The Journal of Economic Inequality
https://doi.org/10.1007/s10888-019-09427-5

The Course of Income Inequality as a Cohort Ages into Old-Age

Thomas L. Hungerford [1]

Received: 21 July 2017 / Accepted: 19 July 2019/Published online: 03 August 2019

Abstract
Several researchers have shown that income inequality of a cohort increases as the cohort ages. The various studies examining cohort income inequality use a variety of data, measures, and methods. Is the U.S. experience documented in other studies due (1) to cumulative advantages and disadvantages continuing to work through market income into retirement, (2) to the relative weakness of the U.S. Social Security program, or (3) to potential biases due to data, measures and/or methods? This study examines cohort income inequality using nationally representative longitudinal data and a variety of inequality measures to follow a large sample of individuals from their late pre-retirement years into their retirement years. The findings are: (1) the course of the Gini coefficient is flat as the cohort ages into retirement, (2) but the course of income inequality as this cohort ages into retirement depends on the inequality measure employed, and (3) the trend results suggest that what is going on in the bottom part of the distribution is different from what is going on in the upper part.

Keywords Aging · Capital income · Earnings · Income inequality · Retirement income · Social security

1 Introduction

It is well established that income inequality has been rising in the U.S. over the past four decades. For example, the income share of the richest 10% increased from 33% in 1975 to 50% by 2015 (Piketty and Saez (2003) data updated to 2015). Many observers expect this trend of increasing inequality to continue into the foreseeable future (e.g., Piketty 2014). Piketty (2014) argues that the rate of return on capital will continue to exceed the growth rate of the economy (the "fundamental force for divergence") thus leading to a further divergence of wealth.

✉ Thomas L. Hungerford
thunger@starpower.net

[1] National Academy of Social Insurance, 1200 New Hampshire Av. NW, Washington, DC 20036, USA

Another, though rarely emphasized, reason that has been offered for the expectation of increasing inequality is demography: the aging of the U.S. population. This reason is based on findings of several researchers who have shown that income inequality of a cohort increases as the cohort ages (David and Menchik 1984; Crystal and Shea 1990a, b; Crystal and Waehrer 1996; Crystal et al. 2016; Deaton and Paxson 1994; Pampel and Hardy 1994). Deaton and Paxson (1994) suggest that as the age distribution of the population shifts to older ages, income inequality within the population will increase because income is more unequally distributed among the more numerous older people than among younger people. The Census Bureau projects the proportion of the population 65 years or older will increase from 15% in 2015 to 22% by 2050.

Three hypotheses have been proposed to explain the course of inequality as a cohort ages. First, Henretta and Campbell (1976) suggested that the facts are consistent with a status persistence model and argue that earlier attainments largely determine income in old age. Consequently, an individual's place in the economic distribution is determined early and persists through to old-age. Hungerford (2007) shows that individuals who experience chronic hardships in middle-age tend to experience adverse old-age outcomes. The implication is inequality should remain fairly constant as a cohort ages.

Second, Dannefer (1987) argues that early life advantages as well as disadvantages cumulate over the life course, which leads to increased heterogeneity or inequality as a cohort ages. O'Rand (1996) argues that cumulative advantage/disadvantage operates at the extremes, and status persistence operates on the large middle. Both O'Rand (1996) and Dannefer (2003) argue that "structural realities" such as the labor market interacts with life course processes to produce stratification and increasing heterogeneity over the life course. Deaton and Paxson (1994) show that a simple model of the permanent income hypothesis implies that inequality in consumption and income should grow as a cohort ages. These related hypotheses are stories about market income and suggest increasing cohort inequality up to at least retirement. The advantaged tend to get a good education that leads to better jobs, better health, and higher income. After retirement, market income is a less important source of income and pensions, savings, and transfers are more important. Of course, pension income and savings are determined by market income during the working career. Higher wages during the working years leads to better pensions, higher savings, and higher post-retirement income. Consequently, cohort income inequality would increase up to and into the retirement years.

A third hypothesis could be referred to as the redistribution hypothesis (O'Rand and Henretta 1999). Transfers, primarily Social Security benefits, tend to be progressive and would work to reduce or at least moderate income inequality as a cohort ages into retirement.

The trajectory of cohort income inequality into retirement, however, depends on the importance of the various retirement income sources and the progressiveness of a country's social welfare system. Some have argued that the U.S. social welfare system conforms to market principles—that is, an individual's well-being, especially in retirement, is largely determined by how well that individual competes and has competed in the past in the market economy, which essentially brings us back to the cumulative advantage/disadvantage hypothesis (Cates 1983; Esping-Andersen 1990; Noble 1997). While the Social Security benefit formula is progressive, benefits do depend on pre-retirement market income—the level of earnings—during the working years. Additionally, some of the progressiveness of the benefit formula could be negated by the decision on when to claim Social Security because of the actuarial reduction for claiming benefits before the full retirement age. Conceivably, the trajectory of cohort inequality after retirement could just be a continuation of the pre-

retirement trajectory. The Commission on Income Maintenance Programs (1969, p. 48) noted "the poor worker will become a poor beneficiary."

Previous research shows that rising cohort income inequality continues into the retirement years suggesting the U.S. social welfare system is relatively weak (i.e., based on market principles) vis a vis market income (Crystal and Shea 1990a, b; Crystal and Waehrer 1996; Crystal et al. 2016; Deaton and Paxson 1994), which is consistent with the cumulative advantage/disadvantage hypothesis. However, Prus (2000) shows the opposite is true in Canada—income inequality decreases as a cohort ages in retirement because the Canadian retirement system tends to level incomes in retirement. This finding is of interest because Canada's social welfare system also tends to conform to market principles (Esping-Andersen 1990).

The various studies examining cohort income inequality use a variety of data, measures, and methods. Some of the studies use cross-sectional data to compare inequality among one age group with another age group. It is not known, however, if the differences are due to aging or to systematic differences between the age groups. Other studies follow synthetic cohorts using a series of cross-sections to get around this potential problem. It is very important that the age group samples are drawn from the same population each year and income is measured the same from year to year.[1] Some studies use longitudinal data for the analysis such as the National Longitudinal Surveys of Adult Men or the Wisconsin Assets and Incomes Study (which is based on Wisconsin tax returns), but these data are not representative of a cohort.

All but three studies use the Gini coefficient as the measure of income inequality. Different inequality measures could produce different results. The various measures have different properties and are sensitive to income differences in different parts of the income distribution.

Lastly, slightly different definitions of income are used across the various studies. David and Menchik (1984) use adjusted gross income from tax records as the income measure, which includes realized capital gains but excludes public assistance benefits. Crystal and Shea (1990b) and Pampel and Hardy (1994) included the value of assets annuitized at an interest rate of 2% in their measure of income.

Is the U.S. experience documented in other studies due (1) to cumulative advantages and disadvantages continuing to work through market income into retirement, (2) to the relative weakness of the Social Security program, or (3) to potential biases due to data, measures and/or methods? This study examines cohort income inequality using nationally representative longitudinal data and a variety of inequality measures to follow a large sample of individuals for 18 years from their late pre-retirement years (ages 53 to 63) into their retirement years (ages 71 to 81). The next section describes the data used for the analysis and the following section provides details on the methods. The results are presented in section 4. The findings are discussed and concluding remarks are offered in the final section.

2 Data

The Health and Retirement Study (HRS) is the longitudinal data file used for this study. The HRS dataset contains information on individuals over the age of 50 and their spouses. The original HRS cohort, the sample used in the study, were born between 1931 and 1941; they were first interviewed in 1992 and every other year since. The survey is nationally

[1] Skip patterns and top codes can change from year to year in national cross-section surveys.

representative of those residing in the United States in 1992. Sample weights are adjusted for nonresponse and post-stratifying to national population data. The data file used is the RAND HRS data file version P, which is a cleaned and streamlined version of the HRS with comparably constructed variables over time.[2] The original cohort was followed from 1992 (wave 1) to 2014 (wave 12). Only information from waves 2 to 11 (1994 to 2012) are used for this study. The first wave is not used because the income variables are not entirely comparable with the variables in subsequent waves. And wave 12 is not used because it is an early release of the data rather than the final release; undoubtedly, there will be modifications to the data before the final release.

A precise definition of income is important in studying inequality. Most people think of income as the salary they receive from their employer or adjusted gross income as reported on their income tax return. A broader definition of income is the Haig-Simons concept of income. Henry Simons (1938, p. 49) started from the proposition that "[p]ersonal income connotes, broadly, the exercise of control over the use of society's scarce resources." Robert Haig (1921, p. 6) defined "income in terms of power to satisfy economic wants rather than in terms of satisfactions themselves." Both economists argue that income is the sum of consumption and additions to wealth.[3] Additions to wealth reflect rights that could have been exercised in consumption and may be so exercised in the future; similar reasoning would apply to an increase in debt which is a subtraction from wealth. The Haig-Simons definition would include home production, the rental value of housing and durable goods, and accrued capital gains.

Hicks (1946, p. 172) offers another definition of income as "…as the maximum value which he can consume during a week, and still expect to be as well off at the end of the week as he was at the beginning." Kaldor (1955, p. 45) argues there is no ideal definition of income in the sense of Haig-Simmons or Hicks or "at least none that could be objectively defined and measured." Ultimately, an analyst must use the measures contained within the statistical survey.

For analytic purposes, however, income has to be measured and expressed in numerical terms in terms of national currency. Consequently, consumed goods and services produced through home production (such as child care services provided by family members and food grown by family members) are not included in income, since a monetary value is difficult to calculate. In this analysis, income is measured in dollars and includes earnings, capital income, pension and annuity income, Social Security retirement benefits net of the Medicare premium, income from other government transfers, and other income (e.g., lump-sum retirement distributions, inheritances, insurance payouts, alimony). Only income received by the aged unit—that is, the respondent and his or her spouse (if present)—is reported in the HRS; income received by other household members is not reported. Consequently, the income measure for individuals in the sample is equivalence-adjusted income of the aged unit. The equivalence factor is one for a single individual or the square of two for a couple. Only observations with positive income are used in the analysis. Overall, 4.7% of the sample report no income in one or more years (4% report no income in only a single year). However, in any single year about 0.5% of the sample report no income.[4]

[2] The HRS is administered by the Institute for Social Research at the University of Michigan under a National Institute on Aging grant. See RAND HRS Data File (2016).

[3] Simons (1938, p. 50) states that "[p]ersonal income may be defined as the algebraic sum of (1) the market value of rights exercised in consumption and (2) the change in the value of the store of property rights between the beginning and end of the period in question."

[4] The results for procedures that allow zero income values are little changed if observations with zero income are included.

Accrued capital gains are difficult to measure especially for assets that are not traded often. As a substitute, many include realized capital gains in the measure of income (if available in the data file). Piketty and Saez (2003) argue that realized capital gains are not an annual flow of income and have large aggregate variations from one year to another; they exclude capital gains from much of their analysis. Blinder (1980) argues that capital gains should not be included in income because what is important is real accrued capital gains. Citing work by Eisner (1980), he points out that realized capital gains represent partial maintenance of principle in an inflationary world. Realized capital gains are not reported in the HRS, and, consequently, are not included in the income measure.

Two research teams (Crystal and Shea 1990b and Pampel and Hardy 1994) incorporated wealth into their measure of income by calculating the annuity value of wealth (over the remaining years of life) at a 2% interest rate. This method is not adopted in the analysis because of the risk of double counting income. In the survey, wealth is measured at the time of the interview while income refers to income received in the past calendar year. Some income may be saved and is thus included in wealth at the time of the interview. Including the annuity value of wealth in the income measure would result in some income being counted twice. Additionally, wealth generates some income during the previous year (e.g., interest and dividends); again, including the annuitized value of wealth runs the risk of double counting the income stream of wealth. Two additional problems are the issue of debt (negative wealth) and what assets to include in the annuity value. Should only liquid assets be included or should quasi-liquid retirement assets and illiquid housing be added?

Some studies use after-tax income while others use before-tax income. The public use version of the HRS does not identify the respondent's state of residence and state income taxes cannot be estimated. Furthermore, since realized capital gains are not reported in the HRS, income taxes would be underestimated for high income individuals and couples. Consequently, before-tax income is used for this study. While the omission of taxes will likely affect the level of inequality, since the U.S. tax system is somewhat progressive, it is unlikely to substantially affect the trajectory of cohort inequality over the sample period.

The analysis sample contains 8,793 men and women from the HRS 1931 to 1941 birth cohort. The characteristics of the sample are reported in Table 1. Slightly over half are women, 23% have more than a high school education, 82% are non-Hispanic white, 9% are non-Hispanic black, and 6% are Hispanic. In 1994, about one-third lived in households with members other than the aged unit present (by 2012, the proportion had fallen to 14%). This

Table 1 Summary statistics for sample, 1994

Characteristic	Mean
Female	0.524
Less than H.S. Education	0.223
High School Diploma only	0.549
More than H.S. Diploma	0.228
White, non-Hispanic	0.824
Black, non-Hispanic	0.093
Hispanic	0.061
Other household members present	0.340
Equivalence-adjusted Total Income	$42,473

Data are unweighted

implies that about two-thirds of the aged units correspond to the household.[5] By wave 11, 28.5% of the original sample have died (surviving spouses who are in the 1931–41 birth cohort continue to be followed) and 14.6% left due to attrition. HRS sample weights are used throughout the analysis.

Three problems could potentially affect the results of this study. First, misreporting of income information has been documented in survey data (Meyer et al. 2015, and Bee and Mitchell 2017). Bee and Mitchell (2017) found that average income in the 2013 Annual Social and Economic Supplement (ASEC) of the Current Population Survey is about 28% lower than income recorded on administrative records of the respondents. Czajka and Denmead (2008) found that average income in the 2003 ASEC is 28% lower than average income in the HRS.[6] Chen et al. (2018) conclude from their analysis of the HRS and other datasets that the HRS captures 96% of retirement income from administrative data and provides consistent estimates across the income distribution.

The second potential problem is attrition bias. With each subsequent wave of the HRS, accumulated attrition could lead to unrepresentative samples and biased empirical results. The HRS staff, however, make every effort to contact and reinterview nonrespondents in subsequent waves. Studies of attrition in the HRS conclude that attrition bias is not a significant problem (Kapteyn et al. 2006, and Michaud et al. 2011).

Third, mortality bias could affect the results since lower income individuals tend to have high mortality rates than higher income individuals. This issue is further examined in the appendix and does not appear to affect the results.

3 Methods

Most studies of the path of cohort inequality have used the Gini coefficient to measure income inequality. The Gini coefficient is widely used because of its intuitive interpretation—it varies between 0 indicating perfect equality and 1 indicating perfect inequality. The Gini coefficient, however, is not the only inequality measure (Jenkins 1991 reviews the measurement of income inequality). For example, Deaton and Paxson (1994) use the variance of log income and Pampel and Hardy (1994) use the Theil's T index.

Different measures of inequality represent different aversions to inequality—that is, stress is placed on different parts of the income distribution. The Gini coefficient places more weight on income differences in the middle of the distribution (mode actually) than on the tails. A generalization of the Gini coefficient known as the extended Gini or S-Gini includes a parameter, υ, that varies which part of the income distribution is stressed (see Yitzhaki 1983, and Yitzhaki and Schechtman 2005 for formulas and properties of the S-Gini). As υincreases from 2 to infinity, the S-Gini places increasing weight on the lower part of the distribution. The traditional Gini corresponds to $\upsilon = 2$. For $1 < \upsilon < 2$, the S-Gini places increasing weight on the top if the income distribution as υ decreases. In addition to using the traditional Gini coefficient, cohort inequality is also tracked with the S-Gini ($\upsilon = 1.1$) and the S-Gini ($\upsilon = 4.0$). Jackknife standard errors are estimated.

[5] Consequently, some of the individuals may have access to income from other household members. The hypotheses tested, however, relate to cohort member income rather than household income.
[6] The issue is further examined in the appendix.

To check the robustness of the results, four measures from the Generalized Entropy class of inequality measures are utilized. The Generalized Entropy indices (denoted as GE(ε)) contain a parameter, ε, that changes the sensitivity of the index to differences in income shares in different parts of the distribution (see Jenkins 1991, and Jenkins and van Kerm 2009 for formulas and properties)—the more positive ε is the more sensitive the GE(ε) is to income differences toward the top of the income distribution and the more negative ε is the more sensitive the measure is to income differences toward the bottom of the distribution. The εparameter is typically restricted to [−1,2] so the inequality estimates are not unduly influenced by the small number of observations in either tail. The four measures correspond to $\varepsilon = -1$, 0 (Theil's L index), 1 (Theil's T index), and 2. Standard errors are estimated using the method of Cowell (1989).

To focus on the contribution of changing shape of the income distribution to the inequality trend, changes in the shape of the income distribution as the cohort ages is examined in two ways. First, the 95th to 5th, the 95th to 50th, and the 50th to 5th percentile ratios are calculated for each survey year. Second, a visual inspection with kernel density plots is employed.

The Gini coefficient is decomposed by income source using the method developed by Lerman and Yitzhaki (1985) to get at the relevance of the various hypotheses in explaining the course of inequality as this cohort ages into old-age. The contribution of each income source ($k = 1, ..., K$) to the overall Gini coefficient depends on (1) how important the income source is to total income (S_k), (2) how the income source is distributed as measured by the Gini coefficient (G_k), and (3) the "Gini correlation" or how the income source is correlated with total income (R_k).[7] The overall Gini coefficient (G) can be written as:

$$G = \sum_{k=1}^{K} S_k \times G_k \times R_k \tag{1}$$

If S_k, G_k, or R_k are close to zero, then the particular income source does not make a significant contribution to income inequality (see Lerman and Yitzhaki 1985 for formulas). Each income source's contribution to the overall Gini coefficient is $S_k \times G_k \times R_k/G$, which is expressed as a percentage. Additionally, the marginal effect of a change in an income source k on the Gini coefficient expressed as an elasticity is $S_k \times G_k \times R_k/G - S_k$.

Total income is split into five categories: (1) earnings, (2) pension and annuity income, (3) Social Security retirement benefits, (4) other government transfers (Social Security disability benefits, unemployment compensation, workers' compensation, Supplemental Security Income, veterans' benefits, welfare, and food stamps), and (5) capital and other income. Capital income (dividends, interest, business income, rent, and other asset income) is combined with all other income, which includes lump-sums, inheritances, and alimony. At this point in the lives of the HRS cohort, the primary source of all other income is likely to be lump-sum distributions from defined contribution pension plans and IRAs (and possibly life insurance payouts), both of which are capital income. Nonetheless, capital income accounts for 80 to 90% of this combined income category in each year.

[7] The Gini correlation is a measure of the correlation between an income component and the cumulative distribution of total income. Rather than normalized by the product of standard deviations (as with the Pearson correlation), it is normalized by the Gini of the income component. Lerman and Yitzhaki (1985) note that its value is between −1 and + 1, but takes on more extreme values than Pearson's correlation.

4 Results

Figure 1 displays the trend in the Gini coefficient and the two S-Gini coefficients between 1994 and 2012 for the HRS 1931–41 birth cohort. In 1994, the sample individuals were 53 to 63 years old, and by 2012, they were 73 to 83 years old. The solid thick line in the top left panel is the trend of the Gini coefficient, the gray area is the 95% confidence interval, and the dashed line is the fitted linear trend. The linear trend is nearly horizontal and fits comfortably within the 95% confidence interval (as does a strictly horizontal line). The 19-year trend in the Gini coefficient fluctuates around the average of 0.488.[8] This suggests the hypothesis that there is no upward or downward trend in the Gini coefficient as this cohort ages cannot be rejected—a finding at odds with previous studies.

Figure 1 also displays the trends for the top sensitive S-Gini ($\upsilon = 1.1$)in the top right panel and the bottom sensitive S-Gini ($\upsilon = 4$) in the bottom left panel. In the case of the S-Gini(1.1), the linear trend line is upward sloping, which indicates income inequality increases as the cohort ages. The 95% confidence interval, however, is quite large and a strictly horizontal line (or even a downward sloping line) could comfortably fit within. On the other hand, the S-Gini(4) trend is downward sloping and the confidence interval is fairly narrow, suggesting inequality falls as this cohort ages into retirement when more weight is placed on the bottom of the distribution. The results shown in Fig. 1 show that the trend in cohort inequality depends on which part of the income distribution is emphasized.

The exercise is repeated with the four Generalized Entropy measures; the results are displayed in Fig. 2.[9] The GE(−1) and GE(0), which tend to be more sensitive to income differences toward the bottom of the income distribution, are downward sloping (though the 95% confidence interval for the GE(0) is fairly wide) suggesting measured inequality falls as the cohort ages. Consistent with the S-Gini(1.1), the trends of the GE(1) and GE(2) are upward sloping but the confidence intervals are also quite wide. It would appear that what is going on in the upper part of the income distribution is different from what is going on in the bottom part: income differences in the lower part appear to be narrowing while widening in the upper part.

4.1 Shape of the Distribution

Figure 3 displays the trend in various percentile ratios and confidence intervals over the period. The 95th to 5th percentile ratio is shown in the top left panel (labeled P95/P5). It remains steady at 21 between 1994 and 2000, and then falls from 21 to 13 between 2000 and 2012 suggesting the distribution narrows as this cohort ages.[10] To focus on the bottom and the top of the income distribution separately, the trends in the 50th to 5th percentile ratio (labeled P50/P5 in the top right panel) and the 95th to 50th percentile ratio (labeled P95/P50 in the bottom left panel) are also displayed in the figure. The P50/P5 ratio steadily falls through this period from 5.7 to 3.2 between 1994 and 2012 (see thin solid line in the figure). The p95/P50 ratio, on the

[8] The linear trend line is actually slightly downward sloping, but falls by less than 1% between 1994 and 2012.
[9] The variance of log income (not shown in the figures) was also estimated along with standard errors. The trend is fairly flat between 1994 and 2000 and steadily falls after 2000.
[10] The P95/P5, however, provides no information on what is happening below the 5th percentile or above the 95th percentile.

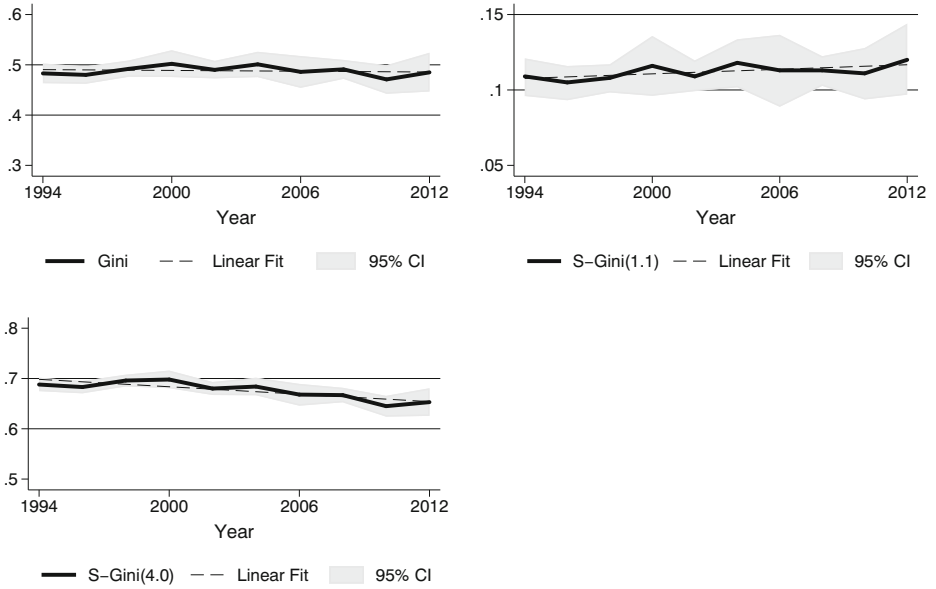

Fig. 1 Gini coefficient and extended Gini coefficients, 1994–2012

other hand, increases from 3.7 in 1994 to 4.3 by 2000, remains fairly steady at about 4.3 until 2008, and then falls slightly to 4.1 in 2012. Together these results provide additional evidence that the bottom half of the cohort income distribution becomes more compressed as the cohort ages, while the top slightly expands, at least initially.

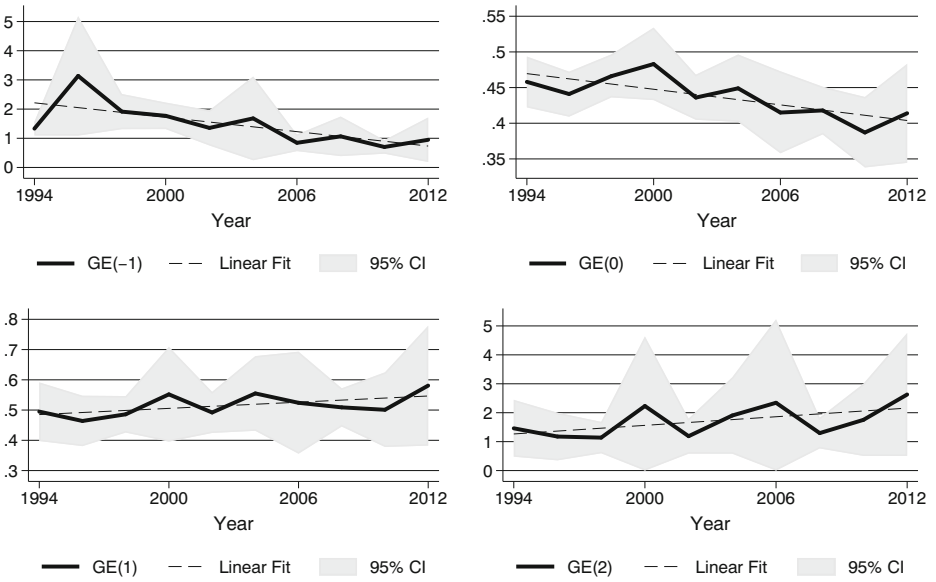

Fig. 2 Generalized entropy measures, 1994–2012

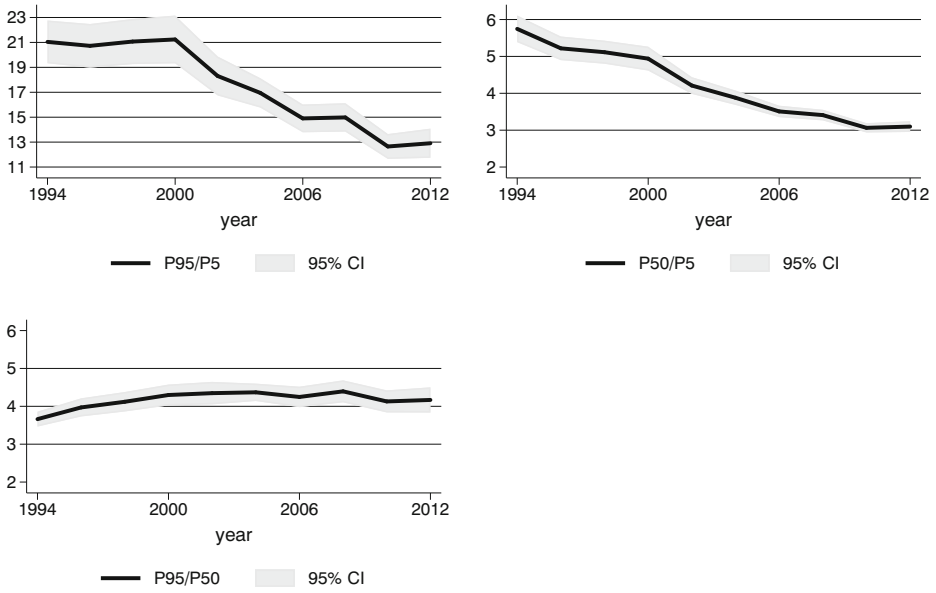

Fig. 3 Percentile ratios, 1994–2012

The kernel density plots of real total income for selected years (1994, 2000, 2006, and 2012) are displayed in Fig. 4. As this cohort ages the income distribution appears to narrow with the upper tail moving toward the mode of the distribution.[11] The mode of the distribution appears to fall slightly over time. Additionally, the lower extreme tail of the 2012 distribution lies within the 1994 distribution (that is, is closer to the mode).

Table 2 provides some additional information on the changing shape of the income distribution. The first three rows of the table report the inflation-adjusted percentiles for selected years. The 5th percentile increased by 17% between 1994 and 2012 while the median decreased by 37%. The falling P50/P5 ratio was due in part to an increasing 5th percentile, but mostly due to a falling median. The story is quite different at the top of the distribution: the 95th percentile decreases as the cohort ages by 28% over the observation period. The 95th percentile is falling, but the median is falling at a slightly faster rate, thus the P95/P50 ratio increases over the observation period.

The next two rows of Table 2 report the income shares for the top 5% and the bottom 20% of the income distribution. The income share of the top 5% increased from 26.3% in 1994 to almost 30% by 2012. At the bottom, the income share of the poorest quintile group also steadily increased over this period from 3.6% to 5%. The tails of the income distribution are gaining income share at the expense of the broad middle.

[11] Individuals with real income above $300,000 are omitted in the construction of the figures. These individuals comprise 0.5 to 0.7% of the sample depending on the year.

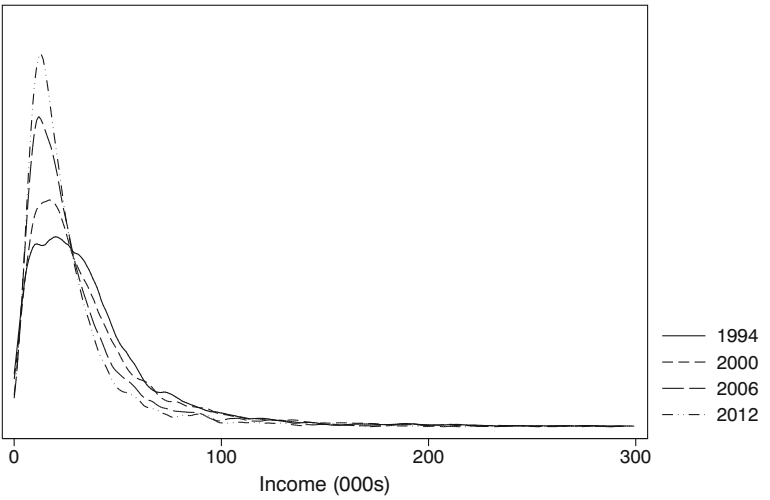

Fig. 4 Kernel density plots, 1994, 2000, 2006, 2012

The sixth row of the table reports the poverty rate (using 125% of the official poverty threshold as the cutoff).[12] The poverty rate shows the proportion of the sample with income below a fixed inflation-adjusted threshold.[13] The poverty rate increases between 1994 and 2012 from 12.9% to 14.7%. The next row reports the extreme poverty rate (equivalence-adjusted income below 50% of the official poverty threshold), which falls from 3.2% in 1994 to 1.3% by 2012. As the original HRS cohort ages, fewer are living in extreme poverty but a larger proportion have income below 125% of the poverty threshold (that is, are poor or near poor).

4.2 Income Sources

As a cohort ages from the late work years to the retirement years, the primary sources of income change. Additionally, in any single year, the primary source(s) of income will differ from one income quantile to another. Table 3 displays the share of income from five income sources by income quantile group for selected years between 1994 and 2012. In 1994, earnings are a major source of income for individuals in each quantile group. For those in the bottom quintile group, earnings account for about 35% of total income and government transfers (Social Security and other transfers) account for about 40%. Overall, for the poorest quintile group about 60% of total income is market-based income (earnings, pension/annuity income, and capital and other income).

[12] The official poverty threshold for a single person is used; the equivalence scale used for this analysis is used in place of the implicit scale built into the official threshold. Many observers consider the official poverty threshold to be too low to reflect adequate income for basic needs. Researchers have use 125%, 150%, and twice the official threshold as a better poverty threshold. The 125% threshold was chosen to provide a better contrast with the extreme threshold of 50% of the official threshold.

[13] In 1994, median income was about 3 times 125% of the poverty threshold; by 2012, it was about 2 times as large.

Table 2 Characterizing the income distribution, selected years

	1994	2000	2006	2012
5th Percentile	$5,232	$5,411	$6,192	$6,144
Median	$30,069	$26,730	$21,726	$19,030
95th Percentile	$110,100	$114,913	$92,287	$79,318
Top 5% Share	26.3%	27.9%	27.4%	29.5%
Bottom 20% Share	3.6%	3.7%	4.5%	5.0%
125% of Poverty Threshold	12.9%	13.03%	14.8%	14.7%
50% of Poverty Threshold	3.2%	2.9%	1.0%	1.3%

Dollars amounts in 1994 dollars

At the other end of the income distribution—the top 20% and top 5%—receive nearly all (over 99%) their income from market-based income sources in 1994, mainly earnings and capital and other income. Market-based income accounts for about 94% of income for the middle 60% with earnings by far the predominant source. Before retirement, most income is from market-based sources and this observation is true across the income distribution.

As the cohort ages into the retirement years, earnings, as expected, becomes a less important source of income and Social Security becomes a more important source. This observation is true across all income quantile groups. The similarity among quantile groups, however, ends there. By 2000, Social Security accounts for half of total income for the bottom quintile group while income from pensions and annuities becomes a less important income source (falling from 14% to about 9% of total income). The explanation for this finding is due to the increased importance of Social Security and to the smaller proportion (relative to Social Security) who receive any

Table 3 Income shares by income quantiles, selected years

	Earnings	Pension	Social security	Other transfers	Capital and other
1994					
Bottom 20%	34.7	13.7	11.8	29.1	10.6
Middle 60%	71.5	9.5	2.6	3.6	12.8
Top 20%	56.9	4.8	0.2	0.6	37.5
Top 5%	43.9	5.2	0.1	0.2	50.6
2000					
Bottom 20%	15.9	8.7	51.0	15.2	9.3
Middle 60%	41.4	18.9	17.5	4.1	18.2
Top 20%	38.8	7.7	2.5	1.1	49.9
Top 5%	29.3	5.0	1.1	0.5	64.2
2006					
Bottom 20%	2.8	4.3	77.0	12.8	3.1
Middle 60%	18.0	23.5	40.6	4.4	13.5
Top 20%	25.5	17.6	11.1	2.0	43.8
Top 5%	21.2	14.9	6.1	1.0	56.8
2012					
Bottom 20%	1.0	4.7	85.4	6.3	2.6
Middle 60%	7.2	24.8	53.9	3.0	11.1
Top 20%	17.0	18.6	15.1	3.5	45.9
Top 5%	18.0	9.8	7.3	1.5	63.3

pension/annuity income.[14] Pension and annuity income becomes an increasingly important income source for those in the middle and at the top of the income distribution. For those in the top quintile group, capital and other income increases in importance between 1994 and 2000 (accounting for almost two-thirds of total income for the top 5%).

By 2012, almost all (about 92%) income of the bottom 20% is from Social Security and other transfers. Almost four-fifths of income is from the traditional retirement income sources (pensions and Social Security) for the middle 60% in the income distribution. For the top 5%, two-thirds of total income is capital and other income, and earnings accounts for almost a fifth of total income; market-based income accounts for over 90% of total income.

The importance of various income sources changes as this cohort ages and differs among the various income quantile groups. Such changes would be expected to affect inequality as measured by the Gini coefficient. The contribution of each income source to the Gini coefficient is reported in Table 4.[15]

The first column in the table reports the proportion of the sample receiving each of the five types of income in the selected years. As would be expected, the proportion receiving earnings steadily falls from 80% in 1994 (before retirement for most of the sample) to just 20% by 2012. The opposite is true for pension/annuity income and Social Security. The proportion receiving income from other transfers falls slightly between 1994 and 2012. The proportion receiving some capital and other income increases from about half in 1994 to three-quarters between 1994 and 2000, and then steadily falls after that to about 65% by 2012.

Column (2) reports the share of total income from each source (S_k in eq. 1; G_k and R_k in the equation are displayed in the next two columns). In 1994, almost two-thirds of total income was from earnings and one-quarter from capital and other income. By 2012, over half was from the typical retirement sources of pensions, annuities, and Social Security. About 30% was capital and other income, and 12% from earnings. As this cohort aged into retirement, market-based income became less important—accounting for 95% of total income in 1994 but 62% by 2012.

Over this 18-year period, there was a dramatic change in the importance of various income sources and who in the distribution relied on the various sources, yet income inequality as measured by the Gini coefficient was essentially unchanged (see Fig. 1). Column (5) in the table displays the contribution of each income source to the overall Gini coefficient and column (6) reports this contribution relative to the source income share (from the second column).

In 1994, earnings accounted for almost 60% of income inequality and capital and other income accounted for 38%. But relative to its income share, the effect of capital and other income on inequality is fairly large—roughly one and a half times its income share. Social Security and other transfers actually reduce the Gini coefficient even though both are very unequally distributed (the source Gini of both is about 0.9). This is due to both income sources being negatively correlated with total income; most of this income is received by individuals toward the bottom of the income distribution. Pension and annuity income accounts for about 4% of inequality, which is low relative to its income share of 7%. Overall, income inequality is almost entirely due to market-based income, which accounts for about 95% of total income.

[14] Under some defined benefit plans, retirees under the early retirement age for Social Security (age 62) would receive a supplement until they reach age 62. The idea was Social Security retirement benefits would replace the income lost with the elimination of the supplement.

[15] The S-Gini(1.1) and S-Gini(4) can be decomposed in the same manner. The results of such a decomposition (not shown) reinforce the conclusions drawn from the Gini coefficient decomposition.

Table 4 Gini coefficient decomposition by income source, selected years

	Percent with income (1)	Source income share (%) (2)	Source Gini (3)	Gini correlation (4)	Percent contribution to Gini (5)	Contribution relative to share (6)	Marginal effect (7)
1994							
Earnings	79.7	62.5	0.549	0.840	59.7	0.955	−0.028
Pension	24.2	7.2	0.882	0.313	4.1	0.572	−0.031
Social Security	13.5	1.7	0.905	−0.228	−0.7	−0.429	−0.024
Other Transfers	25.1	2.9	0.866	−0.230	−1.2	−0.410	−0.041
Capital and Other	53.2	25.7	0.874	0.821	38.1	1.485	0.124
Total	100.0	100.0	0.483	1.000	100.0		
2000							
Earnings	56.6	39.0	0.719	0.740	41.3	1.059	0.023
Pension	42.6	12.4	0.788	0.416	8.1	0.653	−0.043
Social Security	55.7	10.5	0.586	−0.108	−1.3	−0.127	−0.119
Other Transfers	20.0	2.9	0.906	0.043	0.2	0.076	−0.027
Capital and Other	76.5	35.2	0.846	0.872	51.7	1.469	0.165
Total	100.0	100.0	0.502	1.000	100.0		
2006							
Earnings	36.2	21.3	0.837	0.756	27.8	1.302	0.064
Pension	50.7	19.5	0.771	0.638	19.7	1.013	0.003
Social Security	92.9	26.4	0.296	0.305	4.9	0.185	−0.215
Other Transfers	18.5	3.5	0.914	0.176	1.2	0.328	−0.024
Capital and Other	70.2	29.4	0.872	0.882	46.5	1.584	0.171
Total	100.0	100.0	0.486	1.000	100.0		
2012							
Earnings	21.5	12.2	0.922	0.790	18.3	1.500	0.061
Pension	56.3	20.5	0.725	0.684	20.9	1.022	0.005
Social Security	98.1	34.4	0.253	0.441	7.9	0.230	−0.265
Other Transfers	15.7	3.4	0.938	0.463	3.1	0.895	−0.004
Capital and Other	63.5	29.6	0.902	0.907	49.9	1.687	0.203
Total	100.0	100.0	0.485	1.000	100.0		

With each successive year, the contribution of earnings to inequality falls to reach 18% by 2012. Earnings' share of total income falls even more; consequently, the effect of earnings on inequality is 1.5 times more significant than its share of income. Pension and annuity income increased in importance in terms of both its income share and its effect on inequality; by 2012 it accounted for 20% of total income and 20% of inequality. The share of capital and other income increased between 1994 and 2012 from 25% to almost 30%. Over the same period, its effect on inequality increased from 38% to 50%—an increase relative to its income share. All in all, by 2012 market-based income accounted for 62% of total income and accounted for 89% of inequality.

By 2012, almost all of the sample members received Social Security benefits, which accounted for about one-third of total income and 8% of inequality. As the proportion receiving Social Security increased between 1994 and 2012, it became more equally distributed (the source Gini fell from 0.905 to 0.253) and became positively correlated with total income. In general, transfer income (Social Security and other transfers) accounted for 38% of total income but only 11% of inequality.

Column (7) in Table 4 reports the Gini elasticity—the percentage change in the Gini induced by a 1% increase in an income source. In 1994, a small change in most income sources would reduce inequality as measured by the Gini coefficient. The only exception is capital and other income—a 1% across-the-board increase in capital income would increase the Gini coefficient by 0.12%. As the cohort ages into retirement, the marginal effect of Social Security in reducing inequality increases (that is, the elasticity becomes more negative); the marginal effect of increasing capital and other income on increasing the Gini coefficient becomes larger.

5 Discussion and Concluding Remarks

There are three major results from this analysis. First, the measured course of income inequality as this cohort ages into retirement depends on the inequality measure employed. The 18-year trend of the Gini coefficient, the measure most commonly used, is essentially flat—a finding consistent with the status maintenance model but at odds with the consensus from the U.S. empirical literature. But the 18-year trend is downward (that is, decreasing inequality) when employing inequality measures that place more weight on income differences at the bottom of the income distribution. This finding is consistent with the redistribution hypothesis. When measures that emphasize the upper part of the income distribution are used, the 18-year trend is upward sloping—a finding consistent with the cumulative advantage/disadvantage hypothesis.

Second, the trend results suggest that what is going on in the bottom part of the distribution is different from what is going on in the upper part. The bottom half is becoming more compressed as the median falls in real terms and the extreme lower tail thins out. The upper part of the income distribution appears to be stretching and income is becoming more concentrated at the top (and at the bottom as well). This finding is consistent with none of the hypotheses. However, what is going on at the bottom could be consistent with the redistribution hypothesis while what is going on at the top could be consistent with the cumulative advantage/disadvantage hypothesis.

Third, a closer examination of the income sources shows that this combination of hypotheses is indeed consistent with the results. By 2012 a proportionate increase in Social Security

would reduce income inequality and a similar increase in earnings or capital and other income would increase inequality. On the one hand, Social Security is received by nearly all sample members in 2012 and the progressive benefit formula does work to reduce income inequality—cumulated disadvantages appear to be offset by transfer income especially Social Security. On the other hand, capital and other income is highly concentrated at the top of the distribution (almost 85% is received by those in the richest income quintile group). The same is largely true for the other market-based income sources. This situation is due to cumulative advantages persisting over the life course into old-age (better jobs with higher pay and pension coverage as well as more savings).

These results highlight the importance of using multiple inequality measures to examine trends in income inequality and not rely on just a single measure. The encouraging news from these results is the U.S. Social Security system does work to moderate the rise in income inequality and is effective in reducing extreme poverty (i.e., income below 50% of the poverty threshold). It is, however, less effective in keeping income above 125% of the poverty threshold.

The not so encouraging news is the increasing role of capital and other income in increasing income inequality as this cohort ages. Capital income is very unequally distributed and has contributed to increasing inequality in the U.S. and other advanced economies (Piketty 2014). In addition, capital's share of income has been increasing over the past four decades (Karabarbounis and Neiman 2014). If the trends of increasing capital income inequality and increasing capital's share continue for future cohorts, then it is possible the disequalizing effect of capital income could overwhelm the equalizing effect of Social Security. Consequently, income inequality, however measured, could increase as a cohort ages into the retirement years and old-age. Furthermore, the pension landscape has been changing dramatically since the 1980s with the rising popularity of 401(k) and other defined contribution plans. The HRS has been adding new cohorts to the study and as these cohort age, the path of inequality can be tracked—a topic for future research.[16]

Any future changes to the Social Security program could also affect the path of inequality for future cohorts. It is well known that Social Security faces a long-term funding challenge—after 2034, income to Social Security is projected to be less than scheduled benefits. Some have advocated meeting this challenge by increasing tax revenues (see, for example, Hungerford 2016). Others, including some members of Congress, have called for benefit reductions to meet this challenge.[17] Some of the benefit reduction provisions would reduce the progressiveness of the benefit formula and thus reduce the equalizing effect of Social Security.

Even if future birth cohorts ultimately follow the same flat inequality pattern as the original HRS cohort (as measured by the Gini coefficient), changing demographics could contribute to rising income inequality. If inequality is highest for a cohort on the eve of retirement and then flat thereafter, the increasing population share of the elderly will yield a growing share of the population in their high inequality years. To the extent that past birth cohorts followed the

[16] The initial wave total income Gini coefficient for two subsequent birth cohorts (the war babies born 1942–1947 and early baby boomers born 1948–1953) is very close to the initial wave Gini coefficient of the original HRS cohort of a similar age. The Gini for the original HRS cohort is 0.4766 (0.0120), for the war babies it is 0.4986 (0.0231) and for the early baby boomers it is 0.4749 (0.0105). The null hypothesis that the Gini estimates are equal cannot be rejected. The inequality trends for these three birth cohorts appear to be starting from the same point.

[17] For example, Representative Sam Johnson (R-TX) introduced the Social Security Reform Act of 2016 (H.R. 6489) in the 114th Congress, which would meet the challenge solely through benefit reductions.

same flat inequality trend into retirement, changing demographics could have contributed to the rise in inequality since the early 1980s. Nonetheless, the results of this paper cannot be used to judge this hypothesis.

An issue deserving of further study is the role of differential mortality by socio-economic status in driving the course of inequality. It has been well documented that disadvantaged individuals (for example, with less education and lower lifetime income) have higher mortality rates than more advantaged individuals. Additionally, this mortality gap has been growing (see, for example, Menchik 1993; Singh and Siahpush 2006; Waldron 2007; Masters et al. 2012; and Bosworth et al. 2016). Part of what may be going on at the bottom of the income distribution may be the lower tail is thinning out as the disadvantaged die off. In a preliminary analysis, however, repeating the exercise with just survivors over the entire 18-year period yield similar results to those reported in Figs. 1 and 2.

Acknowledgements The author thanks Howard Iams, seminar participants at the Pew-EBRI Retirement Researchers' Network Lunch, an anonymous referee, and associate editor Marcus Jäntti for comments on previous versions of this paper.

Appendix. Misreporting, Attrition Bias, and Mortality Bias

Survey research users have long been concerned about misreporting of income data in household surveys (see, for example, Meyer et al. 2015). The scope of this problem in the Annual Social and Economic Supplement (ASEC) of the Current Population Survey was recently documented by Bee and Mitchell (2017). They find that compared to administrative records linked to the 2013 ASEC, the ASEC underreports total income (from earnings, Social Security, Supplemental Security Income, interest and dividends, and retirement income) by almost 28% for households headed by an elderly individual (65 years or older). The problem is primarily due to misreporting of interest, dividends, and, especially, retirement income. The underreporting appears to occur throughout the income distribution.[18]

HRS income data, however, has been compared to other surveys such as the ASEC, the American Community Survey and the Survey on Income and Program Participation (Czajka and Denmead 2008). Czajka and Denmead (2008) found the 2003 ASEC underreports income compared to the HRS by about 28%. Again, this underreporting compared to the HRS occurs throughout the income distribution. Chen et al. (2018) focused on comparing retirement income in the HRS with administrative data. They find that the HRS captures about 96% of retirement income and provides consistent estimates throughout the income distribution.

Wave 11 of the HRS (2012 interview year; income data inflated to 2012 dollars using CPI) is compared to the 2013 ASEC income data for 2012 to gauge problems of misreporting in the HRS. Unlike previous studies, the market value of food stamps is included in the total income variable. Income is equivalence adjusted. The unit of observation is an HRS age eligible individual. The results are reported in Appendix Table 5.

[18] Bee and Mitchell assign household to income quantiles based on the ASEC survey-based income.

Appendix Table 5 Income differences between HRS wave 11 and 2013 ASEC

Percentile	HRS	ASEC	Percent difference
5th	9,615	9,287	3.5%
10th	12,273	11,339	8.2%
25th	18,533	16,509	12.3%
Median	29,780	24,818	20.0%
75th	50,060	41,736	20.0%
90th	83,439	70,750	17.9%
95th	124,125	95,735	29.6%
Mean	47,103	36,272	29.9%

HRS income data are from 2011; income was inflated to 2012 dollars using consumer price index. ASEC income data are for 2012

Overall, average equivalence-adjusted income in the HRS is 30% higher than in the ASEC, which is comparable to the results of Czajka and Denmead (2008) and Bee and Mitchell (2017). The ASEC underreporting of income compared to the HRS occurs throughout the income distribution, but more so in the top half than in the bottom half. These results suggest there is considerably less underreporting of income information in the HRS than in the ASEC.

A second potential problem common to longitudinal data is attrition bias (see Schoeni et al. 2013). To reduce bias due to unit nonresponse, the HRS makes every effort to reinterview nonrespondents in subsequent waves. Studies of attrition in the HRS conclude that attrition is generally not a serious issue in analyses (see, for example, Kapteyn et al. 2006, and Michaud et al. 2011). Furthermore, the results reported in Appendix Table 5 suggest attrition bias is unlikely to be a problem in this analysis—the results from wave 11 of the HRS and the 2013 ASEC are similar to the purely cross-sectional results of Bee and Mitchell (2017).[19]

By wave 11 of the HRS (2012 interview year), 28% of the initial sample (2,489 respondents) had failed to respond in at least one wave. But 1,254 were interviewed in subsequent waves. In wave 11, 60% of these reinterviewees were interviewed and 21% had died before 2012.

Lastly, biases due to differential mortality by income—lower income individuals tend to have higher mortality rates than higher income individuals—could potentially affect the results. An analysis of wave 2 (1994) inequality by mortality suggests the results are unaffected by differential mortality. Appendix Table 6 report the Gini coefficient, the two S-Ginis, and the four Generalized Entropy measures for individuals who survived to the end of the sample period (Survivors) and those who did not survive until 2012 (Nonsurvivors). The differences between the two groups in the various inequality measures are very small and not statistically significant.

The four Generalized Entropy measures can be cleanly decomposed into with-in group and between group components. The between group component measures how much inequality is due to mean income differences between Survivors and Nonsurvivors. Cowell and Jenkins (1995) argue that dividing the between group component by the inequality measure yields a summary index that measures how much inequality can be explained by differences between the two groups. They call this index the R index, which is somewhat analogous to the R^2 in regression analysis. In each case, the R index is very small and less than 0.03.

[19] Admittedly, this is at best indirect evidence—comparing a late wave of the HRS with a cross-sectional survey that has been compared to administrative income data. But it is likely the results are too similar to be mere coincidence.

Appendix Table 6 Inequality measures for survivors and nonsurvivors, 1994

	Survivors	Nonsurvivors	Difference	R Index
Gini	0.4749	0.4829	−0.008	
	(0.0127)	(0.0125)	(0.0178)	
S-Gini(1.1)	0.1083	0.1015	0.007	
	(0.0079)	(0.0057)	(0.0010)	
S-Gini(4.0)	0.6739	0.6963	−0.0220	
	(0.0089)	(0.0091)	(0.0130)	
GE(−1)	1.2836	1.2806	0.0030	0.0102
	(0.1664)	(0.1457)	(0.2212)	
GE(0)	0.4399	0.4562	−0.0163	0.0282
	(0.0227)	(0.0223)	(0.0318)	
GE(1)	0.4927	0.4496	0.0431	0.0247
	(0.0580)	(0.0380)	(0.0693)	
GE(2)	1.5449	0.8398	0.7051	0.0079
	(0.5872)	(0.1618)	(0.6091)	

Jackknife standard errors in parentheses

References

Bee, A., Mitchell, J.: Do older Americans have more income than we think? SESHD working paper #2017-39. U.S. Census Bureau. (2017)

Blinder, A.S.: The level and distribution of economic well-being. In: Feldstein, M. (ed.) The American economy, pp. 415–479. University of Chicago Press, Chicago (1980)

Bosworth, B., Burtless, G., Zhang, K.: Later retirement, inequality in old age, and the growing gap in longevity between rich and poor. Brookings Institution, Washington (2016)

Cates, J.R.: Insuring inequality. University of Michigan Press, Ann Arbor (1983)

Chen, A., Munnell, A.H., Sanzenbacher, G.T.: How much income do retirees actually have? Evaluating evidence from five national datasets, CRR WP 2018–14, Center for Retirement Research at Boston College (2018)

Commission on Income Maintenance Programs: Poverty Amid Plenty: The American Paradox. Government Printing Office, Washington (1969)

Cowell, F.A.: Sampling variances and decomposable inequality measures. J. Econ. **42**, 27–41 (1989)

Cowell, F.A., Jenkins, S.J.: How much inequality can we explain? A methodology and an application to the United States. Econ. J. **105**(429), 421–430 (1995)

Crystal, S., Shea, D.: Cumulative advantage, cumulative disadvantage, and inequality among elderly people. The Gerontologist. **30**(4), 437–443 (1990a)

Crystal, S., Shea, D.: The economic well-being of the elderly. Rev. Income Wealth. **36**(3), 227–247 (1990b)

Crystal, S., Waehrer, K.: Later-life economic inequality in longitudinal perspective. Journal of Gerontology: Social Sciences. **51B**(6), S307–S318 (1996)

Crystal, S., Shea, D.G., Reyes, A.M.: Cumulative advantage, cumulative disadvantage, and evolving patters of late-life inequality. The Gerontologist. **57**(5), 910–920 (2016)

Czajka, J.L., Denmead, G.: Income data for policy analysis: A Comparative Assessment of Eight Surveys, Final Report submitted to U.S. Department of Health and Human Services, MPR Reference No. 6302–601, Mathematica Policy Research, Inc (2008)

Dannefer, D.: Aging as Intracohort differentiation: accentuation, the Matthew effect, and the life course. Sociol. Forum. **2**, 211–236 (1987)

Dannefer, D.: Cumulative advantage/disadvantage and the life course: cross-fertilizing age and social science theory. J. Gerontol. B Soc. Sci. **58B**(6), S327–S337 (2003)

David, M., Menchik, P.L.: Nonearned income, income instability, and inequality: A life-cycle interpretation. In: Sudman, S., Spaeth, M.A. (eds.) The collection and analysis of economic and consumer behavior data: In Memory of Robert Ferber, pp. 53–73. Champaign, Ill.: Bureau of Economic and Business Research, Champaign (1984)

Deaton, A., Paxson, C.: Intergenerational choice and inequality. J. Polit. Econ. **102**(3), 437–467 (1994)

Eisner, R.: Capital gains and income: real changes in the value of capital in the United States, 1946-1977. In: Usher, D. (ed.) The measurement of capital, pp. 175–346. University of Chicago Press, Chicago (1980)

Esping-Andersen, G.: The three worlds of welfare capitalism. Princeton University Press, Princeton (1990)

Haig, R.M.: The concept of income—economic and legal aspects. In: Haig, R.M. (ed.) The Federal Income tax, pp. 1–28. Columbia University Press, New York (1921)
Henretta, J.C., Campbell, R.T.: Status attainment and status maintenance: a study of stratification in old age. Am. Sociol. Rev. **41**, 981–992 (1976)
Hicks, J.R.: Value and capital, 2nd edn. Oxford University Press, Oxford (1946)
Hungerford, T.L.: The persistence of hardship over the life course. Res. Aging. **29**(6), 491–511 (2007)
Hungerford, T.L.: Broadening the social security Tax Base: issues and options. Tax Notes. **151**(10), 1391–1401 (2016)
Jenkins, S.: The measurement of income inequality. In: Osberg, L. (ed.) Economic Inequality and Poverty, pp. 3–38. M.E. Sharpe Inc, Armonk (1991)
Jenkins, S., van Kerm, P.: The measurement of economic inequality. In: Salverda, W., Nolan, B., Smeeding, T. (eds.) Oxford Handbook on Economic Inequality, pp. 40–67. Oxford University Press, Oxford (2009)
Kaldor, N.: An expenditure tax. Routledge, London (1955)
Kapteyn, A., Michaud, P-C., Smith, J.P., van Soest, A.: Effect of attrition and non-response in the health and retirement study, RAND Working Paper WR-407, RAND (2006)
Karabarbounis, L., Neiman, B.: The global decline of the labor share. Q. J. Econ. **129**(1), 61–103 (2014)
Lerman, R.I., Yitzhaki, S.: Income inequality effects by income source: a new approach and applications to the United States. Rev. Econ. Stat. **67**(1), 151–156 (1985)
Masters, R.K., Hummer, R.A., Powers, D.A.: Educational differences in U.S. adult mortality: A cohort perspective. Am. Sociol. Rev. **77**(4), 548–572 (2012)
Menchik, P.: Economic status as a determinant of mortality among black and white older men: does poverty kill? Popul. Stud. **47**, 427–436 (1993)
Meyer, B.D., Mok, W.K.C., Sullivan, J.X.: Household surveys in crisis. J. Econ. Perspect. **29**(4), 199–226 (2015)
Michaud, P.-C., Kapteyn, A., Smith, J.P., Soest, A.: Temporary and permanent unit non-response in follow-up interviews of the health and retirement study. Longitudinal and Life Course Studies. **2**(2), 145–169 (2011)
Noble, C.: Welfare as we knew it. Oxford University Press, Oxford (1997)
O'Rand, A.M.: The precious and the precocious: understanding cumulative disadvantage and cumulative advantage over the life course. The Gerontologist. **36**(2), 230–238 (1996)
O'Rand, A.M., Henretta, J.C.: Age and inequality. Westview Press, Boulder (1999)
Pampel, F.C., Hardy, M.: Changes in income inequality during old age. Research in Social Stratification and Mobility. **13**, 239–263 (1994)
Piketty, T.: Capital in the twenty-first century. Harvard University Press, Cambridge, MA (2014)
Piketty, T., Saez, E.: Income inequality in the United States, 1913-1998. Q. J. Econ. **118**(1), 1–39 (2003)
Prus, S.G.: Income inequality as a Canadian cohort ages. Res. Aging. **22**(3), 211–237 (2000)
RAND HRS Data File (v. P). Produced by the RAND center for the study of aging, with funding from the National Institute on Aging and the Social Security Administration. Santa Monica, CA (2016)
Schoeni, R.F., Stafford, F., McGonagle, K.A., Patricia Andreski, P. Response Rates in National Panel Surveys. Ann. Am. Acad. Pol. Soc. Sci., 645(1), 60–87(2013).
Simons, H.C.: Personal income taxation: The definition of income as a problem of fiscal policy. University of Chicago Press, Chicago (1938)
Singh, G.K., Siahpush, M.: Widening socioeconomic inequalities in US life expectancy, 1980–2000. Int. J. Epidemiol. **35**, 969–979 (2006)
Waldron, H.: Trends in mortality differentials and life expectancy for male social security-covered workers, by socioeconomic status. Soc. Secur. Bull. **67**(3), 1–28 (2007)
Yitzhaki, S.: On an extension of the Gini inequality index. Int. Econ. Rev. **24**(3), 617–628 (1983)
Yitzhaki, S., Schechtman, E.: The properties of the extended Gini measures of variability and inequality, Working Paper, available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=815564 (2005)