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Factors behind rising U.S. wealth inequality: a decomposition and policy implications

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Abstract

We offer a novel decomposition of wealth inequality and quantify principal factors determining changes in US wealth inequality. We show that the rise in inequality reflects mainly demographic factors related to rising life expectancy and associated increases in savings -- it is not per se evidence of growing inequity and a "threat to society". Importantly, the rise in inequality has been largely driven by differences between rather than within birth cohorts, a phenomenon that has gone largely unnoticed in the literature. Moreover, while changes in saving behavior mitigate the rise in wealth inequality, demographic factors increasingly amplify it. We discuss implications for policy and for structural modeling.

Keywords:
wealth inequality, U.S., saving behavior, rising longevity, demographic factors

JEL Classification
M12, M13, M14, J23

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1 Introduction

Wealth inequality in the United States has been rising since the mid-1970s, attracting attention from both policy makers and academics (Saez and Zucmann 2016; Kuhn et al. 2020; Wolf 2021, Smith et al. 2023). Academics have provided a variety of explanations for the evolution of US wealth inequality (e.g. Castaneda et al. 2003; De Nardi and Fella 2017; and Hubmer et al. 2021), while policy makers have been emphasizing its relevance (it was called "the defining challenge of our times" and a "threat to society" by, among others, President Barack Obama[1]). According to Pew Research Center, 61% Americans share this sentiment.[2]

The literature has identified several potential drivers of rising wealth inequality, including increases in income inequality (e.g., Saez and Zucman 2020, Wolf 2021) and a reduction in capital gains taxes (Hubmer et al. 2021). This has in turn generated a major debate about implications of rising wealth inequality and the extent to which it jeopardizes equity, thus raising policy concerns and encouraging policy intervention (see e.g., Piketty and Saez 2013; Guvenen 2023).

Interestingly, the debate has not considered the possibility that some types of wealth inequality may not jeopardize equity or present a societal problem. Yet, in economic theory, for instance, an overlapping generations model with agents that have identical preferences[3] and income paths produces wealth inequality through differences in age. Individuals from different birth cohorts are at various stages of their life-cycle pattern of accumulation and decumulation of assets. Rising longevity would further amplify the life-cycle effect on wealth inequality. In particular, the between-cohort dispersion of wealth – where younger individuals hold few assets and those nearing retirement are at the peak of their asset holdings – is amplified as the disparity grows in the peak of asset holding between earlier-born (shorter-lived), and later-born (longer-lived) birth cohorts.

On the empirical side, while early evidence suggested that wealth inequality was usually almost as large within birth cohorts as in the population taken as a whole (e.g. Atkinson, 1983), more recently Bauluz and Meyer (2022) document that the gap between assets accumulated at young age and assets held when individuals from the same birth cohort approach retirement is widening for more recent birth cohorts. This suggests that between-cohort inequality may be playing an increasingly important part.

We contribute by developing a decomposition of changes in wealth inequality and demonstrating that the rise in US inequality reflects mainly demographic factors related to rising life expectancy and associated increases in savings. Moreover, the rise in inequality has been largely driven by differences between rather than within age cohorts, a phenomenon that has gone largely unnoticed in the literature. We also show that these phenomena are essential for assessing the extent to which *changes* in wealth inequality jeopardize equity and constitute "the defining challenge of our times" and a "threat to society".

We start by documenting that the increase in U.S. wealth inequality has been to a large extent driven

[1] https://obamawhitehouse.archives.gov/sites/default/files/docs/chapter_3-progress_reducing_inequality_2017.pdf
[2] On average, 80% of Democratic voters and 40% of Republican voters shared this sentiment. https://www.pewresearch.org/social-trends/2020/01/09/most-americans-say-there-is-too-much-economic-inequality-in-the-u-s-but-fewer-than-half-call-it-a-top-priority/.
[3] Heterogeneity in preferences may be quantitatively relevant for explaining the dispersion in wealth. For example, experimental work shows that heterogeneity in time preference explains a sizable share of wealth dispersion (e.g. Epper et al, 2020). This line of research has less potential, however, to explain *changes* in wealth dispersion over time.

by rising between-cohort wealth inequality and that its role has been rising over decades.[4] With our decomposition we identify and quantify three key factors driving changes in U.S wealth inequality: (i) an adjustment in *saving behavior* of successive birth cohorts with rising longevity, (ii) changes in the *population structure* of existing cohorts that occur because the relative share of each birth cohort is changing, and (iii) the *generational exchange* as members of older birth-cohorts die (exit) and members of younger birth-cohorts enter the population.

In this context, we present two novel findings. First, among the three key factors, the behavioral adjustment in savings is reducing wealth inequality, while the changing population structure and generational exchange are amplifying it. We show that the rise in wealth inequality has been driven by the two demographic factors due to rising longevity. The distribution of wealth within birth cohorts has actually been reducing US wealth inequality throughout the post-war period. As we discuss presently, this finding has important implications for both policy and research. In terms of policy implications, our findings indicate that concerns for equity based on raw measures of wealth inequality have been exaggerating the relevance of non-equitable processes in wealth accumulation. In terms of academic research, our findings indicate that models with infinitely-lived agents are not appropriate in this area of research because by construction they ignore rising longevity and changes in the population structure.[5]

Our second novel finding is that the three factors largely offset one another in affecting between- and within-cohort inequality. This contradicts a misguided inference that between-cohort inequality is not particularly relevant for explaining changes in U.S. wealth inequality.[6] In fact, the actual change in wealth inequality attributable to the three factors is much larger than the observed overall decline in U.S. wealth inequality in the first three decades after World War II, and also in its substantial rise since then. Hence, while the public debate focuses on what is perceived as a major rise in overall wealth inequality (e.g., Saez and Zucmann 2016; Kuhn et al. 2020), we demonstrate that this observed rise is in fact "modest" relative to the massive underlying effects brought about by the rise in longevity.

Our findings advance the debate about policy implications of rising wealth inequality. We do not question the arguments that rising wealth inequality may reflect processes that jeopardize equity, thus raising policy concerns. However, we show conceptually and empirically that a paramount role in rising wealth inequality has been played by demographic changes and by changes in individuals' saving behavior driven directly by rising longevity. In particular, the increase in overall wealth inequality is *inter alia* brought about by the younger birth cohorts accumulating more wealth over their working lives than the older birth cohorts because they face rising life expectancy in their old age. Indeed, the U.S. Center for Disease Control reports

[4] Our observation is consistent with Bauluz and Meyer (2022), and we document it in the empirical part of this paper. Note that Bauluz and Meyer (2022) argue that this novel development in the data ought to be attributed to differentiated accumulation patterns in the recent birth cohorts as opposed to the older ones. They establish that in the past most of wealth accumulation was driven by savings (postponed consumption), whereas more recent cohorts receive relatively high returns on their savings.

[5] Some of the studies with infinitely-lived agents argue that they successfully replicate the rise in wealth inequality observed in the data (e.g. Hubmer at al. 2021). However, by construction they operate on solely within-cohort margin and thus they ignore the behavioral implications of rising longevity.

[6] For the period of wealth inequality decline observed in the data between the 1950s and the end of 1970s, the contribution of changes in between-cohort inequality to the changes in wealth inequality was indeed minor, as demonstrated by Atkinson (1983). As we show presently, however, the relative role of between-cohort inequality started changing since 1970s. The key element, however, is that the net effect of changes in between-cohort inequality is minor due to offsetting changes in all the components of between-cohort inequality.

that between 1970 and 2015 life expectancy at age 65 has risen by 4.1 years from less than 15 years to almost 19 years.[7] This is important because the life-cycle theory predicts that asset holding over the life cycle increases with the expectations of a longer retirement spell. The key mechanism here is the old-age saving motive: people nearing retirement hold substantially more wealth than they did at a young age – the life-cycle model predicts that individuals smooth their lifetime consumption by accumulating wealth until they reach retirement age (and peak savings) and they gradually dissave in old-age. If people in more recent birth cohorts tend to have longer old-age lifespans, they are expected to accumulate greater wealth at 65 than those in earlier cohorts. Furthermore, they may dissave more slowly, as their accumulated wealth must finance consumption over a longer period, *ceteris paribus*. This optimizing behavior contributes to greater overall wealth inequality even if within-cohort inequality remains constant over time. In this context, we show that it is crucial to take into account changes in inequality both within and between birth cohorts.

Our analysis contributes to two literatures, one identifying the changes in U.S. wealth inequality and its components, and one examining the role of rising longevity in shaping wealth inequality.

In terms of identifying the changing components of wealth inequality, our paper is closest to Kuhn et al. (2020) and Bauluz and Meyer (2022). We rely on the extended Survey of Consumer Finance data (the so-called SCF+), unearthed and harmonized by Kuhn et al. (2020). However, rather than looking at the components of wealth for subsequent birth cohorts, we provide a decomposition of inequality measures for total wealth.[8] The focus of many other papers in this literature is on changes in various moments of wealth distribution. Wolff (2015) for instance argues that individuals at the top of the wealth distribution recovered from the losses in financial assets incurred during the Global Financial Crisis much faster than individuals at or below the median wealth level. Saez and Zucmann (2016) provide a method for calculating wealth shares based on income data and argue that wealth accumulation at the top of the distribution is driven by rising top incomes and higher savings rates. During the period of rising wealth inequality, individuals with high levels of wealth outpaced the median and the bottom 90% in this regard. This method is questioned by Fagereng et al. (2016) who use administrative data to show that inference based on implied wealth shares proves misleading when compared to actual observational data on wealth. In particular, Fagereng et al. (2019) show that net savings rates are similar across wealth deciles and one must include savings from capital income gains to reproduce any positive correlation between wealth and saving rates. This is relevant particularly through the lens of the overlapping generations framework in which individuals move between no assets at a young age, gradually accumulate to their maximum asset holding just prior to retirement, and systematically dissave thereafter. A similar pattern characterizes earned income, with the key difference being that individuals do not receive wages after retirement, and pension benefits are typically lower than pre-retirement earnings.

The other literature that is related to our paper studies the indirect impacts of rising longevity on wealth inequality. Poterba (2014) for instance demonstrates that longevity enables wealthier individuals to maintain or increase their net worth late in life, as they rely to a lesser extent on liquidating assets to fund their retirement compared to lower-income households. Wolff (2021) revisits this point showing that individuals with

[7] We use this age as it is typically the retirement eligibility age.
[8] While our approach could in principle be applied to various components of net worth from this individual-level survey, we leave this to future research as the focus of our analysis is the role of rising longevity in driving changes in wealth inequality.]

higher accumulated wealth before retirement are better positioned to continue accumulating wealth into old age because they dissave at a lower rate than the rate of return that they earn. The opposite holds for individuals with lower accumulated wealth -- if they withdraw the same amount as the wealthy individuals, they effectively dissave at a higher rate than the interest that they earn. This exacerbates within-cohort wealth inequality in old age. Notably, the impact on overall wealth inequality depends on the motives to save in old age.

Other papers in this latter stream of literature study the motive to save in old age. Wolff (2015) and Pfeffer and Killewald (2018) show that inheritances and gifts account for a significant proportion of wealth held by the top decile of households in the U.S., but this evidence does not seem to be universal. Using administrative data on assets, Elinder et al. (2018) show that inherited wealth actually reduces measures of wealth inequality in Sweden, while Black et al. (2024) use administrative data for Norway to argue that lifetime income is much more relevant for individual wealth accumulation than inheritance.[9] Interestingly, in the U.S. the bequest motive has been shown to be overshadowed by medical expenses in terms of driving old age saving decisions. De Nardi et al. (2024) develop a structural model with bequest motive and health shocks to demonstrate empirically this outcome. Quantitatively, the expectation of high medical expenses rather than the bequest motive explains the saving behavior of old-aged individuals. If old-age health expenses are the main force behind saving in retirement, then increased longevity strengthens the saving motive, thus amplifying the role of between-cohort factors.

The structure of our paper is as follows. In Section 2 we derive the theoretical decomposition of changes in wealth inequality, while in Section 3 we describe our data. In Section 4, we report our main results that provide several new perspectives on changes in US wealth inequality and in Section 5 we show the link between the rise in old-age life expectancy and changes in wealth inequality. We conclude in Section 6 with a discussion of the implications of our study for economic research and policy.

2 Measuring changes in wealth inequality

In developing the novel decomposition we work with the Generalized Entropy (GE) index. First, we introduce the index and its decomposition to within-cohort and between-cohort components. Building on these components we then introduce two propositions offering interpretable decomposition of the overall GE measure of inequality into the three factors: saving behavior and the two demographic changes (population structure and exchange of generations).

We work with the GE index because it has important advantages over alternative measures of inequality. For instance, unlike the Gini index that can only be decomposed across types of assets, the GE index can be decomposed across age groups or birth cohorts. Unlike positional measures, such as the top 1% or top 10%, the GE index covers the entire population. The tradeoff is that while the GE index is monotonic

[9] Using administrative data for Denmark, Boserup et al. (2016) argue that the mechanism needs to be viewed with more depth: absolute wealth distributions are shifted to the right by inheritance, but relative wealth inequality measures such as top wealth shares or Gini indices are unable to detect this shift in the distributions. Boserup at al. (2018) confirm the inference by Elinder at al. (2018) as well as Black et al. (2024): inheritance is not sufficient to explain wealth inequality at later stages in life even if it may serve as a proxy for the intergenerational transmission of earnings and saving behavior. See also Black at el (2023).

(with higher values indicating greater inequality), its values do not have a direct interpretation like the Gini coefficient and the positional measures.

The GE index is given by the formula:

$$GE(\epsilon) = \frac{1}{N\epsilon(\epsilon-1)} \sum_{i=1}^{N} \left[\left(\frac{a_i}{\bar{a}}\right)^{\epsilon} - 1\right], \qquad (1)$$

where N denotes the total population, a_i denotes assets of individual i, $\bar{a}$ denotes the arithmetic mean of all individuals' assets, and ϵ reflects the sensitivity of the GE index to the bottom, middle, and top of the asset distribution. The GE index has within-cohort $GE_w(\epsilon)$ and between-cohort $GE_b(\epsilon)$ components:

$$GE(\epsilon) = GE_w(\epsilon) + GE_b(\epsilon) = \sum_{c=1}^{C}\left[n_c \cdot GE_c(\epsilon) \cdot \left(\frac{\overline{a_c}}{\bar{a}}\right)^{\epsilon}\right] + \frac{1}{\epsilon(\epsilon-1)} \sum_{c=1}^{C}\left[n_c \left(\frac{\overline{a_c}}{\bar{a}}\right)^{\alpha} - 1\right], \qquad (2)$$

where n_c is the population share of birth cohort c and $GE_c(\epsilon)$ denotes the GE index within each birth-cohort $\mathrm{c} = 1, \dots, \mathrm{C}$. We obtain the within-cohort component $GE_w(\epsilon)$ of the index by applying equation (1) to individuals belonging to a given birth cohort c. We also get the between-cohort component $GE_b(\epsilon)$ from equation (1) by using the mean assets for the birth cohort $\overline{a_c}$ instead of a_i.

Since we are analyzing the change in the GE index between periods, we denote by $GE_{\mathrm{t1}}(\epsilon)$ and $GE_{\mathrm{t2}}(\epsilon)$ the Generalized Entropy index in the first and second period, respectively. Then:

$$GE_{t2}(\epsilon) - GE_{t1}(\epsilon) = \Delta GE(\epsilon) = \Delta GE_w(\epsilon) + \Delta GE_b(\epsilon) \qquad (3)$$

denotes the change in GE between the first and second period. The additivity property of the GE index implies that the total change in inequality is given by the sum of the change in the between and within components of the index. The additivity property is useful because by construction the within and between components focus on different aspects of inequality. The within component identifies changes in individual assets a_{i} relative to the cohort average $\overline{a_c}$, whereas the between component identifies the changes in the mean asset of each cohort $\overline{a_c}$ relative to the mean population assets $\bar{a}$.

We next discuss the behavioral and demographic aspects of changes in wealth inequality. Starting with the behavioral aspects, if individuals in a given birth cohort start saving more than individuals in other birth cohorts, then the dispersion of cohort averages will grow (i.e., $\overline{a_c}$ will be more dispersed across birth cohorts). At the same time, within this higher savings cohort, savings (a_i) may become more or less uniform depending on the dispersion of the increase in savings among individuals in this cohort. With rising longevity, individuals in the longer-lived birth cohort tend to save more over their lifetime for retirement and thus generate increased dispersion of $\overline{a_c}$. The effect on within-cohort dispersion is an empirical question as one may expect this effect to lead to either smaller within-cohort disparities in a_i (if individuals with low levels of wealth react disproportionately stronger than those with high levels of wealth) or larger disparities (if the reactions are proportional to asset levels). We call these between-cohort and within-cohort effects of adjustment in *saving behavior* on total wealth inequality the *saving behavior* mechanism.

Proposition 1: The change in wealth inequality brought about by a change in individuals' *saving behavior* and measured by the Generalized Entropy index between periods t_1 and t_2, ($\Delta\mathrm{GE}(\epsilon)$), can be decomposed into:

- a between-cohort change in average cohort wealth (*saving behavior)* of surviving cohorts

$$\frac{1}{\epsilon^2-\epsilon}\sum_{c=1}^{C} n_{\{t_1\},c} \cdot \left(\left(\frac{\overline{a_{\{t_2\},c}}}{\overline{a_{\{t_2\}}}} \right)^{\epsilon} - \left(\frac{\overline{a_{\{t_1\},c}}}{\overline{a_{\{t_1\}}}} \right)^{\epsilon} \right) \quad , \tag{P1:1}$$

- a within-cohort change in average cohort wealth (*saving behavior)* of surviving cohorts

$$\sum_{c=1}^{C} n_{\{t_1\},c} \cdot GE_w(\epsilon)_{\{t_1\},c} \cdot \left(\left(\frac{\overline{a_{\{t_2\},c}}}{\overline{a_{\{t_2\}}}} \right)^{\epsilon} - \left(\frac{\overline{a_{\{t_1\},c}}}{\overline{a_{\{t_1\}}}} \right)^{\epsilon} \right), \tag{P1:2}$$

- and a residual change in within-cohort GE index (*saving behavior)* of the surviving cohorts[10]

$$\sum_{c=1}^{C} n_{\{t_1\},c} \cdot \left(\frac{\overline{a_{\{t_2\},c}}}{\overline{a_{\{t_2\}}}} \right)^{\epsilon} \cdot \left(GE_w(\epsilon)_{\{t_2\},c} - GE_w(\epsilon)_{\{t_1\},c} \right) . \tag{P1:3}$$

Proof: In the Appendix, we provide the derivations that yield the terms in the proposition.

The first term in the proposition corresponds to a change in between-cohort inequality brought about by the changing average wealth of cohorts surviving from t_1 to t_2. It reflects the changing average *saving behavior* across these cohorts. The second term captures the change in within-cohort inequality brought about by the changing average wealth of cohorts surviving from t_1 to t_2.

Note that in the between-cohort contribution (the first term) the change in *saving behavior* across cohorts directly influences the GE measure -- the change in the ratio of the average cohort assets relative to average overall assets enters the measure directly, weighted by the relative size of each cohort. In other words, larger cohorts (e.g., the baby boomers) contribute more in terms of the *saving behavior* to between-cohort inequality. In contrast, in the case of within-cohort contribution (the second term), the *saving behavior* has an indirect effect in the form of a weight -- it amplifies the contribution of within-cohort GE inequality in a given cohort if this cohort has experienced a larger change in its savings than the average change in savings between the two periods. In other words, cohorts with average savings that deviate from the population average contribute more of their within-cohort change in wealth inequality than cohorts with average savings that are more aligned with the population average.

The third term in the proposition captures directly an *additional, residual* change in the within-cohort GE (for the surviving cohorts). While this reflects changes in individuals' behavior, it is driven by changes that are not common for a given birth cohort. We discuss this effect in more detail later.

Turning to the implications of demographic changes for wealth inequality, we note that both the within- and between-cohort effects reflect changes in the population shares n_c over time. Likewise, both are affected by the deceased (exiting) cohorts and the entering (new) cohorts. These intuitive notions may be expressed in the following proposition.

Proposition 2: The change in wealth inequality brought about by direct effects of a change in the *population structure* and measured by the Generalized Entropy index between periods t_1 and t_2, $(\Delta\mathrm{GE}(\epsilon))$, can be

[10] Note that this component is based on GE within-cohort and thus could be further decomposed analogously to the total GE within-cohort. This is thus a first order approximation, and in the empirical analysis we show that quantitatively for our analysis the contribution of this term is already relatively minor.

decomposed into:

- a between-cohort effect of the change in *population shares* of surviving cohorts

$$\frac{1}{\epsilon^2-\epsilon}\sum_{c=1}^{C}(n_{\{t_2\},c}-n_{\{t_1\},c})\cdot\left(\frac{\overline{a_{\{t_2\},c}}}{\overline{a_{\{t_2\}}}}\right)^{\epsilon}, \tag{P2:1}$$

- and a within-cohort effect of the change in *population shares* of surviving cohorts

$$\sum_{c=1}^{C}(n_{\{t_2\},c}-n_{\{t_1\},c})\cdot GE_w(\epsilon)_{\{t_1\},c}\cdot\left(\frac{\overline{a_{\{t_2\},c}}}{\overline{a_{\{t_2\}}}}\right)^{\epsilon}. \tag{P2:2}$$

The two terms reflect the changing *population structure* over time. The first term corresponds to the change in between-cohort inequality brought about by changes in the population shares of the surviving cohorts between t_1 and t_2. The second term applies analogously to within-cohort inequality. For both terms, the change in population structure serves as a weight attached to the wealth distribution within individual cohorts.

Proposition 3: The change in wealth inequality brought about by the direct effects of a *generational exchange* and measured by the Generalized Entropy index between periods t_1 and t_2, ($\Delta\mathrm{GE}(\epsilon)$), can be decomposed into:

- a between-cohort effect of the *generational exchange* (inequality contributed by entering cohorts, indexed by $b = 1, \dots, B$ and by deceased cohorts, indexed by $d = 1, \dots, D$)

$$\frac{1}{\epsilon^2-\epsilon}\sum_{b=1}^{B}(n_{\{t_2\},b})\cdot\left(\frac{\overline{a_{\{t_2\},b}}}{\overline{a_{\{t_2\}}}}\right)^{\epsilon}-\sum_{d=1}^{D}(n_{\{t_1\},d})\cdot\left(\frac{\overline{a_{\{t_1\},d}}}{\overline{a_{\{t_1\}}}}\right)^{\epsilon}, \tag{P3:1}$$

- and a within cohort effect of the *generational exchange*[11]

$$\sum_{b=1}^{B}n_{\{t_2\},b}\cdot GE_w(\epsilon)_{\{t_2\},c}\cdot\left(\frac{\overline{a_{\{t_2\},b}}}{\overline{a_{\{t_2\}}}}\right)^{\epsilon}-\sum_{d=1}^{D}n_{\{t_1\},d}\cdot GE_w(\epsilon)_{\{t_1\},c}\cdot\left(\frac{\overline{a_{\{t_1\},d}}}{\overline{a_{\{t_1\}}}}\right)^{\epsilon}. \tag{P3:2}$$

Proof: In the Appendix, we provide the derivations that yield the terms in the proposition.

The two terms in Proposition 3 reflect an *exchange* of *generations* that is brought about by the older cohorts exiting and younger cohorts entering the population. The between-cohort component measures the extent to which the average assets held by the deceased cohorts differ substantially from the average assets held by the newly arriving young cohorts. For example, in a standard overlapping generations framework, individuals enter with no assets and leave no assets after the final period of their life (barring a bequest motive). In practice, young individuals may enter the sample with inheritance and old, deceased individuals may leave bequests. Hence the sign of this term is an empirical question. The within-cohort component operates analogously, but it focuses on the dispersion of assets held by exiting and entering cohorts relative to their respective cohort means. In a standard overlapping generations framework, these terms should also be approximately zero (if individuals have no assets, there is no dispersion). In empirical terms, the magnitude of

[11] In a decomposition of changes in top wealth shares, Gomez (2023) also accounts for generational exchange in a similar manner.

the effect is therefore not predetermined.[12]

As may be seen from the above discussion, the three propositions allow one to examine the nature and possible insights of various classes of theoretical models. For example, models with infinitely lived agents capture the within-cohort changes related to people's saving behavior (terms in expressions P1:2 and P1:3). The mechanisms in these models can capture changes in optimization by the agents, which can in turn aggregate into changes in wealth inequality as measured for instance by the Gini index or by the Generalized Entropy index that we employ in this study. However, models with infinitely lived agents do not have a cohort structure, making them unsuitable for modeling between-cohort components of changes in wealth inequality.

In contrast, by their very nature models with overlapping generations capture some of the terms related to between-cohort inequality. For example, these models may capture mechanisms addressing between-cohort differences in saving behavior (terms in expression P1:1). Likewise, if enriched with a data-consistent demographic structure, these models may be able to address the between-cohort component of generational exchange (terms in expression P2:1).

If enriched with a bequest motive, the standard overlapping generations framework may also tackle the generational exchange components, both within-cohort and between-cohort (terms in expressions P2:2 and P3:1). For example, a framework with bequests going from deceased generations to entering generations will not capture the between-cohort component of changes in wealth inequality because the transfer between these two types of generations would, on balance, be neutral to the measures of wealth inequality. By contrast, a model with a bequest motive that transfers bequests within a birth cohort or from older- to middle-aged cohorts can deliver insights into the role of generational exchange.

Finally, turning to implications of rising longevity, we note that they may manifest themselves through various components of the changes in wealth inequality. Increasing longevity is reflected in people's accumulation of savings over their life-cycle, and, as life expectancy increases, the life-cycle model predicts that the motive to save for old age becomes more intensive. Accordingly, the mean savings at retirement will be higher for the longer-lived birth cohorts. If the increased saving motive strongly affects all individuals in a given birth cohort, their individual savings (a_i) may become similar to the birth cohort average ($\overline{a_c}$). As the population structure adjusts to changes in longevity, the cohort specific averages ($\overline{a_c}$) may become more similar to the population average ($\bar{a}$). In sum, the rise in longevity may affect each of the seven components of wealth inequality, but in some cases it may amplify wealth inequality, while in others it may reduce it.

Overall, in Propositions 1-3 we identify seven components of changes in wealth inequality. Models with infinitely lived agents can address two of these components. Standard overlapping generations models can address four of them and appropriately enriched overlapping generations models may be able to address all seven. In the next section, we provide an empirical evaluation of the relative importance of the seven components.

[12] Davis and Percheski (2018) show that the absolute wealth gap between elderly and child households in the United States increased substantially, and diverging trends in wealth accumulation exacerbated pre-existing between-group disparities.

3 Data and methodology: cohorts and time intervals

We use Survey of Consumer Finances (SCF) data for 1949-2016 as developed by Kuhn et al. (2020). SCF covers birth cohorts born between 1880 and 1995 and it captures assets and liabilities for a broad sample of households. SCF provides a constructed measure of net wealth that accounts for financial assets (insurance, money market accounts, bonds and other liquid and illiquid financial assets, including retirement accounts) and liabilities (such as personal debt), as well as real estate. The measure of net wealth is adjusted for inflation.

The data on net wealth are accompanied by demographic data, including the year of birth of the household head. We construct birth-cohorts and follow the synthetic cohort approach because SCF is a repeated cross-section survey. It was administered at annual frequency between 1949 and 1971 (with gaps in 1961, 1964 and 1966). Subsequently, the data were collected once every six years for 1971-1989 and every three years thereafter. In addition, the samples from the 1960s and 1971 are smaller, while the samples after 1983 are larger (Kuhn et al., 2020 provide balancing weights).

We use individual-level SCF data to decompose overall wealth inequality into within-cohort and between-cohort components, and we assess the relative importance of the main components of these two types of inequality for the level and evolution of overall wealth inequality. In order to form a birth cohort (denoted by c in our derivations), we group individuals born within five adjacent years into a cohort, (e.g., individuals born between 1920 and 1924 form one birth-cohort). The birth cohorts do not overlap. In order to determine a period (denoted by t_1 and t_2 in our derivations) we combine datasets within one decade to determine a period of time (e.g., data for 1960-1969 form one period). We include data for 1949 in the 1950-1959 period.

We work with the GE index and we set the value of the scaling parameter at $\epsilon = 0.5$.[13] Our motivation for using $\epsilon = 0.5$ is twofold. First, as we show in Figure B1 in Appendix B, the measure tracks well the evolution of the Gini coefficient. Likewise, it provides inference that is similar to that of positional measures such as the top 10% or top 1% wealth share. Thus, the choice of $GE(\epsilon = 0.5)$ introduces no distortion in the time evolution of wealth inequality relative to other measures.

Second, with $\epsilon = 0.5$ the GE index is not overly sensitive to inequality at the top or bottom of the distribution. Low values of ϵ tend to put greater weight on the lower part of the distribution, whereas the values of ϵ above 1 tend to be sensitive to evolutions at the top of the distribution. In Figure B2 in Appendix B we compare our preferred $GE(\epsilon = 0.5)$ with the alternatives of $GE(\epsilon = 0.3)$ and $GE(\epsilon = 1.2)$. We show that in this range inferences about changes in wealth inequality do not depend on the selected value of the ϵ parameter.

In analyzing the changes in wealth inequality, we first split the sample into two long periods. The first period covers the years 1949-1979 and captures the decline in wealth inequality in the U.S. The second period covers years 1979-2016 and captures the period of rising U.S. wealth inequality. We first present the

[13] Particular values of ϵ in the GE index correspond to well-known measures – for instance the Theil index is the GE index with $\epsilon = 1$ and the mean log deviation index is the GE index with ϵ=0. However, these two indices cannot be used for individuals that have no assets, which is an important consideration as households with no assets typically constitute more than 10% of the SCF sample in each year.

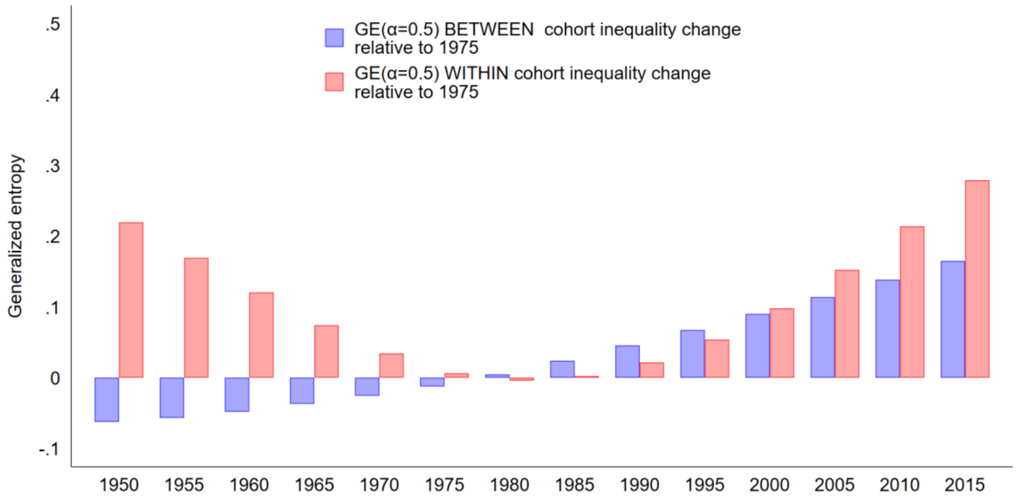
results of our decompositions for these two periods.

While capturing well the periods of declining and rising wealth inequality, respectively, the 30-year time spans may be considered to be too long in the sense that large changes in demographic factors may play a disproportionally large part as compared to the behavioral factor. To ensure that our results are not affected by this choice of time periods, we also present the results of our decomposition over adjacent ten-year time spans. In this latter exercise we take as starting points the decades beginning in 1949, 1959, 1969, 1979, 1989, 1999, and 2009, and we present the results of decompositions until 1959, 1969, 1979, 1989, 1999, 2009, and 2016, respectively.

4 Results

In Figure 1 we show the contribution of within- and between-cohort inequality to the change in the GE index of wealth inequality between 1949 and 2016. As may be seen from the figure, the within-cohort component contributed positively to (i.e., enhanced) overall inequality throughout the period. Its magnitude declined until 1980 and then rose until 2016 to a level that is similar to that observed in the 1950s. While the positive contribution of within-cohort inequality is not new, the novel, previously unobserved phenomenon that we quantify and discuss is the important and changing role of the between-cohort component of inequality. In particular, in Figure 1 we demonstrate that the between-cohort component of the GE index reduced inequality in the early decades, but substantially raised it after 1975. From the data in Figure 1 it is also clear that the between-cohort effects are quantitatively relevant for gauging the scale of changes in overall U.S. wealth inequality.

Figure 1 The contribution of within and between cohort inequality to the *change* in the GE index of wealth inequality



Data source: Kuhn et al. (2020).

Note: We calculate the GE index for $\epsilon = 0.5$. We combine the observations from 1949 to the five-year period denoted as 1950 and encompassing 1950-1954. We combine the observations from 2016 into the five-year period denoted as 2015 and encompassing years 2015-2016. We compute changes relative to the period 1975-1979. We portray values adjusted for changes in population structure and smoothened by HP filter.

Keeping in mind the insights gained from Figure 1, we next analyze the three major factors that affect the evolution of wealth inequality: (a) the saving behavior, (b) the changing population structure and (c) the generational exchange. We start by using our decomposition to present the net contributions of these three factors to wealth inequality. Next we show the extent to which the changes in wealth inequality may be attributed to the within- and between-cohort components of each of these three factors.[14]

In Figure 2(a) we show that the magnitudes of the three factors are very large, especially when compared to the observed changes in overall wealth inequality. In the figure we depict with black diamonds the changes in the GE index of overall wealth inequality, and with the three different colors the decomposition of these GE changes into the three major factors: saving behavior (blue), population structure (orange) and exchange of generations (green).[15] As may be seen from the figure, the changes in the GE index are minor relative to the net contribution of the change in the population structure (+0.7 in the first period and +0.9 in the second period) or in the behavioral adjustment and generational exchange in the first period (-0.5 and -0.4, respectively). In other words, the underlying effect of the demographic factors is large when compared to the observed overall net effect captured by the GE index. The discrepancy is brought about by the fact that these underlying factors are to a significant extent offsetting one another.

Another important finding in Figure 2(a) is that people's saving behavior is contributing negatively to (i.e., is reducing) inequality in both periods. In other words, during the first period of declining overall wealth inequality, the behavior of households was adding to this downward trend, while during the second period of rising overall wealth inequality it was mitigating the rise. The changes in the saving behavior of households hence resulted in lower levels of overall wealth inequality than would have been observed if households had not been adjusting their saving behavior. Note that this inequality-reducing effect of the saving behavior of households is completely masked by the increasingly positive contribution to inequality of the demographic factors, especially the changing population structure. Moreover, while the effect of the changing generational exchange was negative in both periods, the effect of the change in the population structure was rising and in the second period it outweighed the effect of the saving behavior and generational exchange.

In Figure 2(b) we use our decomposition to present a detailed picture of the three factors and their within- and between-cohort components. While the net changes in the GE index are obviously the same as those in Figure 2(a) (-0.2 and 0.4 in the two periods, respectively), the total changes that we present in Figure 2(b) are large, ranging between as much as -1.5 and nearly 2.0, that is they are of the same order of magnitude as the overall *level* of the GE index. Quantitatively, demographic factors continue to be the main factor whereas the part played by people's saving behavior is smaller and works almost uniformly towards reducing inequality.

[14] For illustrative purposes in Appendix C we present the general contributions of within and between components to the level and change in GE measure of wealth inequality.

[15] In the 1949-79 period of declining overall wealth inequality, the GE index fell by approximately -0.2, while in the 1979-2016 period of increasing overall wealth inequality the GE index increased by approximately 0.4. These values compare to the average GE value of 1.4 in the 1949-2016 period and they are equivalent to an initial decline in the Gini coefficient by 6 points from 81 to 75 and a subsequent increase by 8 points from 75 to 83.

Figure 2(a): The ***net*** contribution of the three main factors (behavioral adjustment in savings, change in population structure and generational exchange) to the change in the GE index of wealth inequality

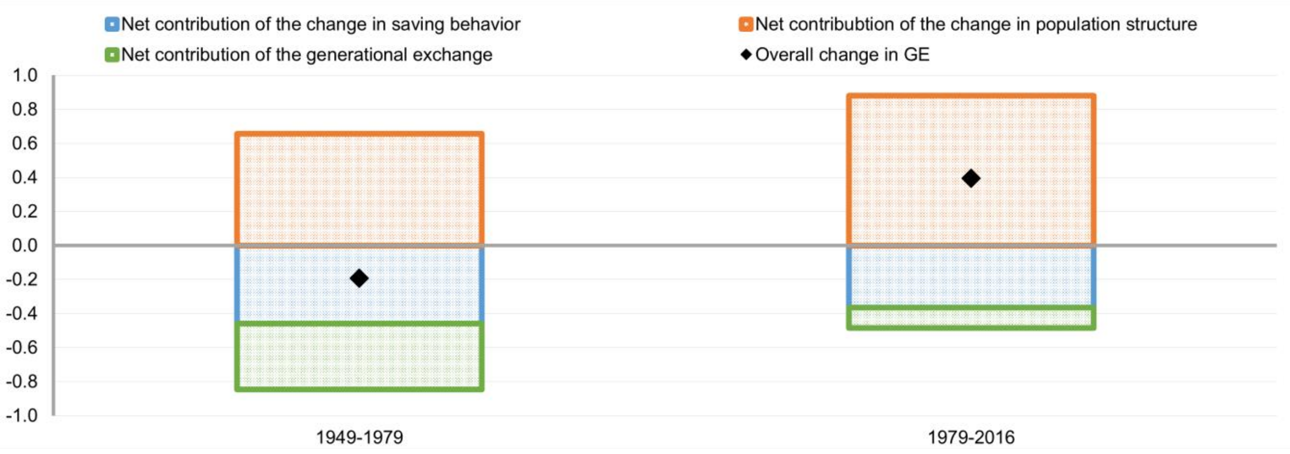


Figure 2(b): The ***gross*** contribution of the three main factors (behavioral adjustment in savings, change in population structure and generational exchange) to the change in the GE index of wealth inequality

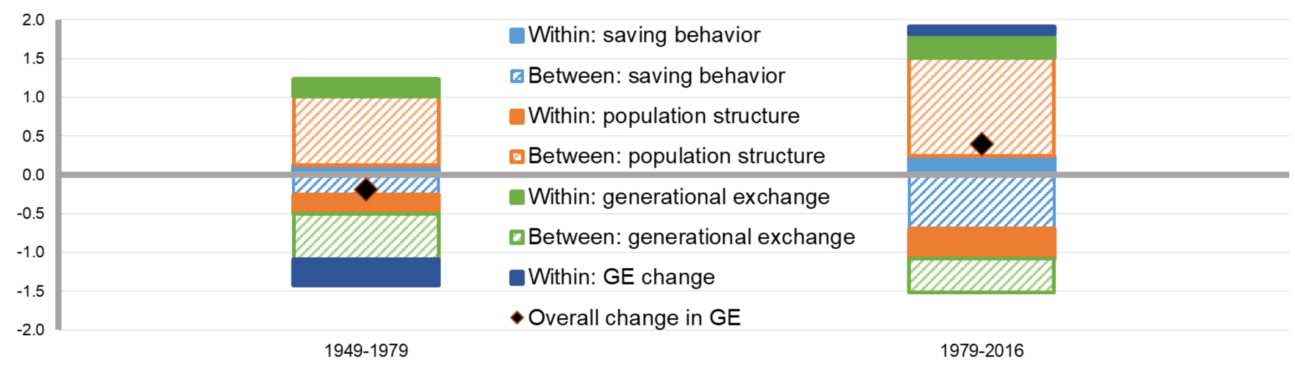
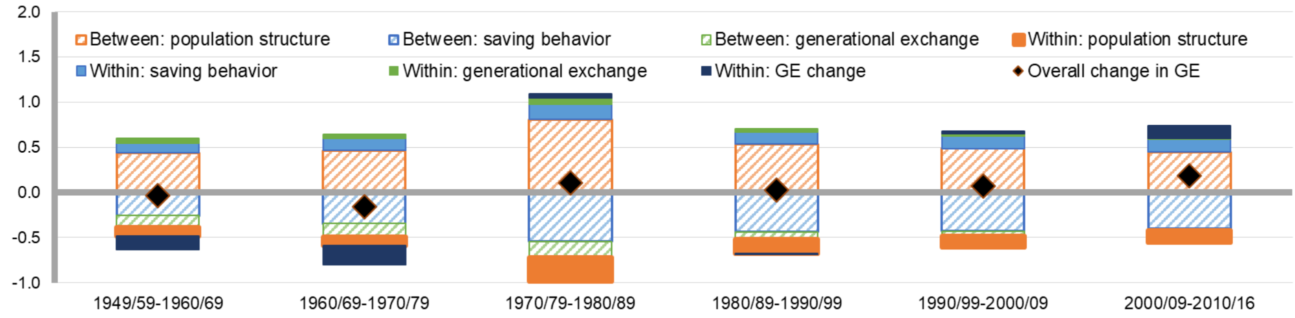


Figure 2(c): The ***gross*** contribution of the three main factors to the change in the GE index of wealth inequality, disaggregated over time periods



Data source: Kuhn et al. (2020).

Note: The GE index is calculated for $\epsilon = 0.5$.

As may also be seen from Figure 2(b), within the two demographic factors no component changes sign between the period of inequality decline and period of inequality rise. With one exception, all components become quantitatively larger in the second period. We report the between-cohort components as striped bars and within-cohort components as full bars for the population structure (orange) and generational exchange (green), respectively. By far the largest effect on the change in overall wealth inequality is provided by the between-cohort component of the population structure. The contribution of this component goes up from almost 0.9 to almost 1.3 in the GE metric. This means that average assets held by various cohorts in the early periods were more similar to the total population average in the period of overall wealth decline than in the period of overall wealth increase. Note that in both periods the mean asset $\overline{a_c}$ of the various cohorts was very different from the mean population assets $\bar{a}$, but the difference increased over time.

By contrast, we observe a declining role of the between-component related to generational exchange -- from -0.6 to -0.4, i.e., 0.2 in the GE metric. In terms of average asset holding, the cohorts entering the population were hence increasingly more similar to the exiting (deceased) cohorts. In Figure 2(b) one also observes the growing role of the within-cohort component for the generational exchange, which rises from 0.2 to 0.3 and captures the growing relative dispersion of assets held by the exiting and entering cohorts relative to their respective cohort means. Note that in models with infinitely lived agents, this component would be non-existent, while in the standard OLG framework it would be close to zero (individuals early in their life-cycle and late in their life-cycle have little to no assets, thus generating little dispersion).

The saving behavior is denoted by a light blue color striped bar for the between component and full bar for the within component. The residual GE within component, constituting the residual change in saving behavior in the within-cohort GE index of the surviving cohorts (term P1:3 in Proposition1), is depicted in navy blue color. As may be seen from Figure 2(b), the between-cohort change in the average cohort wealth of surviving cohorts contributes to reducing overall inequality, whereas the within-cohort change in average cohort wealth of surviving cohorts operates towards raising inequality. These changes are large, ranging from -0.3 to -0.7. They imply that average wealth among the surviving cohorts has become less dispersed, whereas differences among individuals within the surviving birth cohorts have increased.

The residual within GE change switches signs from negative in the earlier period of wealth inequality decline to positive in the later period of rise in overall wealth inequality. While quantitatively the role of this channel is smaller, it suggests that changes in the saving behavior have not been uniform among the surviving birth cohorts. In fact, the net assets of the surviving cohorts are becoming more similar in the first three decades of our analysis and less similar in the second three decades for reasons not driven by factors common to these birth cohorts. These factors can be time-specific or entirely idiosyncratic at an individual level. They may also reflect inequality driven by inheritance from older generations and other economic processes with a direct and indirect wealth effect. However, the contribution of within-cohort GE wealth inequality of the surviving cohorts is quantitatively small when compared to the demographic factors.

In Figures 2(a) and 2(b) we decompose changes in wealth inequality with a unit of analysis being three decades. To test the robustness of our findings, in Figure 2(c) we take the unit of analysis to be one decade. This allows us to put in perspective the role of demographic and economic factors because changes in population shares and in generational exchange are substantially less pronounced over the span of one rather than three decades. We also compare individual decades to one another, with the change from the first to the last decade being the compounded effect of these decade-to-decade changes.

As may be seen from Figure 2(c), when we use one decade as the unit of analysis, the within and between contributions of each of the three factors continue to be substantially larger than the change in overall GE inequality. In fact, the range of these contributions is as wide as -1.0 to 1.0 in a decade. We also observe that with the exception of the GE within-cohort inequality among surviving cohorts, no component changes its sign.

Our analysis by decades reveals that in the period between the 1970s and 1980s there was a relatively small change in the overall GE index of wealth inequality, but that this small change conceals a massive underlying change in the between-cohort component of (a) the population structure and (b) the saving behavior. Given that these two factors operate in opposite directions, their individual effects do not manifest themselves in analyses of changes in overall wealth inequality. In terms of economic analysis, we note that while models with infinitely lived agents are bound to ignore the between-cohort component of the population structure, they also have a problem identifying the within-cohort component of the saving behavior. Moreover, the within-cohort component of the saving behavior is not changing its magnitude throughout the decades and only the residual change in within-cohort GE index (*saving behavior)* of the surviving cohorts can drive the models without the overlapping generations structure. Finally, while the residual within-cohort GE operates towards noticeably reducing inequality in the first two decades and towards raising them in the last decade, this component is relatively unimportant in the middle decades of the data.

Overall, our analysis generates three important findings. First, demographic changes are the most important factors affecting changes in overall wealth inequality in the US. This effect is driven especially by the changing population structure of the surviving cohorts, but also by the generational exchange. The direction of the demographic effects is uniform across periods. Quantitatively, the dominant effect is the between-cohort contribution of the change in the population structure.

The second finding is that the saving behavior of the subsequent birth cohorts is becoming more similar in terms of cohort averages. This pushes the measures of wealth inequality down over time and it is the second largest driver of changes in wealth inequality -- in both the initial period of inequality decline and in the subsequent period of inequality rise.

The third finding is that the within-cohort contribution to GE and the within-cohort GE of the surviving cohorts add to wealth inequality in recent decades. In fact, the former adds to wealth inequality ever since the post-war period, whereas the latter works negatively when inequality declines and positively when it rises.[16]

We interpret our findings as evidence that papers without an explicit demographic structure overlook the key factor of the change in wealth inequality, both in terms of levels and in terms of their massive contribution to the overall changes. At the same time, the change of the sign of the residual within GE measure of the surviving cohorts suggests that between the period of 1949-1969 and the most recent decade there have been substantial behavioral changes to the individuals' saving behavior that are not driven by factors common to the respective birth cohorts.

[16] Among all the seven analyzed components, this is the only one to change the size of the contribution to the total GE measure of wealth inequality used in this study. Recall that this residual component could in principle be further decomposed and attributed to our six main factors (as second- or higher-order approximations). Given that it can be further attributed to the main six factors, there is no intuitive interpretation of its changing sign.

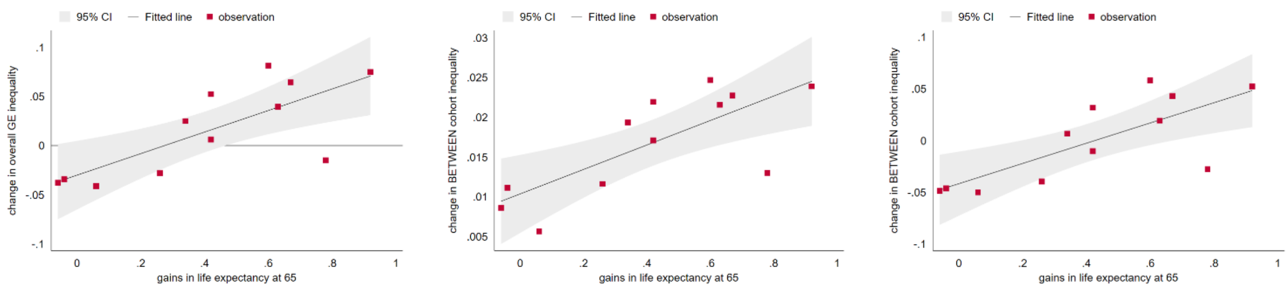
5 Do cohorts with greater life expectancy contribute more to the rise in wealth inequality?

In this section we check our interpretation of the factors behind changes in wealth inequality by exploring whether cohorts with greater life expectancy contribute more to wealth inequality. We do so by performing two analyses. First, we explore the correlation between changes in life expectancy and changes in wealth inequality measures. Second, we examine which birth-cohorts affect more and which ones less the observed changes in wealth inequality. Our hypothesis is that birth-cohorts whose members expect to live the longest after retirement ought to have the greatest positive effect on wealth inequality.

In the first analysis we focus on the behavioral effects. In order to do so we reweigh the age structure of the population to 1950, thus suppressing the effects of changes in the population structure. In Figure 3 we juxtapose the changes in wealth inequality against the gains in life expectancy at age 65, with the scatter diagram of red squares relating in panel (a) to overall wealth inequality, in panel (b) to between-cohort wealth inequality, and in panel (c) to within-cohort wealth inequality. The change in wealth inequality and gains in life expectancy are both computed for twenty-year intervals. As may be seen from the figure, increases in between-cohort inequality, within-cohort inequality and overall inequality are positively correlated with gains in life expectancy at 65. Thus, the higher the gain in life expectancy over a given period, the greater the accompanying increase in total, between- and within-cohort wealth inequality.

Figure 3: The relationship between changes in wealth inequality and gains in life expectancy at 65

(a) Changes in total wealth inequality | (b) Changes in between-cohort wealth inequality | (c) Changes in within-cohort wealth inequality



Data: Kuhn et al. (2020) for wealth measures and CDC for life expectancy.

Notes: In panel (a), the total GE measure of wealth inequality is first HP-filtered. The changes in the total GE index of wealth inequality are calculated over 20-year time periods and juxtaposed against gains in life expectancy over those 20-year periods. In panel (b), the population structure is fixed at 1950 levels in order to focus on the effect of people's behavioral adjustment to the changes in life expectancy. The total and the between-cohort GE measure of wealth inequality is HP-filtered. For the sake of completeness, we also include panel (c) for change of within-cohort wealth inequality.

In order to obtain the impact of birth-cohorts on the GE index, conditional on age patterns and time trends, we deploy the Firpo, Fortin, and Lemieux (2009) Recentered Influence Function (RIF). Moreover, in order to attribute changes in the GE index to specific birth-cohorts, we deploy the Deaton and Paxson (2000) decomposition, in which birth cohorts and age are expressed as factors relative to selected base levels and the year effects are orthogonalized. In other words, this decomposition overcomes the challenge that age, birth-cohort and year are jointly perfectly collinear. Note that this approach captures the year effects as fixed effects that add up to zero.

We work with the individual data from SCF and estimate the following model:

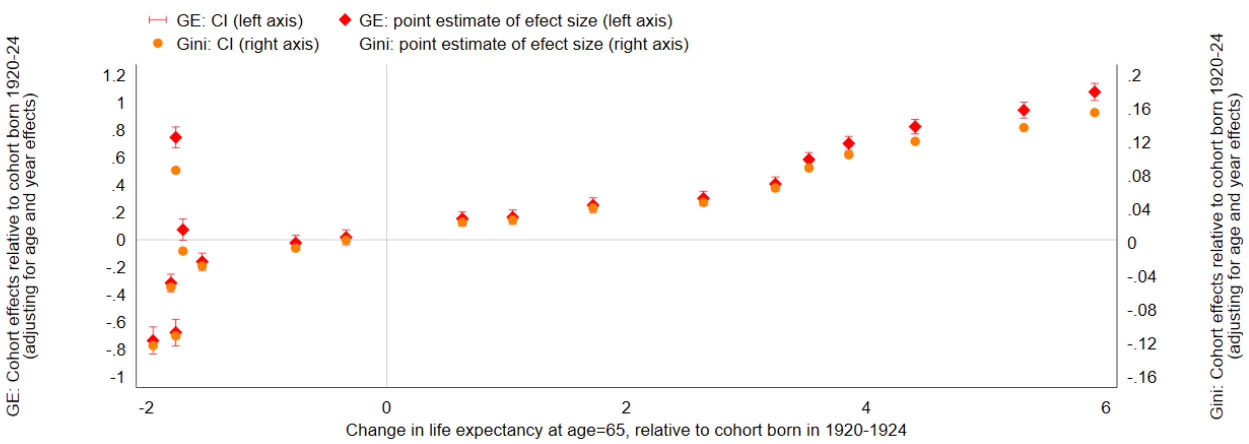
$$RIF\{wealth_i, GE(\epsilon)\} = \beta_c Birth\ cohort_c + \beta_a Age_a + \beta_y year_y + \epsilon_i \quad (4)$$

$$GE(\epsilon) = \boldsymbol{E}[RIF\{wealth_i, GE(\epsilon)\}], \quad (5)$$

where RIF enables us to estimate unconditional partial effect β_c of each cohort c on the GE index of wealth inequality. We focus on the estimates of β_c. Note that these estimates of patterns of wealth accumulation adjust for age profiles (absorbed by β_a) and time patterns (absorbed by β_y). To work with stationary distributions of assets, we scale assets from each wave of SCF by their maximum value in that wave. In the regressions we adjust for population weights.

In Figure 3 we present our estimates of the birth-cohort effects relative to the cohort of 1920-24, which is the most recent cohort whose members have by and large completed their life cycle. We depict the results in terms of both the GE index and Gini coefficient. The dots in Figure 3 represent our estimates of the cohort effects, i.e. estimates of β_c in equation (4), with confidence intervals. They are scattered against gains in life expectancy at retirement for a given birth-cohort, expressed as gains relative to the 1920-1924 birth cohort. As mentioned above, the estimates of β_c adjust for age composition and year effects.

Figure 3: The contribution of cohorts to wealth inequality in the US



Data: Kuhn et al. (2020) for wealth and demographic variables, and CDC for life expectancy.

Notes: Coefficients β_c with robust standard errors come from a Deaton-Paxson orthogonal decomposition to cohort, age and year effects. We obtain decomposition for $GE(\varepsilon = 0.5)$. Analogous estimates for Gini coefficient are available upon request. Individuals with negative assets are treated as individuals with no assets. The results are robust to this adjustment: inference is the same if observations with negative assets are dropped.

As may be seen from the figure, the relatively shorter-lived cohorts born before 1920, with relatively small rises in longevity, have all comparable and volatile estimates of the cohort effects, by and large contributing negatively to overall wealth inequality. In cohorts born after 1920-24, rising longevity is associated positively with wealth inequality. For example, the presence in the sample of birth-cohorts expecting to live 4 years longer than the birth-cohort 1920-1924 amplifies the overall Gini coefficient by as much as 0.15 points. Overall, the change in life expectancy is highly predictive of the cohort effects obtained from estimating equation (4): the R^2 of the fitted line is equal to 0.84. This empirical exercise shows that longer lived cohorts contribute positively to wealth inequality, which supports the conclusions that we drew from the results obtained from our wealth decomposition

Summary and Conclusions

The rise of wealth inequality in the United States since 1970s has generated a major academic and policy debate about the extent to which it may jeopardize equity and constitute “the defining challenge of our times” and a “threat to society”. While we do not question these concerns, we show conceptually and empirically that a major part of the rise in U.S. wealth inequality reflects demographic factors related to rising life expectancy in old age and is therefore not *per se* evidence of growing inequity and a “threat to society”.

We develop a decomposition of overall wealth inequality into components that reflect (a) changes in the *saving behavior* of successive birth cohorts that reflect an adjustment in individuals’ saving behavior due to rising life expectancy (b) changes in the *population structure* of existing cohorts which occur because the relative share of each birth cohort in the population structure is changing, and (c) the effect of *generational exchange* as new cohorts enter and old cohorts exit the population over time. In presenting our model, we show how our decomposition accounts for both between-cohort and within-cohort effects. Using U.S. data we show that changes in the population structure and exchange of cohorts have been increasing wealth inequality, while the third factor in our decomposition – an adjustment in individuals’ saving behavior due to rising life expectancy – has been reducing it. Importantly, we show that the impact of the two demographic factors has been larger than the impact of saving behavior.

We also demonstrate that the three determinants of the rise in U.S. wealth inequality – the two demographic factors and the saving behavior factor – largely offset one another in how they affect between- and within-cohort inequality. Ignoring this phenomenon has led to a misguided inference that between-cohort inequality is not relevant for explaining changes in US wealth inequality. The actual change in wealth inequality attributable to each of the three channels is in fact much larger than the observed change in overall wealth inequality. Hence, while the public debate relates to what is considered a major rise in overall, observed wealth inequality, we show that this observed major rise is in fact “modest” relative to the large underlying effects brought about by the rise of longevity.

From the policy standpoint one needs to recognize that increasing life expectancy, operating through demographic factors and changes in individuals’ saving behavior, has been the principal determinant of increasing wealth inequality in the United States. In particular, demographic factors that have been largely missing in the policy debates and economic studies should be explicitly incorporated.

In terms of academic research, our findings indicate that models with infinitely-lived agents are not appropriate for analyses in this area because by construction they ignore the role of demographic factors such as the rising longevity and changes in the population structure. Our findings show that studies without an explicit demographic structure overlook two key factors driving the change in wealth inequality -- in terms of both magnitude and specific mechanisms through which they operate.

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Appendix A: Proofs

Lemma 1. GE decomposition

Recall equation (2) in Section 2:

$$GE(\epsilon) = GE_{within}(\epsilon) + GE_{between}(\epsilon) = \sum_{i=1}^{C}\left[n_c \cdot GE_c(\epsilon) \cdot \left(\frac{a_c}{\bar{a}}\right)^{\epsilon}\right] + \frac{1}{\epsilon(\epsilon-1)}\sum_{i=1}^{C}\left[n_c\left(\frac{a_c}{\bar{a}}\right)^{\epsilon} - 1\right],$$

where n_c is the population share of birth cohort c, $\overline{a_c}$ is the average wealth of birth cohort $c = 1, \ldots, C$, $\bar{a}$ is the overall average wealth and $GE_c(\epsilon)$ denotes the GE index within each birth-cohort. The change in the inequality measured by GE between two periods $\{t_1, t_2\}$ can be decomposed into the change of the within contribution and the change of the between contribution. Due to additivity of GE, the change between period $\{t_2\}$ and $\{t_1\}$ can be written down as:

$$GE_{t2}(\epsilon) - GE_{t1}(\epsilon) = \Delta GE(\epsilon) = \Delta GE_w(\epsilon) + \Delta GE_b(\epsilon)$$

Then, we propose to decompose the within change in GE and between change in GE each into three components: (a) change in saving behavior; (b) change in population structure and (c) generational exchange.

Proof of Lemma 1

We provide the proof of Lemma 1 by decomposing the between contribution to change in GE measure of inequality and, analogously, the within contribution.

Decomposition of $\boldsymbol{\Delta GE_{between}(\epsilon)}$

Note that the $GE_{between}(\epsilon)$ in particular period $\{t_1\}$ can be further decomposed into the:

$$GE_{\{t_1\},between}(\epsilon) = \frac{1}{\epsilon^2-\epsilon}\left\{\underbrace{\sum_{c=1}^{C} n_{\{t_1\},c} \cdot \left(\frac{\overline{a_{\{t_1\},c}}}{\overline{a_{\{t_1\}}}}\right)^{\epsilon}}_{Contribution\ of\ surviving\ cohorts} + \underbrace{\sum_{d=1}^{D} n_{\{t_1\},d} \cdot \left(\frac{\overline{a_{\{t_1\},d}}}{\overline{a_{\{t_1\}}}}\right)^{\epsilon}}_{Contribution\ of\ exiting\ cohorts}\right\} \quad \text{(A1)}$$

Where we label "surviving cohorts" those which survive to period $\{t_2\}$ and exiting cohorts those which do not survive. Similarly, $GE_{between}(\epsilon)$ in particular period $\{t_2\}$ can be further decomposed into the:

$$GE_{\{t_2\},between}(\epsilon) = \frac{1}{\epsilon^2-\epsilon}\left\{\underbrace{\sum_{c=1}^{C} n_{\{t_2\},c} \cdot \left(\frac{\overline{a_{\{t_2\},c}}}{\overline{a_{\{t_2\}}}}\right)^{\epsilon}}_{Contribution\ of\ surviving\ cohorts} + \underbrace{\sum_{b=1}^{B} n_{\{t_2\},b} \cdot \left(\frac{\overline{a_{\{t_2\},b}}}{\overline{a_{\{t_2\}}}}\right)^{\epsilon}}_{Contribution\ of\ born\ cohorts}\right\} \quad \text{(A2)}$$

Subtracting (A1) from (A2), the $\Delta GE_{between}(\epsilon)$ between two periods $\{t_1, t_2\}$ can be written as:

$$\Delta GE_{between}(\epsilon) =$$

$$\frac{1}{\epsilon^2-\epsilon}\left\{\underbrace{\sum_{c=1}^{C} n_{\{t_1\},c} \cdot \left(\frac{\overline{a_{\{t_2\},c}}}{\overline{a_{\{t_2\}}}}\right)^{\epsilon}}_{Contribution\ of\ surviving\ cohorts} - \underbrace{\sum_{c=1}^{C} n_{\{t_1\},c} \cdot \left(\frac{\overline{a_{\{t_1\},c}}}{\overline{a_{\{t_1\}}}}\right)^{\epsilon}}_{Contribution\ of\ surviving\ cohorts}\right\} +$$

$$\underbrace{\frac{1}{\epsilon^2-\epsilon}\sum_{b=1}^{B} n_{\{t_1\},b} \cdot \left(\frac{\overline{a_{\{t_2\},b}}}{\overline{a_{\{t_2\}}}}\right)^{\epsilon} - \sum_{d=1}^{D} n_{\{t_1\},d} \cdot \left(\frac{\overline{a_{\{t_1\},d}}}{\overline{a_{\{t_1\}}}}\right)^{\epsilon}}_{\text{P3:1:}Exchange\ of\ generations} \quad \text{(A3)}$$

The second line we label as "*exchange of generations"* (P3:1).

The first line is further decomposable into the:

$$\frac{1}{\epsilon^2-\epsilon}\sum_{c=1}^{C} n_{\{t_1\},c}\cdot\left(\frac{\overline{a_{\{t_2\},c}}}{\overline{a_{\{t_2\}}}}\right)^{\epsilon}-\frac{1}{\alpha^2-\alpha}\sum_{c=1}^{C} n_{\{t_1\},c}\cdot\left(\frac{\overline{a_{\{t_1\},c}}}{\overline{a_{\{t_1\}}}}\right)^{\epsilon}=$$

$$\underbrace{\frac{1}{\epsilon^2-\epsilon}\sum_{c=1}^{C}(n_{\{t_2\},c}-n_{\{t_1\},c})\cdot\left(\frac{\overline{a_{\{t_2\},c}}}{\overline{a_{\{t_2\}}}}\right)^{\epsilon}}_{\text{P2:1:Change in } population\ shares}+\underbrace{\frac{1}{\epsilon^2-\epsilon}\sum_{c=1}^{C} n_{\{t_1\},c}\cdot\left(\left(\frac{\overline{a_{\{t_2\},c}}}{\overline{a_{\{t_2\}}}}\right)^{\epsilon}-\left(\frac{\overline{a_{\{t_1\},c}}}{\overline{a_{\{t_1\}}}}\right)^{\epsilon}\right)}_{\text{P1:1:Change in average cohort wealth}} \qquad \text{(A4)}$$

The sum of the "exchange of generations" (P3:1) + "change in population shares" (P2:1) + "change in average cohort wealth" (P1:1) provides complete decomposition of the $\Delta GE_{between}(\epsilon)$ between two periods $\{t_1, t_2\}$.

Decomposition of $\Delta GE_{within}(\epsilon)$

Note that the $GE_{\{t_1\},within}(\epsilon)$ in particular period $\{t_1\}$ can be written as:

$$GE_{\{t_1\},within}(\epsilon)=\underbrace{\sum_{c=1}^{C} n_{\{t_1\},c}\cdot GE_w(\epsilon)_{\{t_1\},c}\cdot\left(\frac{\overline{a_{\{t_1\},c}}}{\overline{a_{\{t_1\}}}}\right)^{\epsilon}}_{Contribution\ of\ surviving\ cohorts}+\underbrace{\sum_{d=1}^{D} n_{\{t_1\},d}\cdot GE_w(\epsilon)_{\{t_1\},c}\cdot\left(\frac{\overline{a_{\{t_1\},d}}}{\overline{a_{\{t_1\}}}}\right)^{\epsilon}}_{Contribution\ of\ deceased\ cohorts} \qquad \text{(A5)}$$

Again, we label "surviving cohorts" those, which survive to period, $\{t_2\}$ and exiting cohorts those, which do not survive. Similarly, $GE_{\{t_2\},within}(\epsilon)$ in particular period $\{t_2\}$ can be further decomposed into the:

$$GE_{\{t_2\},within}(\epsilon)=\underbrace{\sum_{c=1}^{C} n_{\{t_2\},c}\cdot GE_w(\epsilon)_{\{t_2\},c}\cdot\left(\frac{\overline{a_{\{t_2\},c}}}{\overline{a_{\{t_2\}}}}\right)^{\epsilon}}_{Contribution\ of\ surviving\ cohorts}+\underbrace{\sum_{b=1}^{B} n_{\{t_2\},b}\cdot GE_w(\epsilon)_{\{t_2\},b}\cdot\left(\frac{\overline{a_{\{t_2\},b}}}{\overline{a_{\{t_2\}}}}\right)^{\epsilon}}_{Contribution\ of\ born\ cohorts} \qquad \text{(A6)}$$

Subtracting (A3) from (A4), the change in $\Delta GE_{within}(\epsilon)$ between two periods $\{t_1, t_2\}$ can be written as:

$$\Delta GE_{within}(\epsilon)=$$

$$\underbrace{\sum_{c=1}^{C} n_{\{t_2\},c}\cdot GE_w(\epsilon)_{\{t_2\},c}\cdot\left(\frac{\overline{a_{\{t_2\},c}}}{\overline{a_{\{t_2\}}}}\right)^{\epsilon}}_{Contribution\ of\ surviving\ cohorts}-\underbrace{\sum_{c=1}^{C} n_{\{t_1\},c}\cdot GE_w(\alpha)_{\{t_1\},c}\cdot\left(\frac{\overline{a_{\{t_1\},c}}}{\overline{a_{\{t_1\}}}}\right)^{\epsilon}}_{Contribution\ of\ surviving\ cohorts}+$$

$$\underbrace{\sum_{b=1}^{B} n_{\{t_2\},b}\cdot GE_w(\epsilon)_{\{t_2\},c}\cdot\left(\frac{\overline{a_{\{t_2\},b}}}{\overline{a_{\{t_2\}}}}\right)^{\epsilon}-\sum_{d=1}^{D} n_{\{t_1\},d}\cdot GE_w(\epsilon)_{\{t_1\},b}\cdot\left(\frac{\overline{a_{\{t_1\},d}}}{\overline{a_{\{t_1\}}}}\right)^{\epsilon}}_{\text{P3:2:}Exchange\ of\ generations} \qquad \text{(A7)}$$

The second line we label as "*exchange of generations"* (P3:2). The first line is further decomposable into the:

$$\sum_{c=1}^{C} n_{\{t_2\},c}\cdot GE_w(\epsilon)_{\{t_2\},c}\cdot\left(\frac{\overline{a_{\{t_2\},c}}}{\overline{a_{\{t_2\}}}}\right)^{\epsilon}-\sum_{c=1}^{C} n_{\{t_1\},c}\cdot GE_w(\epsilon)_{\{t_1\},c}\cdot\left(\frac{\overline{a_{\{t_1\},c}}}{\overline{a_{\{t_1\}}}}\right)^{\epsilon}=$$

$$=\sum_{c=1}^{C}\underbrace{(n_{\{t_2\},c}-n_{\{t_1\},c})\cdot GE_w(\epsilon)_{\{t_1\},c}\cdot\left(\frac{\overline{a_{\{t_2\},c}}}{\overline{a_{\{t_2\}}}}\right)^{\epsilon}}_{\text{P2:2:Change in } population\ shares}$$

$$+\sum_{c=1}^{C}\underbrace{n_{\{t_1\},c}\cdot GE_w(\epsilon)_{\{t_1\},c}\cdot\left(\left(\frac{\overline{a_{\{t_2\},c}}}{\overline{a_{\{t_2\}}}}\right)^{\epsilon}-\left(\frac{\overline{a_{\{t_1\},c}}}{\overline{a_{\{t_1\}}}}\right)^{\epsilon}\right)}_{\text{P1:2:Change in average cohort wealth}}$$

$$+\sum_{c=1}^{C}\underbrace{n_{\{t_1\},c}\cdot\left(\frac{\overline{a_{\{t_2\},c}}}{\overline{a_{\{t_2\}}}}\right)^{\epsilon}\cdot\left(GE_w(\epsilon)_{\{t_2\},c}-GE_w(\epsilon)_{\{t_1\},c}\right)}_{\text{P1:3:}Direct\ change\ in\ the\ \text{within cohort inequality}} \qquad \text{(A8)}$$

The sum of the “exchange of generations” (P3:2) + “change in population shares” (P2:2) + “change in average cohort wealth” (P1:2) + “Direct change in the within cohort inequality” (P1:2) provides complete decomposition of the $\Delta GE_{within}(\alpha)$ between two periods $\{t_1, t_2\}$.

Proof of Proposition 1:

Using the Proof of Lemma 1, recall equations (A8) and (A4).

Proof of Proposition 2:

Using the Proof of Lemma 1, recall equations (A8) and (A4).

Proof of Proposition 3:

Using the Proof of Lemma 1, recall equations (A7) and (A3).

APPENDIX B. The measurement of inequality

In Figure B1, we show overall wealth inequality when measured by the Gini coefficient (left-hand vertical axis) and the GE index with values of $\epsilon = 0.5$ (right-hand vertical axis). As may be seen from the figure, the time evolutions of Gini and GE index graphs are very similar, indicating that using the GE index allows us to capture the same inequality dynamics as one observes with the Gini coefficient. In Panel B, we show that the chosen GE($\epsilon = 0.5$) tracks positional measures of inequality well. In particular, the top 10% increase after 1970 was somewhat slower than the top 1% measure and the behavior of the GE index falls in between those measures.

Figure B1: Panel A The dynamics of US wealth distribution as measured by the Gini coefficient and GE index

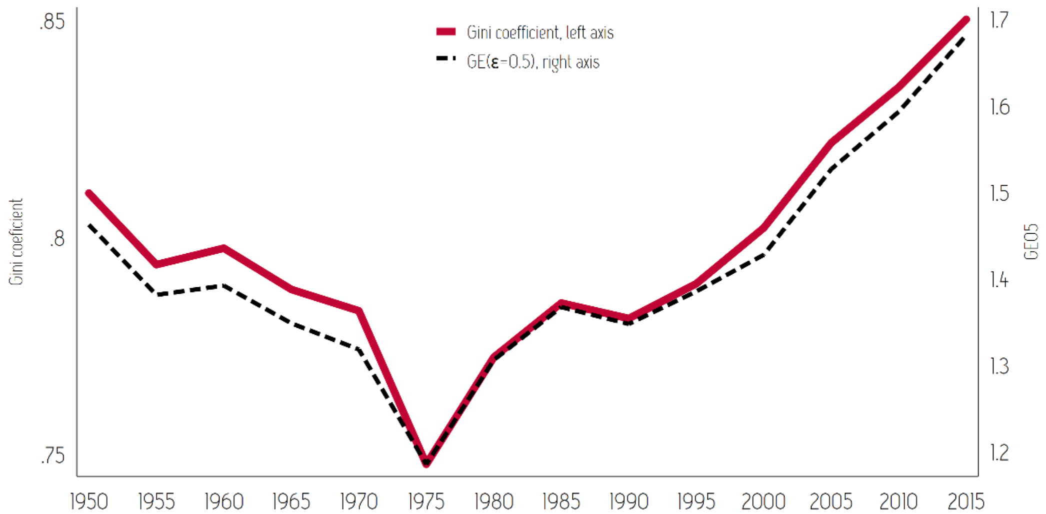


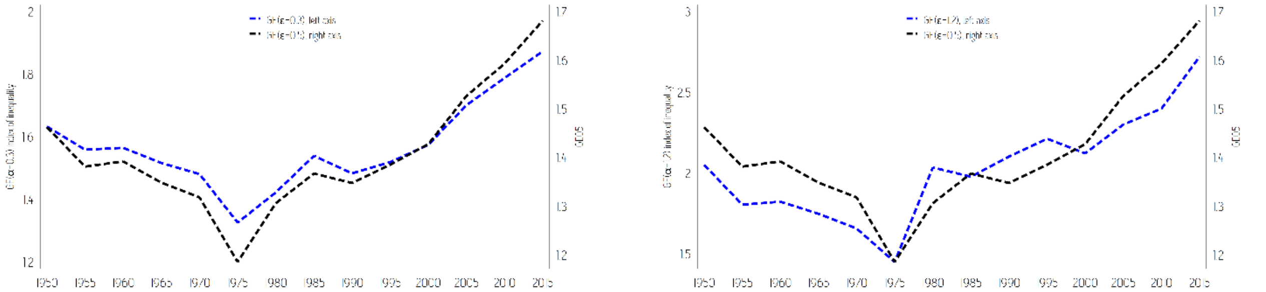
Figure B1: Panel B The dynamics of US wealth distribution as measured by the positional measures and GE index

Data: Kuhn et al. (2020).

Notes: Generalized Entropy measures calculated for a range of $\epsilon = 0.5$. We combine the observations from 1949 to the five year period denoted as 1950 and encompassing 1950-1954. We combine the observations from 2016 into the five year period denoted as 2015 and encompassing years 2015-2016.

In Figure B2, we inspect the relevance of parametrizing $\epsilon = 0.5$ for the generalized entropy index. While depending on the selected value of the sensitivity parameter ϵ the index may be more sensitive to lower or upper parts of the distribution. Specific values of ϵ in the GE index correspond to well-known measures -- for instance the Theil index is the GE index with $\epsilon = 1$ and the mean log deviation index is the GE index with $\epsilon = 0$. However, these two indices cannot be used for individuals that have no assets, which is an important consideration as households with no assets typically constitute more than 10% of the SCF sample in each year. We present the results for the values 0.3 and 1.2 (above and below the selected 0.5, ignoring the problematic value of 1). While the scale differs between the right axis and the left axis, the time evolutions of the two indices computed for alternative values of ϵ are not substantially different from our selected value $\epsilon = 0.5$.

Figure B2. Comparison of GE(0.5) with GE indices with alternative parametrizations of ϵ



Data: Kuhn et al. (2020). We combine the observations from 1949 to the five year period denoted as 1950 and encompassing 1950-1954. We combine the observations from 2016 into the five-year period denoted as 2015 and encompassing years 2015-2016.

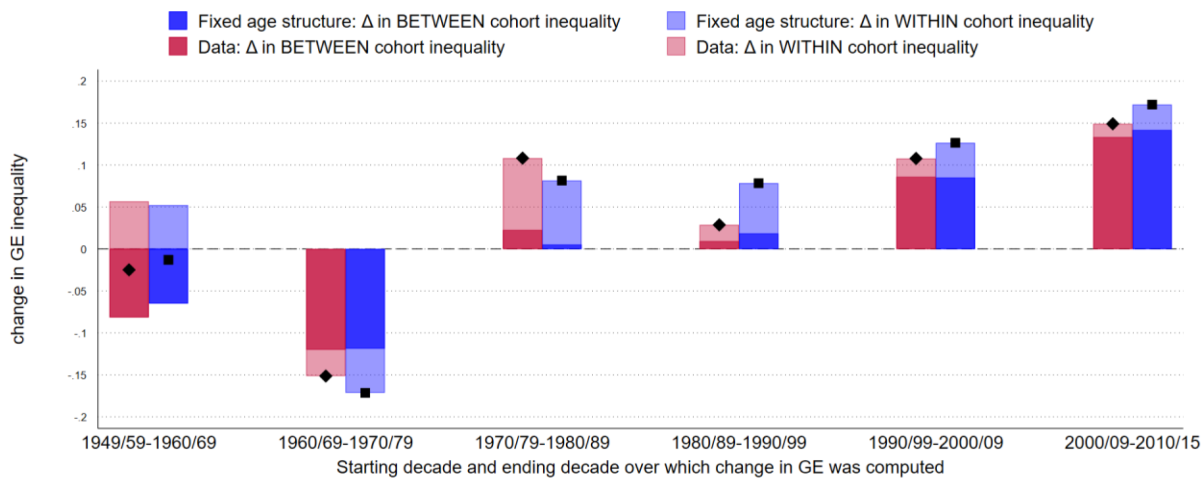
APPENDIX C. The overall, between and within inequality

As we show in Figure 1, throughout the 1949-2016 period within-cohort wealth inequality contributed much more than between-cohort wealth inequality to overall wealth inequality. However, the contribution of between-cohort inequality was substantial and it was steadily rising. Indeed, when one examines the change in overall wealth inequality between 1949 and 2016, one observes that the entire increase is brought about by the rise in between-cohort inequality.

We next decompose the change in overall wealth inequality over successive (non-overlapping) 10-year time periods into the within- and between-cohort components and examine the contribution of various birth cohorts to changes in the GE index. We show the results in Figure C2, where we use bars to depict on the vertical axis 20-year changes in the GE index of wealth inequality. Each bar portrays a 20-year change, with the first bar using the US population in 1950-54. The starting dates of neighboring bars are five years apart, so that the first bar shows the change in the GE index between 1950-54 and 1970-74, the second bar the change between 1955-59 and 1975-79, etc. In each bar, the dark part denotes the 20-year contribution of between-cohort inequality, while the light part denotes the contribution of within-cohort inequality. Positive values of the bar indicate a positive contribution to (i.e., increase in) wealth inequality, while negative values show a negative contribution to (i.e., decrease in) wealth inequality.

The diamond dots in Figure C2 depict the change in overall wealth inequality, given by the sum of the light and dark components in each bar. As may be seen from the figure, in the first three 20-year periods overall inequality was decreasing on account of the falling within-cohort inequality that more than offset the increase in between-cohort inequality. In the next two periods overall inequality was slightly rising as increasing between-cohort inequality more than offset the slightly decreasing within-cohort inequality. Finally, in the last five periods overall inequality was rising on account of increases in both components of inequality.

Figure C2: Twenty-year changes in overall, between-cohort and within-cohort wealth inequality in the US



Data: Kuhn et al. (2020).

Notes: The figure displays changes in the values of the Generalized Entropy index for $\epsilon = 0.5$. The bars portray 20-year changes in the GE index, with the starting dates of the successive bars being five years apart. The change in the GE index is decomposed into the contribution of the between-cohort change to the GE index (darker bars) and the contribution of the within-cohort change to the GE index (lighter bars). The blue bars display decomposition of wealth inequality performed directly on the data. The purple bars isolate the behavioral effect, because they show decomposition performed on the data with the population structure set to its 1950 level. Individuals with negative assets are treated as individuals with no assets. The results are robust to this adjustment: inference is the same if observations with negative assets are dropped.