Inequality and Mobility over the Past Half Century using Income, Consumption and Wealth

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Abstract:

We use the Panel Study of Income Dynamics (PSID), which has followed individuals and families over almost five decades. The PSID has been the benchmark source for measuring both intra- and inter-generational mobility, and it is the only data set with income, consumption and wealth. Using income, consumption and wealth provides a more complete picture of the inequality and mobility of individuals and families. We find that overall resources increase from our oldest cohorts to our youngest cohorts, spanning those born from 1916-1925 to those born from 1976-1985 at least for income and consumption. This emerges at the mean and the median and above, while there have been little tangible improvements across cohorts at the 10th percentile. While resources are generally improving, inequality is increasing across cohorts at the same age, and intra-generational mobility is falling or flat. We put inequality and mobility together to show that intra-generational mobility is lower when that cohort is experiencing higher inequality. We are the first to show this intra-generational Great Gatsby Curve, matching the finding that countries with higher inequality experience lower inter-generational mobility.

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Milton Friedman (1962) suggested that a society with a great deal of mobility could also demonstrate a high level of inequality in any particular year, and that this could be "…a sign of dynamic change, social mobility, equality of opportunity." Corak (2013), in contrast, finds that countries with higher income inequality have lower intergenerational income mobility. This finding suggests that countries with higher inequality do not experience more social mobility or more equality of opportunity. The idea that there could be a trade-off between inequality and mobility could also apply to intra-generational inequality and mobility. As Friedman suggested, a high degree of inequality may be associated with a higher degree of churn in and out of the top or bottom of the distributions. Alternatively, higher inequality driven by technological change, returns to human capital, and increased investment by parents in kids may lead to less intra-generational mobility. The structural advantages that lead to higher inequality could also lead to lower intra-generational mobility.

Relying on income alone may not tell the whole story. First, the income, consumption, and wealth distributions inform our perceptions of economic well-being – both inequality and mobility. The Stiglitz report (Stiglitz et al., 2009, pg. 33) states: "…the most pertinent measures of the distribution of material living standards are probably based on jointly considering the income, consumption, and wealth position of households or individuals." Yet most research on inequality and mobility limit analysis to just one of these variables, typically income. Examining income, consumption, and wealth and how they evolve over the life-cycle can further highlight the relationship between inequality and mobility.

It does not need to be the case that the patterns observed for income inequality and mobility automatically transfer to consumption and wealth. It is informative if one measure changes and another remains constant or moves in the opposite direction. Krueger and Perri (2006) show that

the increased availability of financial markets could suggest that increases in income inequality do not lead to increases in consumption inequality. These life-cycle trajectories of income and wealth affect the consumption path, which all impact the trends in inequality and mobility over time. Our purpose is to examine the relationship between inequality and mobility over individuals' life-cycle paths.

Understanding the relationship between inequality and intra-generational mobility requires more than a series of one-year snapshots of inequality and mobility. One-year snapshots may be misleading depending on the year used. Thus, it is necessary to use a panel of individuals and follow individuals over a long period of time. Multiple cohorts allow one to compare inequality and mobility at similar ages for different cohorts. We combine these factors and are the first paper to study to use income, consumption, and wealth to compare their level, inequality, and mobility across cohorts at the same age.

We use the Panel Study of Income Dynamics (PSID), which provides us with seven cohorts over fifty years, allowing us to compare at least four cohorts at any particular age during the working-age years. We find that younger cohorts experience a higher level of resources at the mean, median, and 90th percentiles. However, there has been little or no improvement at the 10th percentile. This pattern in the level of resources implies higher inequality across cohorts, which we find with the Gini coefficient as well as with the 90/10 ratio. Lastly, we find intra-generational mobility that is no higher and sometimes lower for younger cohorts. We measure intra-generational mobility using the rank-rank correlation at all observable 10-year periods (i.e., the rank-rank correlation using the rank at 26 years old and the rank at 36 years old). Putting these results together, we see evidence similar to Corak (2013) that higher inequality is

associated with lower intra-generational mobility, yielding what could be called an intra-generational Great Gatsby Curve.

While we are the first to put all of these pieces together, some individual pieces have been found in prior research. Chetty et al. (2017) find that 92% of children in the 1940 birth cohort had higher before-tax income than their parents, falling to 50% of children in the 1984 birth cohort. This matches our finding that younger cohorts have higher income than older cohorts, at least at the median. Gale and Harris (2020) find higher mean wealth for younger cohorts, at least before the Great Recession. No comparable cohort evidence exists for consumption.

Guvenen et al. (2018) find increasing earnings inequality across cohorts. But again there is little evidence on cohort inequality in consumption or wealth. Most research shows there has been a large increase in income and wealth inequality (Saez and Zucman, 2014; Wolff, 2014, Piketty, 2014). Fisher, Johnson and Smeeding (2015) find that consumption inequality is about 80 percent as large as disposable income inequality and that the rise in consumption inequality was two-thirds that of income inequality in the United States from 1984 to 2011.

The Distribution of Income, Consumption and Wealth

To measure household well-being over a lifetime, ideally we would have a measure of lifetime income, or permanent income. In a world of perfect information, with no borrowing or liquidity constraints, and with accurate surveys that measure both income and consumption, we could measure permanent income using consumption at one point in time. Consumption would contain all of the information needed to understand inequality, intra-generational mobility, and intergenerational mobility. Because perfect surveys do not exist, foresight is imperfect, and there are real world constraints on both borrowing and liquidity, one year of consumption is

insufficient. Researchers have turned to using income, consumption, *or* wealth to measure resources available to households.

However, using income, consumption, or wealth alone is imperfect. Given that all consumers do not follow the life-cycle, permanent income hypothesis, the need to study income, consumption, and wealth for the same households can be demonstrated using the intertemporal budget constraint (Blundell, 2014).

$$\sum_{k=0}^{T-t} Q_{t+k} C_{t+k} = \sum_{k=0}^{L-t} Q_{t+k} Y_{t+k} + A_{i,t}$$

where Q is a discount rate, C represents consumption, Y represents income, and A represents net wealth. Time T is death, and time L is retirement. In surveys, we observe snapshots of consumption, income, and wealth. Each individual measure alone provides a noisy estimate of life-time well-being at a point in time. A retired household may have high wealth, with consumption above income. Using income alone would make the household seem worse off, while wealth may overstate the household's well-being because they are drawing down wealth.

The joint distribution of all three provides more information about well-being over the life-time. Blundell (2014) states in his presidential address: "These different dimensions capture different aspects of inequality, and analyzed together they can considerably enhance our understanding of inequality dynamics." The PSID has been the primary source to study income mobility in the U.S. (see Duncan, Rodgers, and Smeeding, 1993; Duncan, Boisjoly, and Smeeding, 1996; Shin and Solon, 2011; Dynan, Elmendorf, and Sichel, 2012; Mazumder, 2018; 2013; Latner, 2018; Bayaz-Ozturk, Burkhauser, and Couch, 2013). More recently with the addition of wealth and

consumption to the PSID, researchers have used the PSID to study wealth mobility (Charles and Hurst, 2003; Pfeffer and Killewald, 2015) and consumption mobility (Fisher and Johnson, 2006; Jappeli and Pistaferri, 2006; Bruze, 2018).

Recent research has begun documenting the important interactions between income, consumption, and wealth. Fisher et al. (2016) are the first to use the PSID to examine the conjoint distribution of income, consumption and wealth. They rely on the 1999-2013 PSID because wealth and consumption are not always available prior to those years. They find that intra-generational income and consumption mobility are about the same but that wealth mobility is lower. They also find that intra-generational income mobility is lower at the top and bottoms of the wealth distribution, highlighting the role that wealth can play in income and consumption mobility.

Fisher and Johnson (2006) are the first to examine the intra-generational mobility of consumption in the U.S. Japelli and Pistaferri (2006) conducted a similar analysis for Italy. Both papers found that consumption mobility was higher than income mobility. In examining Spanish data, Gradin, et al. (2008) also find that expenditure mobility is higher than income mobility. Attanasio and Pistaferri (2016) find a similar result for *inter*generational mobility and suggest that "…as consumption is more equally distributed than income, there is also more intergenerational mobility when looking at consumption than income." Charles, et al. (2014) also find intergenerational consumption mobility higher than income mobility. D'Ambrosia et al. (2019) examine the volatility of income, consumption, and wealth and find that the volatility of consumption is less than income, which is lower than wealth volatility. While volatility examines the absolute changes in resources, we examine relative mobility. Since the income distribution is

more disperse than the consumption distribution, changes in income that may not affect the *relative* position of a family in the income distribution, may translate into smaller changes in consumption that yield less volatility but that do impact their relative position in the consumption distribution yielding more mobility.

Japelli and Pistaferri (2006) provide a framework to examine the relationships between income and consumption mobility and the influence of other factors (such as wealth or education). They shows that consumption mobility would be zero in a consumption insurance model where complete consumption smoothing is possible. Consumption mobility would be highest and similar to income mobility in a rule of thumb economy. Finally, in the permanent income model, with partial consumption smoothing, consumption mobility would be in between the two extremes. They also show that the presence of measurement error and/or taste shocks increases consumption mobility.

Data and Imputation

The Panel Study of Income Dynamics (PSID) is a longitudinal survey of households and their individuals that began in 1968. The PSID began with a representative sample of about 5,000 households in 1968 and continues to follow the individuals and households over time. From 1968-1997, families are interviewed each year. Beginning in 1999, interviews took place every other year. The PSID is a commonly used data set and others have provided a comprehensive overview of the PSID (see Brown, Duncan, and Stafford 1996).

The PSID attempts to follow individuals of the original family even as they form separate families and households. The PSID attempts to follow both adults of a divorced family, if they

were both part of a 1968 PSID family. As a result, the PSID increased the number of families it followed from 4,802 in 1968 to 9,607 in 2017 (see PSID, 2019). There are about 1,000 people who were heads or spouse/partners in 1968 and who were still in the survey in 2017.

Data are collected in the year of the survey; income is reported for the previous taxable year, wealth is reported for the time of interview (the survey year), and consumption is a mixture of time periods. In our analysis, we use the survey year to represent the year for the resource means. We adjust by family size using an equivalence scale given by the square root of family size, and we use the family level file, merge the individual file, and use longitudinal weights.[2]

Total Family Income is the sum total of taxable, transfer, and social security income of the head, wife, and other family units. Total household wealth is the sum total of eight asset variables minus debt. Asset variables are farm and business, checking and savings, other real estate (i.e. second home, land, rental real estate, or money owed on a land contract), stocks, vehicles, other assets (i.e. life insurance policy), annuity/IRA, and home equity. Up until 2007, debt was total debt. Beginning in 2009, debt is the sum total of debt from farm or business, real estate, credit card, student loan, medical, legal, family loan, or other.

We impute consumption to the PSID using the Consumer Expenditure (CE) Survey. The imputation methodology is described in detail in the appendix. The appendix also includes measures of the quality of the imputation. Our measure of consumption includes the amount that the household actually spends for current consumption plus the estimated service flows from

[2] We also compare the cross-section results using the family weights and results are qualitatively similar.

homeownership and vehicles. It includes expenditures for food, housing, transportation, apparel, medical care, entertainment, and miscellaneous items.[3]

Figure 1 shows the overall inequality for the entire sample over the 1968-2017 period. This figure shows the Gini coefficients and demonstrates the standard result that wealth inequality is higher than income inequality, which is higher than consumption inequality. All three measures demonstrate increases in inequality. Appendix Figure A6 compares the results to other measures of income, consumption and wealth inequality and confirms that our measures have similar trends to the others using other data sets.

We measure income and consumption using three-year moving averages to smooth out measurement error and some transitory shocks to resources. Because the PSID went from an annual survey to a biennial survey in 1997, we always average t-2, t, and t+2. Thus, 1970 income is the average of income in 1968, 1970, and 1972, making 1970 the first year and 2015 the last year in our results.

The PSID timing lines up well typical conceptions of cohorts in the United States and with our ability to smooth out some year-to-year shocks by pooling across birth years. We create 10-year birth cohorts and center the cohorts around the first Baby Boom wave. Our oldest cohort was born between 1916 and 1925, and we observe them in the PSID when they are 45-54 years old in 1970. The first cohort we observe at the beginning of their working career is the second half of the Silent Generation, those born from 1936-1945, which we observe at ages 25-34 in 1970. Our youngest cohort captures the tail end of Generation X and the beginning of Millennials, those

[3] Excluded are expenditures for pensions and social security, savings, life insurance, principal payments on mortgages, and gifts to organizations or persons outside the consumer unit.

born 1976-1985. Table 1 details the seven cohorts. We begin with the age profiles by cohort, inequality by cohort, and then mobility by cohort.[4]

Table 1: Cohort definition

Birth years	First used observation in PSID	Age range at first observation	Sample size
1916-1925	1970	45-54	423
1926-1935	1970	35-44	525
1936-1945	1970	25-34	818
1946-1955	1980	25-34	2,244
1956-1965	1990	25-34	2,927
1966-1975	2001	26-34	2,732
1976-1985	2011	26-34	3,836

Results

Age profiles

Figures 2A, 2B and 2C show the age-income, age-consumption, and age wealth profiles by cohort.[5] Income peaks in the late 50s, while consumption peaks at slightly older ages. The profiles exhibit a clear inverted U-shape for income, but the consumption profiles flatten out after the peak rather than making a distinct downturn, consistent with consumption smoothing in retirement (Fisher et al., 2008; Haider and Stephens, 2007). Wealth, on the other hand, continues to increase with age until at least 70.

[4] There is concern that imputation will understate the true variance in the distribution. Multiple imputation addresses at least some of the concerns that the distribution of imputed values from mean regressions will understate the dispersion in the true distribution. Multiple imputation adds noise, and calculating the dispersion measures correctly involves using all imputed values and adding the extra term for the uncertainty inherent in imputation (Rubin, 1987).
[5] For now, we only have wealth for 1984, 1989, 1994, and 1999-2017. We are also imputing wealth to every year of the PSID and will update results with those results in a future version of the manuscript.

A clear pattern across the income, consumption, and wealth profiles is the increasing standard-of-living between our oldest cohort and the first Baby Boom cohort. From the first age we observe them until the peak in income, each successive cohort experienced higher average equivalent income through those born between 1946 and 1955 (Figure 2A). At age 51, our oldest cohort had $46,000 in equivalent income, increasing to $60,500 for our 1926-1935 cohort, $72,300 for the 1936-1945 cohort, and $76,400 for our first Baby Boom cohort. After age 55, it appears that there is little difference in mean income between the 1936-1945 cohort and the 1946-1955 cohort. A similar pattern across our four oldest cohorts is seen for consumption (Figure 2B). At age 51, equivalent consumption increases from $24,900 for our oldest cohort to $37,100 for the first Baby Boom cohort. Wealth does not follow the same pattern. We observe little difference in mean wealth for all but the oldest cohort. Because wealth is so skewed, it will make more sense to focus on percentiles of the wealth distribution across the cohorts rather than mean wealth.

After the 1946-1955 cohort, there are smaller gains in income and consumption when the cohorts were in their 30s. Younger cohorts experience higher income and consumption, but the improvements across cohorts are smaller for the younger cohorts. The improvements mostly disappear after age 40 for income and consumption. The large gains experienced by older cohorts were not experienced by the younger cohorts. The younger cohorts are not worse off than the older cohorts, but they are about the same at least in terms of mean income, consumption, and wealth at a given age.

We next turn to the age profiles at the 10^{th}, 50^{th}, and 90^{th} percentiles of the distribution to help understand whether the patterns observed at the mean persist through the entire distribution. The

increase in inequality over the last 40 years is driven by the top of the distribution (Piketty and Saez, 2003; Saez and Zucman, 2016), and our results are consistent with that finding. The largest and most consistent gains across cohorts occur at the 90th percentile (Figure 3). All cohorts experienced higher income at the 90th percentile except for our youngest cohort. We do not observe our youngest cohort until 2011 and are thus those who entered the job market during the Great Recession or just after it, showing the scares at the beginning of the working life of the Great Recession even for the top of the income distribution. Consumption also shows increases across cohorts at the 90th percentile, while wealth shows little difference at the 90th percentile.

At the median, we observe smaller gains using income for the more recent cohorts, while there are more visible gains using consumption and visible losses for wealth. The gains in consumption are coming at the expense of wealth, suggesting the younger cohorts could have permanently lower wealth as they age without a change in behavior. At the 10th percentile, we can see that consumption often exceeds income within a cohort, and wealth is correspondingly negative.

While the patterns are similar, but not identical, for income and consumption across our cohorts, the wealth patterns are different. We see little differences in age-wealth profiles across cohorts using the 10th, 50th, and 90th percentiles (Figures 3A, 3B and 3C).

Inequality by cohort

We turn from individual points in the distribution to summary measures of inequality. Specifically, we use the Gini coefficient by cohort and age, presenting age-Gini profiles. The age-inequality profile for income shows clear increases in income inequality within all cohorts

and across most cohorts (Figure 4A), consistent with the patterns across the 10th, 50th, and 90th percentiles of the distribution (Figures 3A, 3B and 3C). The increases in inequality across cohorts is most obvious at younger ages. The income Gini for the 1946-1955 cohort is around 0.28 when the cohort is in their late 20s, while the income Gini is 0.35 or higher for the three younger cohorts. After age 50, the differences in inequality across cohorts falls, but we still observe a general increase in inequality across cohorts.

Consumption inequality is higher for younger cohorts as it was for income (Figure 4B), increasing from about 0.22 around age 30 for our two cohorts born from 1936-1955 to 0.25 for the next three younger cohorts. We also see increasing consumption inequality within cohorts, at least after the cohorts turn about 40-years old, matching the results from Deaton and Paxson (1994), which found increasing consumption inequality within cohorts.

Wealth inequality increases substantially across cohorts (Figure 4C). For our second oldest cohort, the Gini when the cohort is around age 60 is 0.6, while the Gini for our Baby Boom cohorts around age 60 is above 0.7. Wealth inequality is also higher at the youngest ages for our younger cohorts, with our three younger cohorts showing higher wealth inequality in their 30s than the first Baby Boom cohort.

Combined, we see relatively stagnant real income and consumption for our three youngest cohorts (Figures 2A, 2B and 2C) but higher inequality for those cohorts (Figures 4A, 4B and 4C). The median is staying the same but the spread is increasing, driven by relatively little change at the 10th percentile and large improvements across cohorts at the 90th percentile (Figures 3A, 3B and 3C).

Mobility measures

One common measure of mobility is rank-rank correlations. The sample sizes in our three older cohorts do not support using percentiles as each of the older cohorts have less than 1,000 people (Table 1). We take everyone in a given cohort who is 25-34 in a given year and rank them into the twenty vingtiles. We then do the same for the same cohort 10 years later when they are the 35-44 years old. We regress the rank when they are 35-44 years old on the rank when they were 25-34 years old and report the resulting coefficient. We repeat this exercise for every age. When the PSID switches to every other year, we use the observation 11 years later if we cannot use the measure 10 years later. For our youngest cohort, the first year we observe them at least 25 years old is 2011, and the last year of data is 2017. We measure mobility for this six-year period as our best proxy of the 10-year mobility, but caution should be used when comparing this youngest cohort to the older cohorts because the number of years between the two observations is different.

Figure 5 shows the age-mobility profile using the rank-rank correlation by cohort. Our Generation X cohort, those born between 1966 and 1975, have a higher income rank-rank correlation (0.94) around age 30 than the three older cohorts (0.92) we measure at age 30, indicating less income mobility for Generation X. For consumption and wealth, Generation X is in the middle of the two Baby Boom cohorts that just precede it.

No clear pattern across the life-cycle emerges for income and consumption mobility (Figures 5A, 5B and 5C). However, it does appear that the income rank-rank correlation is increasing over time (i.e., mobility is lower), as most cohorts see a higher rank-rank correlation in the last seven or eight observations that occur in the 2000s. Consumption mobility is relatively flat over the

life-cycle and over time. Wealth mobility differs, with significantly less mobility over the life-cycle across all cohorts. As cohorts age, there is a relatively consistent increase in the rank-rank correlation or decrease in mobility.

In contrast to inequality, the pattern is that consumption mobility is greater than income mobility (Figure 5). While theory predicts that consumption mobility should be lower than income mobility, we are not the first to document this pattern (Fisher and Johnson, 2006; Jappelli and Pistaferri, 2006; Attanasio and Pistaferri, 2016). We can rule out that this pattern is caused by the imputation because reported the PSID includes reported consumption from 1999-2017. Reported consumption mobility is higher than income mobility as shown in the appendix. As expected, reported consumption mobility is lower than imputed consumption mobility, but both exceed income mobility. Consumption mobility is also higher than income mobility using a Shorrocks measure of mobility and the Gini mobility. The Shorrocks using fewer bins than the rank-rank correlation, while the Gini mobility is closer to a continuous measure than the rank-rank correlation. Thus, this result persists across a wide spectrum of mobility measures.

Combining Figures 4 and 5 yields intra-generational Great Gatsby curves in the spirit of the intergenerational Great Gatsby curves (Corak, 2013). Figures 6A, 6B and 6C plot the rank-rank correlation with the Gini coefficient for the same resource measure. We include a linear best fit line by cohort. Similar to Corak (2013), we find that higher inequality is associated with less mobility. The pattern within a cohort and across cohorts is clearer for consumption and wealth, while the within cohort evidence for income is more mixed. The evidence suggests that when a cohort is experiencing higher inequality, it also experiences less mobility. More evidence is needed to establish whether this relationship is causal.

Conclusion

Using income, consumption and wealth provides a more complete picture of the inequality and mobility of individuals and families. In order to evaluate all three for the same individuals, we need a data source with all measures – the PSID provides that unique opportunity. While wealth inequality is higher than income inequality, which is higher than consumption inequality, we find the reverse relationship for intra-generational mobility – consumption mobility is greater than income mobility, while there is more variation over the life-cycle for wealth mobility. At younger ages, there is more wealth mobility but it decreases over the life-cycle until there is less wealth mobility than income or consumption mobility. We also show that all cohorts experience a fall in intra-generational mobility for income and wealth. This is coupled with increasing inequality within cohorts. Finally, we find that the younger cohorts, while experiencing higher mean income and consumption than their older cohorts, also experience higher inequality and lower mobility.

An open question remains regarding the relationship between consumption mobility and income mobility. Like previous research, we find that consumption mobility exceeds income mobility, contrary to standard theoretical models. We ruled out that the result is generated by the imputation of consumption or by the mobility measure used. We find higher consumption mobility using reported consumption from 1999-2017 as well. And, we find that consumption mobility is higher than income mobility using three very different measures of mobility. Future research will need to continue to investigate this puzzle.

Figure 1: Inequality in income, consumption, and wealth by year for all individuals

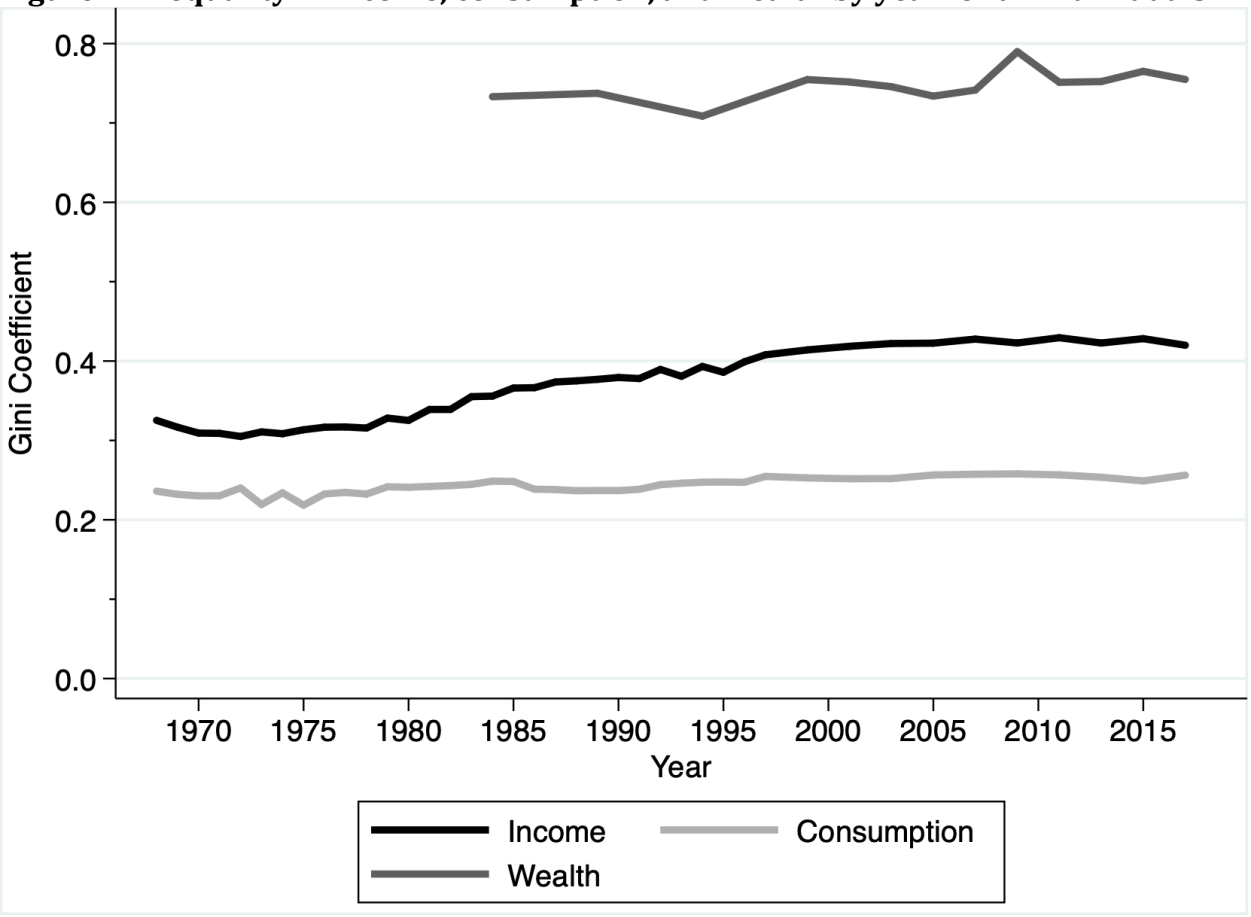


Figure 2A: Mean age-income profile by cohort

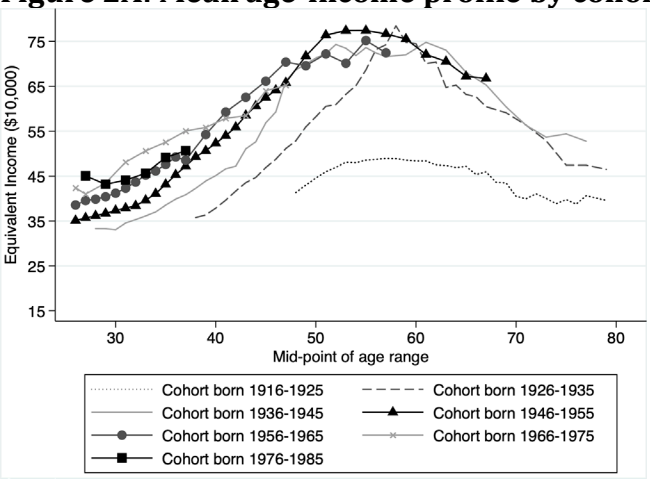


Figure 2B: Mean age-consumption profile by cohort

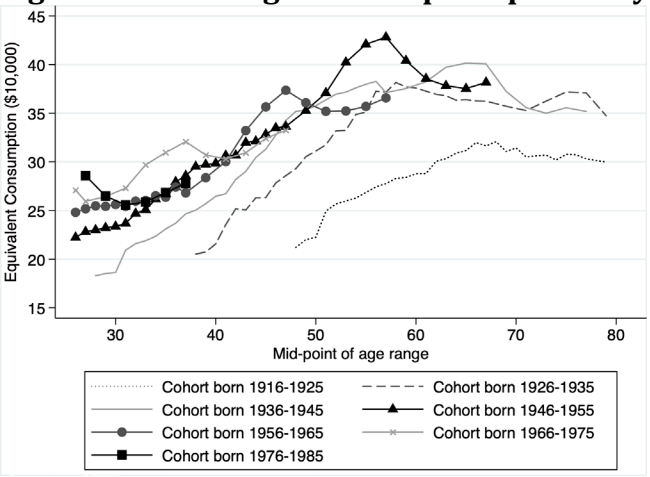
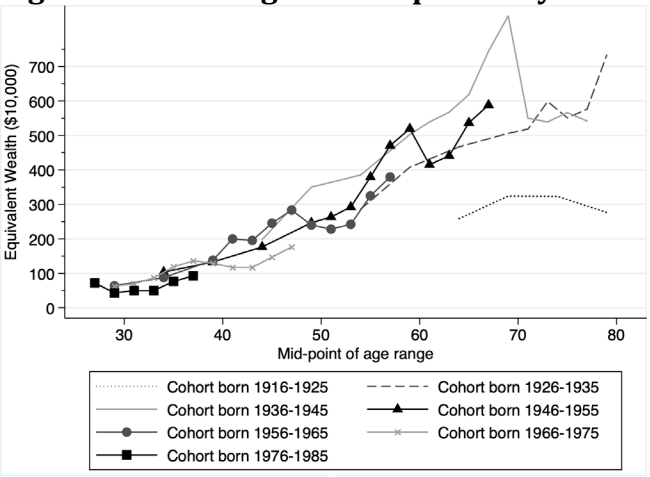


Figure 2C: Mean age-wealth profile by cohort



Source: Author's calculations using the 1968-2017 PSID.

Figure 3A: Age-profiles at 10th, 50th, and 90th for income

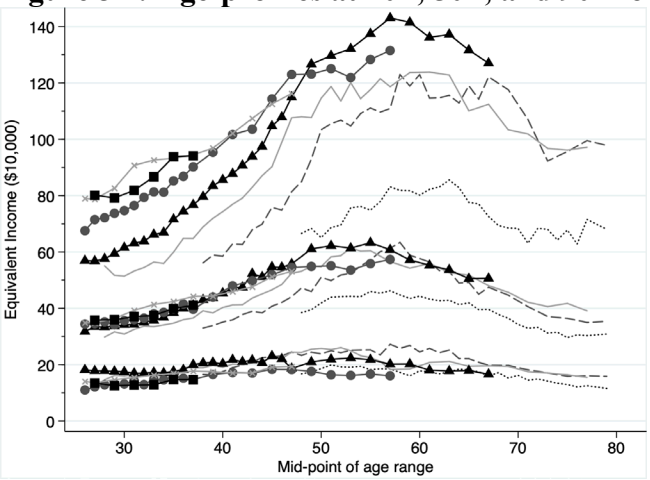


Figure 3B: Age-profiles at 10th, 50th, and 90th for consumption

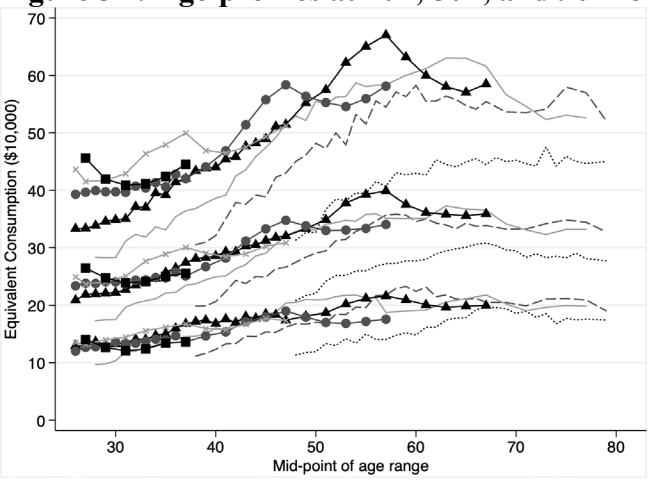


Figure 3C: Age-profiles at 10th, 50th, and 90th for wealth

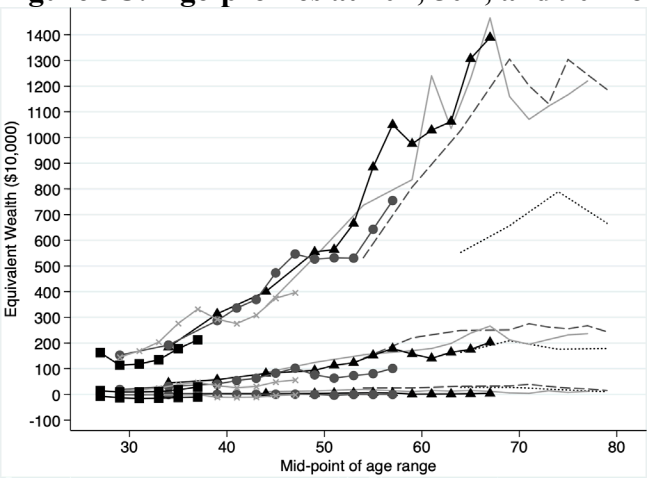


Figure 4A: Income inequality by cohort using Gini coefficient

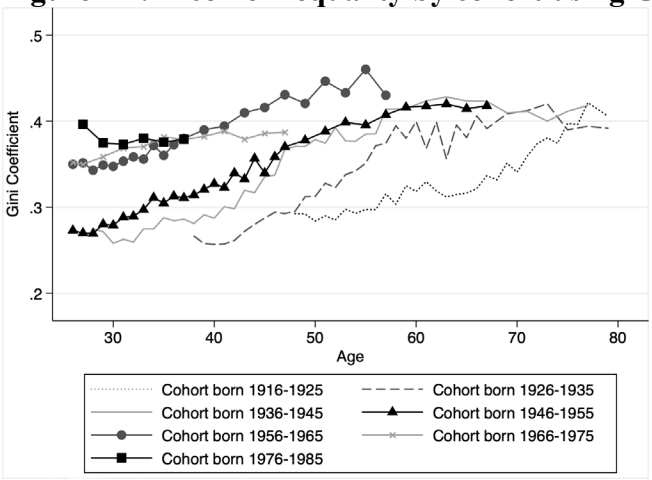


Figure 4B: Consumption inequality by cohort using Gini coefficient

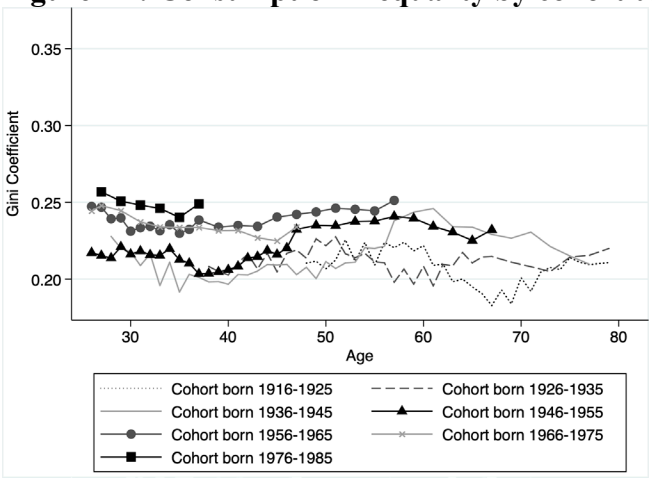


Figure 4C: Wealth inequality by cohort using Gini coefficient

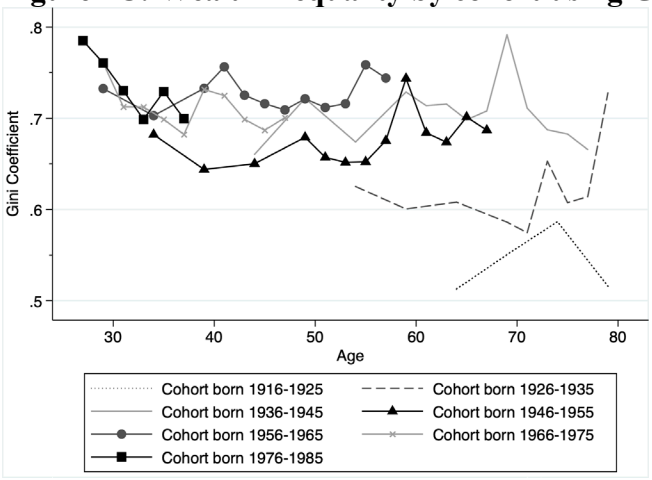
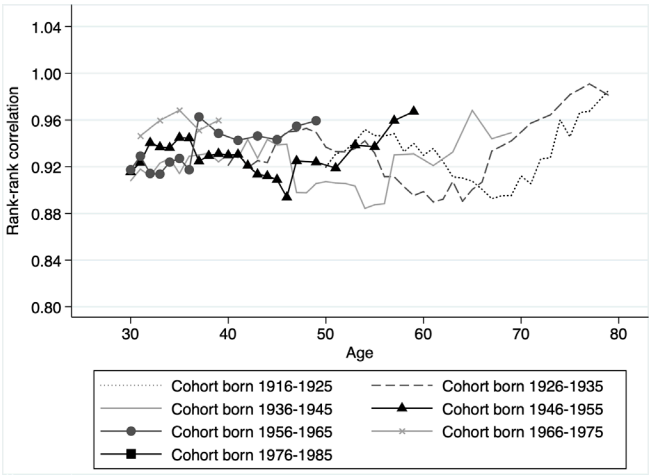
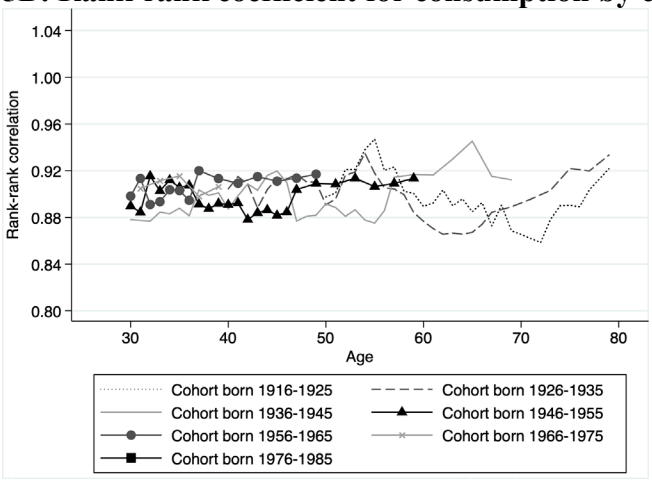


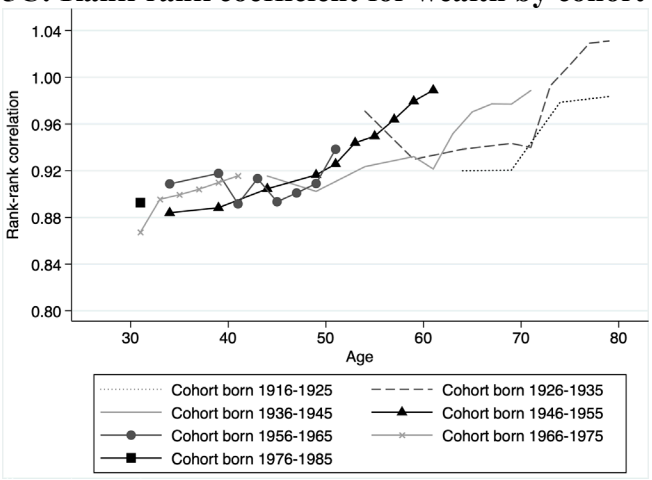
Figure 5A: Rank-rank coefficient for income by cohort



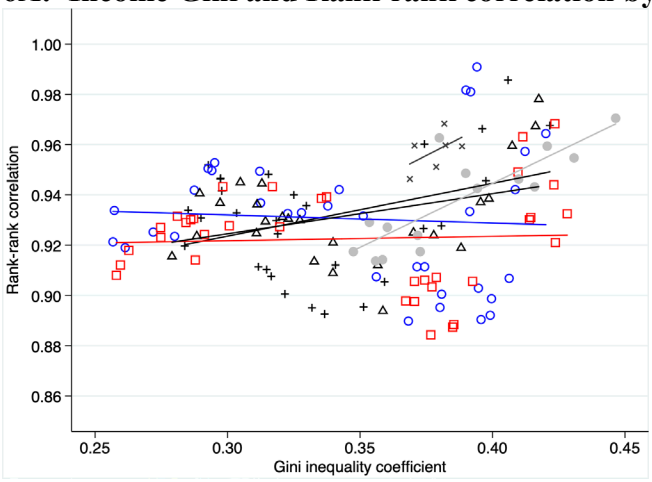
5B: Rank-rank coefficient for consumption by cohort



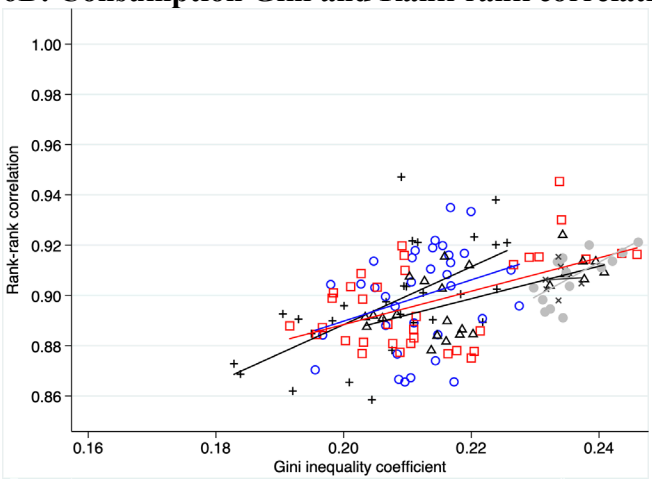
5C: Rank-rank coefficient for wealth by cohort



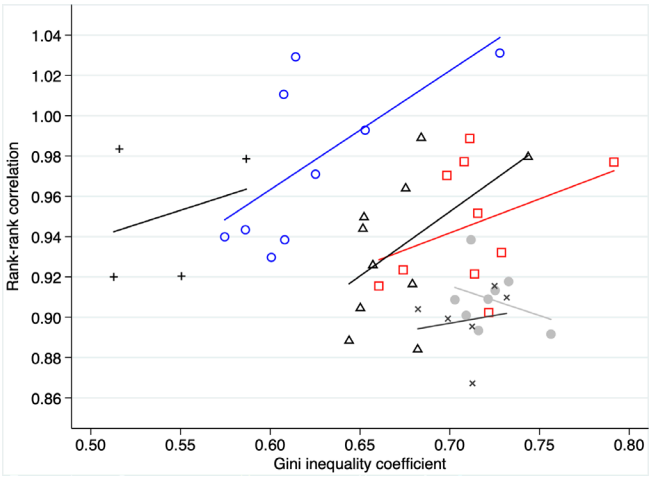
6A: Income Gini and Rank-rank correlation by cohort



6B: Consumption Gini and Rank-rank correlation by cohort



6C: Wealth Gini and Rank-rank correlation by cohort



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Appendix: Consumption Imputation Methodology and Comparison

This appendix describes the methodology used to impute consumption to the Panel Study of Income Dynamics (PSID). Then, we present several comparisons to help judge the quality of the imputation, comparing the PSID to the Consumer Expenditure (CE) Survey and comparing imputed PSID consumption to reported PSID consumption, when reported consumption is available. We first begin by describing the CE Survey data.

Consumer Expenditure Survey Data

The CE survey has been a continuing quarterly survey since 1980, with an earlier collection in 1972-73. Data are collected from consumer units five times over a 13-month period.[6] The second through fifth interviews are used to collect expenditures for the previous three months; for example, a consumer unit that is visited in March reports expenditures for December, January and February. Also collected in this survey is the inventory of certain durable goods, e.g., homes, real estate, vehicles, and major appliances. To obtain an annual measure of consumption and income, we use consumer units who participate in the survey for all interviews (representing 75-80 percent of all consumer units). The consumer units are then placed in the quarter in which their last interview occurred, and the weights and household demographics are those from the last interview.

Several changes in the CE methodology and sample make creating a consistent measure of consumption more difficult. There was no CE survey from 1968-1971 and 1974-1979. While there was a CE Survey in 1972 and 1973, the survey made significant changes between the 1972-1973 version and those that followed. In 1972-1973, the CE surveyed every household once and

[6] A consumer unit comprises members of a household who are related or share at least two out of three major expenditures--housing, food, and other living expenses. Since 2015, data are only collected for four quarters.

asked about consumption over the previous year. Since 1980 the CE surveyed every household four times and asked about quarterly consumption. The level of inequality differs depending on whether the household is asked about annual consumption or quarterly consumption, resulting in a significant break in the time series when we attempted to impute using 1972-1973 and post-1980 data. Thus, we use the 1980-1981 CE to impute back to 1968 for the PSID. We do not use the 1972-1973 CE.

Another significant change is that the CE only surveyed urban households in 1982 and 1983. We use the 1980-1981 CE, which includes urban and rural households, to impute for 1982 and 1983. The CE also redrew its sample in 1986, 1996, and 2005 to update the sample for the most recent Decennial Census. In practice, this means that the CE would drop many households that were sampled in 1986Q1 that should have been interviewed in 1986Q2 and replaced them with new households. This redrawing of the CE sample results in a significantly smaller number of four-quarter households in those three years. To boost the sample size, we use the year before and the year after the change in the sample. For 1986, we use 1985, 1986, and 1987. The small sample size issue also applies to 1984 when the CE reintroduced rural households. When imputing consumption for the 1984 PSID, we use the 1984 and 1985 CE Surveys.

Our measure of consumption includes the amount that the consumer unit actually spends for current consumption plus the estimated service flows from homeownership and vehicles. It includes expenditures for food, housing, transportation, apparel, medical care, entertainment, and miscellaneous items for the consumer unit. Excluded are expenditures for pensions and social security, savings, life insurance, principal payments on mortgages, and gifts to organizations or persons outside the consumer unit. The service flow from homeownership represents the rental equivalence of the owned home. For renters, we use the rent. The vehicle service flow is

estimated using the make, model (when available), and year of the vehicle to generate the flow of services of the vehicle in a given year.[7]

Imputation Methodology

Several researchers have imputed consumption for the PSID individuals using the CE data. Skinner (1987) first imputed total consumption for the PSID, and most subsequent research has followed this method. Using CE data, Skinner (1987) estimates an equation with total consumption as the dependent variable. In his preferred specification, the independent variables are food at home, food away from home, rent if a renter, utilities, market value of the home if a homeowner, and the number of vehicles owned.

More recently, Blundell, Pistaferri, and Preston (2008) estimate a log-linear demand function for food consumed at home. Blundell et al. (2008) deviate from the Skinner (1987) methodology because they argue that their demand for food equation comes from economic theory rather than a statistical procedure. Their estimated equation is:

$$ln(food\ at\ home) = M'\mu + \beta * ln(C) + e \quad \text{(A1)}$$

The dependent variable equals food at home expenditures divided by the CPI for food at home, resulting in an estimate of the quantity of food purchased. Using the quantity of food purchased is consistent with their estimation of the demand for food. The matrix M contains the CPI for food at home (i.e., the price of food), food away from home expenditures, age of the household head, family size, children, race, education, region of residence, and interaction terms with the price of food. C equals the total non-durable expenditures from the CE. Once estimated in the CE, Blundell et al. (2008) invert equation (A1), and the estimated coefficients are used to impute

[7] See online appendix for Fisher et al. (2015) for details on service flow imputations.

consumption in the PSID. This method captures the change in the variance well but overstates the level of the variance and level of consumption.

Ziliak (1998) takes a different approach to estimating total consumption in the PSID. Rather than using another data set, Ziliak (1998) uses the PSID information on household wealth and income. First, he calculates savings by subtracting current asset holdings from next period's asset holdings. Using this measure of savings, he then subtracts savings from current income to generate composite consumption. Ziliak (1998) argues that composite consumption improves upon Skinner's (1987) imputed consumption because Skinner's measure may be unstable if relative prices are changing. We avoid this problem by estimating separate equations for each year of the PSID data. The coefficients are allowed to differ across years, which will reflect price changes.

In this work, our estimated equation expands the Skinner (1987) model, but we also follow the Blundell et al. (2008) method by including demographic characteristics in the estimated equation. To impute total consumption for the PSID, we will estimate the following using the CE:

$$ln(C) = \alpha_0 + X'\alpha_1 + \alpha_2 * food\ home + \alpha_3 * food\ away + v \quad \text{(A2)}$$

The dependent variable, C, equals total household consumption as described above. The vector X contains:

- a quartic in age of the household head
- dummies for region of residence
- family size
- dummies for having one child, two child children, and three or more children (omitted is having no children)

- dummies for those with a high school education, those with some college, and those with at least a college degree (omitted is less than a high school degree)
- number of labor income earners
- whether the household owns or rents
- number of automobiles
- labor income decile
- government income decile
- whether the household has business income

Food at home and food away from home were not asked in the 1973, 1988, and 1989 PSID. We impute these values within the PSID before imputing consumption. We use the surrounding values of the variable to impute. For example, we use 1972 food at home and 1974 food at home to help impute 1973 food at home, along with demographic characteristics of the household. We follow a similar methodology to impute number of automobiles in 1973 and 1974, autos from 1987-1997, and rent in 1988 and 1989.

Following our earlier work in imputing income (Fisher, Johnson, and Smeeding, 2015), we use the multiple imputation methodology of Rubin (1987) and produce five estimates of consumption for each wave. Multiple imputation allows researchers to account for the extra uncertainty generated by the imputed values relative to reported values.

Judging Quality of the Imputation – Comparisons to the CE Survey

We first present the simplest comparison – the means of the distributions over time. Figure A1 displays the mean of CE consumption and the five PSID implicates from 1980-2017. The means match well as one would expect when using predictive mean matching for the imputation. The years when the CE re-samples (1986 and 2015 in particular), the CE mean exceeds the imputed

mean, likely because of the smaller sample sizes in the CE those years. Remember that we used three years of CE data to impute to the PSID in those years, which would smooth out the PSID.

Figure A2 presents the kernel density for CE consumption and one PSID implicate for 2017. The two overlap across most of the distribution. Figure A3 shows the Gini inequality from 1980-2017. The patterns tell the same basic story. Inequality is relatively flat from 1980-1995, while it rises from 1995-2007; inequality falls starting with the Great Recession. Figure A6 shows that our Gini is similar to the Gini from Attanasio and Pistaferri (2014) who use an alternative imputation method.

Judging Quality of the Imputation – Comparisons to the Reported Consumption

The PSID introduced a more complete definition of consumption in 1999 and then expanded it again in 2005. From 1999-2003, consumption is the sum total of food, housing, transportation, education, and child care. Beginning, in 2005, consumption also includes spending on travel, clothing, other recreation, home repair, home furnishings, and home phones.

We first compare the Gini coefficient between imputed and reported consumption. As expected, reported consumption inequality is higher than imputed inequality (Figure A4). The trends in inequality within cohorts generally, though there is more year-to-year variation in the reported Gini. The biggest difference is for the second oldest cohort, where reported consumption inequality is increasing while imputed consumption inequality is falling.

Next we compare mobility with reported and imputed consumption using the rank-rank correlation in Figure A5. The rank-rank correlation is higher using reported consumption, meaning mobility is lower with reported consumption. We expect reported mobility to be lower than imputed mobility because of the imperfection of the imputation. The patterns across cohorts generally match between reported and imputed mobility, and the trends over ages within a cohort generally match as well.

Figure A1: Mean of CE Consumption and Five PSID Imputed Consumption, 1980-2017

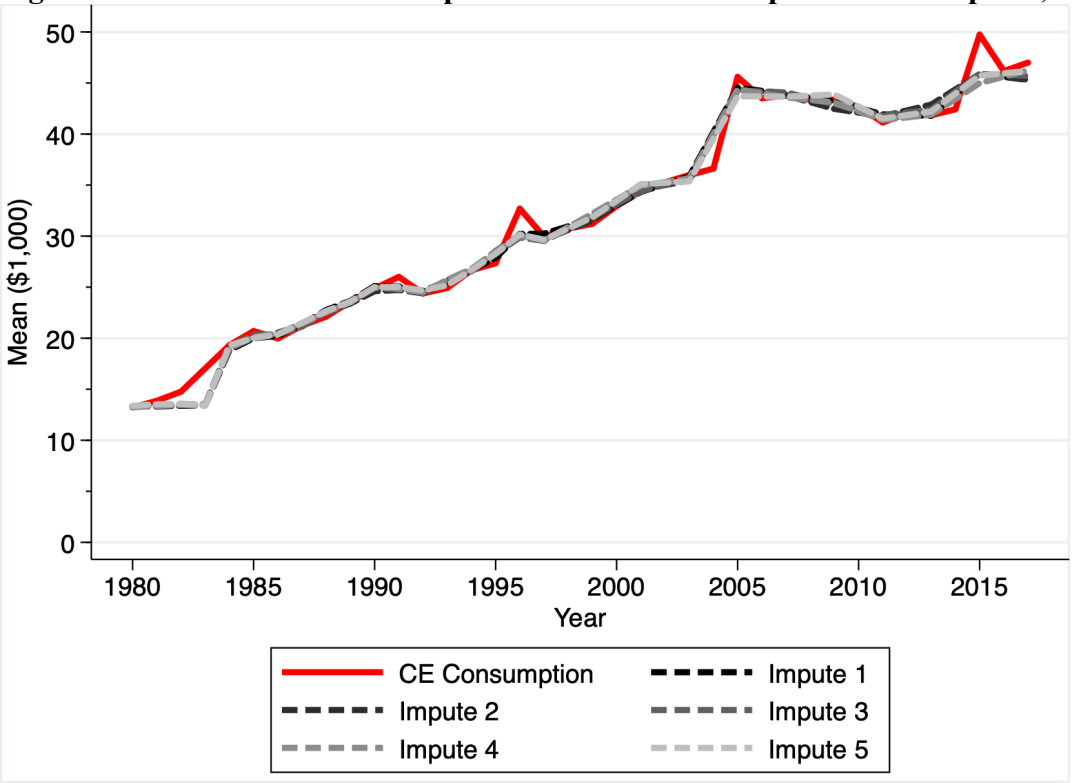


Figure A2: Kernel Density of CE Consumption and PSID Imputed Consumption, 2017

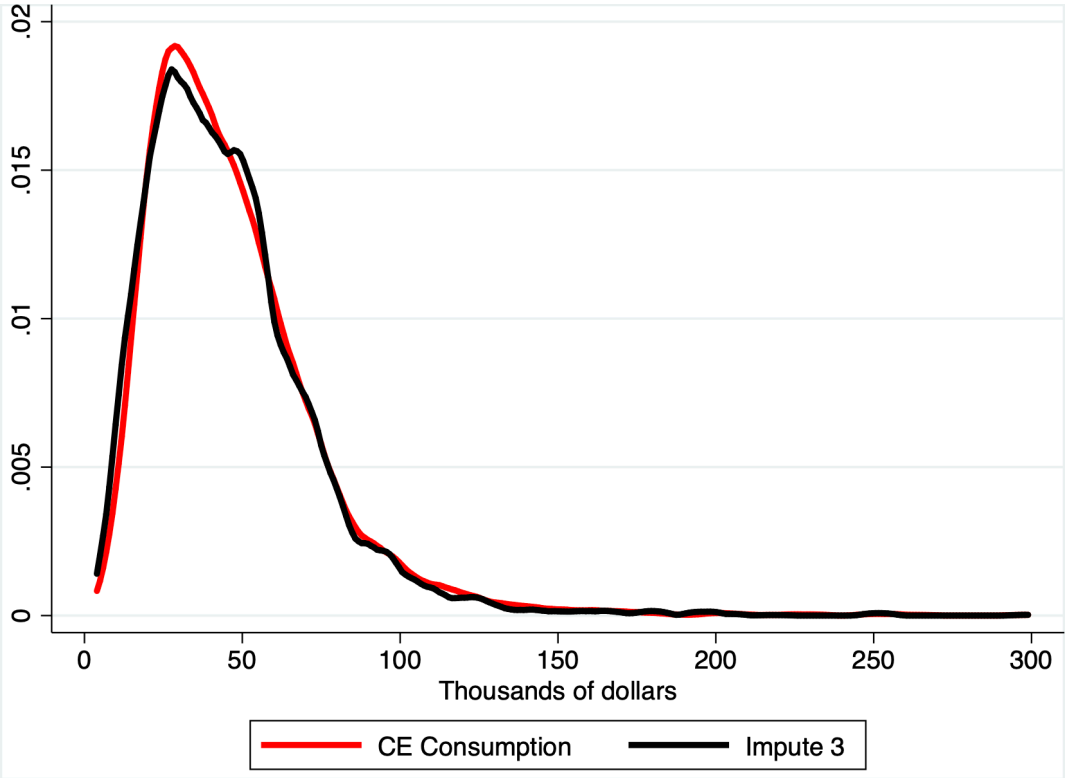


Figure A3: Gini of CE Consumption and Five PSID Imputed Consumption, 1980-2017

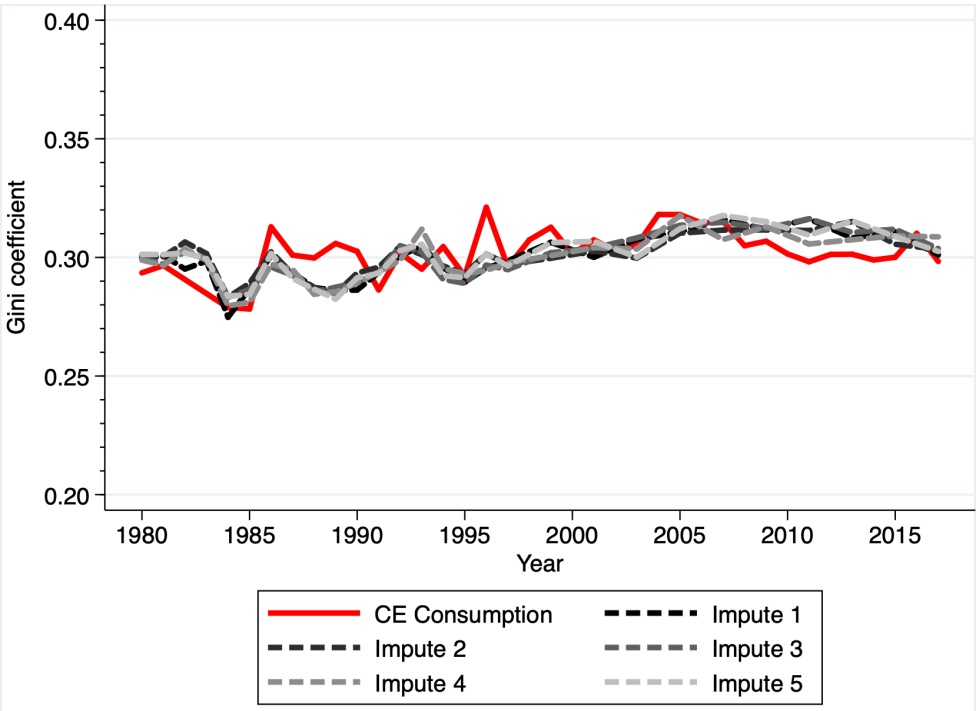
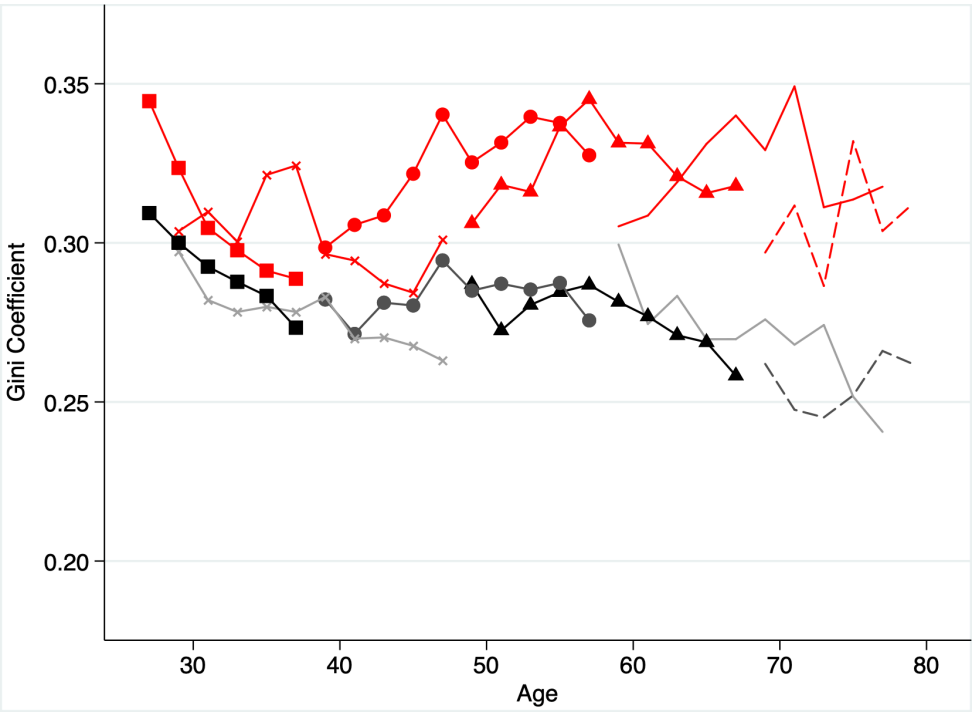
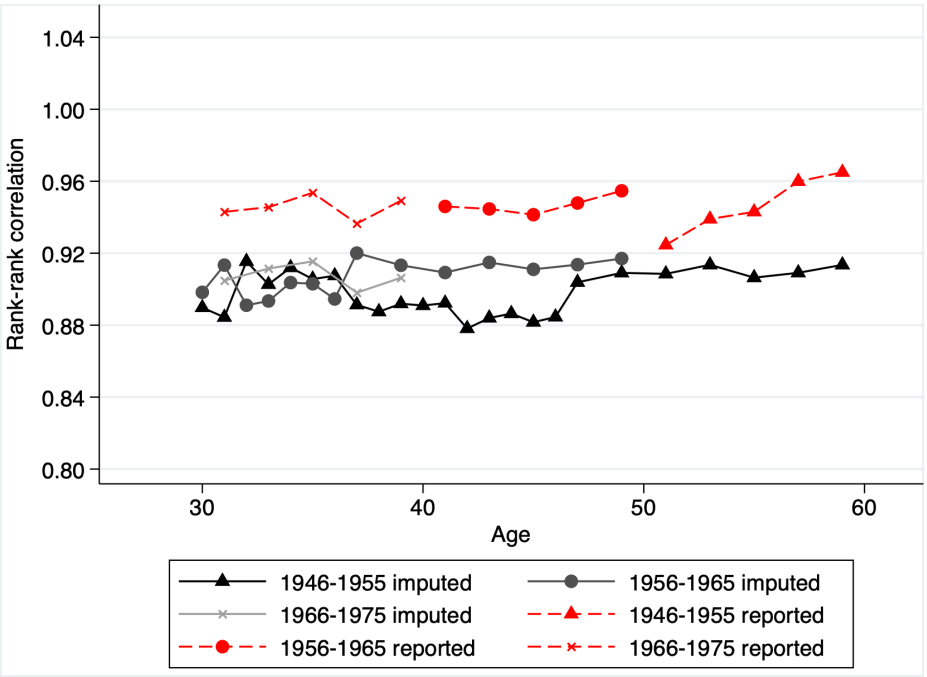


Figure A4: Gini Coefficient for Reported and Imputed Consumption by Cohort (PSID)



Notes: The red lines represent reported consumption inequality using the 1999 consumption definition. The black and gray lines represent imputed consumption. The figure uses 1999-2017.

Figure A5: Rank-Rank Correlation using Reported and Imputed Consumption (PSID)



Notes: The red lines use the 1999 consumption definition.

Figure A6: Comparison of Gini Coefficients for wealth (SCF), income (CPS), and consumption (Attanasio and Pistaferri) to those from PSID