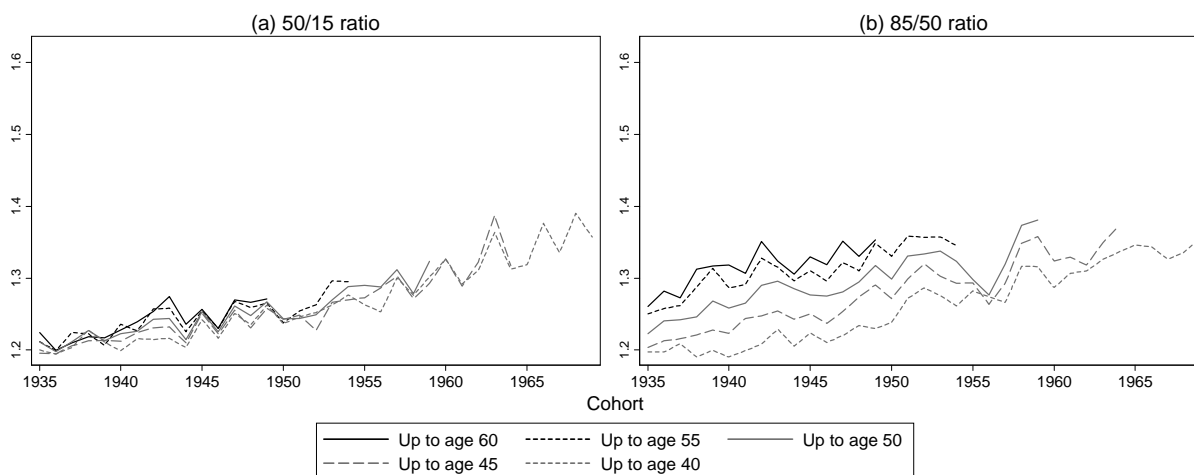
Figure C2: 50th / 15th and 85th / 50th ratio of UAX with imputation for registered unemployment

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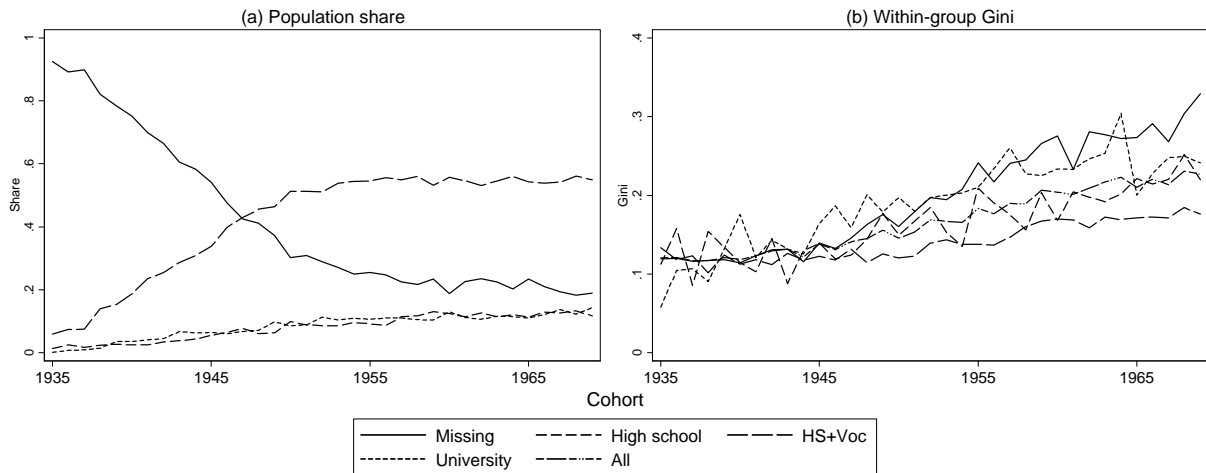Source: FDZ-RV − VSKT2002, 2004-2009_Bönke, own calculations using weighted data.

Figure C3: 50th / 15th and 85th / 50th ratio of UAX with imputation if not employed

D. Educational attainment and inequality across cohorts

Figure D1: Educational attainment and inequality in our sample

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 D.2: Educational attainment of cohorts of West German men according to the SOEP
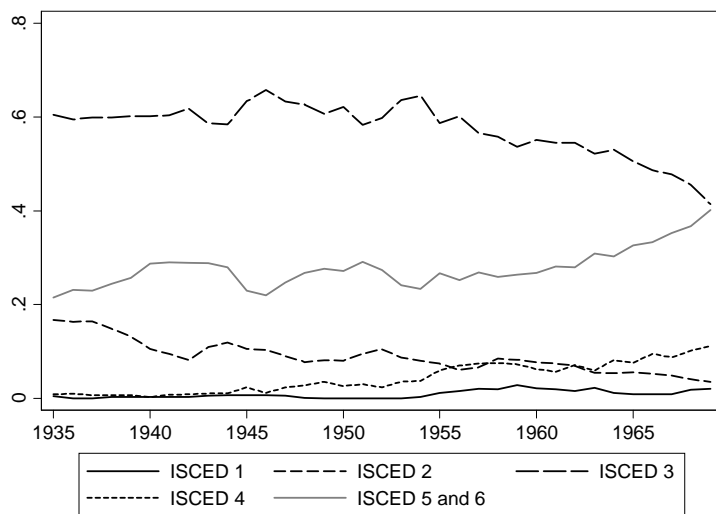
Note: The education groups are defined according to the International Standard Classification of Education 1997 (ISCED-97):
ISCED 1: Primary education; ISCED 2: Lower secondary education; ISCED 3: Upper secondary education; ISCED 4: Post-secondary non-tertiary education; ISCED 5/6: Tertiary education. All cohorts born after 1944 are analyzed at age 40. Since the SOEP starts in 1984, older cohorts are analyzed at the closest distance to age 40, e.g. age 45 for those born in 1939.
Source: SOEP v28, own calculations using weighted data.