Inequality and mobility over the past half century using income, consumption and wealth

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Abstract:
Inequality in income, consumption, and wealth is increasing, and inequality in the joint distributions is increasing faster than inequality in any of the single distributions (Fisher, Johnson, Smeeding, and Thompson, 2016b). The joint distribution of all three provides more information about well-being over the life-time. Thus, studying the joint distribution of income, consumption, and wealth tells us something about past well-being, current well-being, and future well-being.

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. This paper builds on our previous work (Fisher et al. (2016a)) and extends these results back to 1972, and will eventually produce estimates back to 1968. Following the methods in Fisher and Johnson (2006) and Fisher et al. (2016a), we impute consumption to the earlier years in the PSID to obtain measures of inequality and mobility from 1972 to 2015. We find that consumption mobility is higher than income mobility, which is higher than wealth mobility. We also find that people with low wealth in 1984 are more likely not to move up relative to others.

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Income, consumption, and wealth distributions inform our perceptions of inequality. Yet most research on inequality limit analysis to just one of these variables. Even the studies using more than one almost invariably do so one at a time.[2] The most influential studies on income inequality examine income alone (Piketty and Saez, 2003; CBO, 2018). Those studying consumption inequality compare the trends in consumption inequality and income inequality, but the focus is on the univariate distributions and not the conjoint distribution (Fisher et al., 2015; Attanasio and Pistaferri, 2014, Aguiar and Bils, 2015). Similarly, wealth inequality is studied by itself or with income inequality, but the focus is on the univariate distributions (Saez and Zucman, 2014; Wolff, 2016, Pfeffer and Schoeni, 2016). In contrast, *The Report by the Commission on the Measurement of Economic Performance and Social Progress* (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." And recommendation 4 states: "Give more prominence to the distribution of income, consumption and wealth."[3]

Most research shows there has been a large increase in income and wealth inequality. Saez and Zucman (2014) and Wolff (2014) find that income and wealth inequality are highly related. Piketty (2014) makes this point more dramatic by arguing that the increase in income inequality yields more wealth inequality, which in turn increases income inequality. 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.

Studying these measures separately misses the important synergy between the three measures explicit in the life-cycle budget constraint. An increase in income held by the top of the distribution means that consumption and/or wealth of the top also increases. The joint distribution between any two, and more importantly the conjoint distribution amongst all three, provides more information than any of the univariate distributions. The concern is whether the increases over time in all three are similar, or whether the rankings across countries are similar. Recent evidence shows that the levels of income, consumption and wealth inequality are different, with wealth inequality greater than income, which is greater than consumption.

One must also ask, how does inequality of income translate to consumption or wealth? Alternatively, if one increases and another remains constant – what does that mean about well-being or the effects of inequality on social mobility? Piketty (2014) suggests that increases in wealth inequality translate to increases in income inequality, stating "…many shocks to the

[2] One exception is Jäntti, Sierminska, and Smeeding (2008), who model the joint distribution of income and wealth in a cross-national context.

[3] Blundell (2014) in his address to the Royal Statistical Society states the importance of all three measures: "One thing is for sure, the results of the research presented here provide a strong motivation for collecting consumption data, along with asset and earnings data, in new longitudinal household surveys and linked administrative register data."

wealth trajectories of families can contribute to making the wealth distribution highly unequal (indeed, in every country and time period for which we have data, wealth distribution *within each age group* is substantially more unequal than income distribution…)." Alternatively, 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.

Following Fisher et al. (2015b) in their study of inequality in three dimensions, we focus here on the conjoint distributions of income, consumption, and wealth for the same individuals. Here we examine all three measures of inequality using the 1984-2015 Panel Study of Income Dynamics (PSID). The PSID allows for longitudinal analysis and intra- and inter-generational mobility issues not feasible with any other dataset.[4]

Following the methods in Fisher and Johnson (2006), Fisher et al. (2016a) and Fisher et al. (2016b), we look at multi-dimensional inequality and mobility by comparing mobility in income and consumption by initial wealth quintile. High wealth at young ages may allow individuals to work in careers with initially low earnings but high potential growth, such as entrepreneurship. In contrast, low wealth households, including those with negative net worth, may take higher paying jobs but with less growth.[5]

Historically, 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; DeBaker, at al., 2010; 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)). One of our contributions is to present income, consumption, and wealth mobility for the same households over the same period. Then we extend the research to understand income and consumption mobility by wealth, highlighting the interactions between the three measures.

[4] In other ongoing comparable work we combine income and wealth in the SCF with consumption in the Consumer Expenditure (CE) Survey databases to pursue similar aims. While the SCF does not follow individuals longitudinally, it does include a special sample of the top one percent of the income and wealth distributions, something missing from the PSID and all other household income or consumption databases. The SCF aggregates compare well with National income and Product Accounts suggesting an important confluence of both macro and microeconomic accounts (Dettling et al., 2015).

[5] This paper is a natural extension of our previous work (Fisher and Johnson, 2006; Fisher et al., 2016a; and, Fisher et al., 2016b). Our earlier work looked at 1984-1999 but only looked at one dimension of mobility at a time and not the interaction (Fisher and Johnson, 2006). Our later work looked at the interaction but only started in 1999 (Fisher et al., 2016a; and, Fisher et al., 2016b). We will extend the work by going back to 1968.

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. One year of 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." OECD (2013) further explains: "For given levels of consumption and wealth, and everything else being equal, people with a higher income can be regarded as having a higher level of economic well-being than people with a lower income." They suggest that for given levels of consumption and income, people with greater wealth have a higher level of economic well-being. Basically, they will have more opportunity to increase consumption both now and in the future; wealth informs about past savings behavior and provides a future capacity to consume. Hence, studying the joint distribution of income, consumption, and wealth tells us something about past well-being, current well-being, and future well-being.

Similarly for intergenerational mobility, taking a snapshot of parent's income, consumption, or wealth along with a snapshot of the child's income, consumption, or wealth misses important interactions between generations. Parent's wealth may help a child attend college, take an unpaid internship that leads to greater future income and consumption growth, start a business, or many other well-being enhancing activities.

Recent research has begun documenting the important interactions between income, consumption, and wealth. Fisher et al. (2016a) 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.

Other research demonstrates that the consumption changes in response to income changes differ across the income and wealth distribution. For instance, Kaplan, Violante, and Weidner (2014) find the wealthy hand-to-mouth households, with high illiquid wealth but little liquid savings, have the largest response (or highest marginal propensity to consume). Johnson et al. (2006) find that consumption response to the 2001 tax rebates were larger for households with low wealth and for households with low income. Fisher et al. (2018) find that the marginal propensity to consume is higher for low wealth families.

Recent work by Krueger et al. (2016) emphasizes the importance of examining heterogeneity in the income and wealth to the changes in consumption and the overall macroeconomic outcomes. They claim that their important contribution is "…the introduction of additional dimensions of household heterogeneity, so that the model can better capture the joint distribution of wealth, income and expenditure we observe in the data. A more accurate mapping between the model and household micro data might change our quantitative conclusions regarding the impact of household heterogeneity on macro dynamics." Their work again highlights that income, consumption, or wealth alone miss important heterogeneity in household behavior, and that this heterogeneity can be better captured looking at the interactions of income, consumption, and wealth.

Smeeding (2017) also stresses the importance of all three measures in terms of intergenerational mobility, stating: "Children are overrepresented in the bottom half of all of these distributions, leading to concerns about their upward mobility, certainly in comparison to the minority of advantaged children who are located at the top of the wealth and consumption scales."

To better understand the household's well-being, we study the joint distribution of consumption, income, and wealth rather than any of these measures alone. A household with high income, high

consumption, but low wealth may have very different future prospects as a household with high income, high consumption, and high wealth. An unexpected income shock will negatively affect the household with low wealth as that household may not be able to smooth consumption as well as an otherwise similar household with high wealth. That scenario may suggest wealth alone is sufficient because it summarizes the ability to consume in the future independent on income, but we also need to know how high wealth is relative to consumption and/or income. A household with $100,000 in wealth and $20,000 in consumption is much different than a household with $100,000 in wealth and $100,000 in consumption.

Data

The analysis that follows uses two data sets: the Consumer Expenditure (CE) Survey and the PSID. Because the PSID only begins collecting consumption information in 1999, we use the more comprehensive data from the CE to impute total consumption to the PSID.

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.

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.[7]

Panel Study of Income Dynamics (PSID) Data

The 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

[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.

[7] 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.

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).

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. For the inequality and mobility measures 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.[8]

Total Family Income is the sum total of taxable, transfer, and social security income of the head, wife, and other family units.[9] 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.

The definition of consumption changes in the PSID. Up until 2003, consumption is the sum total of food,[10] 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.

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 9,048 in 2015 (see PSID (2017)). From 1968-2015, there are about 1000 people who were heads or spouse/partners in 1968 and who are still in the survey in 2015.

For most of the analysis in the current paper, we use the 1972-2015 period with additional analysis focusing on the 1984-2015 period because collection on wealth began in 1984. Eventually, we will have consumption and wealth imputed for every wave since the PSID began in 1968. Family income, however, is collected from every family for the entire 50 years. For this paper, we use a balanced sample of people who were the head or spouse/partner in 1972,

[8] We also compare the cross-section results using the family weights and results are qualitatively similar.
[9] In the future, we will use after tax income, by imputing taxes using a model constructed by Kimberlin et al. (2014) using NBER TAXSIM.
[10] Following Fisher and Johnson (2006) and Attanasio and Pistaferri (2014), we include the amount of food stamps (or SNAP) in the total food consumption.

between ages 21 to 40, and who remain in the survey for the other periods (about 1,200 people).[11]

Consumption imputation

The PSID has included spending on food and rent in almost every year since 1968, but a more complete measure of consumption began in 1999. We impute consumption to the PSID using the CE Survey.

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 et al. (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.

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

$$ln(C) = \alpha_0 + X'\alpha_1 + \alpha_2 * food\ home + \alpha_3 * food\ away + v \qquad (1)$$

The dependent variable, *C*, equals total household consumption as described above.[12] The vector *X* contains demographic characteristics such as a spline for the age of the household head, region of residence, family size, number of children, race, education, number of labor income earners, and whether the household owns or rents.

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 methods allow researchers to account for the extra uncertainty generated by the imputed values relative to reported values. In this paper, we impute consumption in the years the PSID includes wealth: 1984, 1989, 1994, and every wave since 1999, and for the earlier years of 1972-73 and 1980-81. In future work, we will impute

[11] For the social welfare analysis, we use a larger sample for those who remain for the shorter period from 1984 to 2015.

[12] Bee, Meyer, and Sullivan (2012) find that reported total food away from home is falling in the CE relative to the PCE aggregates over time. We will test the sensitivity of the imputation to the exclusion of food away from home on the right-hand side. We will also examine using the rank in the food away from home distribution instead of the level of spending.

wealth and consumption in every year since 1968. Finally, we impute consumption from 1999-2015 even though the PSID includes reported consumption in those years. We compare inequality and mobility between reported consumption and imputed consumption to show that our results are consistent with both measures.

Results

Now that we have a measure of total consumption for the PSID, we present the results for inequality, mobility, and social welfare using income, consumption, and wealth. All results use the square root of family size to create equivalent values. We begin with the age profiles and cross-sectional measures of inequality. Exploiting the panel nature of the PSID, we then present three mobility measures, and how wealth can impact income and consumption mobility. Finally, we examine mobility and inequality in a single framework and examine how changes in welfare are affected by growth in consumption, changes in inequality, and the level of mobility.[13]

Age profiles

Figure 1 shows the age-income profile and age-consumption profile by age cohort for 1999-2015. For example, those ages 31-34 in 1999 had mean equivalent income of $27,900, and mean equivalent consumption of $19,200. The peak in income occurs around ages 55-58, while the peak in consumption is at slightly older ages. Figure 2 shows the age-income and age-consumption profiles for the entire 1972-2015 period. Similar to the 1999-2015 period, the peak in consumption occurs around age fifty-five, while income peaks in the late fifties. The profiles exhibit a clear inverted U-shape for income, but the consumption profiles are clearly flatter. Within cohorts, the two trends in the profiles are remarkably similar.

Overall Inequality

We use the balanced sample to examine the inequality over time. Recall that these people have been in the sample since 1972 and were either married couples or cohabiting partners. Hence, they are more stable and may not demonstrate as much volatility as shown with the entire sample. This also translates to a smaller increase in inequality over the period.[14] Figure 3 shows the Gini coefficients.[15] These figures demonstrate the standard result that wealth inequality is

[13] 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).

[14] The Gini includes zero and negative values for income and wealth.

[15] Appendix figure 1 compare the Gini coefficient for all PSID families to our restricted sample, while appendix figure 2 shows the income and consumption inequality using the mean log deviation (MLD).

higher than income inequality, which is higher than consumption inequality. All three measures demonstrate increases in inequality. Yet all show different trends over this 30 year period.[16]

These inequality measures represent one-dimensional inequality (along each of three dimensions – income, consumption and wealth). Following Fisher et al. (2016b), we can also produce two- and three-dimensional inequality measures. For example, the share of people in the top quintile for income and consumption is 5.8 percent in 2015, while the share of people in the top quintiles for all three measures is 3.9 percent. This share has increased over the past 10 years (see appendix figures A3 and A4).

Mobility measures

The focus on the paper is on the intra-generational mobility of these adults. To examine mobility, this section uses transition matrices following Jappelli and Pistaferri (2006). Tables 1 looks at transitions between quintiles of the income, consumption, and wealth distributions between 1972 and 1980, 1984 and 1999, 1999 to 2015, and over the entire period – 1972 - 2015. In contrast to inequality, the pattern is that consumption mobility is greater than income mobility, while wealth mobility is lower than income mobility (Jappelli and Pistaferri 2006; Attanasio and Pistaferri 2016). Wealth inequality is the highest while wealth mobility is the lowest.

Table 1A shows the transition mobility matrices for income and consumption for the first period, 1972-1980. Tables 1B and 1C show mobility matrices for all three measures for 1984-1999 and 1999-2015. All three show the standard twin peaks phenomenon seen in the relative mobility literature – with larger percentages remaining in the top and bottom quintiles than in the middle three quintiles (see Fisher and Johnson, 2006).

These tables suggest that mobility is highest for consumption, then income, and lowest for wealth. Another key difference is in that the stickiness at the top is more apparent in wealth, than in income and consumption. The elements of the main diagonal detail the proportion of individuals that remain in the respective quintile. For example, in Table 1B, 42 percent of individuals were in the bottom quintile of equivalent income in both 1984 and 1999 (55 percent from 1999 to 2015). There are more transitions across the three middle quintiles than at the bottom and top quintiles for both income and consumption. In the middle three quintiles, only 21 to 29 percent of individuals remain in the same quintile, while 42 and 44 percent of individuals remain in the top or bottom quintile. For consumption, 38 percent and 33 percent remain in the bottom and top quintiles between 1984 and 1999. The twin peaks are most prominent for wealth, with 55 percent of individuals in the top wealth quintile in 1984 also in the top wealth quintile in 1999, and 57 percent of individuals staying in the bottom wealth quintile. Only 2 percent of those in the bottom wealth quintile in 1984 made it to the top wealth quintile in

[16] The Gini for the reported consumption since 1999 has a similar level and trend to the imputed consumption.

1999. The wealth twin peaks are even more well-defined between 1999 and 2015, with 56 percent staying in the bottom wealth quintile, but 65 percent staying in the top wealth quintile.

Finally, Table 1D shows the mobility matrices for income and consumption for the entire period, 1972-2015. The mobility is very large with the entries on the diagonal close to 20 percent, with only 31 percent of people remaining in the bottom quintiles of income or consumption.

Similar to others (see Bayaz-Ozturk et al. (2014)), mobility increases for all three measures as the period becomes longer. Over the entire 30 year period (from 1984 to 2015), only 40, 38 and 49 percent remain in the bottom quintile for income, consumption, and wealth. Similar to our previous papers, Fisher and Johnson (2006) for 1984-1999 and Fisher et al. (2017) for 1999-2013, we find that wealth is stickier at the top. Between 1999-2015, 65 percent remain in the top wealth quintile compared to 58 percent for income and 40 percent for consumption.

We also present summary statistics that encapsulate the information into a single measure of relative mobility using two measures – the Shorrocks index and the Gini index of mobility. The Shorrocks index requires the grouping of data into percentiles (quintiles are used here); the Gini does not require any grouping. Thus, the Shorrocks index misses within quintile mobility that is captured by the Gini mobility index.

Table 2 shows the Shorrocks index, which uses the diagonal of the transition matrices from Tables 1A-1D. The Shorrocks index equals the number of groups (five in our case) minus the sum of the main diagonal, all divided by the number of groups minus one. If there are no transitions, meaning households remain in their respective quintile, then the Shorrocks index equals zero. If 20 percent of households remain in their respective quintiles, then the index equals one.

The Shorrocks index uses the transition matrices above and can be interpreted as the proportion of individuals moving across the distribution. Between 1984 and 1999, 84.5 percent of individuals move across the income distribution while 91.8 percent move across the consumption distribution, and only 72.8 percent of the wealth distribution. These results summarize the intuition shown in Tables 1 that consumption mobility is higher than income mobility and wealth mobility is low.

Another measure of mobility using the Shorrocks index is the percent of individuals that do not change status, which equals one minus the Shorrocks index. Bayaz-Ozturk et al. (2014) use a similar measure of immobility to compare US and German mobility. They find that mobility increases with the length of the period. We can also see that mobility for all three measures is higher for the 30 year period. However, mobility over the past 15 years is lower than it was in the 1984-1999 period. And over the entire 1972-2015 period 94 percent of families moved quintiles, with similar mobility in income and consumption.

Another measure of mobility is the Gini index of mobility constructed by Yitzhaki and Wodon (2004), which uses the covariance between individual income or consumption and the individual's rank in that distribution over the two periods. The index, *M*, is defined as:

$$M = \frac{G_1(1-\Gamma_{12}) + G_2(1-\Gamma_{21})}{G_1 + G_2} \qquad (2)$$

G_i equals the Gini coefficient of inequality for period *i*, and $\Gamma_{ij} = cov(Y_i,(F_j(Y))/cov(Y_i,F_i(Y))$, $i \neq j$; $F_i(Y)$ represents the cumulative distribution of the measure of well-being in year *i*, which represents the individuals rank or relative position in the distribution.[17] If the individual's income and rank do not change between periods, then $\Gamma=1$ and $M = 0$, indicating that there was no mobility. On the opposite extreme, if the distribution completely flips between the two periods – the richest person becomes the poorest and the second richest becomes the second poorest, then $\Gamma = -1$ and $M = 2$, meaning there was complete mobility. The range of the Gini index of mobility, *M*, is then from zero to two, and an increase in the Gini index for mobility indicates an increase in mobility.

Table 3 shows the Gini index of mobility for income, consumption, and wealth for the various periods. Between 1984 and 1999, the mobility index for income equals 0.433, while it equals 0.613 for consumption. As with the Shorrocks index, this pattern exists regardless of the reference years; income mobility is lower than consumption mobility (and lowest for wealth) using the Gini index of mobility. Table 3 also illustrates the impact of longer time periods, with the income mobility measure increasing from 0.210 between 1984-1989, to 0.433 for 1984-1999, and 0.527 for 1984-2015.

With consumption smoothing over the life-cycle (as shown in Figure 1), consumption is more equally distributed and could yield more opportunities for 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." Since the income distribution is more disperse than the consumption distribution, small changes in income that may not affect the *relative* position of a family in the income distribution, may translate into small changes in consumption that do impact their relative position in the consumption distribution. In fact, the average change in income for families moving across quintiles is about twice that of the consumption change moving across consumption quintiles. Finally, Japelli and Pistaferri (2006) show that increased measurement error in consumption will yield higher

[17] The Γ_{ij} equal the covariance of the individual's income in period *i* with his rank in the income distribution in period *j* divided by the covariance of the individual's income in *i* with his rank in the income distribution in the same period.

mobility. However, it is not clear that measurement error in consumption is higher than in income.

Both sets of mobility measures demonstrate the expected result that longer time periods yield more mobility (comparing 1984-1999 and 1984-2015) for all three measures. The entire 43 period having the largest mobility. This could simply be due to the aging of the sample, and is a topic for future research. Both measures show that mobility decreased over the 1984-2015 period, with the first 15 years showing higher mobility than the last 15 years.

Following Fisher et al. (2017), we can examine the mobility for income and consumption by the level of wealth by creating separate mobility matrices for the top and bottom wealth quintiles (see Tables 4A and 4B). These tables show the percentage of individuals who are in the top and bottom wealth quintiles in 1984 and remain in the bottom two quintiles in 1984 and 1999 (and 1984 and 2015, 1999 and 2015). As expected, there is less income mobility at lower wealth quintiles. While 24 percent of all individuals remain in the bottom two quintiles in 1984 and 1999, 51 percent of those in the bottom wealth quintile remain in the bottom two income quintiles in 1984 and 1999. Yet only 8 percent of those in the top wealth quintile remain in the bottom two income quintiles in both periods. It is similar for consumption.

We can also calculate a Shorrocks index measure for the bottom and top wealth quintile. For the 1999-2015 period these follow the expected results. The Shorrocks index for the bottom wealth quintile is 0.770 for income and 0.915 for consumption, while in the top quintile both are slightly larger – 0.803 and 0.963, respectively.

Inequality, mobility, and social welfare

Wodon and Yitzhaki (2005) provide a method of analyzing economic growth, inequality, and mobility in a consistent framework using a social welfare function. Using a social welfare function suggested by Sen (1976), $\mu(1 - G)$ (μ equals the mean of the measure of well-being (income or consumption), and G represents the Gini index for inequality), we can show the impact of mobility and inequality on society well-being.

To analyze growth, inequality, and mobility together, Wodon and Yitzhaki (2005) modify equation (2) and define welfare over two periods.[18] They provide a decomposition in three parts -- the impact of the growth in the measure of well-being on welfare, the weighted inequality effect, and weighted mobility effect. Social welfare is strictly decreasing in inequality, and increasing in mobility.

[18] $SW(w) = \mu_w(1 - G_w)$ where w is the individual's average well-being over the two periods, or $w_j = \sum(x_{1j} + x_{2j})/2$; $j=1…n$, and n represents the number of individuals. The variable x is the measure of well-being, income (Y) or consumption (C). For income, this means that $w_j = \sum[(Y_{1j} + Y_{2j})/2]$, which is just average income over the two periods for each individual.

Table 5 presents the results of the decomposition for income and consumption for the three periods – 1984-1999, 1999-2015 and the entire 1984-2015 period. These measures use the cohort beginning in 1984. Using income as the measure of well-being, social welfare increased 17 percent between 1984 and 2015, and increased 22 percent for consumption. Wodon and Yitzhaki's social welfare function increases with mobility. Hence, social welfare is higher when considering consumption than when considering income not only because of less unequal distribution of consumption (relative to income), but also because of higher mobility.

Conclusion and Next Steps

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 and their inter-relationships, we need a data source with all measures for the same individuals – 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 > income mobility > wealth mobility. In our aging sample, intra-generational mobility falls between the latter two 15 year periods.

The next step is to impute consumption and wealth every wave back to 1968 and include children and other adults in the families. With this new dataset we will extend the intra-generational results, and examine age cohorts. We can actually compare birth cohorts – how does mobility in all three differ for those between ages 25 and 40 born in the 1940s compared to those born in the 1950s, 1960s, and 1970s.

Finally, we will examine intergenerational mobility. We will use both a rank-rank of parents' and children's resources for all three measures and the rank-rank for income and consumption by wealth quintile of parents. This latter measure allows us to determine the importance of initial wealth (mainly home-ownership) in the eventual mobility for children. The crucial question is how important is the income, wealth, and consumption of parents to the future economic well-being of children.

Table 1A: Mobility transition matrices between 1972 and 1980 by income and consumption (in percent; each row adds to 100 except for rounding errors)

		Income (1972-1980)			
	Q1	**Q2**	**Q3**	**Q4**	**Q5**
Q1	46%	22%	16%	10%	6%
Q2	23%	31%	24%	18%	4%
Q3	17%	18%	26%	26%	14%
Q4	8%	15%	20%	26%	32%
Q5	3%	14%	14%	21%	48%
		Consumption (1972-1980)			
	Q1	**Q2**	**Q3**	**Q4**	**Q5**
Q1	39%	20%	20%	14%	7%
Q2	22%	21%	23%	19%	15%
Q3	23%	25%	20%	18%	14%
Q4	9%	16%	22%	26%	26%
Q5	5%	15%	16%	26%	39%

Table 1B: Mobility transition matrices between 1984 and 1999 by income, consumption, and wealth (in percent; each row adds to 100 except for rounding errors)

		Income (1984-1999)			
	Q1	**Q2**	**Q3**	**Q4**	**Q5**
Q1	42%	25%	20%	8%	5%
Q2	25%	26%	24%	15%	10%
Q3	14%	18%	21%	25%	21%
Q4	11%	17%	20%	29%	23%
Q5	6%	13%	15%	23%	44%
		Consumption (1984-1999)			
	Q1	**Q2**	**Q3**	**Q4**	**Q5**
Q1	38%	25%	17%	11%	9%
Q2	22%	16%	25%	18%	18%
Q3	16%	23%	22%	23%	16%
Q4	13%	19%	18%	24%	26%
Q5	8%	16%	19%	24%	33%
		Wealth (1984-1999)			
	Q1	**Q2**	**Q3**	**Q4**	**Q5**

Q1	57%	27%	8%	7%	2%
Q2	22%	35%	26%	12%	4%
Q3	9%	21%	29%	26%	15%
Q4	4%	10%	28%	32%	27%
Q5	3%	5%	10%	26%	55%

Table 1C: Mobility transition matrices between 1999 and 2015 by income, consumption, and wealth (in percent; each row adds to 100 except for rounding errors)

		Income (1999-2015)			
	Q1	**Q2**	**Q3**	**Q4**	**Q5**
Q1	55%	27%	13%	4%	2%
Q2	26%	28%	28%	14%	4%
Q3	8%	22%	21%	36%	13%
Q4	7%	14%	22%	32%	25%
Q5	3%	9%	16%	14%	58%
		Consumption (1999-2015)			
	Q1	**Q2**	**Q3**	**Q4**	**Q5**
Q1	43%	26%	17%	6%	7%
Q2	25%	24%	21%	17%	12%
Q3	16%	21%	19%	25%	18%
Q4	12%	16%	23%	27%	21%
Q5	4%	12%	20%	24%	40%
		Wealth (1999-2015)			
	Q1	**Q2**	**Q3**	**Q4**	**Q5**
Q1	56%	31%	7%	3%	3%
Q2	26%	34%	23%	14%	3%
Q3	9%	19%	37%	27%	7%
Q4	7%	12%	26%	35%	21%
Q5	3%	4%	6%	22%	65%

Table 1D: Mobility transition matrices between 1972 and 2015 by income and consumption (in percent; each row adds to 100 except for rounding errors)

		Income (1972-2015)			
	Q1	**Q2**	**Q3**	**Q4**	**Q5**
Q1	31%	19%	19%	12%	18%
Q2	18%	21%	25%	17%	19%
Q3	17%	25%	18%	27%	12%
Q4	15%	15%	22%	24%	24%
Q5	12%	20%	17%	21%	30%
		Consumption (1972-2015)			
	Q1	**Q2**	**Q3**	**Q4**	**Q5**
Q1	31%	28%	14%	14%	14%
Q2	21%	19%	24%	19%	17%
Q3	18%	23%	19%	18%	22%
Q4	11%	18%	18%	27%	25%
Q5	13%	12%	24%	26%	24%

Table 2: Shorrocks measures for income, consumption, and wealth

	Income	**Consumption**	**Wealth**
1972-1980	0.808	0.888	--
1980-1984	0.621	0.843	--
1984-1989	0.671	0.879	--
1989-1994	0.706	0.901	--
1994-1999	0.636	0.882	--
1999-2003	0.641	0.850	--
2003-2007	0.588	0.835	--
2007-2011	0.628	0.850	--
2011-2015	0.592	0.860	--
1984-1999	0.845	0.918	0.728
1999-2015	0.763	0.866	0.684
1984-2015	0.865	0.901	0.769
1972-2015	0.940	0.948	--
Fisher et al 1999-2013	0.775	0.794	0.713
Fisher & Johnson 1984-1999	0.815	0.819	

** Using reported consumption from 1999-2015, the Shorrocks measure of mobility is 0.841, which is in line with our imputed measure.*

Table 3: Gini mobility measures for income and consumption, and wealth

	Income	Consumption – Imputed	Consumption - Reported 1999 Def
1972-1980	0.423	0.543	--
1980-1984	0.201	0.447	--
1984-1989	0.210	0.599	--
1989-1994	0.251	0.656	--
1994-1999	0.233	0.709	--
1999-2003	0.257	0.480	0.463
2003-2007	0.184	0.422	0.418
2007-2011	0.186	0.471	0.581
2011-2015	0.188	0.459	0.545
1984-1999	0.433	0.613	--
1999-2015	0.385	0.530	--
1984-2015	0.527	0.683	--

Tables 4: Mobility transition matrices for income and consumption for people in the bottom and top wealth quintiles

Table 4A: Mobility transition matrices between 1984 and 1999 by income and consumption for top and bottom wealth quintile (in percent; each table adds to 100 for the total in each wealth quintile)

Bottom Wealth Q		**Income (1984-1999)**			
	Q1	**Q2**	**Q3**	**Q4**	**Q5**
Q1	25%	12%	5%	3%	0%
Q2	8%	7%	7%	4%	2%
Q3	4%	4%	5%	4%	2%
Q4	1%	2%	1%	2%	2%
Q5	0%	0%	0%	0%	1%
Bottom Wealth Q		**Consumption (1984-1999)**			
	Q1	**Q2**	**Q3**	**Q4**	**Q5**
Q1	23%	9%	7%	4%	2%
Q2	10%	6%	3%	2%	2%
Q3	5%	4%	2%	3%	3%
Q4	2%	1%	2%	3%	2%
Q5	1%	2%	1%	1%	1%
Top Wealth Q		**Wealth (1984-1999)**			
	Q1	**Q2**	**Q3**	**Q4**	**Q5**
Q1	2%	1%	1%	1%	0%
Q2	3%	2%	4%	0%	1%
Q3	1%	4%	4%	4%	2%
Q4	0%	5%	5%	6%	7%
Q5	1%	4%	4%	10%	28%
Top Wealth Q			**Consumption (1984-1999)**		
	Q1	**Q2**	**Q3**	**Q4**	**Q5**
Q1	0%	2%	2%	1%	1%
Q2	1%	2%	3%	2%	2%
Q3	2%	5%	3%	5%	6%
Q4	3%	4%	4%	8%	8%
Q5	1%	4%	6%	10%	17%

Table 4B: Mobility transition matrices between 1999 and 2015 by income and consumption, for top and bottom wealth quintile (in percent; each table adds to 100 for the total in each wealth quintile)

Bottom Wealth Q	**Income (1999-2015)**				
	Q1	**Q2**	**Q3**	**Q4**	**Q5**
Q1	20%	9%	4%	3%	0%
Q2	7%	7%	8%	4%	2%
Q3	2%	4%	6%	6%	3%
Q4	1%	2%	2%	3%	3%
Q5	0%	1%	1%	1%	2%
Bottom Wealth Q	**Consumption (1999-2015)**				
	Q1	**Q2**	**Q3**	**Q4**	**Q5**
Q1	17%	7%	5%	3%	2%
Q2	8%	7%	5%	2%	2%
Q3	5%	5%	3%	4%	3%
Q4	2%	2%	3%	4%	3%
Q5	1%	2%	2%	2%	2%
Top Wealth Q	**Wealth (1999-2015)**				
	Q1	**Q2**	**Q3**	**Q4**	**Q5**
Q1	4%	2%	1%	0%	0%
Q2	3%	3%	4%	1%	1%
Q3	1%	5%	5%	4%	2%
Q4	1%	5%	6%	6%	7%
Q5	1%	3%	5%	7%	21%
Top Wealth Q			**Consumption (1999-2015)**		
	Q1	**Q2**	**Q3**	**Q4**	**Q5**
Q1	2%	3%	2%	1%	0%
Q2	1%	3%	4%	2%	3%
Q3	3%	4%	4%	5%	5%
Q4	2%	3%	4%	8%	8%
Q5	2%	4%	4%	8%	14%

Table 5: Decomposition of Gini Mobility and Social Welfare (using sample from 1984)

	1984-2015			1984-1999			1999-2015	
	Income	**Cons.**		**Income**	**Cons.**		**Income**	**Cons.**
Mean								
Year 1	44,283	24,444		43,700	24,214		71,593	31,936
Year 2	63,524	36,109		71,323	31,700		63,520	36,108
Gini								
Year 1	0.350	0.248		0.350	0.249		0.420	0.270
Year 2	0.435	0.280		0.419	0.270		0.435	0.280
Gini mobility	0.554	0.652		0.416	0.552		0.379	0.543
Decomposition								
Growth Effect	1.217	1.239		1.316	1.155		0.944	1.065
Inequality + Mobility Effect	0.962	0.983		0.912	0.997		1.470	1.294
Inequality Effect	0.918	0.961		0.882	0.977		1.410	1.266
Mobility Effect	0.045	0.023		0.030	0.019		0.060	0.028
Total Effect	1.171	1.218		1.200	1.151		1.387	1.378

Figure 1: Age-income and age-consumption profiles for cohorts between 1999 and 2015

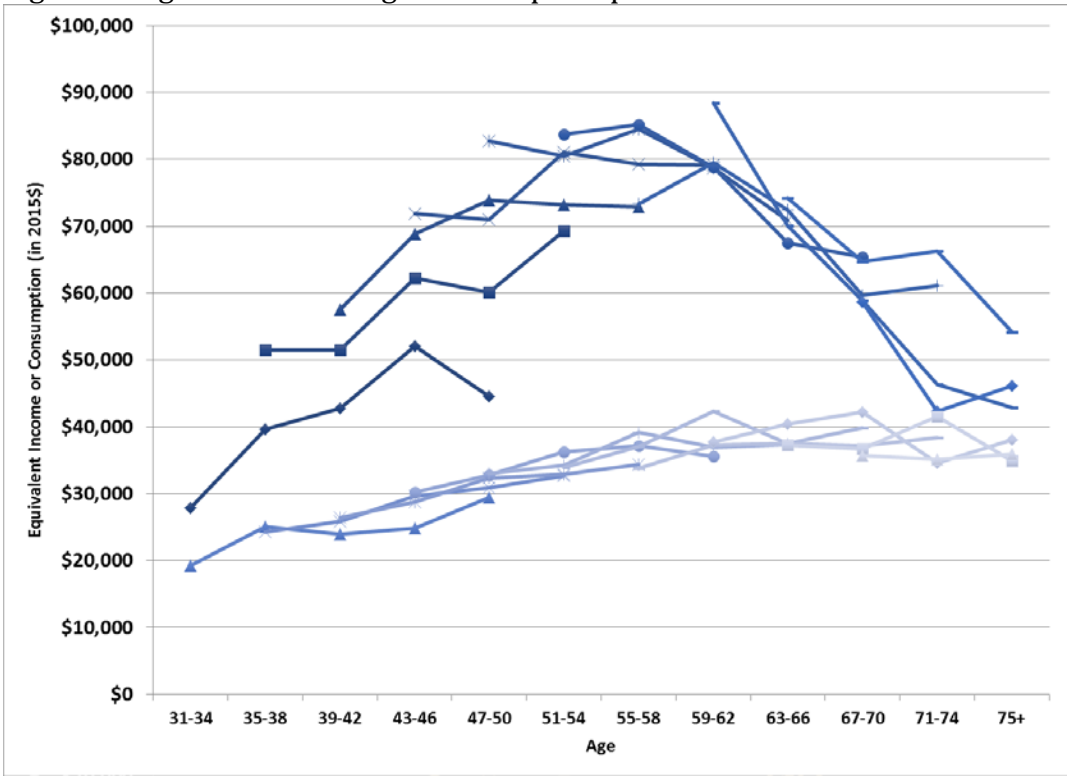


Figure 2: Age-Income and age-consumption profiles for cohort from 1972-2015

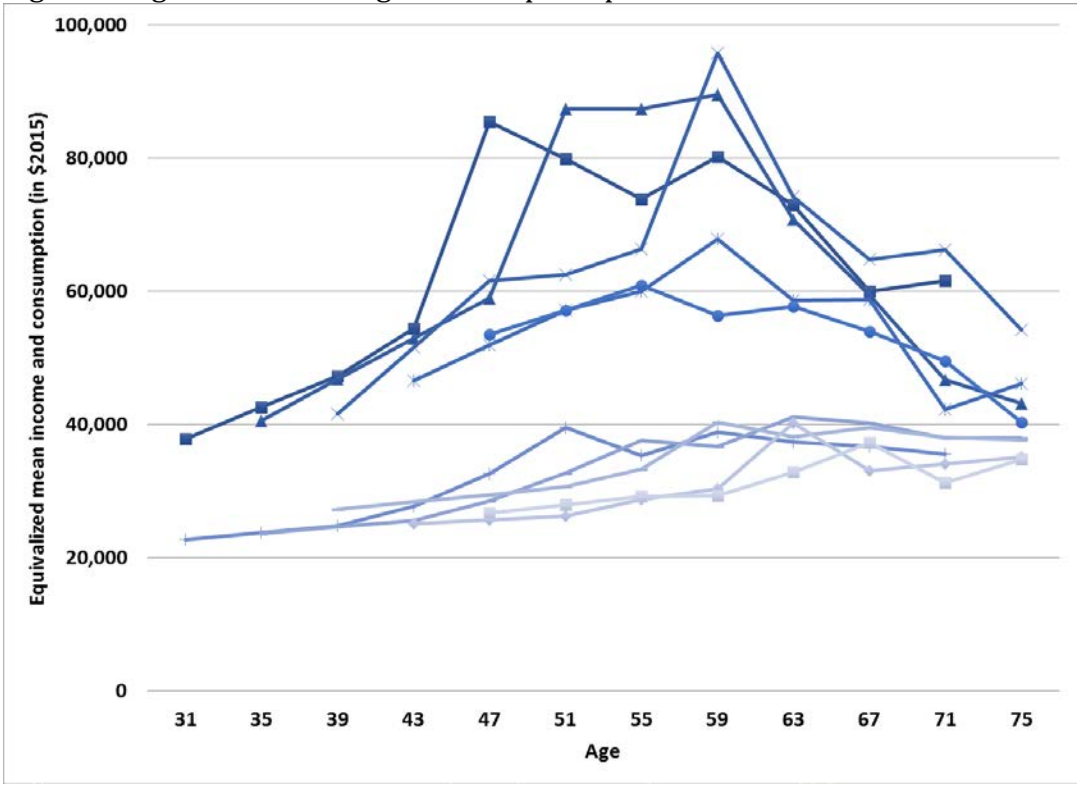
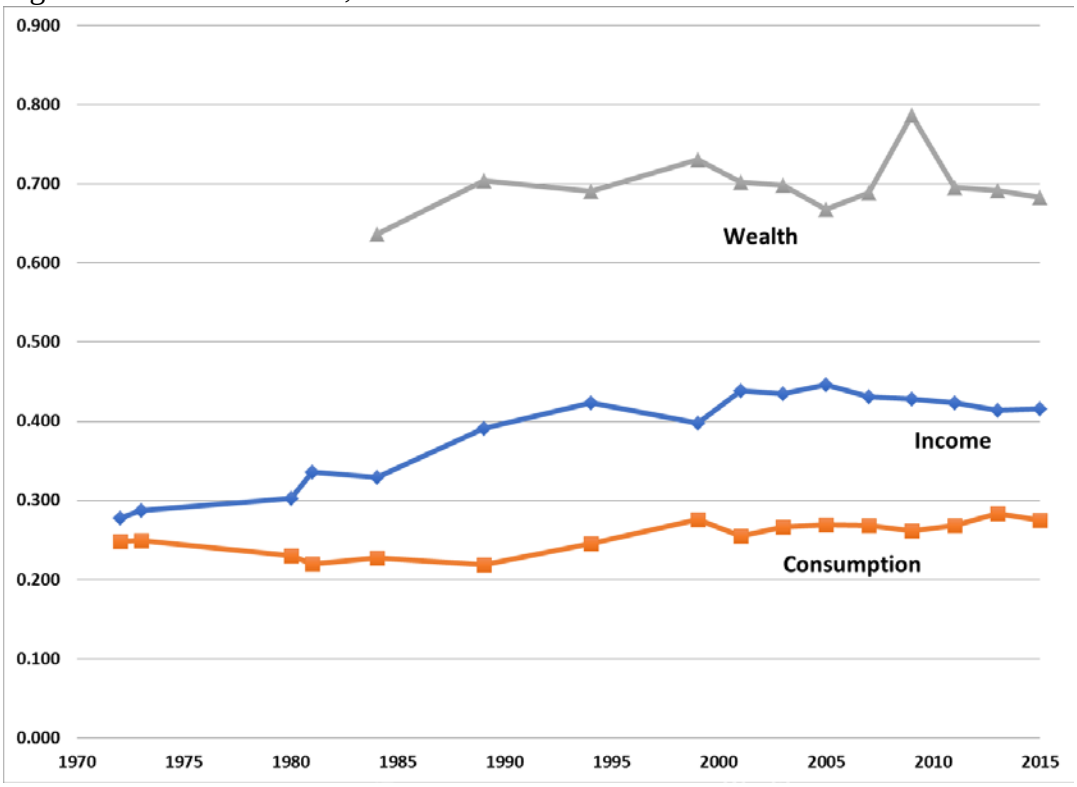


Figure 3: Gini Coefficient, 1972-2015



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Appendix Figures

Figure A1: Comparison of Gini Coefficients for sample and all families and Attanasio and Pistaferri (2014)

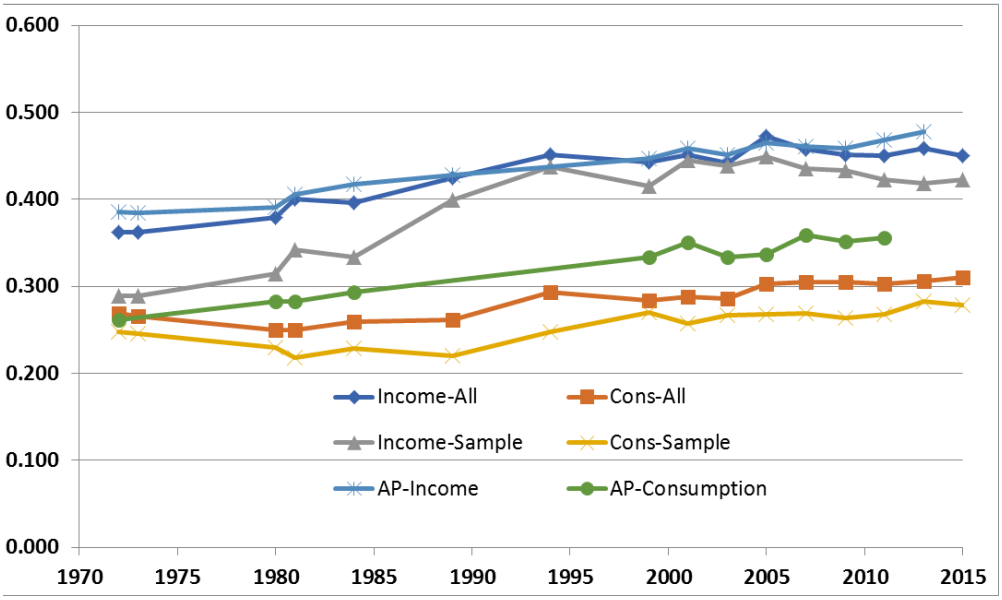

Figure A2: Mean Log Deviation (MLD) for income and consumption, 1972-2015

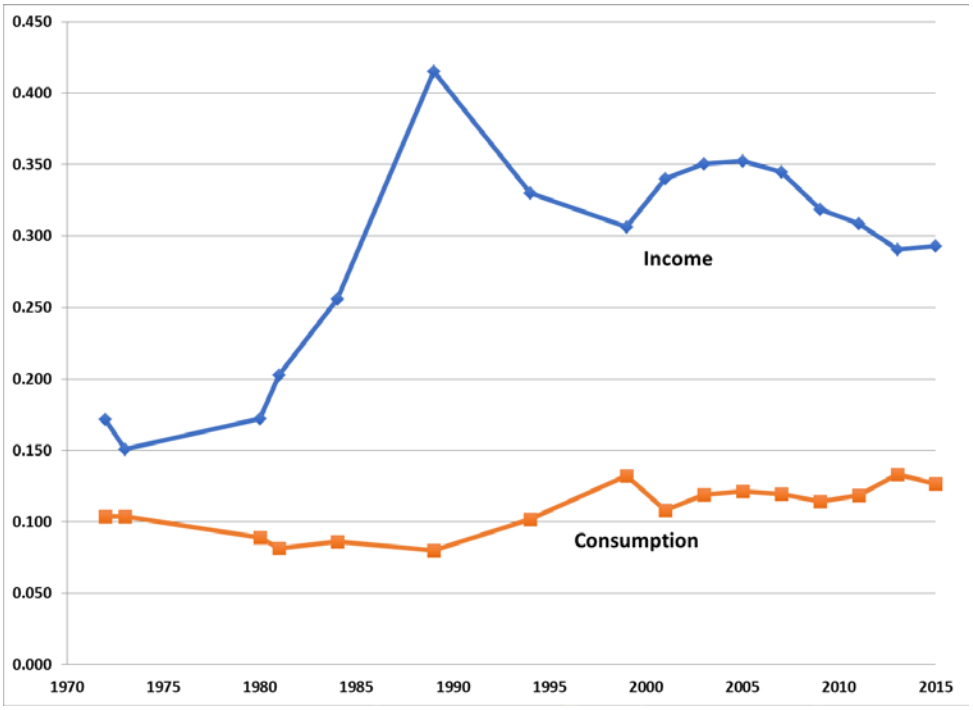

Figure A3: Percent in Top Quintile of Two or Three Measures

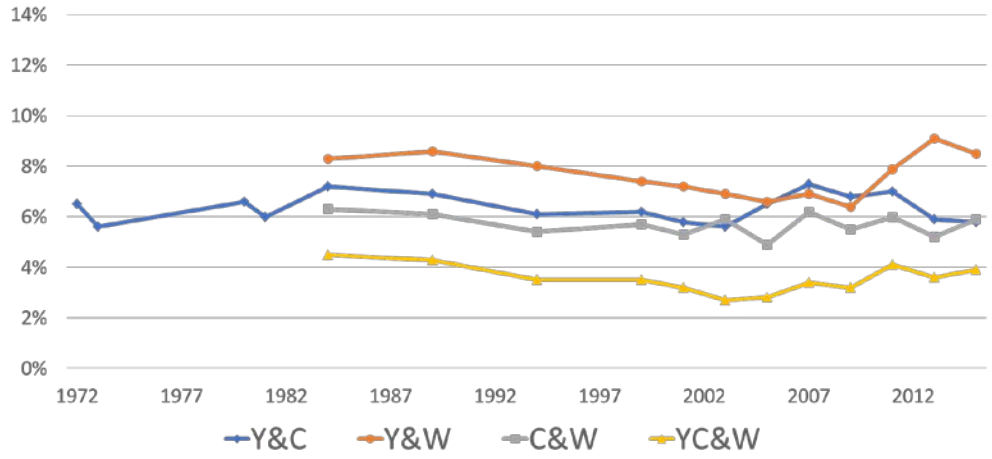

Figure A4: Percent in Bottom Quintile of Two or Three Measures