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Christian Scharrer

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Christian Scharrer

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Christian Scharrer*

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Abstract

This paper studies the age-group-specific evolution of inequality of total income among highly and less educated females and males at ages 26–80 from 2005 to 2018 in the US. On the one hand, it presents time series of Gini coefficients and associated decompositions by different income components. On the other hand, it investigates the extent to which changes in Gini coefficients were associated with a redistribution of total income between the bottom 40 percent, the middle class, and the top 10 percent. The results indicate that increases in inequality particularly burdened the youngest age groups in the bottom 40 percent. However, older age groups, especially elderly individuals, from the middle class also contributed to the increasing income shares of the top 10 percent.

Keywords: Inequality, Total Income, Age Groups, Gini Coefficient, Income Shares
JEL Codes: D63, P10, J11

*University of Augsburg, Department of Economics, Universitätsstraße 16, 86159 Augsburg, Germany; e-mail: christian.scharrer@wiwi.uni-augsburg.de.

1 Introduction

The study of income and wealth inequality is of fundamental importance in economic research because unequal distributions of capital and labor income constitute one of the most important challenges of our time. In their seminal paper, Piketty and Saez (2003) provide empirical evidence that the pretax income shares of the top 10 percent followed a U-shaped pattern in the US over the last century. Moreover, according to their latest data covering the years 1913–2018, these shares further increased.[1] For example, with respect to market income, excluding government transfers and capital gains, the shares of the top 10 percent rose from 42.23% in 2001 to 47.78% in 2018. Specifically, the associated academic and public debates intensified after the publication of Capital in the Twenty-First Century by Piketty (2014). The book also presents historical data consistent with the pioneering works of Kuznets and Jenks (1953) and Atkinson and Harrison (1978). These data show that the concentrations of income and wealth have increased during the last decades. Furthermore, Saez and Zucman (2020) found that the annual growth of pretax income was very unevenly distributed between 1980 and 2018. The average annual growth rate amounted to only 0.2% up to the 50th percentile, whereas adults at the very top of the income distribution faced explosive growth rates. These findings have been supported by many other studies. Kuhn et al. (2020) show, for example, that the share of total household income accruing to the top 10 percent increased from 34.5% in 1950 to 47.5% in 2016, while the Gini coefficient of total household income rose from 0.44 to 0.58 over the same period. Moreover, Hoffmann et al. (2020) find that the standard deviations of labor and total income for both females and males strongly increased between 1975 and 2018.

The vast majority of studies on trends in income inequality focus on the total population of households, individuals, or tax units. However, individual income profiles follow a hump-shaped pattern over the life cycle and, in particular, differ by gender and education:[2] Incomes are low at a young age, increase until middle age, and decrease at more advanced ages. The resulting inherent inequality contributes to the total inequality in a population and is a natural consequence of income differences between population subgroups at different life cycle stages, which can be justified to a certain extent in a society. Thus, we should also be more concerned about the evolution of inequality in different age groups

[1] Source: https://eml.berkeley.edu/~saez/ (accessed June 8, 2022).

[2] See, for example, Attanasio et al. (1999), Bosworth et al. (2000), and Gourinchas and Parker (2002).

to detect important changes in intra- and intergenerational inequality over time.[3] Moreover, population subgroups respond quite differently to economic shocks. For example, workers are better able to deal with higher economic risks by changing their labor supply and savings rates, whereas retirees can only adjust their savings rate. In contrast, the total income of young individuals mainly consists of labor income, whereas Social Security benefits, as well as asset and pension incomes, represent the primary income sources for elderly individuals. As a consequence, changes in income sources also have different impacts on the inequality of different age groups. For these reasons, it is also very important to study how age-specific inequality of total income evolves and how changes in different income sources contribute to the associated changes in inequality over time. Furthermore, a stable middle class is often considered a stabilizing factor in politics and economics. For example, Easterly (2001) provides empirical evidence that higher income shares of the middle class are linked to higher per capita income and higher economic growth, as well as other desirable developments such as better health, better economic policies, or less political instability. Therefore, it is crucial to determine whether age-specific changes of inequality are associated with an income redistribution between the bottom 40 percent, the middle class in the lower 40–90 percent, and the top 10 percent in the corresponding age groups. The answers to these questions will allow us to obtain a clearer and more accurate picture of inequality trends by age, which, in turn, affect the total inequality in a population, while they improve our understanding of income inequality and its sources.

To address these questions, I use data from the American Community Survey (ACS) and study the evolution of total income inequality in different age groups between 2005 and 2018, especially during the Great Recession (2007–2009). These age groups either comprise highly or less educated females or males at ages 26–80 split into 5-year age bins. Such empirical studies of heterogeneous agents are usually very difficult to implement because the sample sizes of most surveys tend to be much too small, which severely limits the validity of the results. In contrast, the ACS interviews more than 2.8 million individuals per year, such that its huge sample size allows us to study the trends of total income inequality, measured by the Gini coefficient, of individuals by sex, educational level, and, in particular, age, simultaneously.

In the first part of this paper, following Mookherjee and Shorrocks (1982), Lerman and Yitzhaki (1985), and Lambert and Aronson (1993), I decompose the trends of age-group-specific Gini coefficients by different income sources, where I also explicitly take the contri-

[3] See, for example, Atkinson (1971), Deaton and Paxson (1994), and Heathcote et al. (2005).

bution of individuals with a total income of zero to inequality into account. The inclusion of a zero income component is particularly important because both this income component and higher contributions of wage incomes to inequality explain large parts of the observed increases of Gini coefficients among females with low levels of education and males in most young and prime age groups during and especially after the Great Recession. In contrast, asset incomes primarily increased the inequality of elderly individuals, especially among females and males with low levels of education in the age groups 71–75 and 76–80, between 2005 and 2008. Thereafter, however, this income component contributed to a lower level of inequality among elderly individuals, but the observed declines of Gini coefficients were only temporary. Its negative contributions to inequality faded and/or were increasingly outweighed by higher contributions of other income components, so the inequality increased again up to 2018. The second part of this paper investigates the extent to which the observed age-group-specific changes of Gini coefficients of total income were associated with a redistribution between the bottom 40 percent, the middle class in the 40–90 percent range, and the top 10 percent. Therefore, I first present the age-group-specific time series of income shares for these income classes and then examine the corresponding empirical relationships with the Gini coefficients of these age groups. The results, among others, indicate that the observed increases in Gini coefficients were significantly associated with a redistribution from both the bottom 40 percent and the middle class to the top 10 percent in the oldest age groups of 71–75 and 76–80 years, irrespective of educational level and gender. Moreover, among younger age groups in the bottom 40 percent, increases in inequality resulted in more pronounced declines of their income shares.

In addition to the aforementioned studies, this paper primarily builds on works by Lerman and Yitzhaki (1985), Hungerford (2020), Zewde and Crystal (2021), and Piketty et al. (2018). Lerman and Yitzhaki (1985) show that the contributions of a given income source to the overall inequality of total income is given by the product of the respective Gini coefficient of this income source, its share in total income, and its correlation with the rank of total income. In the corresponding empirical part, they use data from the March Current Population Survey and find that wage incomes of family heads explained approximately 59% of total inequality in 1980. Hungerford (2020) uses longitudinal data provided by the Health and Retirement Study at the University of Michigan and investigates the evolution of income inequality between 1994 and 2012 with respect to the HRS 1931–41 birth cohort. In contrast to many other studies, for example Deaton and Paxson (1994), Crystal and Waehrer (1996), or Crystal et al. (2016), he finds that the Gini coefficients of total income remained relatively constant and fluctuated only weakly around an average value of 0.49 as

this cohort aged. Moreover, he shows that Social Security benefits and other transfers were able to decrease the inequality among the elderly because these income sources accounted for 38% of total income but only explained 11% of total inequality in 2012. Zewde and Crystal (2021) create a pseudopanel with data from the Survey of Consumer Finances and show that the Gini coefficients of size-adjusted household income of cohorts in their primary working years (Generation-X and Baby Boomers) increased between 2007 and 2016. In contrast, the inequality among younger millennials who were aged 18–27 in 2007 and 27–36 in 2016 decreased over this period. Regarding the US, Piketty et al. (2018) build distributional national accounts by combining tax, survey, and national account data. The authors find that the pretax income shares of the bottom 50 percent declined from 20% in 1980 to 12% in 2014, while the shares of the top 1 percent strongly increased from 12 to 20%. The associated average pretax income of the bottom 50 percent declined by 20 and 8% among adults aged 20–45 and 46—65, respectively.

The remainder of this paper is organized as follows. Section 2 describes the data used in this study. Section 3 outlines the decomposition of age-group-specific Gini coefficients and presents the corresponding results for females and males with high and low educational levels. Section 4 studies the relationships between the Gini coefficients and income shares in different age groups before Section 5 concludes.

2 Data

I use data from the 1-year public use micro-data sample of the ACS provided by the Integrated Public Use Microdata Series (IPUMS) USA, see Ruggles et al. (2021). The ACS is the largest household survey in the US and has been fully implemented by the US Census Bureau since 2005. This survey provides annual social, economic, housing, and demographic data about more than 2.8 million individuals. For that reason, its large sample size allows us to study the evolution of total income inequality among individuals simultaneously by age, sex, educational level, and several income components over time.

In this paper, I define the total income of an individual as the sum of six income components: wage and salary income (WI), business and farm income (BI), Social Security benefit income (SSBI), asset income (AI)[4], retirement income (RI) from pensions excluding Social

[4] Note that the ACS does not provide data on realized capital gains. However, Piketty and Saez (2003) point out on page 6 that "realized capital gains are not an annual ow of income (in general, capital gains are realized by individuals in a lumpy way) and form a very volatile component of income with

Security, and other income (OI) from sources not included in the previously mentioned income types.[5] Table 1 provides the detailed definitions of these income sources.

Income Source	Definition
Wage and salary income (WI)	pretax wage and salary income including commissions, bonuses, or tips (INCWAGE)
Business and farm income (BI)	pretax self-employment income from a business, professional practice, or farm, including proprietorships and partnerships (INCBUS00)
Social Security benefit income (SSBI)	pretax income from Social Security pensions, survivors benefits, or permanent disability insurance, as well as US government Railroad Retirement insurance payments (INCSS)
Asset income (AI)	pretax income from an estate or trust, interest, dividends, royalties, and rents received (INCINVST)
Retirement income (RI)	pretax retirement, survivor, and disability pension income, other than Social Security (INCRETIR)
Other income (OI)	sum of pretax income from public assistance programs (INCWELFR), Supplemental Security Income (INCSUPP) and other sources of income (INCOTHER) like Veterans' payments, unemployment compensation, child support, or alimony, excluding lump sum payments such as money from an inheritance or the sale of a home

Table 1: Income Sources of Total Income (the variables in parenthesis in the right column denote the original IPUMS variables)

Moreover, to ensure the comparability of these income components over time, I restrict my analysis to the 2005–2018 ACS samples.[6] For confidentiality reasons, some income compo-

large aggregate variations from year to year depending on stock price variations." For that reason, the exclusion of capital gains is only a minor point of criticism, which is also present in many other studies. See, for example, Burkhauser et al. (2012), Alvaredo et al. (2013), or Hoffmann et al. (2020).

[5] This definition of total income implies that it coincides with the total income variable INCTOT provided by IPUMS USA. Moreover, the associated questions in the ACS questionnaire refer to the previous 12 months.

[6] The ACS 2019 revised a retirement income question to include a more detailed instruction that resulted in an increase in reported retirement income. Moreover, in 2020, the COVID-19 pandemic disrupted the data collection process. Therefore, the US Census Bureau released the 2020 ACS 1-year data products with experimental weights that limit temporal comparisons. See the website "Changes to the Retirement Income Question" and "Census Bureau Releases Experimental 2020 Amer-

nents (the variables INCWAGE, INCBUS00, INCINVST, INCRETIR, and INCOTHER in Table 1) with values above the 99.5th percentile in the state of residence are top-coded as the state's mean of values above the threshold. Note that top-coding generally limits the examination of income distributions. Larrimore et al. (2008) and Burkhauser et al. (2011) show, however, that cell-mean series, which provide the mean income of all top-coded individuals, alleviate this problem. In particular, Larrimore et al. (2008) calculate Gini coefficients of total household income with data from the March Current Population Survey for the years 1976 to 2007, when the total income is also top-coded by income source. On page 116, they conclude that cell-mean series provide "a consistent way of capturing inequality as measured using the internal data". For this reason, I do not trim the samples with respect to, for example, the top 1 percent.

Furthermore, I use the Gini coefficient as a measure of total income inequality and decompose it into several income components. Thus, I follow many other studies, for example Mussini (2013) or Hungerford (2020), and drop individuals reporting at least one negative value in the above income groups.[7] In addition, I exclude individuals living in group quarters or in households containing 10 or more people because the ACS disguises the age of these persons due to confidentiality concerns. To keep the analysis traceable and to facilitate visual interpretations in the figures hereinafter, I focus on individuals aged 26 to 80 years and divide each sample into eleven 5-year age groups. Finally, I define individuals with a high educational level as holding a college degree or higher, while individuals with a low educational level (LE) are those holding a high school diploma or below.

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ican Community Survey 1-Year Data", *US Census Bureau*, www.census.gov/programs-surveys/acs/technical-documentation/user-notes/2020-01.html and www.census.gov/newsroom/press-releases/2021/experimental-2020-acs-1-year-data.html (accessed April 27, 2022).

[7] The inclusion of incomes with negative values may lead to Gini coefficients larger than one, which violate the normalization principle with respect to comparisons over time. Moreover, Manero (2017) notes that the Gini decomposition formula by Lerman and Yitzhaki (1985), which I present in the next section, is inappropriate, if negative income values are taken into account.

3 Evolution of Gini Coefficients

One of the most established measures of income inequality is the Gini coefficient that ranges from zero to one if only nonnegative incomes are taken into account. A Gini coefficient of zero represents perfect equality, i.e., everyone receives the same income. In contrast, a Gini coefficient of one implies perfect inequality with only one person receiving the total income in a population. Section 3.1 explains the decomposition of the Gini coefficient used in this study before Sections 3.2 and 3.3 present the associated results for highly and less educated females and males with respect to the 2005–2018 ACS samples.

3.1 Gini Decomposition

Lambert and Aronson (1993), Mookherjee and Shorrocks (1982), and Bhattacharya and Mahalanobis (1967) show that the Gini coefficient G of total income Y can be decomposed into

$$G = G_B + \sum p_k a_k G_k + R. \tag{1}$$

The term G_B denotes the between-groups Gini coefficient, in which every income in every subgroup is replaced by its respective subgroup mean. The variables p_k and a_k represent the population and income share of subgroup k, respectively. The Gini coefficient within subgroup k is denoted by G_k, and R is a residual that is equal to zero if the subgroup income ranges do not overlap. In this study, I split the population into two subgroups: subgroup $k = 1$ consists of individuals whose total income is equal to zero ($Y = 0$) and subgroup $k = 2$ represents individuals with positive total income ($Y > 0$). These assumptions imply $a_1 = 0$, $G_1 = 0$, $a_2 = 1$, $R = 0$, and $p_2 = 1 - G_B$.[8] Hence, the associated decomposition of the overall Gini coefficient G is given by

$$\begin{aligned} G &= G_B - G_B G_2 + G_2, \\ &= Z_{\text{ZI}} + G_2. \end{aligned} \tag{2}$$

This equation shows that the Gini coefficient G depends on the between-groups Gini coefficient G_b, the within-subgroup Gini coefficient G_2 among individuals with positive total income, and a (negative) composition effect due to interactions between G_b and G_2.

[8] The mathematical derivations and proofs are provided in Yitzhaki (2002). Moreover, because I use sample weights with respect to the aggregation from sample to population values, I use the formulas for the calculation of the Gini coefficient by Lerman and Yitzhaki (1989).

Moreover, compared with studies restricted to individuals with positive total income, the term $Z_{\text{ZI}} = G_B - G_B G_2$ can be interpreted as the contribution of individuals with zero income (ZI) to overall inequality if this subgroup was additionally taken into account.

Furthermore, because total income is the sum of different income types, I follow Hungerford (2020) and decompose G_2 by different income sources using the method developed by Lerman and Yitzhaki (1985):

$$G_2 = \sum_{i \in L} Z_i = \sum_{i \in L} S_i G_i R_i, \tag{3}$$

in which the term $Z_i = S_i G_i R_i$ represents the contribution of income source i to the overall Gini coefficient G_2. This approach is particularly interesting as it provides a more detailed picture of inequality between the respective age groups. The variables S_i and G_i denote the share in total income and the Gini coefficient of income component i, respectively. The term R_i measures the "Gini correlation" between income component i and total income. To keep the analysis tractable, I divide total income into the aforementioned six categories from Section 2 such that $L = \{\text{WI, BI, SSBI, RI, AI, OI}\}$. Hence, the final total decomposition of the Gini coefficient G is given by

$$G = Z_{\text{ZI}} + Z_{\text{WI}} + Z_{\text{BI}} + Z_{\text{SSBI}} + Z_{\text{RI}} + Z_{\text{AI}} + Z_{\text{OI}}. \tag{4}$$

3.2 Gini Coefficients of Females

Figure 1 presents the age-group-specific Gini coefficients of total income of females (F) and their decompositions with respect to the income components ZI, WI, BI, SSBI, RI, AI, and OI according to equation (4). The first and second rows show the results for the 2005 and 2018 ACS samples, respectively. The corresponding left and right panels represent females with a high and a low level of education, respectively. The x-axes denote the age groups. In these panels, the absolute contributions of each income component to inequality are displayed as stacked bar plots such that the age-group-specific vertical sums are equal to the respective Gini coefficients of total income, denoted by black dots at the midpoint of each age interval. Moreover, for ease of comparison, the two stacked bar plots in the third row of Figure 1 display the corresponding absolute changes of each income component between 2005 and 2018 divided by the associated Gini coefficients of 2005 so that these plots show the contributions of each income source to overall inequality growth. This normalization is very useful as it makes the magnitude of changes more comparable

both across age groups and educational levels over time. The corresponding age-group-specific vertical sums of all income components are equal to the relative changes in Gini coefficients, which are also depicted by black dots at the midpoint of each age interval.

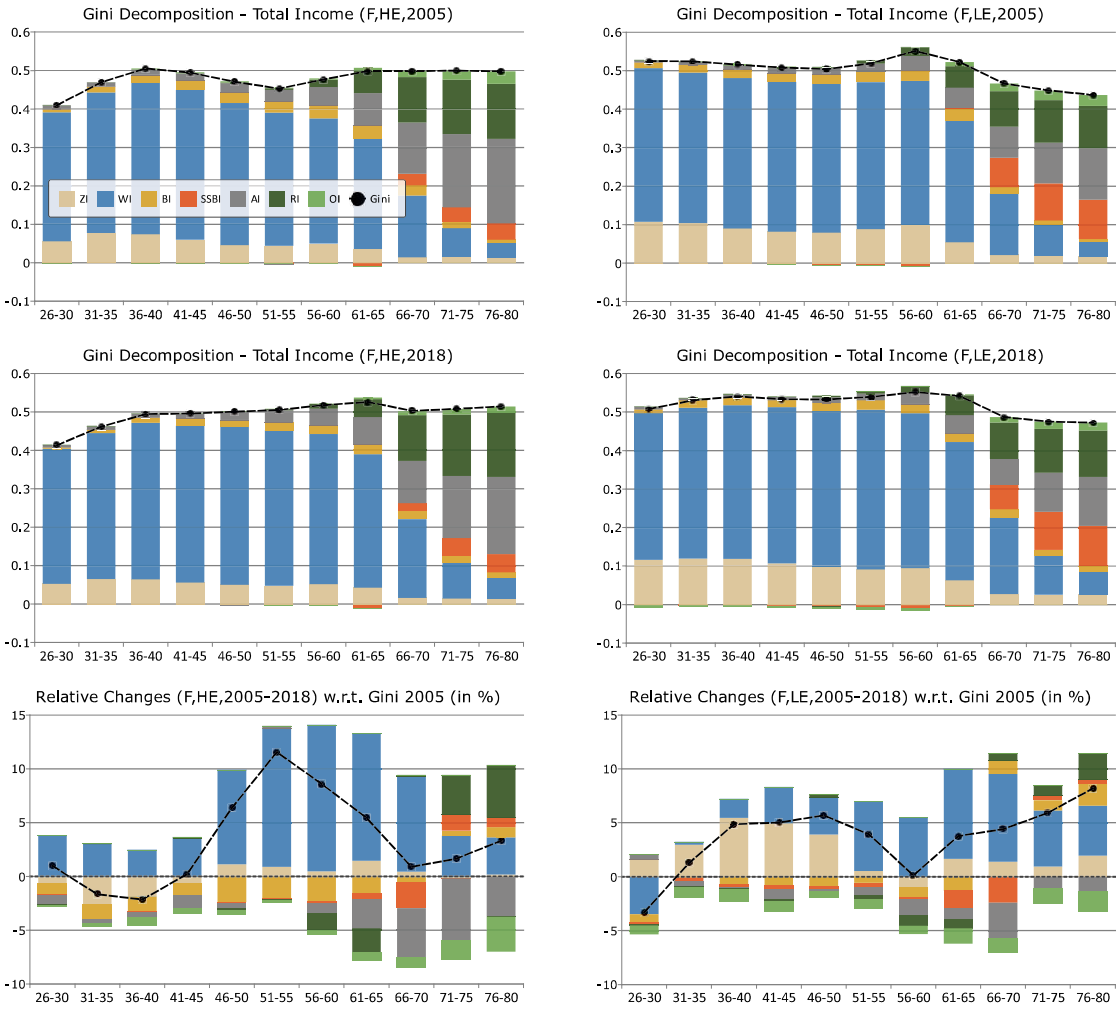

Figure 1: Gini coefficient decomposition of total income of females (F) with high (HE) and low (LE) education, ACS 2005 and 2018. The x-axes denote the age groups.

The left panel in the first row displays the inequality decompositions for highly educated females with respect to the 2005 ACS sample. The inequality of total income of females aged 26–30 was relatively low with a Gini coefficient of 0.41 and increased to 0.51 among females between ages 36–40 due to higher contributions of the wage income component WI and the zero income component ZI to overall inequality, as shown by the blue and beige areas, respectively. The corresponding absolute contributions of WI and ZI amounted to 0.34 and 0.06 in the youngest age group, respectively, and increased to 0.40 and 0.07

among females at ages 36–40. Inequality then fell again and followed a weakly pronounced U-shaped pattern, with the Gini declining to 0.45 in the age group 51–55 and then rising again to 0.50 for females at ages 61–65. Thereafter, the Gini coefficient remained relatively constant around this value for older age groups. This pattern mainly resulted from a steady decline in WI between the age groups 41–45 and 76–80, which was increasingly outpaced by larger contributions of the asset and retirement income components AI and RI with increasing age, according to the gray and dark green areas, respectively. Moreover, Social Security benefit incomes, which are displayed in orange, marginally decreased the overall inequality in the age groups 51–55 to 61–65 due to a negative correlation with total income and contributed to a higher level of inequality among older age groups. Furthermore, the contributions of business incomes BI and other incomes OI to overall inequality, see the yellow and light green areas, respectively, were relatively small across all age groups. In contrast, as the beige areas show, ZI made more pronounced contributions to inequality up to age group 61–65 because it accounted for a greater share of total inequality. On average, this share was equal to 11.69% in these age groups.

The left panel in the second row presents the corresponding decompositions for 2018. Interestingly, the aforementioned U-shaped pattern of inequality among highly educated females aged 36–65 completely disappeared. The Gini coefficients of total income remained relatively constant around 0.50 in age groups with females at ages 36–55 and then slowly increased to 0.53 among females aged 61–65. The profiles for the remaining age groups were otherwise qualitatively similar to their empirical counterparts in 2005. However, as displayed in the left panel in the third row of Figure 1, the inequality in the youngest age group with highly educated females aged 26–30 increased by 0.97% from 2005 to 2018. The associated growth decomposition shows that WI increased inequality by 3.77%, while the declines in ZI, BI, AI, and OI in total decreased inequality by 2.80%. In contrast, the inequality of females in the age groups 31–35 and 36–40 fell by 1.67 and 2.16%, respectively. The associated increases in WI were less pronounced. However, the contributions of ZI decreased inequality by 2.61 and 1.88% in these two age groups, respectively, and in particular, reinforced the declines of other income components, so overall inequality decreased. Moreover, this figure reveals that the disappearance of the U-shaped pattern is attributable to very large increases in WI, which in turn resulted in very pronounced increases in inequality among females in the age groups 46–50 to 61–65. For example, among females aged 51–55, the income components WI and ZI increased inequality by 12.87 and 0.88%, respectively, whereas the declines of the remaining income components in total decreased inequality by 2.20%. The Gini coefficient of total income, therefore,

increased by 11.55% in this age group. Furthermore, the inequality of females between ages of 71–75 increased only slightly by 1.64% while it rose by 3.31% in the oldest age group with females aged 76–80 years. Note that, in total, the income components WI, BI, RI, and SSBI increased inequality by 9.40 and 10.14% in the age groups 71–75 and 76–80, respectively. The lower contributions of AI and OI to overall inequality, however, dampened the aforementioned pronounced increases because they decreased the inequality of age groups 71–75 and 76–80 by 7.56 and 7.00%, respectively. In contrast, the impacts of the zero income component ZI were rather negligible in these age groups.

The right panel in the first row of Figure 1 presents the age-group-specific decompositions of Gini coefficients of total income of females with a low level of education for the 2005 ACS sample. Compared with highly educated females, females with a low educational level in the age groups 26–30 to 61–65 faced higher levels of inequality, whereas inequality was considerably lower in the last three age groups. Specifically, the Gini coefficient of the youngest age group with females with low levels of education at ages 26–30 was much higher, by as much as 28.25%, with respect to the Gini coefficient of 0.41 for highly educated females and amounted to 0.53, which only slightly decreased to 0.50 among females aged 46–50. Then, inequality increased to its maximum of 0.55 in the age group 55–60, before it steadily declined to 0.44 in the oldest age group with females at ages 76–80. As the associated decompositions show, the contributions of ZI were much more pronounced in the first eight age groups of females with low levels of education at ages 26–65. On average, its absolute contributions amounted to 0.09 and 0.06 among females with low levels of education and highly educated females, respectively. The zero income component, therefore, explained a higher share of total inequality in these age groups, which was, on average, equal to 16.91%, in contrast to the previously mentioned 11.69% among females holding a college degree. Moreover, compared with highly educated females, the contributions of SSBI to overall inequality were much more pronounced in the last three age groups comprising females between ages 66–80. However, the income sources AI and RI particularly contributed much less to inequality in these age groups, which is why the Gini coefficients of total income declined. For example, for females with low levels of education aged 76–80, the absolute contributions of SSBI, AI, and RI amounted to 0.10, 0.13, and 0.11, while the corresponding values were equal to 0.04, 0.22, and 0.14 among highly educated females, respectively.

The decompositions of inequality of less educated females for the 2018 ACS sample are displayed in the right panel in the second row of Figure 1. The right panel in the third row shows the corresponding relative changes of income components with respect to the Gini

coefficients of total income of the 2005 ACS sample. In comparison to highly educated females depicted in the left panel in the third row, the Gini coefficients and the associated contributions of income components to overall inequality evolved very differently between 2005 and 2018. The Gini coefficient in the youngest age group of females with low levels of education aged 26–30 decreased by 3.31%, which mainly resulted from a decline of WI that decreased inequality by 3.48%. In contrast, as displayed in the first panel of the third row, this income source was responsible for the observed increase in inequality among highly educated females in this age group. Moreover, ZI contributed the most to the decline of inequality of highly educated females in the age groups 31–35 and 36–40, while it primarily increased the inequality among females with low levels of education at ages 31–50 in the respective age groups. For example, ZI and WI increased the Gini coefficient of females with low levels of education aged 41–45 by 4.96 and 3.33%, respectively. In contrast, the remaining income components decreased overall inequality by 3.27% so that the total increase of the Gini coefficient amounted to 5.02%. It is also interesting to note that the business income component BI contributed less to overall inequality up to the age groups 66–70 and 61–65 with highly and less educated females, respectively, whereas it increased the inequality in the older age groups. The declines in BI were, however, a little bit more pronounced among females holding a college degree. However, the increases were stronger among older, less educated females. Furthermore, the increases in inequality of females with low levels of education in the age groups 66–70, 71–75, and 76–80 were much more pronounced and amounted to 4.41, 5.92, and 8.18%, respectively, because larger declines in AI attenuated the rise of inequality among highly educated females in these age groups.

The results presented above refer to the 2005 and 2018 ACS samples. However, it is both interesting and important to investigate how total income inequality evolved among age and educational groups over time, particularly during the Great Recession (2007–2009). These time series are displayed in Figures 2 and 3 for highly and less educated females, respectively. In each panel, the black dashed lines with dots show the evolution of the normalized Gini coefficient (NGC) in every age group from 2005 to 2018, with 2005=100 as the base year. Moreover, the stacked bar plots in each panel display the associated absolute changes of income components ZI, WI, BI, SSBI, RI, AI, and OI with respect to 2005. These values were divided by the corresponding Gini coefficients of 2005 and multiplied by 100. Thus, these bar plots show the contributions of income components to inequality growth in that the vertical sums are equal to the relative changes in the 2005 Gini coefficients. For the readers' convenience, I centered these changes at the 100 line in each panel, so the sums coincide visually with the NGCs. Thus, stacked bar plots

above (below) this line represent positive (negative) changes. The x-axes denote the time in years, and the legend is displayed in the lower right corner of Figures 2 and 3.

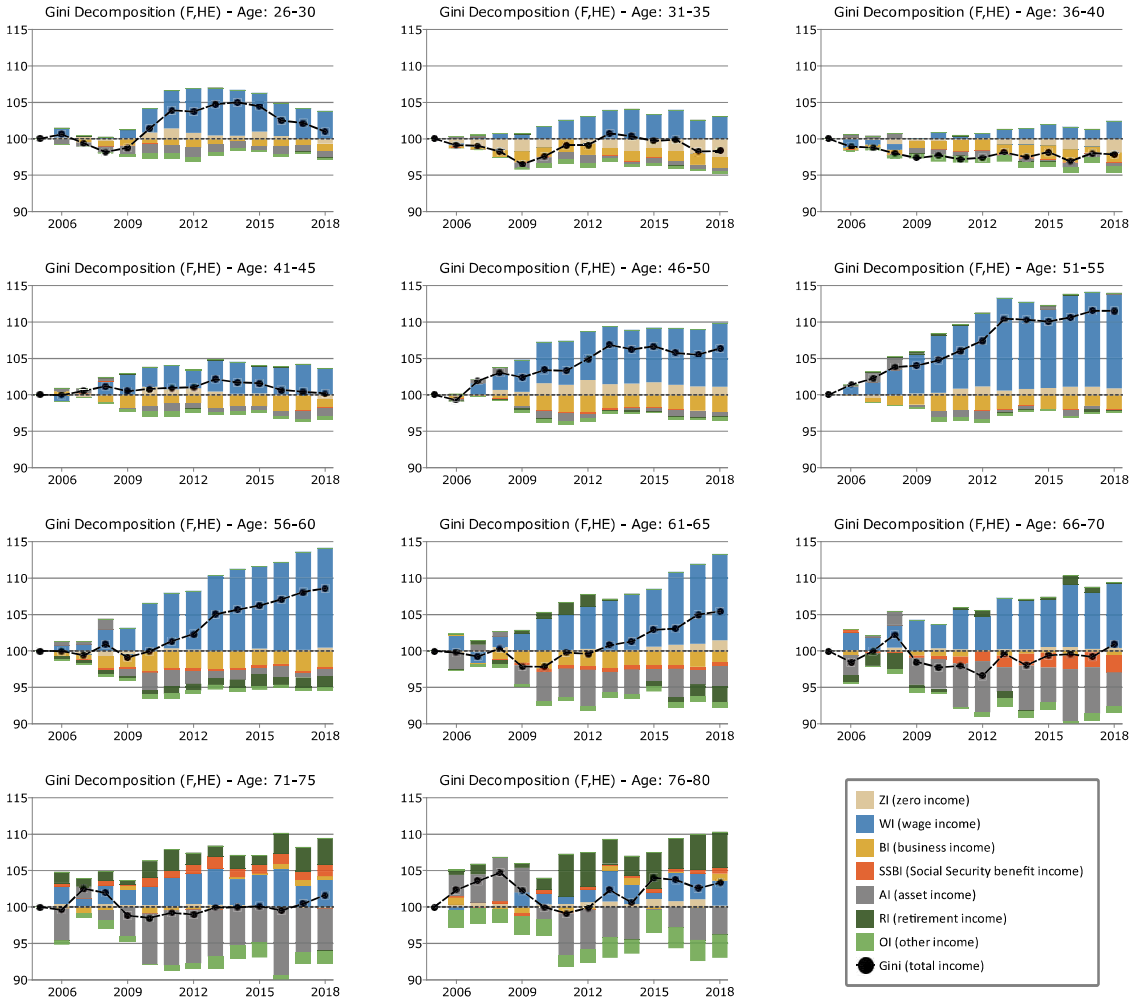

Figure 2: Decomposition of normalized Gini coefficients of total income (2005=100) between 2005 and 2018 - Females (F) with high education (HE). The x-axes denote the time in years.

The first panel in the first row of Figure 2 shows that the normalized Gini coefficient of total income of highly educated females aged 26–30 decreased to 98.17 until 2008, mainly due to lower contributions of both BI and AI to overall inequality in 2008. However, WI increased most strongly after the Great Recession and, thereby, followed an inverted U-shaped pattern until 2018, while ZI increased inequality only slightly between 2009 and 2016. In contrast, the declines of the remaining income components were much less pronounced. The inequality in this age group, therefore, increased to 105.00 until 2014 and then decreased again in the following years, with the NGC declining to 100.97 in

2018. As depicted in the second panel in the first row, ZI and BI primarily contributed to a lower inequality among females aged 31–35 until 2009, when the NGC decreased to 96.49. Thereafter, the positive contributions of WI became more important, so the NGC rose to 100.74 in 2013, before it slowly declined to 98.33 until 2018. The third panel in the first row shows that the NGC of females at ages 36–40 decreased to 97.34 up to 2009 and stayed relatively constant at this level in the subsequent years. According to the associated decompositions, this development mainly resulted from lower contributions of BI, AI, OI, and ZI to inequality and a moderate increase in WI after the Great Recession. Highly educated females in the 41–45 age group faced similar declines in BI, AI, and OI, as depicted in the first panel in the second row. However, they were also exposed to more pronounced increases in WI, which increased until 2013 and slightly decreased thereafter. Thus, their NGC increased to 102.15 in 2013 and then declined to 100.20 until 2018. The inequality among females aged 46–50, shown in the second panel in the second row, rose from 99.28 in 2006 to 106.86 in 2013 and almost plateaued at comparable levels between 2014 and 2018. These increases resulted from higher contributions of WI after 2006 and more pronounced increases in ZI after 2009, which outweighed the weak declines in the remaining income components. Moreover, as depicted in the third panel in the second row, the largest increases in inequality occurred among highly educated females in the age group 51–55. Their NGC increased quite steadily to 110.45 until 2013, then decreased temporarily to 110.06 in 2015, and reached its maximum of 111.55 in 2018. The decompositions show that these changes were primarily attributable to WI, which followed a similarly pronounced pattern over time.

The first panel in the third row of Figure 2 shows that the NGC of the age group 56–60 changed little until 2007 and slightly increased to 100.89 in 2008. Thereafter, it temporarily decreased to 99.11 in 2009 and steadily increased to 108.59 until 2018. This movement resulted from increasing contributions of WI, negligible changes of ZI, and relative stable declines of the remaining income components over time. The inequality among females aged 61–65, shown in the second panel in the third row, evolved very similarly as those of the age group 56–60. However, after 2009, this age group faced, in particular, more pronounced declines in AI, which mitigated the increases in inequality. For that reason, the NGC decreased from 100.34 in 2008 to 97.87 in 2009 and then only rose to 105.44 until 2018. The third panel in the third row of Figure 2 shows that the NGC in the age group 66–70 increased from 98.42 in 2006 to 102.24 in 2008, which was mainly attributable to higher contributions of WI and AI. Then, inequality decreased temporarily to 96.53 up to 2012 and rose to 99.63 in 2013, when it almost plateaued in the subsequent years, before

it slightly increased again to 100.88 in 2018. The large declines in AI and, compared with the age groups 56–60 and 61–65, the somewhat more pronounced lower contributions of SSBI to overall inequality, therefore, primarily dampened the increases in WI after the Great Recession. Additionally, note that the contributions of BI to the changes of overall inequality were nearly negligible in this and older age groups, while this income component decreased the inequality of younger age groups during and especially after the Great Recession.

The NGC of highly educated females aged 71–75 declined from 102.52 in 2007 to 98.52 in 2010 and slowly increased to 101.64 until 2018, as displayed in the first panel in the fourth row of Figure 2. The decompositions of inequality show that in addition to WI, both RI and SSBI contributed to a higher inequality over time. These increases were, however, also strongly dampened by AI from 2009 onward, whereas this income component contributed to the increase in inequality between 2006 and 2007. Note that the partially observed higher contributions of RI among some younger age groups were rather unimportant due to the much more pronounced increases in WI. In contrast, Social Security benefits decreased the inequality in the age group 66–70 and were almost completely irrelevant in younger age groups, while they contributed to a higher inequality in this age group. The last panel shows that the NGC of females aged 76–80 increased to 104.70 until 2008. This was also primarily attributable to higher contributions of AI, which also decreased thereafter and became negative in the following years, so the NGC declined to 99.14 in 2011. Thereafter, inequality increased to 103.31 until 2018 due to the higher contributions of RI and WI, which mainly outweighed the declines in AI and OI.

Figure 3 presents the corresponding results for females with low levels of education. The NGC of the youngest age group, see the first panel in the first row, decreased to 97.20 in 2008 and then increased to 102.18 until 2013, which was mainly attributable to declines in WI until 2009 and higher contributions of ZI to overall inequality thereafter. However, the influence of WI decreased again between 2016 and 2019, so the NGC in 2018 was even lower than its prerecession levels and amounted to 96.69. In contrast, as depicted in the second panel in the first row, the NGC of females aged 31–35 remained nearly constant until 2010 and then increased to 104.02 in 2014, mainly due to higher contributions of WI and ZI. Thereafter, WI also declined again so that the NGC decreased to 101.27 until 2018. Moreover, the inequality in the age groups 36–40 to 46–50, shown in the third panel in the first row and the first two panels in the second row, evolved very similarly. The NGCs remained almost constant until 2009 and increased by nearly 5% from 2005 to 2013. Thereafter, inequality somewhat plateaued and slightly decreased in 2018. These changes

primarily resulted from higher contributions of both WI and ZI because the declines in other income components were much less pronounced and stayed relatively constant over time. Note that, in particular, the zero income component ZI often contributed the most to the observed increases in inequality among females with low levels of education up to an age of 50 years in the respective age groups after 2009. This suggests that the inequality in these age groups increased because less educated females became unemployed and/or left the labor market in the aftermath of the Great Recession. In contrast, the NGCs of females aged 51–55, shown in the third panel in the second row, were hardly affected by changes in ZI. Therefore, the increases of inequality were slightly less pronounced compared with females at ages 46–50.

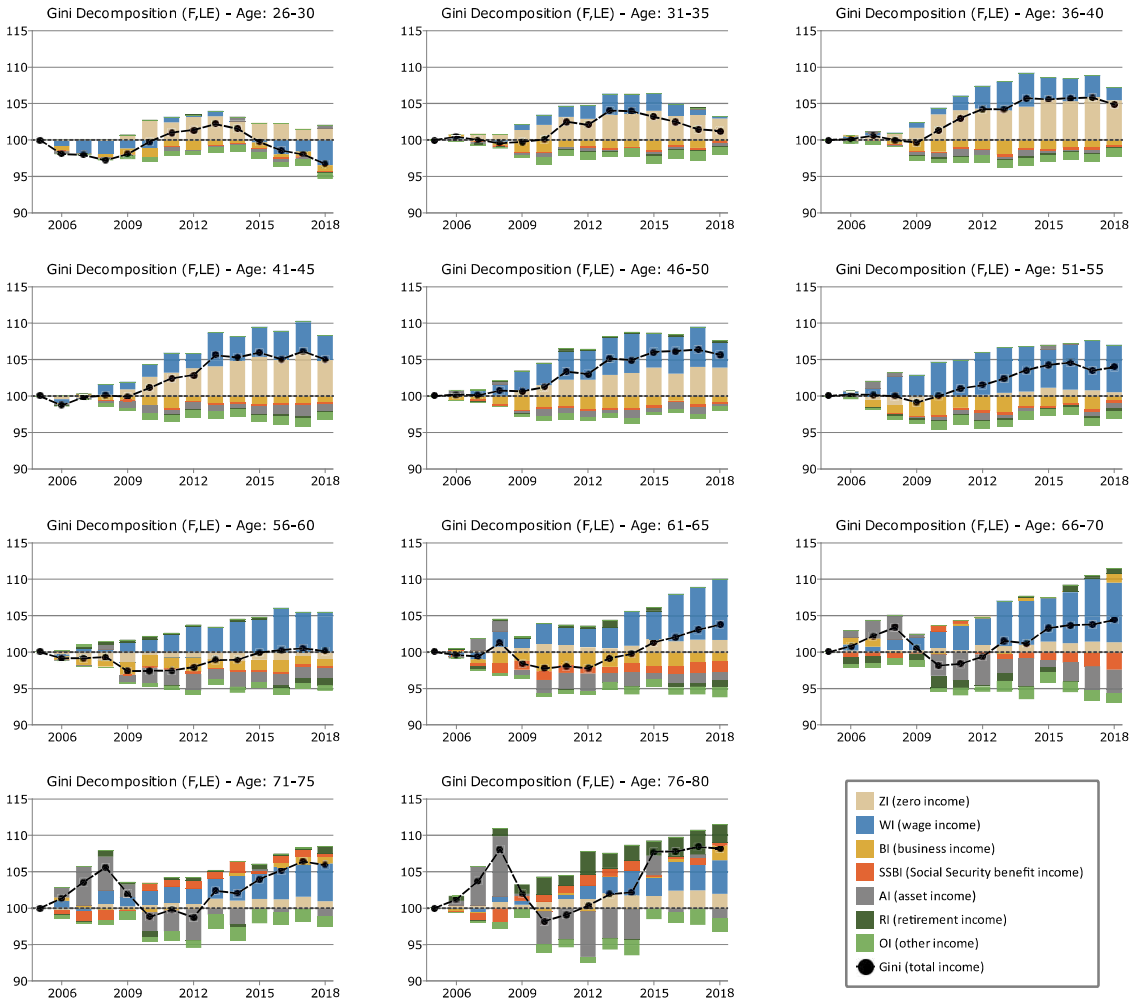

Figure 3: Decomposition of normalized Gini coefficients of total income (2005=100) between 2005 and 2018 - Females (F) with low education (LE). The x-axes denote the time in years.

The first panel in the third row of Figure 3 shows that the NGC of less educated females aged 56-60 decreased from 99.34 in 2008 to 97.38 in 2009. This mainly resulted from lower contributions of ZI and AI after 2008, which reinforced the total declines of other income components. The increasing contributions of WI, however, increasingly outweighed the total declines in other income components. Therefore, the NGC increased again to 99.94 until 2015 and stayed at comparable levels in the subsequent years. As displayed in the second panel in the third row, the inequality of age group 61–65 declined slightly to 99.39 until 2008 and then increased to 101.24 in 2009, mainly due to higher contributions of the income components WI and in particular AI to inequality. The asset income component AI also declined thereafter and, compared with younger age groups, the decreases in SSBI were also somewhat more pronounced. However, the total declines remained relatively constant after 2009. In contrast, the higher contributions of WI were nearly constant between 2010 and 2012 but increased strongly until 2018. For these reasons, the NGC decreased to 97.74 in 2010 and almost remained at this level until 2012, before it steadily increased to 103.77 to 2018. The third panel in the third row and the first two panels in the first row show that the evolution of inequality was qualitatively very similar in the last three age groups. The NGCs of age groups 66–70, 71–75, and 76–80 increased until 2008, to 103.36, 105.59, and 108.18, respectively. Then, they declined to almost the same value until 2010, which, on average, amounted to 98.38. These changes were also mainly attributable to AI that strongly increased up to 2008 and declined in the subsequent years. Thereafter, the NGCs of the age groups 66–70 and 71–75 increased quite steadily to 104.41 and 105.92 up to 2018, respectively. These increases were mostly linked to a rise in WI over time. Note that SSBI also contributed to a higher inequality in the 71–75 age group between 2010 and 2018, whereas it decreased the inequality in the age group 66–70 after 2012 and in both age groups until 2008. In contrast, the NGC of females with low levels of education aged 76–80 rose to 107.75 until 2015, with a sharp increase between 2014 and 2015. Then, inequality almost plateaued in the following years, when the NGC slightly increased to 108.18 in 2018. The associated decompositions of inequality show that, after the Great Recession, the observed increases of inequality in this age group were primarily attributable to higher contributions of RI, SSBI, and WI to overall inequality. Compared with the age groups 66–70 and 71–75, the increases of ZI were also somewhat more pronounced. Moreover, as with highly educated females, the contributions of the business income component BI were rather negligible in the three oldest age groups, whereas they weakly dampened the observed increases in inequality up to the age group 61–65.

3.3 Gini Coefficients of Males

Figure 4 is analogous to Figure 1 except that it displays the age-group-specific decompositions of inequality for males with respect to the 2005 and 2018 ACS samples. Comparing highly and less educated males in the first row, the 2005 Gini coefficients were slightly lower for highly educated males in the age groups 26–30 and 31–35 and amounted to 0.38 and 0.39, respectively, whereas the corresponding values were equal to 0.40 among less educated males. Then, the Gini coefficients of highly educated males increased to 0.49 up to age group 66–70, before they decreased to 0.47 in the oldest age group. In contrast, the Gini coefficients of males with low levels of education only increased to 0.46 up to age group 61–65 and then decreased to 0.42 in the age group 76–80. Thus, the decline of inequality among less edcuated males in the oldest age groups was somewhat more pronounced. Compared with males holding a college degree, the associated decompositions of inequality show that mainly WI and AI contributed less to overall inequality among less educated males in the age groups 66–70 to 76–80 and thereby dampened the higher contributions of SSBI. For example, the absolute contributions of WI, AI, and SSBI amounted to 0.09, 0.18, and 0.02 for highly educated males aged 76–80 years, respectively, while the corresponding values were equal to 0.06, 0.12, and 0.05 for less educated males. Moreover, the influence of the wage income component WI on overall income inequality became less important with increasing age for both education types across all age groups and was primarily replaced by the income components AI, RI, OI, and SSBI. Furthermore, the income component ZI explained, on average, only 2.23% of total income inequality in the age groups comprising highly educated males between ages 26–65. However, it accounted for a larger share of total income inequality among males with low levels of education in these age groups, which was on average equal to 5.29%. Additionally, note that the business income component BI contributed more to overall inequality than ZI. On average across all age groups, BI explained 9.47 and 9.35% of total inequality among highly and less educated males, respectively.

The decompositions of inequality for 2018 are displayed in the second row of Figure 4 and the third row shows the corresponding relative changes of income components with respect to the Gini coefficients of total income of 2005. Overall, inequality increased relatively uniformly among both highly and less educated males across all age groups. On average, across all groups, the Gini coefficients of males with (without) a college degree increased by 6.29% (7.27%). The associated growth decompositions in the first panel of the third row show that the observed increases in inequality among highly educated males

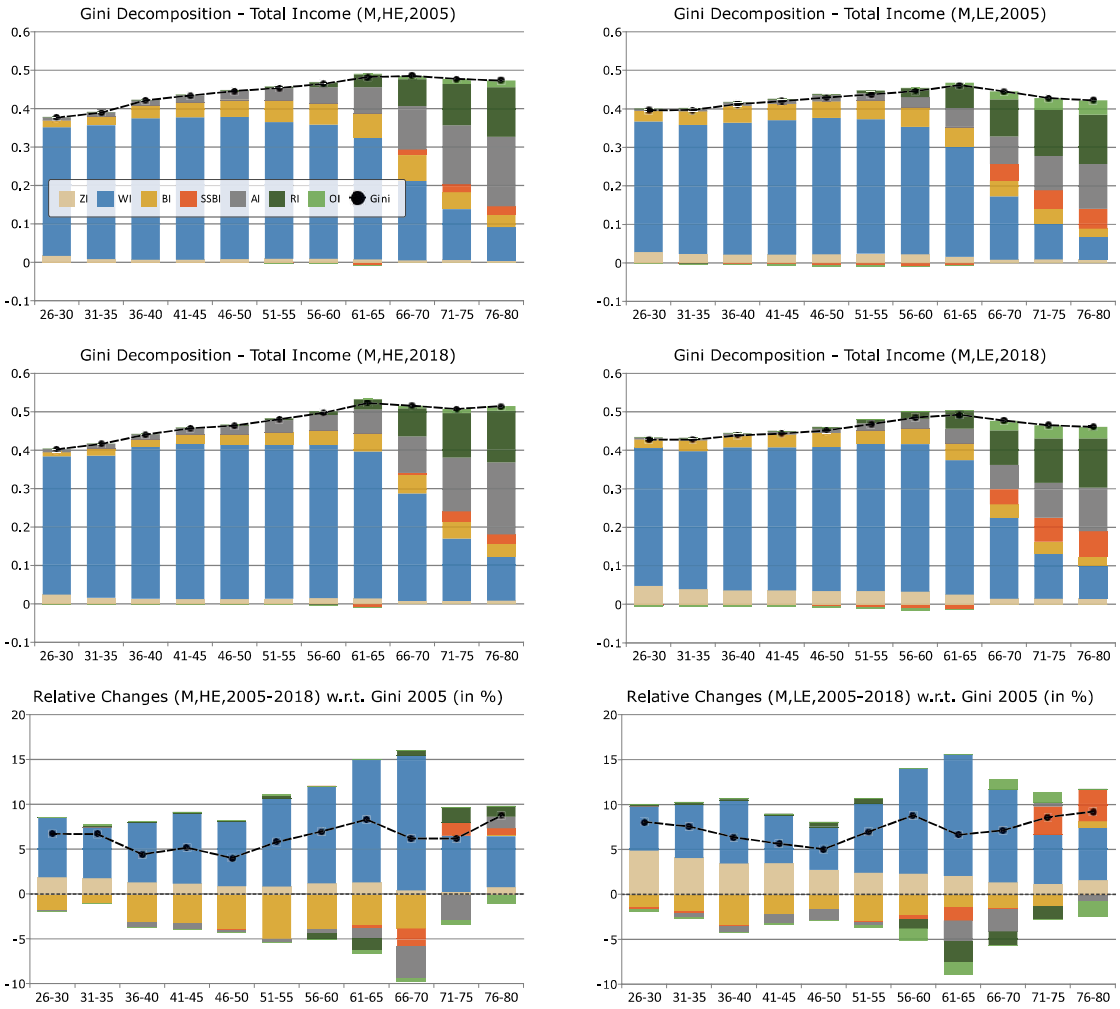

Figure 4: Gini coefficient decomposition of total income of males (M) with high (HE) and low (LE) education, ACS 2005 and 2018. The x-axes denote the age groups.

were primarily attributable to increases WI across all age groups. In contrast, the higher contributions of ZI to overall inequality were also very pronounced among young males with low levels of education and declined with increasing age, as displayed in the second panel in the third row. Moreover, males with low educational levels in the age groups 71–75 and 76–80 also faced relatively large increases in SSBI. Furthermore, the decreases in BI were more pronounced among highly educated males and especially dampened the increases in the Gini coefficients of highly and less educated males up to the age groups 66–65 and 56–60, respectively. Also note that the observed declines of RI, OI, or AI in some of the older age groups additionally mitigated the increases in inequality among the elderly.

Figure 5 is analogous to Figure 2 but displays the age-group-specific time series of inequality of total income for highly educated males from 2005 to 2018. The first panel in the first row shows that the normalized Gini coefficients of highly educated males aged 26–30 remained relatively constant until 2008. However, inequality rose strongly from 100.21 in 2009 to 109.04 in 2013, before it slowly declined to slightly lower levels in 2017 and 2018. As displayed in the second panel in the first row, the inequality of males between ages 31–35 rose to 107.14 until 2013 and remained at a similarly high level thereafter. Moreover, the right panel in the first row and the panels in the second row show that the NGCs changed only slightly in the age groups 36–40 to 51–55 until 2012 and then leveled off at higher values in the following years. For example, the NGC among males aged 51–55 rose from 102.63 in 2012 to 105.03 in 2013, when it also plateaued in subsequent years. The inequality among males aged 56–60 increased relatively linearly to 107.30 until 2015 and remained nearly constant thereafter, as displayed in the first panel in the third row. In contrast, the inequality in the age group 61–65, shown in the second panel in the third row, increased to 101.67 up to 2008 and then fell to almost the same level as in 2005 until 2010. Thereafter, the NGC followed a linear growth trend and increased to 108.31 in 2018. The third panel in the third row and the first panel in the fourth row show that the inequality of age groups 66–70 and 71–75 increased to 102.19 and 103.77 up to 2008, respectively. The NGCs then fell briefly in 2009 and followed a positive trend thereafter, which increased the inequality among males aged 66–70 to 106.19 until 2018. In contrast, the NGC of highly educated males at ages 71–75 increased to 106.66 until 2015 and stayed relatively constant in the subsequent years. Furthermore, according to the last panel in the fourth row, the NGC of highly educated males aged 76–80 rose to 103.44 until 2007 and declined to 99.22 in 2010. In the following years, it increased to 108.75 until 2018.

The associated decompositions of inequality show that the observed increases in inequality up to the age group 66–70 were primarily attributable to the income component WI, even though ZI somewhat amplified the increases in the youngest age groups. Moreover, the asset income component AI contributed only slightly to the observed increases of inequality in the age groups 26–30 to 61–65 until 2009, whereas its increases were much more pronounced in the three oldest age groups, especially among highly educated males aged 76–80 years. As for females, see Figures 2 and 3, the contributions of both this income component and the business income component BI to overall inequality declined in the subsequent years. In particular, AI also strongly mitigated the observed increases in inequality in the three oldest age groups between 2010 and 2018. The only exception were males at ages 76–80, when AI dampened the rises of inequality only up to 2013. In

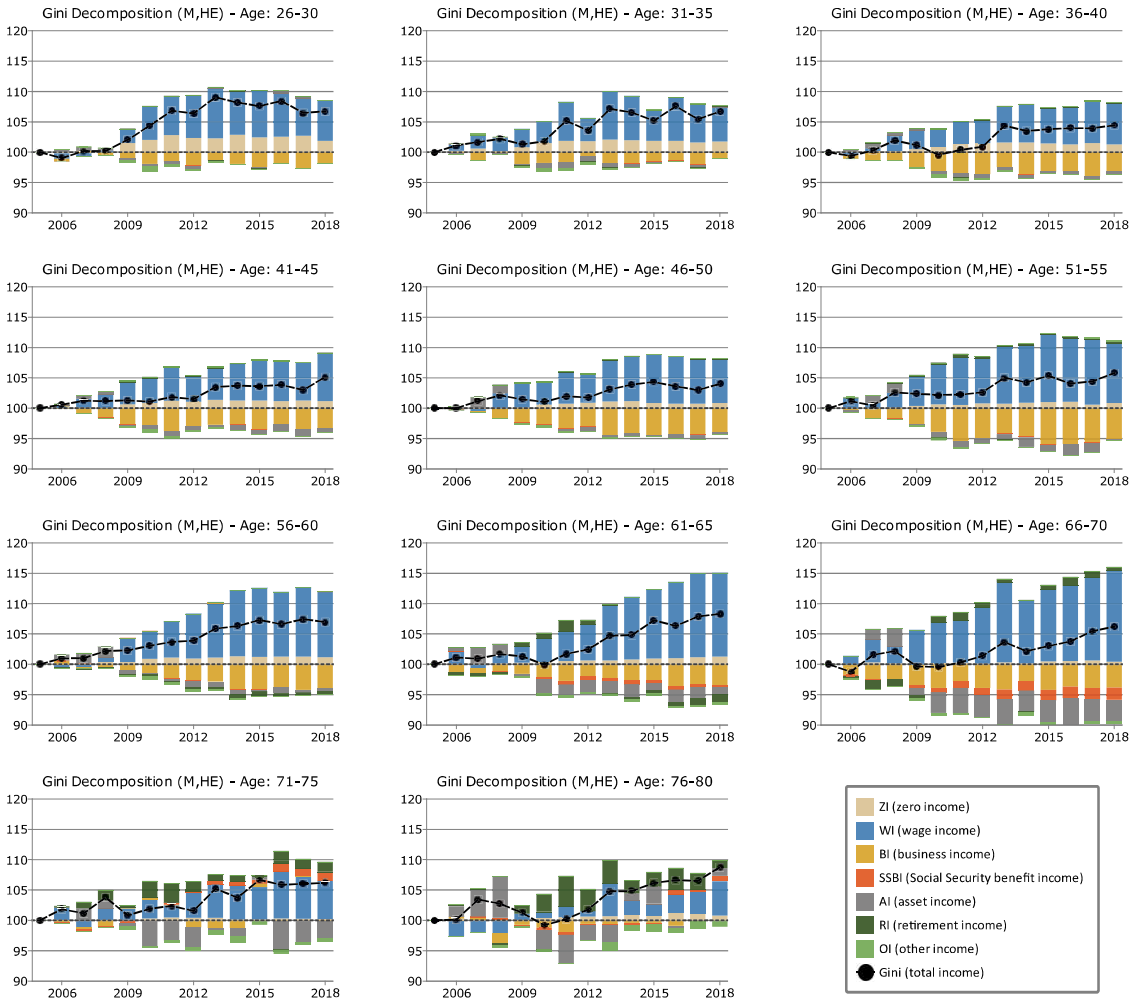

Figure 5: Decomposition of normalized Gini coefficients of total income (2005=100) between 2005 and 2018 - Males (M) with high education (HE). The x-axes denote the time in years.

contrast, the lower contributions of AI were almost negligible up to the age group 56–60, while BI only marginally changed in the two oldest age groups 71–75 and 76–80. For that reason, it was mainly business incomes that attenuated the increases of Gini coefficients among males at ages 26–60 in the respective age groups. Additionally, note that SSBI decreased the inequality among highly educated males in the age group 66–70 after 2008, whereas the changes in this income component played a minor role in the other age groups. Furthermore, the increases in inequality of age groups 71–75 and 76–80 mainly resulted from higher contributions of RI and WI over time.

Figure 6 presents the time series for less educated males. The first two panels in the first row show that the NGCs of males with low levels of education aged 26–30 and 31–35

increased only slightly to 101.12 and 102.25 until 2008, respectively. Thereafter, the inequality followed a very pronounced hump-shaped pattern in these age groups between 2009 and 2018. The NGCs increased to 114.95 and 113.65 in the age groups 26–30 and 31–35 until 2013, respectively, and then decreased to 108.07 and 107.55 up to 2018. Moreover, the inequality of age groups 36–40 to 51–55, shown in the third panel in the first row and the panels in the second row, evolved very similarly between 2005 and 2018, but the hump-shaped patterns were somewhat less pronounced than in the first two age groups. In contrast, as displayed in the first panel in the third row, the NGC rose to 108.68 among males aged 56–60 until 2013 and then stayed relatively constant until 2018. Compared to highly educated males in Figure 5, the associated decompositions of inequality indicate that the contributions of ZI were, in particular, much more pronounced among males with low levels of education up to the age group 56–60. They strongly increased from 2008 to 2010 and then plateaued until 2018. The observed trends of the NGCs, therefore, mainly followed the changes of WI in these age groups because the total declines of other income components were rather moderate and relatively constant between 2010 and 2018.

The second panel in the third row shows that the inequality of age group 61–65 changed little until 2008 and decreased to 97.90 in 2009, mainly due to the lower contributions of BI and AI. Thereafter, WI primarily contributed to the increase of inequality until 2018, when the NGC rose to 106.63. Furthermore, the NGCs evolved very similarly in the age groups 66–70, 71-75, and 76–80, as depicted in the third panel of the third row and in the first two panels of the fourth row. The NGCs of males with low levels of education at ages 66–70, 71–75, and 76–80 increased to 103.49, 103.18, and 107.05 until 2008, respectively. Then, the inequality in the age groups 66–70 and 76–80 declined to 98.18 and 99.15 up to 2010, respectively, while the NGC of males aged 71–75 decreased to 100.13 in 2011. As with females and highly educated males, these changes were also primarily attributable to the income component AI. Thereafter, WI was the main contributor to the increase in inequality in the age group 66–70, so the NGC rose to 107.12 until 2018. The higher contributions of WI and SSB, in particular, also led to similar increases in inequality in the last two age groups until 2018. As a result, the NGCs of age groups 71–75 and 76–80 increased to 108.59 and 109.21 in 2018, respectively. In addition, note that the higher contributions of SSBI were much more pronounced among less educated males in these age groups, compared with the results for highly educated and less educated females as well as highly educated males presented in Figures 2, 3, and 5.

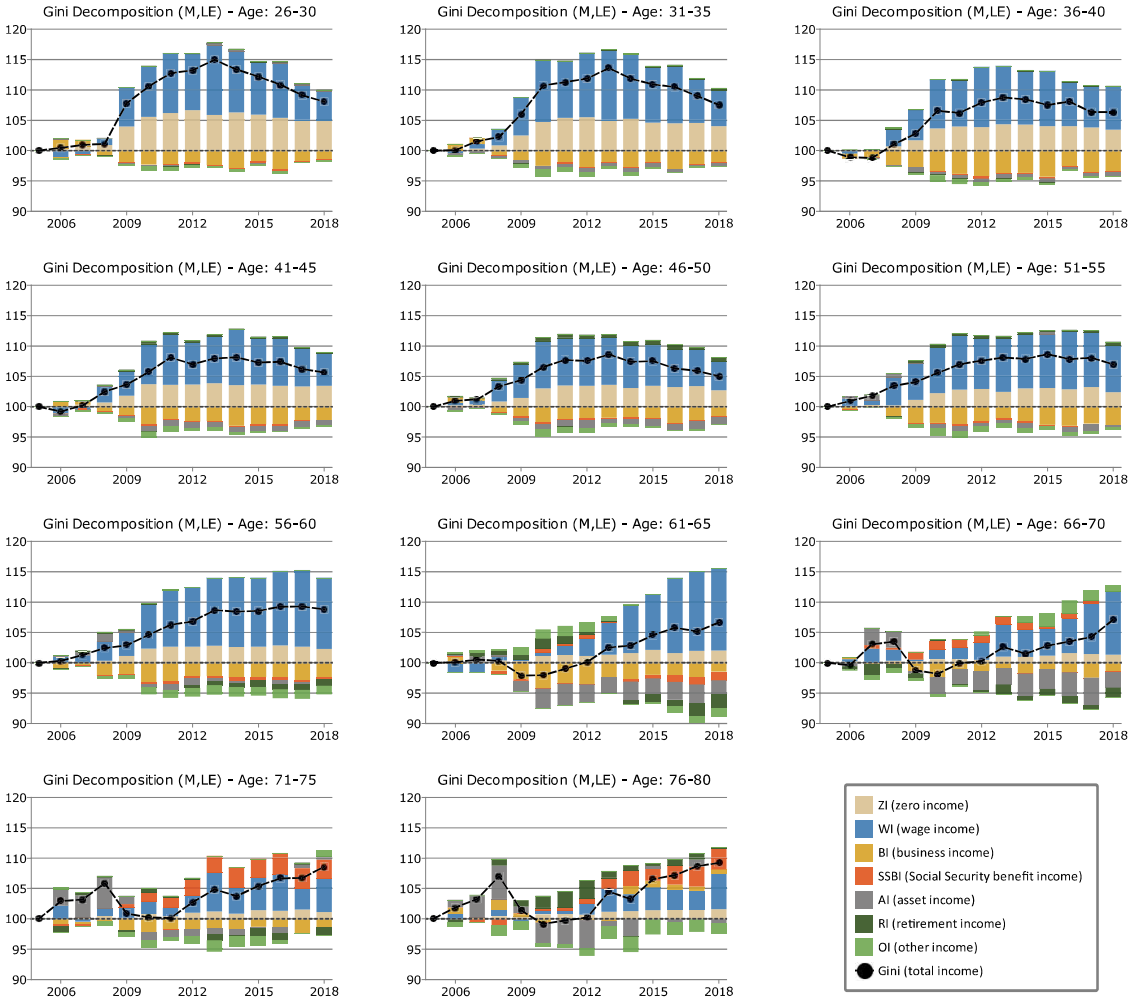

Figure 6: Decomposition of normalized Gini coefficients of total income (2005=100) between 2005 and 2018 - Males (M) with low education (LE). The x-axes denote the time in years.

4 The Relationship between Gini Coefficients and Income Shares

This section investigates the extent to which the changes in Gini coefficients presented in the previous section were associated with a redistribution of total income between the bottom 40 percent, the middle class, and the top 10 percent. For that reason, Sections 4.1 and 4.2 first discuss the age-group-specific evolutions of income shares of highly and less educated females and males. Section 4.3 presents the corresponding correlations with the Gini coefficients and results from simple regressions.

4.1 Evolution of Income Shares of Females

The first row of Figure 7 displays the income shares of both highly and less educated females in 2005 and 2018, which I divide into a bottom class (BC, 0–40%, in blue), a middle class (MC, 40–90%, in red), and an upper class (UC, 90–100%, in green). The dotted and solid lines represent the 2005 and 2018 ACS samples, respectively. Moreover, the second row shows the corresponding relative percentage changes of income shares with respect to 2005. The x-axes denote the age groups. As depicted in the left panel of the first row, in 2005, the income shares of highly educated females in the middle class amounted to 60.57% in the youngest age group 26–30 and decreased to 51.91% in the age group 76–80. The respective income shares of the top 10 percent increased relatively strongly from 26.42% among females at ages 26–30 to 33.07% in the age group 41–45, before they declined to 30.77% in the age group 51–55 and then rose to 37.05% in the oldest age group. Furthermore, the bottom 40 percent of females aged 26–30 received 13.01% of total income. This share declined to 7.87% up to age group 36–40 and increased to 11.54% among females aged 51–55. Thereafter, it decreased to 9.23% in the age group 61–65 and rose to 11.03% in the age group 76–80. The red solid lines in the left panel in the first row and, in particular, the left panel in the second row show that the income shares of highly educated females of the middle class decreased relatively uniformly across all ages groups between 2005 and 2018, on average by 2.56% (1.46 pp). In contrast, females of the upper class faced increases in income shares, which were, in particular, very pronounced in the age groups 46–50 to 61–65. For example, the income share of highly educated females aged 51–55 increased by 14.18% (4.36 pp), from 30,77% in 2005 to 35.14% in 2018. Additionally, note that the changes of income shares of the bottom 40 percent evolved very differently in each age group. For example, on the one hand, the income shares of age groups 31–35 and

36–40 increased by 13.84 (1.31) and 19.10% (1.50 pp), respectively. On the other hand, the shares strongly decreased among females at ages 46–65, where the age group 51–55 faced the most pronounced decline of 19.11% (2.21 pp).

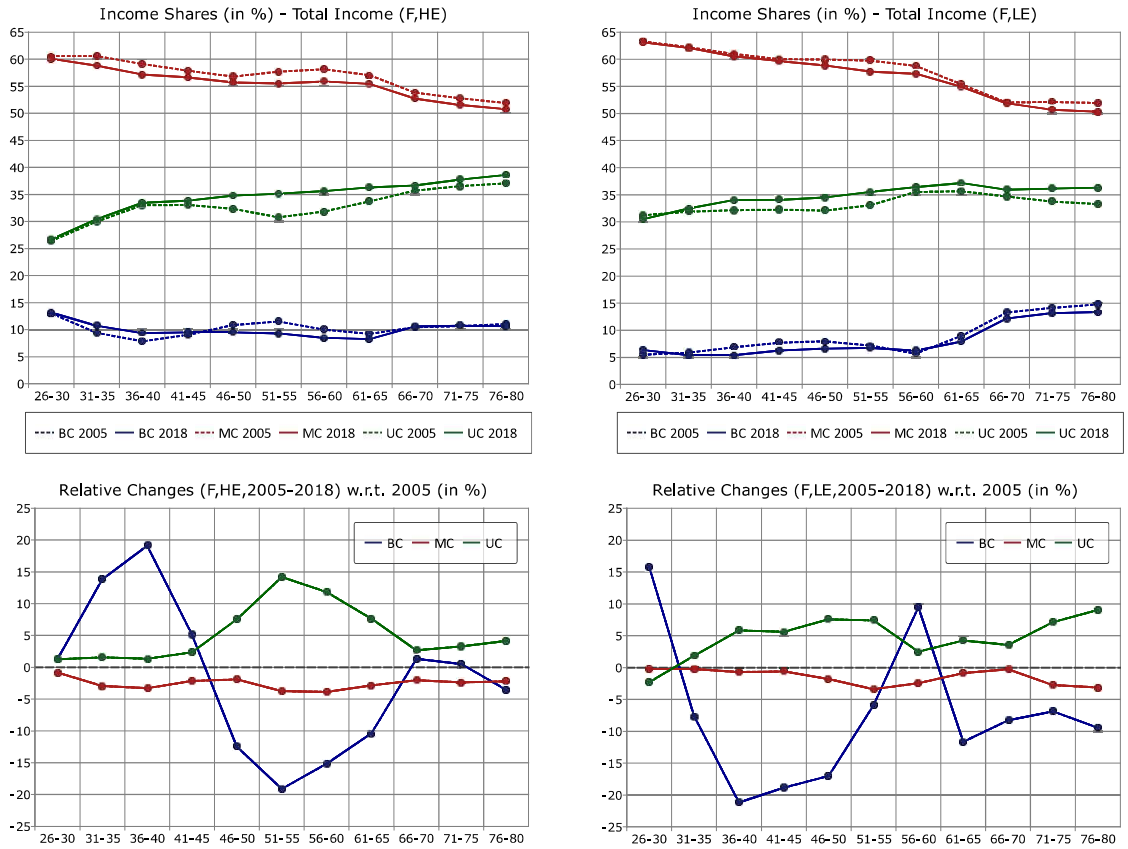

Figure 7: Shares of total income of of females (F) with high (HE) and low (LE) education, ACS 2005 and 2018. BC = bottom class (0-40%), MC = middle class (40-90%), UC = upper class (90-100%). The x-axes denote the age groups.

Compared with females holding a college degree, the age profiles of females with low levels of education of the middle class followed a qualitatively similar pattern in 2005, as displayed in the right panel in the first row of Figure 7. The income shares of less educated females at ages 26–30 amounted to 63.27% and decreased to 51.94% among females in the oldest age group. In contrast, the income shares of the top 10 percent were equal to 31.24% in the age group 26–30 but increased to 35.65% only up to age group 61–65, before they decreased to 33.30% in the age group 76–80. With respect to the bottom 40 percent, females with low levels of education aged 26–30 received 5.50% of total income. For older age groups, this share increased to 7.98% in the age group 46–50, declined to 5.70% among females aged 56–60, and then increased strongly to 14.76% in the oldest age group. The

right panels in the first and the second row of Figure 7 show that the income shares of the upper class increased in all age groups, except among young females at ages 26–30, while the respective income shares of the middle class decreased only slightly between 2005 and 2018. The corresponding average relative changes across all age groups amounted to 4.77% (1.59 pp) and -1.49% (-0.84 pp) in the upper and the middle class, respectively. Less educated females of the bottom class at ages 26–30, however, faced a very pronounced increase in 15.76% (0.87 pp) of their income share. In contrast, the income share of females aged 56–60 increased by 9.50% (0.54 pp), whereas females received a lower share of total income in the remaining age groups. These declines were, in particular, very pronounced in the age groups 36–40, 41–45, and 46–50 and amounted to 21.15 (1.45), 18.82 (1.45) and 17.00% (1.36 pp), respectively. These results show that, in comparison to highly educated females, especially the income shares of the top 10 percent and the bottom 40 percent by age evolved very differently in these education groups between 2005 and 2018.

Figure 8 displays the age-group-specific evolutions of normalized income shares (NIS, 2005=100) of highly educated females from 2005 to 2018. For the sake of clarity and the readers' convenience, the terms BC-NIS, MC-NIS, and UC-NIS refer to the normalized income shares of the bottom class, middle class, and upper class hereinafter, respectively. Overall, the normalized income shares of the middle class, which are depicted by red lines, hardly changed over time. In all age groups, except in the youngest age group, the MC-NISs decreased somewhat approximately 2007 or 2008 and weakly increased in the first years thereafter, before they slightly declined again until 2018. In contrast, the green lines show that the income shares of the top 10 percent rose very strongly in the age groups 51–55 and 56–60 between 2005 and 2018, as displayed in the right panel in the second row and the first panel in the third row, while the relative changes were less pronounced in the other age groups over time. Also note that the income shares of the top 10 percent were highly negatively correlated with the income shares of the bottom 40 percent, which are represented by the blue lines, for most age groups. In particular, the changes of income shares of the bottom 40 percent were more pronounced in age groups with females at ages 26–65. As depicted in the first and second panel in the first row, the BC-NIS slightly rose to 103.22 among females aged 26–30 until 2008, while females aged 31–35 faced a very pronounced increase to 113.42 until 2009. However, their income shares strongly declined during the aftermath of the Great Recession, when the BC-NIS of females aged 26–30 and 31–35 decreased to 91.80 and 103.95 up to 2011, respectively. Thereafter, they slowly increased again to similar values as in 2009 until 2018. The BC-NIS of females at ages 36–40, shown in the third panel in the first row, also rose strongly to 111.21 in 2008 but

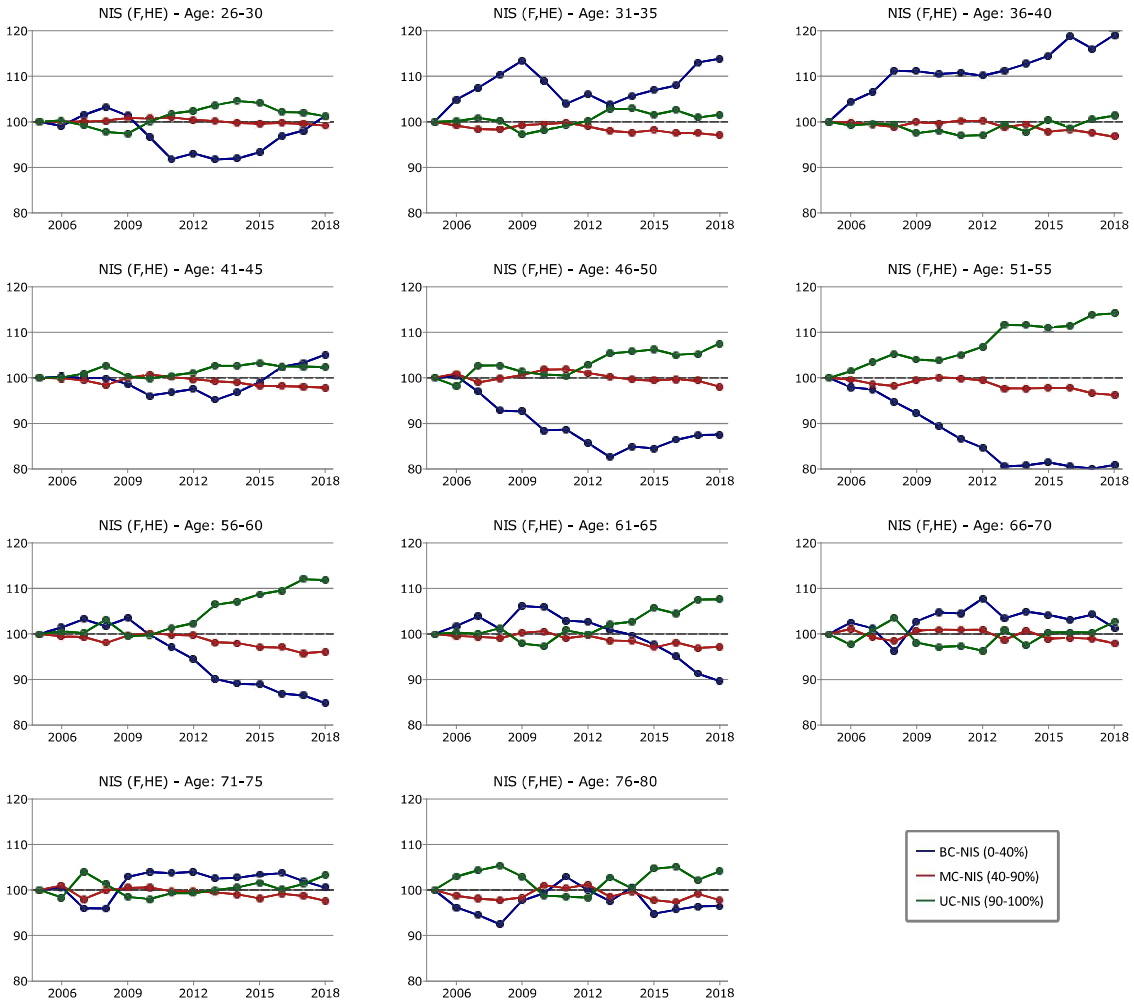

Figure 8: Normalized income shares (NIS, 2005=100) between 2005 and 2018 - Females (F) with high education (HE). BC = bottom class (0-40%), MC = middle class (40-90%), UC = upper class (90-100%). The x-axes denote the time in years.

plateaued between 2009 and 2012 and then increased to 119.10 in 2018. In contrast, the BC-NIS of females aged 41–45 declined to 95.16 up to 2013 and, thereafter, steadily rose to 105.10 until 2018, as displayed in the first panel of the second row. Furthermore, the two right panels in the second row and the two left panels in the third row show that highly educated females aged 46–65 in the bottom class faced the most pronounced declines in the respective age groups over time. On the one hand, the BC-NIS of females at ages 46–50 and 51–55 declined to 82.60 and 80.57, respectively, until 2013. Thereafter, it slightly increased again to 87.51 up to 2018 with respect to females aged 46–50, while it remained relatively constant among females aged 51–55. On the other hand, the BC-NIS of age groups 56–60 and 61–65 temporarily increased to 103.48 and 106.13 in 2009, respectively,

before it steadily decreased to 84.84 and 89.63, respectively, until 2018. The third panel in the third row and the panels in the fourth row show that the BC-NIS of age groups 66–70, 71–75, and 76–80 declined to 96.27, 95.94, and 92.48 until 2008 and then sharply increased to 102.78, 102.87, and 97.66 in 2009, respectively. Thereafter, the income shares of age groups 66–70 and 71–75 remained relatively constant in the subsequent years and decreased only slightly approximately 2018. The BC-NIS of the oldest age group, however, further increased to 102.87 up to 2011, declined to 94.83 until 2015, and then moderately increased to 96.47 in 2018.

For females with low levels of education, the evolution of normalized income shares are displayed in Figure 9. Similar to highly educated females, the income shares of the top 10 percent were also highly negatively correlated with the income shares of the bottom 40 percent in most age groups. However, from 2005 to 2018, the UC-NIS of females with low levels of education in the top 10 percent increased the most among females at ages 46–55 and 71–80 in the respective age groups, as displayed in the two right panels in the second row and the two left panels in the fourth row. Moreover, the income shares of the middle class changed only modestly between 2005 and 2018. However, the observed declines in most age groups between 2012 and 2018 were slightly more pronounced in the age groups 51–55 and 56–60, as well as in the two oldest age groups with females at ages 71–80 according to the third panel in the second row, the first panel in the third row, and the panels in the fourth row. With respect to the bottom 40 percent, the first two panels in the first row show that the BC-NIS of females aged 26–30 rose very sharply to 115.57 between 2005 and 2008, while females aged 31–35 faced only a moderate increase to 104.52 during this period. Thereafter, the BC-NIS of females at ages 26–30 and 31–35 strongly declined to 89.85 and 80.96 during the aftermath of the Great Recession until 2013 and then steadily rose to 115.76 and 92.37 up to 2018, respectively. Moreover, according to the third panel in the first row and the first two panels in the second row, the BC-NIS declined the most in the age groups 36–40, 41–45, and 46–50 and reached its minimum at values of 75.80, 77.41, and 81.61 in 2017, respectively. Note that these values were only somewhat higher in 2018. The third panel in the second row shows that the BC-NIS of females aged 51–55 rose to 107.42 until 2009, decreased almost linearly to 92.02 until 2015 and then slightly increased to 94.11 up to 2018. In contrast, the BC-NIS of the 56–60 age group increased very strongly to 117.50 until 2009, as displayed in the first panel of the third row. This value remained quite constant until 2011, before it decreased to 107.32 up to 2017 and slightly increased to 109.50 in 2018. Furthermore, the last two panels of the third row and the first two panels of the fourth row show that the BC-NIS declined among

older females at ages 61–80 in the corresponding age groups in 2008. Then, the income shares increased again during the first years after the Great Recession and declined in the subsequent years. For example, the BC-NIS of females aged 76–80 declined to 90.67 until 2008 and then increased to 101.92 in 2010, before it again declined to 90.56 up to 2018.

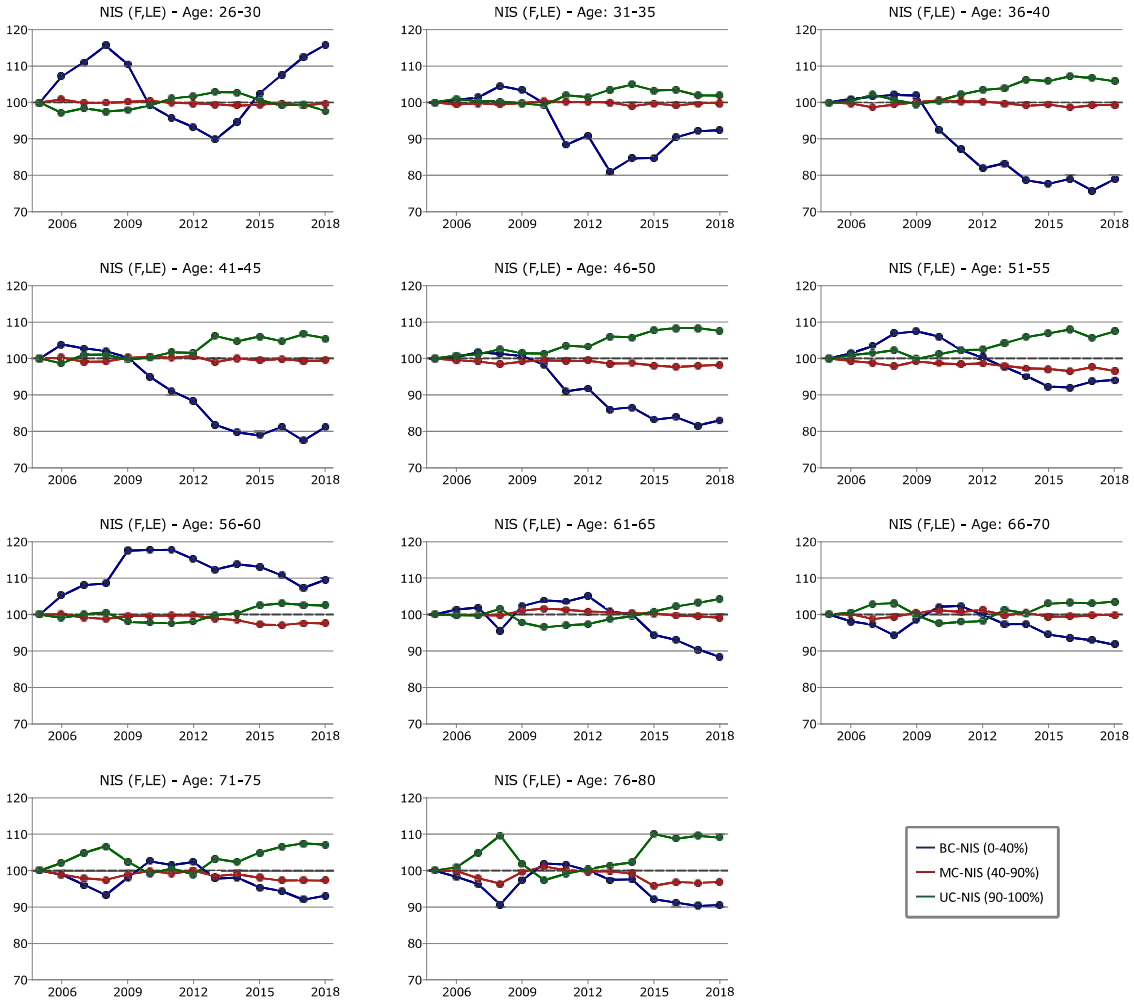

Figure 9: Normalized income shares (NIS, 2005=100) between 2005 and 2018 - Females (F) with low education (LE). BC = bottom class (0-40%), MC = middle class (40-90%), UC = upper class (90-100%). The x-axes denote the time in years.

4.2 Evolution of Income Shares of Males

Figure 10, which is analogous to Figure 7, presents the age-group-specific shares of total income of highly and less educated males in 2005 and 2018 as well as the associated relative changes. The left panel in the first row shows that in 2005, the income share of highly educated males at ages 26–30 amounted to 56.44% in the middle class and declined to 51.09% in the oldest age group 76–80. Meanwhile, the income shares of age groups with males aged 36–55 remained fairly constant at an average value of 51.52%. The corresponding income share of the top 10 percent strongly increased from 26.93% in the youngest age group to 32.85% in the age group 36–40. Thereafter, it rose at a lower rate to 35.97% in the age group 61–65 and then stayed relatively constant among the older age groups. In contrast, males aged 26–30 of the bottom 40 percent faced an income share of 16.63% that further declined to 12.00% up to age group 61–65 and then slowly increased to 13.00% in the oldest age group. As displayed in the right panel of the first row, the income shares of males with low levels of education followed similar patterns compared with highly educated males. With respect to 2005, the income share of the bottom 40 percent of low-educated males aged 26–30 decreased from 14.79 to 12.53% in the age group 56–60 and subsequently rose more strongly to 15.59% among males at ages 76–80. The associated income shares of the middle class were equal to 58.60% in the youngest age group and declined to 56.69% with regard to males at ages 36–40. Thereafter, these shares remained relatively constant up to age group 56–60 and declined to 51.73% in the oldest age group. Moreover, the income share of the top 10 percent was equal to 26.61% in the youngest age group and was thus relatively comparable with the corresponding income share of highly educated males in this age group. The income share of males with low levels of education, however, increased at a lower rate between the age groups 26–30 and 56–60, so it only rose to 30.93% among males aged 56–60. Thereafter, it increased again substantially to 33.56% in the age group 61–65 and then fell only slightly to 32.68% with respect to males aged 76–80.

The solid lines in the panels of the first row of Figure 10 represent the income shares of each income class for the 2018 ACS sample and the panels in the second row display the relative changes between 2005 and 2018. Overall, the left and right panels of the second row show that, regardless of educational status and across all age groups, the income shares of the top 10 percent increased, while the income shares of the bottom 40 percent decreased. In contrast, the income shares of the middle class hardly changed among low-educated males across all age groups and in age groups with highly educated males at ages 26–65, whereas

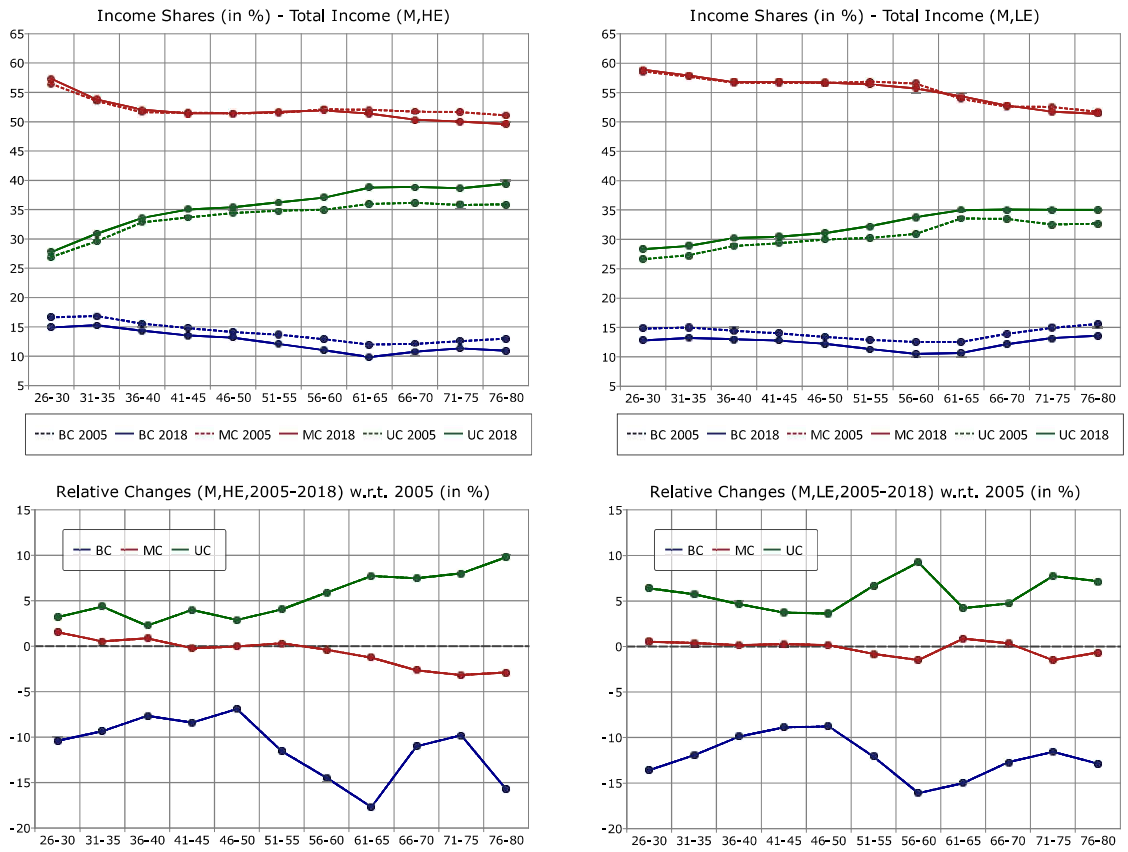

Figure 10: Shares of total income of of Males (M) with high (HE) and low (LE) education, ACS 2005 and 2018. BC = bottom class (0-40%), MC = middle class (40-90%), UC = upper class (90-100%). The x-axes denote the age groups.

older highly educated males in the age groups 66–70, 71–75, and 76–80 faced slightly more pronounced declines of 2.65 (1.37), 3.17 (1.64), and 2.88% (1.48 pp). Additionally, note that the relative changes of income shares of highly and less educated males in the bottom 40 percent followed a relatively similar pattern across age groups. The relative declines were, however, less pronounced in age groups comprising highly educated males at ages 26–50 and 66–75 compared with less educated males in the respective age groups. For example, the income shares of highly educated males aged 26–30 and 46–50 decreased by 10.40 (1.73) and 6.91% (0.98 pp), whereas males with low levels of education of these age groups faced declines of 13.58 (2.01) and 8.77% (1.18 pp), respectively. Moreover, according to the left panel in the second row, the income shares of highly educated males in the bottom 40 percent decreased the most in the age groups 56–60, 61–65, and 76–80. The declines amounted to 14.47 (1.87), 17.69 (2.12), and 15.74% (2.04 pp), respectively. The right panel in the second row further shows that less educated males aged 56–60 and

61–65 also faced the most pronounced declines of 16.10 (2.02) and 15.00% (1.88 pp) in their education group, while the income share of age group 76–80 did not decrease as much. Furthermore, the relative increases in income shares of highly educated males in the top 10 percent were relatively similar up to age group 46–50 and were on average equal to 3.34%. However, the relative increases among older age groups were more pronounced with increasing age such that they rose to 9.79% in the oldest age group. In contrast, the relative increases of the top 10 percent income shares of males with low levels of education evolved very differently across age groups. First, they declined from 6.40% in age group 26–30 to 3.63% in age group 46–50, before they rose to 9.24% up to age group 56–60. Thereafter, they dropped to 4.23% in age group 61–65, increased again to 7.73% up to age group 71–75, and slightly declined to 7.18% in the oldest age group.

Figure 11 displays the age-group-specific evolutions of normalized income shares (NIS, 2005=100) of highly educated males between 2005 and 2018. With respect to the age groups 26–30 to 56–60, the panels in the first two rows and the first panel in the third row show that the normalized income shares of the bottom 40 percent decreased until approximately 2013 and then either plateaued or slightly increased again up to 2018. For example, the BC-NIS of highly educated males at ages 51–55 declined to 88.48 in 2013 and remained relatively constant thereafter, so it was equal to 88.45 in 2018. In contrast, as displayed in the remaining panels, the BC-NISs of age groups with males aged 61–80 decreased almost steadily after 2009 or 2010, although it initially looked as if these age groups would recover from the observed short-term declines beforehand. The BC-NIS of the oldest age group, for example, declined to 93.25 in 2007 and then increased to 99.93 until 2010, before it again strongly decreased to 84.26 up to 2018. However, the age group 61–65, shown in the second panel in the third row, faced the strongest declines because the BC-NIS decreased from 98.16 in 2010 to 82.31 in 2018. Moreover, the panels also show that the income shares of the top 10 percent were negatively correlated with the income shares of the bottom 40% in most age groups. Also note that the observed increases were more pronounced in the older age groups with males aged 56–80. Furthermore, the normalized income shares of the middle class changed little until 2008 and temporarily increased somewhat during the aftermath of the Great Recession, particularly in younger age groups. Thereafter, they slightly decreased again up to 2018.

From 2005 to 2018, the normalized income shares of males with low levels of education are displayed in Figure 12. The panels in the first row show that the income shares of the bottom 40 percent in the age groups 26–30, 31–35, and 36–40 strongly decreased until 2013 and then followed a pronounced positive growth trend up to 2018. For example, the

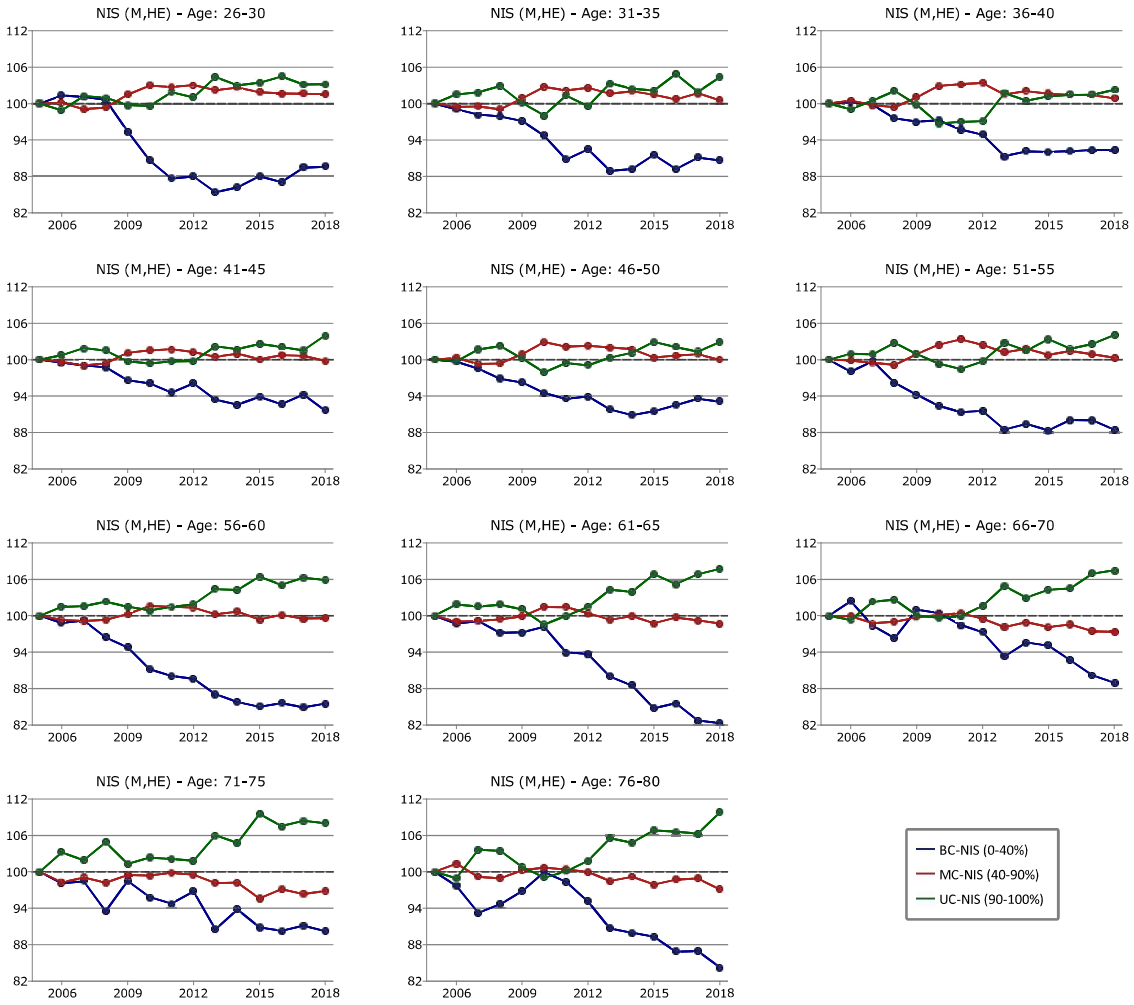

Figure 11: Normalized income shares (NIS, 2005=100) between 2005 and 2018 - Males (M) with high education (HE). BC = bottom class (0-40%), MC = middle class (40-90%), UC = upper class (90-100%). The x-axes denote the time in years.

BC-NIS of males aged 26–30 decreased to 75.72 until 2013, before it linearly increased again to 86.42 in 2018. As displayed in the first and second panel in the second row, the BC-NIS of age groups 41–45 and 46–60 developed relatively similarly, whereby it only decreased until 2011. The third panel in the second row shows that the BC-NIS of males aged 51–55 declined to 84.21 in 2011, remained relatively constant up to 2015, and then slightly increased to 87.91 until 2018. Moreover, the BC-NIS of the age group 56–60 declined to 83.10 until 2013, shown in the first panel in the third row, and hardly changed thereafter. In contrast, as displayed in the second panel in the third row, the BC-NIS of males at ages 61–65 steadily declined after the Great Recession, from 100.05 in 2010 to 85.00 in 2018. Furthermore, the third panel in the third row and the two left panels in

the fourth row show that the BC-NIS of males with low levels of education aged 66–70, 71–75, and 76–80 temporarily dropped to 95.70, 92.45, and 90.97 in 2008, respectively, and quickly returned to similar levels as in 2005 in the subsequent years. After 2010 or 2011, however, pronounced negative trends emerged, so the BC-NIS declined to 87.29, 88.43 and 87.14 in the respective age groups until 2018. Compared with the bottom 40 percent, the normalized income shares of the top 10 percent evolved similarly across age groups but in opposite directions, while they only slightly changed in most age groups in the middle class.

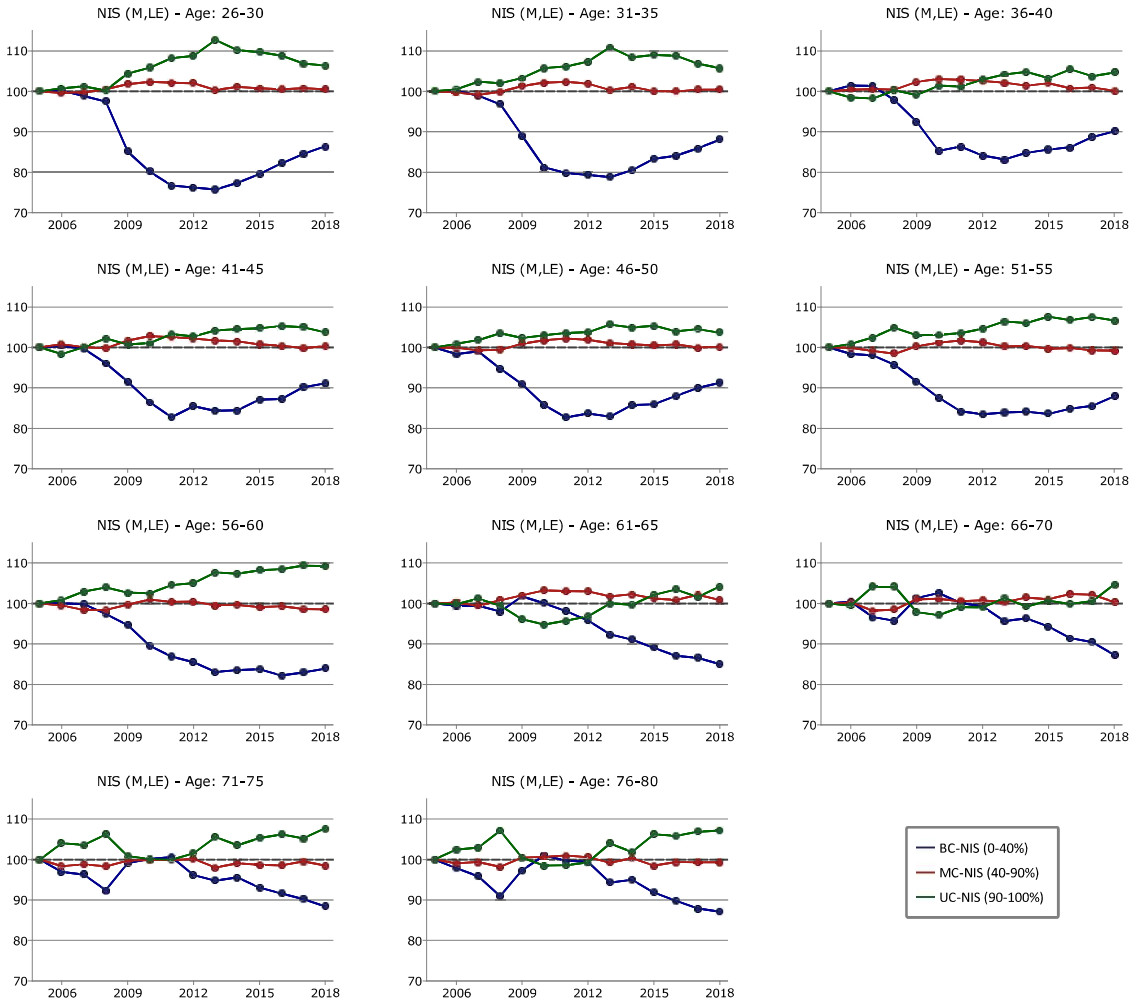

Figure 12: Normalized income shares (NIS, 2005=100) between 2005 and 2018 - Males (M) with low education (LE). BC = bottom class (0-40%), MC = middle class (40-90%), UC = upper class (90-100%). The x-axes denote the time in years.

4.3 Correlations and Regression Results

A raw graphical comparison of the NGCs in Figures 2, 3, 5, and 6 with the normalized income shares in Figures 8, 9, 11, and 12, respectively, suggests that the income shares of the bottom 40 percent and the top 10 percent were highly correlated with the Gini coefficients in most age groups. Meanwhile, the relationship is less clear with respect to the income shares of the middle class. Thus, Figure 13 displays the age-group-specific correlation coefficients ρ between these two variables. High correlations are hereinafter defined as $|\rho| \in [0.7, 1.0]$, moderate correlations as $|\rho| \in [0.3, 0.7[$, and weak correlations are given by $|\rho| \in]0.0, 0.3[$. As expected, irrespective of gender and education status, the

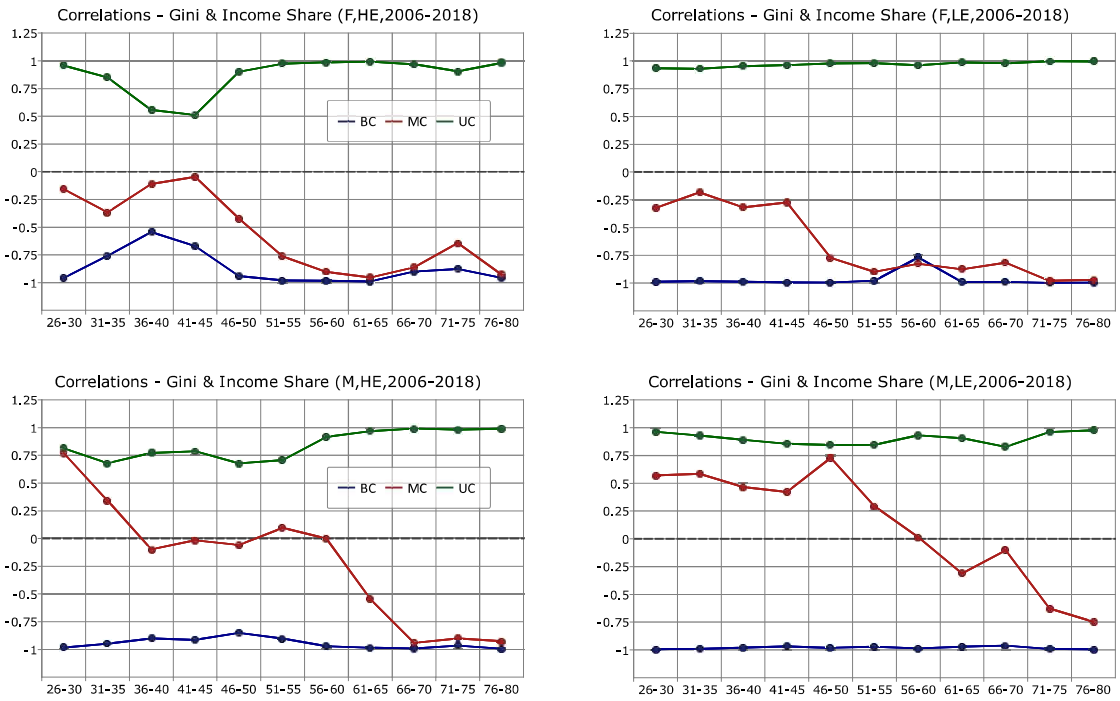

Figure 13: Correlations between Gini coefficients and income shares - Females (F) and males (M) with low (LE) or high (HE) education. BC = bottom class (0-40%), MC = middle class (40-90%), UC = upper class (90-100%). The x-axes denote the age groups.

panels in Figure 13 show that the Gini coefficients were highly positively correlated with the income shares of the top 10 percent and highly negatively correlated with the income shares of the bottom 40 percent across almost all age groups. The only exception are highly educated females at ages 36–40 and 41–45 with moderate correlation coefficients around an absolute value of 0.50, as well as highly educated males aged 31–35 and 46–50, where the correlations between the Gini coefficient and the income share of the top 10 percent

were only slightly below the standard threshold for high correlations of 0.70. Interestingly, the panels in the first row indicate that the income shares of highly and less educated females in the middle class were often only very weakly negatively correlated with the Gini coefficients up to age group 41–45. However, the negative correlation coefficients further declined with increasing age, so the relationships became highly negative in most of the older age groups. In contrast, the left panel in the second row shows that the correlation coefficients between the Gini coefficients and the income shares of highly educated males in the middle class were highly positive in the youngest age group and then dropped to approximately zero in age groups with males aged 36–60. Then, they also further declined and were highly negative in the last three age groups. Furthermore, as displayed in the right panel in the second row, the Gini coefficients and the income shares of middle class males with low levels of education were rather moderately positively correlated up to age group 46–50. For older age groups, the correlation coefficients also strongly declined, but the relationship became only highly negative in the oldest age group.

To understand the quantitative extent of redistribution, Table 2 presents the age-group-specific regression results of the income share of the bottom class (BC-IS), the middle class (MC-IS) and the upper class (UC-IS) on a constant and the Gini coefficient, $IS = const + 100 \times b \times Gini$, for highly and less educated females.[9] As displayed in the third column of Table 2, for highly educated females, the regression coefficients b of Gini coefficients on the income shares of the middle class are negative across all age groups but often insignificant or less significant up to the age group 46–50, and highly significant at the 1% level in almost all older age groups. The only exception is the age group 71–75, where b is only significant at the 5% level. Moreover, the regression coefficients b are also negative in the bottom class for all age groups, whereas they are always positive in the upper class. The corresponding p-values are, however, less significant in the age groups 36-40 and 41-45 of the upper class and in the age group 36-40 of the bottom class with $p \leq 0.05$, while they are highly significant in the remaining age groups. Note that, in comparison to the bottom class, the regression coefficients b for the middle class are lower and/or insignificant up to age group 51–55. Thus, an increase in the Gini coefficient was associated, for the most part, with a redistribution between the bottom 40 and top 10 percent in these age groups, whereas more income from the middle class was redistributed to the top 10 among older age groups. For example, an increase in the Gini coefficient by 1 pp decreased the income shares of the bottom and the middle class by 0.46 (0.34)

[9] See also Leigh (2007), who conducts similar regressions and shows that the Gini coefficients and top income shares are highly correlated across different countries.

Age	Indep. Var.	(F,HE) | Dep. Var.			(F,LE) | Dep. Var.		
		BC-IS	MC-IS	UC-IS	BC-IS	MC-IS	UC-IS
26-30	constant	35.567^{***}	62.883^{***}	1.550	32.236^{***}	68.494^{***}	-0.729
	Gini	-0.550^{***}	-0.054	0.604^{***}	-0.509^{***}	-0.103	0.611^{***}
	$\bar{R}^2$	0.910	−0.064	0.909	0.971	0.023	0.863
31-35	constant	31.916^{***}	76.163^{***}	-8.079^{*}	34.610^{***}	65.044^{***}	0.346
	Gini	-0.468^{***}	-0.356^{**}	0.824^{***}	-0.547^{***}	−0.056	0.603^{***}
	$\bar{R}^2$	0.536	0.055	0.699	0.960	−0.054	0.851
36-40	constant	38.717^{***}	70.563^{**}	−9.279	35.930^{***}	65.739^{***}	−1.669
	Gini	-0.605^{**}	−0.244	0.848^{**}	-0.562^{***}	−0.095	0.657^{***}
	$\bar{R}^2$	0.232	−0.078	0.247	0.973	0.020	0.900
41-45	constant	37.785^{***}	61.325^{**}	0.889	36.294^{***}	63.402^{***}	0.304
	Gini	-0.577^{***}	−0.079	0.656^{**}	-0.562^{***}	−0.067	0.629^{***}
	$\bar{R}^2$	0.400	−0.089	0.195	0.984	−0.009	0.920
46-50	constant	34.023^{***}	69.011^{***}	−3.034	33.392^{***}	71.322^{***}	-4.714^{*}
	Gini	-0.496^{***}	-0.248^{*}	0.743^{***}	-0.501^{***}	-0.233^{***}	0.734^{***}
	$\bar{R}^2$	0.875	0.103	0.797	0.988	0.560	0.951
51-55	constant	32.384^{***}	72.570^{***}	-4.954^{*}	28.043^{***}	84.775^{***}	-12.818^{***}
	Gini	-0.461^{***}	-0.325^{***}	0.786^{***}	-0.396^{***}	-0.496^{***}	0.892^{***}
	$\bar{R}^2$	0.956	0.546	0.945	0.953	0.789	0.957
56-60	constant	29.731^{***}	80.019^{***}	-9.750^{***}	22.939^{***}	102.972^{***}	-25.911^{***}
	Gini	-0.411^{***}	-0.464^{***}	0.875^{***}	-0.303^{***}	-0.824^{***}	1.127^{***}
	$\bar{R}^2$	0.963	0.799	0.971	0.555	0.654	0.917
61-65	constant	28.685^{***}	83.061^{***}	-11.746^{***}	33.048^{***}	73.945^{***}	-6.993^{***}
	Gini	-0.386^{***}	-0.531^{***}	0.917^{***}	-0.463^{***}	-0.351^{***}	0.815^{***}
	$\bar{R}^2$	0.977	0.902	0.984	0.977	0.746	0.973
66-70	constant	27.742^{***}	89.323^{***}	-17.065^{***}	34.474^{***}	67.140^{***}	−1.614
	Gini	-0.343^{***}	-0.722^{***}	1.065^{***}	-0.456^{***}	-0.319^{***}	0.774^{***}
	$\bar{R}^2$	0.794	0.719	0.935	0.977	0.637	0.955
71-75	constant	31.814^{***}	80.563^{***}	−12.377	33.199^{***}	70.660^{***}	-3.859^{***}
	Gini	-0.419^{***}	-0.562^{**}	0.981^{***}	-0.422^{***}	-0.420^{***}	0.842^{***}
	$\bar{R}^2$	0.748	0.361	0.805	0.995	0.956	0.994
76-80	constant	28.002^{***}	87.363^{***}	-15.365^{***}	31.496^{***}	75.300^{***}	-6.796^{***}
	Gini	-0.339^{***}	-0.708^{***}	1.048^{***}	-0.383^{***}	-0.533^{***}	0.916^{***}
	$\bar{R}^2$	0.908	0.848	0.959	0.989	0.938	0.988

Table 2: Age-group-specific regressions of total income shares (IS) on Gini coefficients, $IS = const + 100 \times b \times Gini$. - Females (F) with high (HE) and low (LE) education. BC = bottom class (0-40%), MC = middle class (40-90%), UC = upper class (90-100%), p-values (with robust standard errors): $^{*}p \leq 0.10$, $^{**}p \leq 0.05$, $^{***}p \leq 0.01$.

and 0.33 (0.71) pp in the age group 51–55 (76–80), while the income share of the top 10 percent rose by 0.79 (1.05) pp. The results for females with low levels of education are presented in the fourth column of Table 2. Overall, the results are very similar to those of highly educated females. However, in comparison to the bottom 40 percent, the increases in Gini coefficients were only linked to more pronounced redistributions of incomes from the middle to the upper class in the age groups 51–55, 56–60, and 76–80. Additionally, note that the negative regression coefficients b of the bottom class are generally lower in younger age groups for both highly and less educated females compared with the older age

groups. This result indicates that the observed increases in inequality were particularly burdensome for the poorest individuals in the youngest age groups. However, the positive regression coefficients b of the top 10 percent tend to be higher in the older age groups because income was significantly redistributed from both the bottom and the middle class to the upper class in these age groups. Consequently, elderly individuals in the top 10 percent often benefited the most from the inequality increases.

Table 3 presents the regression results for males. Irrespective of education status, the regression coefficients b of the Gini coefficients on the income shares of the bottom 40 percent are negative, while they are positive in the top 10 percent. The corresponding p-values are highly significant. In contrast, the third column of Table 3 shows that, for highly educated males in the middle class, the regression coefficient b is positive and highly significant in the youngest age group 26–30. Between the age groups 31–35 and 56–60, the regression coefficients b are, however, insignificant and often very close to zero. Thus, an increase of inequality mainly transferred income from the bottom 40 percent to the top 10 percent in these age groups, while the income shares of the middle class remained almost unaffected. For older age groups, b is negative and highly significant in the three oldest age groups. As displayed in the fourth column, the regression coefficients b of the middle class are positive among males with low levels of education up to age group 56–60, but the corresponding p-values are only significant at the 1% level in the age group 46–50 and significant at the 5% level up to age group 41-50. In contrast, the coefficients b are negative among older age groups of the middle class. However, the p-values are only significant at a significance level of 1% in the age groups 71–75 and 76–80. Furthermore, compared with females, for both highly and less educated males, the negative regression coefficients b of the bottom 40 percent are also lower in younger age groups, so increases in inequality also especially burdened the poorest of these age groups. Nevertheless, as opposed to females, the middle class received some of these income declines in the youngest age groups, whereas the middle class was also burdened in the oldest age groups.

Age	Indep. Var.	(M,HE) | Dep. Var.			(M,LE) | Dep. Var.		
		BC-IS	MC-IS	UC-IS	BC-IS	MC-IS	UC-IS
26-30	constant	44.301^{***}	40.348^{***}	15.352^{***}	40.433^{***}	52.766^{***}	6.801^{***}
	Gini	-0.735^{***}	0.429^{***}	0.306^{***}	-0.648^{***}	0.148^{**}	0.499^{***}
	$\bar{R}^2$	0.963	0.555	0.630	0.985	0.264	0.922
31-35	constant	41.653^{***}	44.524^{***}	13.822^{**}	40.522^{***}	49.841^{***}	9.637^{***}
	Gini	-0.639^{***}	0.236	0.402^{***}	-0.640^{***}	0.192^{**}	0.449^{***}
	$\bar{R}^2$	0.890	0.037	0.412	0.979	0.283	0.853
36-40	constant	38.181^{***}	55.630^{***}	6.189	39.901^{***}	49.583^{***}	10.516^{***}
	Gini	-0.543^{***}	-0.076	0.619^{***}	-0.621^{***}	0.184^{**}	0.437^{***}
	$\bar{R}^2$	0.794	-0.080	0.559	0.957	0.146	0.775
41-45	constant	39.301^{***}	52.308^{***}	8.391	40.092^{***}	48.657^{***}	11.250^{***}
	Gini	-0.567^{***}	-0.012	0.578^{***}	-0.623^{***}	0.195^{**}	0.428^{***}
	$\bar{R}^2$	0.820	-0.091	0.585	0.931	0.104	0.707
46-50	constant	38.328^{***}	54.582^{***}	7.090	43.027^{***}	40.765^{***}	16.208^{***}
	Gini	-0.547^{***}	-0.057	0.605^{***}	-0.685^{***}	0.358^{***}	0.327^{***}
	$\bar{R}^2$	0.699	-0.087	0.410	0.960	0.487	0.688
51-55	constant	41.711^{***}	48.282^{***}	10.007	40.172^{***}	50.452^{***}	9.376^{**}
	Gini	-0.621^{***}	0.080	0.540^{***}	-0.621^{***}	0.139	0.482^{***}
	$\bar{R}^2$	0.797	-0.081	0.456	0.941	0.003	0.689
56-60	constant	40.676^{***}	52.206^{***}	7.119^{*}	38.478^{***}	55.998^{***}	5.524^{*}
	Gini	-0.598^{***}	-0.000	0.598^{***}	-0.579^{***}	0.005	0.574^{***}
	$\bar{R}^2$	0.939	-0.091	0.825	0.972	-0.091	0.856
61-65	constant	37.401^{***}	60.768^{***}	1.831	36.118^{***}	61.427^{***}	2.455
	Gini	-0.528^{***}	-0.177^{**}	0.705^{***}	-0.517^{***}	-0.142	0.659^{***}
	$\bar{R}^2$	0.968	0.232	0.932	0.939	0.015	0.804
66-70	constant	33.736^{***}	72.757^{***}	-6.493^{***}	38.035^{***}	55.592^{***}	6.373
	Gini	-0.446^{***}	-0.436^{***}	0.882^{***}	-0.543^{***}	-0.059	0.602^{***}
	$\bar{R}^2$	0.982	0.875	0.982	0.918	-0.079	0.657
71-75	constant	30.946^{***}	80.575^{***}	-11.521^{***}	36.029^{***}	61.119^{***}	2.853
	Gini	-0.386^{***}	-0.604^{***}	0.990^{***}	-0.491^{***}	-0.204^{***}	0.695^{***}
	$\bar{R}^2$	0.928	0.794	0.961	0.982	0.339	0.917
76-80	constant	34.412^{***}	70.066^{***}	-4.478^{**}	36.181^{***}	61.647^{***}	2.172
	Gini	-0.457^{***}	-0.395^{***}	0.851^{***}	-0.489^{***}	-0.230^{***}	0.719^{***}
	$\bar{R}^2$	0.986	0.845	0.980	0.988	0.518	0.950

Table 3: Age-group-specific regressions of total income shares (IS) on Gini coefficients, $IS = const + 100 \times b \times Gini$. - Males (M) with high (HE) and low (LE) education. BC = bottom class (0-40%), MC = middle class (40-90%), UC = upper class (90-100%), p-values (with robust standard errors): $^{*}p \leq 0.10$, $^{**}p \leq 0.05$, $^{***}p \leq 0.01$.

5 Conclusion

In this paper, I have presented a detailed analysis of the age-group-specific evolutions of total income inequality among highly and less educated females and males at ages 26–80 in 5-year age bins between 2005 and 2018. The first part examined the age-group-specific trends of the Gini coefficients of total income, which I decomposed by six normal income components, such as wage or asset incomes, and an additional zero-income component for individuals with a total income of zero, similar to Lerman and Yitzhaki (1985). Overall, the inequality of total income evolved very differently by age among highly and less educated females. For example, from 2005 to 2018, the Gini coefficients of females with a college degree at ages 51–55 and 56–60 strongly rose by 11.55 and 8.59%, respectively, while the inequality even decreased by 1.67 and 2.16% in the age groups 31–35 and 36–40, respectively. In contrast, the two largest increases of 5.92 and 8.18% occurred among less educated females at ages 71–75 and 76–80, respectively, whereas the Gini coefficients only declined by 3.31% in the youngest age group, with females aged 26–30. The inequality of both highly and less educated males, however, increased relatively consistently across all age groups. On average, the Gini coefficients of highly and less educated males rose by 6.29 and 7.27%, respectively.

The associated decompositions of the Gini coefficients show that the economic shocks during the Great Recession had a permanent effect on the zero income component. Until approximately 2010, it strongly increased in age groups with less educated females and males aged 31-50 and 26–60, respectively, and then remained almost constant until 2018. As a consequence, this income component additionally amplified the observed increases in inequality in these age groups between 2010 and 2018. These increases were, in particular, very pronounced in most of these age groups up to 2013. However, thereafter, inequality slowly declined again in some age groups until 2018 due to lower contributions of wage incomes to inequality. Nevertheless, the permanent increases of the zero income component suggest that young less educated individuals were especially left behind economically during the recovery phase after the Great Recession. Furthermore, asset incomes primarily contributed to the increases in inequality in the age groups with elderly individuals at ages 66–80 until 2008, which were somewhat more pronounced among less educated individuals. Thereafter, the contributions of this income component to inequality strongly declined, so the Gini coefficients also decreased. However, the declines of inequality were only temporary because the contributions of other income components, such as Social Security benefits, retirement, or wage incomes, strongly increased over time. For this reason,

the corresponding Gini coefficients increased again in these age groups until 2018.

The second part of this paper studied the extent to which the changes in Gini coefficients were associated with a redistribution of total income between the bottom 40 percent, the middle class in 40–90 percent, and the top 10 percent. On the one hand, irrespective of educational level and sex, the Gini coefficients were highly negatively correlated with the income shares of the bottom 40 percent and highly positively correlated with the income shares of the top 10 percent across almost all age groups. The only notable exception were highly educated females at ages 36–45 with rather moderate correlations. On the other hand, the results were mixed with respect to the income shares of the middle class. The correlations were weakly negative in age groups with highly and less educated females up to an age of 50 and 45 years, respectively. However, they were highly negative in most of the older groups. In contrast, among males with high levels of education, the Gini coefficients and the income shares of the middle class were highly positively correlated at ages 26–30. Then, the correlations almost declined to zero in the age groups with males aged 36–60, before they further decreased with increasing age. Therefore, the correlations were highly negative among males aged 66–80 in the three oldest age groups. With respect to males with low levels of education, the correlations were moderately positive among males at ages 26–50 in the most age groups but they also declined with increasing age, which led to a highly negative correlation in the oldest age group 76–80. These results suggest that the observed increases in inequality were primarily linked to income redistribtions from the bottom 40 percent to the top 10 percent and, partially, the male middle class in the younger age groups. In contrast, both the bottom 40 percent and the middle class contributed to the increasing income shares of the top 10 percent in the oldest age groups of males and in age groups comprising females at middle age and beyond. Furthermore, the associated regressions indicate that increases in inequality especially burdened young age groups in the bottom 40 percent as the declines in their income shares were more pronounced than those of the oldest age groups in the bottom 40 percent.

In sum, both the distributions of total income and the associated intragenerational redistributions differed in many ways across age groups and over time. Therefore, political decision-makers and economists should pay more attention to age-specific trends of inequality over time. Nevertheless, the results of this study should be interpreted with caution for the following three reasons. First, in contrast to, for example, the Survey of Consumer Finances, the ACS does not oversample the wealthiest households, so the Gini coefficients and the redistributions to the top 10 percent were likely somewhat downward biased between 2005 and 2018. This shortcoming occurs in many other studies as well.

Second, this study covered only a relatively short history of inequality in the US. Third, I intentionally refrained from a cohort-based inequality analysis to compare more precisely trends across age groups, but such an analysis with ACS data might prove valuable for future research.

Competing Interests

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