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CONSUMPTION AND INCOME INEQUALITY IN THE U.S. SINCE THE 1960S

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ABSTRACT

Official income inequality statistics indicate a sharp rise in inequality over the past five decades. These statistics do not accurately reflect inequality because income is poorly measured, particularly in the tails of the distribution, and current income differs from permanent income, failing to capture the consumption paid for through borrowing and dissaving and the consumption of durables such as houses and cars. Such limitations suggest that consumption inequality would more accurately reflect inequality in economic well-being. Highly cited recent work concludes that the rise in consumption inequality mirrors, or even exceeds, the rise in income inequality. We revisit this finding, constructing improved measures of consumption, focusing on its well-measured components that are reported at a high and stable rate relative to national accounts. While overall income inequality (as measured by the 90/10 ratio) rose over the past five decades, the rise in overall consumption inequality was small. The patterns for the two measures differ by decade, and they moved in opposite directions after 2006. Income inequality rose in both the top and bottom halves of the distribution, but increases in consumption inequality are only evident in the top half. We show that our results are robust to several different approaches, including one that accounts for measurement error using a demand system. Previous work that concluded that consumption inequality rises at least as much as income inequality is sensitive to how consumption is measured; excluding small, poorly measured components of consumption yields results very similar to ours. The declining quality of income data is likely an important reason for the differences between income and consumption at the very bottom. Asset price changes likely account for some of the differences between the measures in recent years for the top half of the distribution.

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1. Introduction

The extent of inequality is an important factor in the debates on some of our largest policy issues including income tax policy, immigration, and globalization. Until recently, the debate over inequality relied almost exclusively on earnings and income data. Official income statistics indicate that inequality has increased sharply. But these official statistics may not accurately reflect changes in economic well-being. They ignore taxes and transfers and rely on income that is badly reported in surveys. Even improved income measures reflect transitory changes and fail to capture consumption out of financial wealth and durables such as housing and cars, and therefore provide a narrow, short-term view of how well-being has changed.

Consumption may provide a better indicator of economic well-being for several reasons. Consumption better reflects long-run resources and is more likely to capture disparities that result from differences across families in the accumulation of assets or access to credit. Consumption will reflect the loss of housing services flows if homeownership falls, the loss in wealth if asset values fall, and the belt-tightening that a growing debt burden might require, all of which an income measure would miss. Furthermore, consumption is more likely than income to be affected by access to public insurance programs. Thus, consumption will do a better job of capturing the effects of changes in access to credit or the government safety net. In addition to these conceptual advantages, consumption may better reflect economic well-being because of measurement issues—income has been shown to be substantially under-reported in surveys, especially for those with few resources, and the extent of under-reporting has increased over time (Meyer and Sullivan, 2003, 2011; Meyer et al., 2015). Empirical evidence supports the notion that consumption is a better measure of well-being than is income. For example, consumption has been shown to be more strongly correlated with other indicators of economic well-being than income (Meyer and Sullivan 2003, 2011, 2012a).

Several researchers have documented the patterns in consumption inequality. While some previous work has shown little change in consumption inequality over the past few decades, some more recent studies have concluded that the rise in consumption inequality mirrors, or even exceeds, the rise in income inequality. These differences arise from the use of different data sources or definitions of consumption (i.e. non-durable versus total consumption), and different methods of addressing measurement error.

Our study advances this literature by presenting new evidence on consumption inequality that relies on improved measures of consumption. To account for measurement error in consumption we take a simple approach that relies on clear, testable, and transparent assumptions. In addition, we show that the conclusion from previous work that consumption inequality trends mirror those for income inequality is overturned when well-measured components of consumption are relied upon. We also extend the literature by providing results for both income and consumption inequality for more recent years that span the Great Recession, and by considering possible explanations for changes in inequality over time and why the patterns for income and consumption inequality differ.

To address concerns about measurement error in consumption we build upon recent evidence showing that some components of consumption reported in survey data compare quite favorably to national accounts, both in levels and in changes over time. Other components are sharply under-reported with this bias increasing over time (Bee, Meyer, and Sullivan, 2015). We construct a measure of consumption that relies on the well-measured components. These components represent an important share of overall consumption—they include key components such as food at home, housing and vehicles. Even though several other papers rely on subsets of total consumption, they rarely test the conditions under which distributional statistics for these subsets can be extrapolated to total consumption. We show that the validity of well-measured consumption as a proxy for total consumption is robust to income and price changes—it is close to a constant share of total consumption and has aggregate price changes similar to the total consumption bundle.

We report measures of inequality for income and consumption over the past five decades, using income data from the Current Population Survey and consumption data from the Consumer Expenditure Interview Survey. We investigate inequality patterns in different parts of the distribution by reporting ratios of percentiles, focusing on the 90/10, 90/50, and 50/10 ratios that are less affected by errors in the extreme tails. Thus, our analyses capture changes in the bulk of the distribution but not in the extreme tails.

Using our improved measures of consumption, we show sharp differences in the patterns for consumption and income inequality. Since the early 1960s, the rise in income inequality as measured by the 90/10 ratio (25 percent) has significantly exceeded the rise in

consumption inequality (9.5 percent). Furthermore, this much smaller percentage increase in consumption inequality started from a considerably lower base. In some decades, such as the 1960s and 1990s, income and consumption inequality moved in parallel, but in other decades the differences were sharp. In the 1980s, inequality for both measures rose, but the increase was much greater for income (26 percent) than for consumption (5 percent). After 2005 these measures moved in opposite directions as income inequality rose sharply while consumption inequality fell. The differences between income and consumption through 2005 are almost exclusively in the bottom half of the distribution, indicating that the under-reporting of consumption by the rich is not an explanation for the differences.

Our main results are robust to using different measures of consumption, including total consumption, and we find similar results when we use the demand system approach proposed by Aguiar and Bils (2015) that is designed to correct for systematic measurement error. We also show that the sharp differences between our main results and those of Aguiar and Bils can be explained by the sensitivity of their results to small changes in how consumption is defined—if one uses their approach to address measurement error, but focuses on large or well-measured consumption components, excluding tiny, poorly measured components that do not fit their assumed functional form, the resulting patterns for consumption inequality are very similar to the patterns we find, and are therefore sharply different from those for income.

We also consider several possible explanations for the differences in these patterns. Decompositions show that changing demographics can account for some of the changes in consumption inequality, but they account for little of the changes in income inequality. We also find that the divergence between income and consumption inequality measures is almost exclusively concentrated in single parent headed families and single individuals, who have the largest increases in income inequality, but the largest declines in consumption inequality. The declining quality of income data is likely an important reason for the differences between income and consumption at the very bottom. Given the evidence on limited assets and debts for those near the bottom, borrowing and saving do not appear to be a significant explanation for the differences. However, changes in asset prices likely account for some of the differences between the measures in recent years for the top half of the distribution.

2. Previous Research on Income and Consumption Inequality

Official measures of income inequality, which are based on the pre-tax money income of the household, indicate that inequality has risen steadily in the U.S. since the mid-1970s—between 1975 and 2017 the 90/10 ratio rose by 49 percent (Semega et al. 2020). Many studies have considered alternative approaches to measuring income inequality by, for example, adjusting for changes in family size, accounting for taxes and in-kind transfers, and accrued capital gains (Burkhauser et al. 2009; Heathcote et al., 2010; Armour et al., 2014; Fisher et al., 2015; Piketty et al., 2018; Larimore, et al. 2021). A common finding in this literature is that measures of income that more closely reflect resources available for consumption display a less noticeable increase in inequality in recent decades than other measures of income. Research using data on tax filing units finds a sharp increase in inequality in the very top percentiles (Piketty and Saez, 2003, 2007; Piketty et al. 2018), though other research has argued that definitional changes, tax base changes, income shifting, and other tax responses and measurement issues have exaggerated these changes (Reynolds, 2007; Guvenen and Kaplan 2017; Auten and Splinter 2019; Splinter 2020; Larimore et al. 2021).

The evidence from the consumption inequality literature on whether consumption inequality trends are different from income is mixed. Cutler and Katz (1991) find that changes in consumption inequality were comparable to changes in income inequality for the period between 1960-61 and 1988, but Slesnick (1994) finds consumption inequality rose less than income inequality for the 1960-1991 period. Several studies indicate that consumption inequality has risen less than income inequality since the early 1980s (Johnson and Shipp, 1997; Slesnick, 2001; Krueger and Perri, 2006; and Heathcote et al., 2010). Fisher, Johnson, and Smeeding (2015) indicate that income and consumption inequality follow similar patterns from 1984-2006, but the patterns diverge between 2006 and 2011.

All of these studies that conclude that the rise in consumption inequality is more muted than the rise in income inequality rely on expenditure data from the Consumer Expenditure (CE) Interview Survey (the CE has both an Interview and Diary component), which provides the most comprehensive data on household spending for a nationally representative sample. However, there are many consumption categories in the Interview

data, including alcohol, tobacco and jewelry, that are greatly under-reported and for which under-reporting has risen over time (Bee et al. 2015).

Recent studies have questioned the validity of these data, and have argued that once one corrects for the measurement error the evidence indicates that changes in consumption inequality mirror or exceed changes in income inequality (Attanasio, Battistin and Ichimura 2007; Attanasio, Hurst, and Pistaferri 2015; Aguiar and Bils 2015). These studies use the less well-measured CE Diary Survey as well as some of the poorly measured Interview Survey components. These papers tend to use clever approaches to try to overcome the measurement error issues, but the assumptions are largely untestable. Expenditures in the CE Diary Survey tend to be less well reported than in the CE Interview Survey. For nearly all categories, the Interview Survey data compare more favorable to national aggregates than the Diary data (Bee et al. 2015). In addition, diary data generate biased trends in inequality due to the short time interval over which consumption is reported combined with changes in shopping frequency and the size of purchases—Coibion et al. (2019) conclude that most of the rise in expenditure inequality since 1980 calculated using the Diary Survey can be accounted for by changing shopping patterns.

Employing a demand system approach, estimates from Aguiar and Bils (2015) indicate that consumption inequality rose more than income inequality over the period from 1980 to 2010. Attanasio and Pistaferri (2014) use data from the Panel Study of Income Dynamics (PSID) to measure consumption inequality. Historically, the PSID included only a few components of consumption, but additional components have been added in recent years. Some of the components of consumption measured in the PSID are ones that, at least for the CE data, have not compared well to national aggregates and have been deteriorating over time, such as food away from home and child care (Bee, Meyer, and Sullivan, 2015). Blundell et al. (2016) report comparisons to National Income and Product Accounts (NIPA) for two broad categories in the PSID: nondurables and services (including food away from home and child care). These comparisons indicate that for nondurables and services the PSID to NIPA ratio ranges from 0.64 to 0.73 for the years from 1998 to 2008, which is significantly lower and varies more noticeably over time, than the ratio for the key consumption components in the CE that we rely on for our analyses. Attanasio and Pistaferri (2014) use the relationship

between a total spending measure in the PSID and spending on food in the PSID in recent years to impute a measure of total spending for the years prior to 1999. This procedure relies on having a base year without under-reporting of any goods, which is not available given the long-standing differential under-reporting for some expenditure components.

3. Econometric Model

To address concerns about measurement error we estimate changes in inequality using a measure of consumption that relies on its well-measured components. Under a few simple assumptions, changes in inequality in well-measured consumption is an appropriate proxy for changes in inequality of total consumption. In particular, our model of consumption with measurement error is:

$$ln\, x_{hjt} = lnx^*_{hjt} + \psi^j_t + \nu_{hjt}, \quad (1)$$

where *x* is observed consumption, *x** is true consumption, *h* indexes households, *j* goods, and t years. ψ^j_t is systematic error in good j in year t, while ν_{hjt} is idiosyncratic error that is assumed to be uncorrelated with x^*_{hjt}.

We split goods into two composite categories, w for well-measured, and n for not well-measured. Because one of the features of the components of well-measured consumption is that the reporting of these goods has changed little over time, as discussed below, we assume that ν_{hwt} has the same distribution over time. For the goods where there is substantial evidence of declining quality of reporting, ν_{hnt} is not required to have the same distribution over time. ψ^j_t allows for changes in the reporting of goods and services consumed that differs across goods and over time.

This simple model allows us to calculate changes in distributional statistics, in particular, ratios of percentiles, directly from the well-measured components under two additional assumptions. First, we assume that the well-measured components are a constant share of the total (plus an error) as total consumption rises. In other words,

$$ln\, x^*_{hwt} = \alpha + lnx^*_{ht} + \varepsilon_{hwt} \quad (2)$$

so that the total consumption elasticity of the well-measured components is one. Second, we require that the price of the well-measured consumption components has not changed relative to the price of the entire market basket. Equation (2) would include the relative price of well-

measured components, but if relative prices do not change they can be safely ignored. Importantly, these two assumptions can be directly examined. While they do not hold exactly, they are fairly close to true as we show in Section 6.

Given these assumptions, estimates of changes in various indicators of inequality in well-measured consumption approximate changes in inequality in total consumption. By inserting equation (2) into the version of equation (1) where j = w, and exponentiating we get:

$$x_{hwt} = x^*_{ht} e^{\alpha+\psi^w_t}\, e^{\varepsilon_{hwt}+\nu_{hwt}} \quad (3)$$

This equation expresses observed well-measured consumption as true total consumption times two functions of errors, the first is constant across households and differences out, while the second error differs across households and requires further discussion. In the online appendix (Section D) we show that, under the assumption that these errors are independent of true consumption and their distributions do not change over time, changes in the variance of well-measured consumption are equal to changes in the variance of true total consumption; and we note that, with an additional distributional assumption, changes over time in the ratios of percentiles for both income and consumption would be reduced by measurement error. This approach ignores the part of the dispersion in well-measured consumption that comes from the idiosyncratic error in equation (3). Although typically not explicitly stated, ignoring this error is standard in the inequality literature (Blundell et al., 2008; Krueger and Perri, 2006), but worth noting. Much of the income inequality literature similarly ignores idiosyncratic error.

As a robustness check, we also employ the demand system approach of Aguiar and Bils. Combining their equations (1) and (2), we have

$$ln\, x_{hjt} = lnx^*_{hjt} + \psi^j_t + \phi^i_t + \nu_{hjt}\,. \quad (4)$$

This equation adds ϕ^i_t to our equation (1), allowing systematic measurement error to vary by income quintile and time. This additional flexibility comes at substantial expense, and we argue that it is not needed in the case of well-measured consumption components. First, one needs to globally linearize the model. Given the wide range of the data, it is not clear what biases this generates. More fundamentally, one cannot estimate any standard measures of inequality, such as unconditional quantiles or Gini Coefficients. Rather, through inverting the demand system and globally linearizing it, one can estimate the ratio of the mean of

consumption within one measured income quintile (which is prone to substantial error that has changed over time) to the mean of consumption within another measured income quintile.

Assumptions on the errors are required to consistently estimate any measure of inequality using the AB demand system approach. The assumption emphasized by AB is that the systematic measurement error (mean understatement or overstatement) in logs is the same for all incomes for a given good and time period, except for a common degree of systematic error (mean understatement or overstatement) that is the same for all goods, but differs by income. This assumption relies on the lack of interaction effects; in other words, that under-reporting does not vary over time with income differentially for different goods. Although this assumption is untestable, it is likely to be a good approximation when there is no or little systematic error in the goods examined. For goods that have substantial error, however, this assumption is less plausible. If the primary source of measurement error is under-reporting, as is strongly suggested by recent research (Bee et al. 2015, Meyer et al. 2015), then if there is little overall bias (under-reporting) that leaves little room for there to be differential under-reporting by income. On the other hand, when a good is greatly under-reported on average, it mechanically leaves much more room for there to be misreporting that varies by income.

For this model to say anything about the distribution of consumption as opposed to the mean of consumption within income quintiles, one would need to make some fairly strong assumptions on the joint distribution of income and consumption and how it has changed or not changed over time. As with our base model, one must additionally assume that the errors are uncorrelated with the true values. This model is overidentified, and can be estimated with only a few categories of goods. We rely on this below when considering the robustness of the results to small changes in the set of goods employed.

4. Data and Measures of Income and Consumption

The official inequality measures in the U.S. are based on data from the Current Population Survey Annual Social and Economic Supplement (CPS). We use data from the 1964-2018 CPS surveys which provide information on income for the previous calendar year. Our analysis focuses on after-tax money income, although we also consider a pre-tax measure

of income as well as one that includes the cash value of some transfers. See the online appendix (Section C) for more details.

Our consumption data come from the Consumer Expenditure (CE) Interview Survey, which is the most comprehensive source of consumption data in the U.S. We use data from the 1960-1961, 1972-1973, 1980-1981 and 1984-2017 survey years. For our main analyses, we report measures of total consumption and well-measured consumption (described in Section 6), focusing on the latter. To convert reported expenditures into a measure of consumption, we make a number of adjustments. First, we convert vehicle spending to a service flow equivalent, which we calculate using information on the market value of the car and a fixed depreciation rate. Second, to convert housing expenditures to housing consumption for homeowners, we substitute the reported rental equivalent of the home for the sum of mortgage interest payments, property tax payments, spending on insurance, and maintenance and repairs. Finally, we exclude spending that is better interpreted as an investment such as spending on education and health care, and outlays for retirement including pensions and social security. To adjust for differences in family size and composition we scale all income and consumption measures in the paper using an NAS recommended equivalence scale (Citro and Michael, 1995). See the online appendix (Sections A and B) for more details on the CE, its sample frame, and our measures of consumption.

5. Income and Consumption Under-Reporting

Income in the CPS is substantially under-reported, especially for categories of income important for those with few resources, and the extent of under-reporting has increased over time. Many studies that either compare weighted micro-data to administrative aggregates (Meyer and Sullivan 2003, 2011; Meyer, Mok and Sullivan 2015) or that link survey data to administrative micro-data (Meyer and Mittag 2019; Meyer, Mittag, and Goerge forthcoming) have shown that government transfers are significantly under-reported. Other studies have shown that other components of income are significantly under-reported including earnings (Davies and Fisher 2009) and retirement income (Bee and Mitchell 2017).[1] The direct

[1] Several papers conclude that earnings are over-reported at the bottom of the income distribution (Bollinger (1998), Hokayem et al. (2015) and Bollinger et al. (2014)). However, this evidence on over-reporting at the bottom relies on the assumption that earnings from the Social Security Detailed Earnings Record (DER) reflect

substitution of administrative program data for survey data shows that measures of poverty and inequality are sharply overstated when calculated using reported income (Bee and Mitchell 2017; Meyer and Mittag 2019). Consistent with many of these results, income is often far below consumption for those with few resources, even for those with little or no assets or debts (Meyer and Sullivan 2003, 2011a).

There is also substantial evidence that aggregate consumption is under-reported in the CE and that this under-reporting has increased over time. However, Bee, Meyer and Sullivan (2015) show that among the eight largest categories of expenditures in the CE Interview Survey for which comparable CE and National Account data are available, six are reported at a high rate and that rate has been roughly constant over time. These well-measured categories are the imputed rent on owner-occupied nonfarm housing, rent and utilities, food at home, gasoline and other energy goods, communication, and new motor vehicles. In 2010, the ratio of CE to PCE is 0.95 or higher for imputed rent, rent and utilities, and new motor vehicles. The largest poorly measured expenditure categories are food away from home with a ratio of 0.51, furniture and furnishings at 0.44, clothing at 0.32, and alcohol at 0.22, and for all of these poorly measured categories, the ratio has fallen noticeably since 1980. Bee, Meyer and Sullivan (2015) also show that ownership of durables such as houses and vehicles is reported reasonably well, which is important because information on ownership of these durables is used to calculate service flows that are included in consumption.

6. Addressing Under-Reporting of Consumption

To address concerns about measurement error in consumption, we build upon this evidence that some components of consumption reported in the CE compare quite favorably to national accounts, both in levels and in trends, while other components do not compare well and are deteriorating in quality.[2] In particular, we construct a measure of economic well-being

true earnings even in cases where households report positive income in the survey (the CPS), but have zero or low income according to the DER. Recent evidence from Meyer et al. (2020) shows that the DER misses substantial earnings that are reported on W-2s, 1040s or in the CPS, as the DER often misses entire jobs, misses the millions of unauthorized workers who file taxes, and only includes a portion of self-employment income.

[2] The conclusion that spending categories that compare favorably to national accounts or other aggregates are better measured implicitly assumes that most of the mis-reporting is under-reporting. This assumption seems reasonable given that under-reporting appears to be the dominant pattern that one finds for income and consumption in surveys (Meyer, Mok and Sullivan 2015).

that is based on "well-measured consumption," which is composed of the components that have been shown to be measured well: food at home, rent plus utilities, gasoline and motor oil, the rental value of owner-occupied housing, and the rental value of owned vehicles.[3] As discussed above and reported in Bee, Meyer, and Sullivan (2015), the first four of these components have reporting ratios that are high and constant or that decline slowly over time. Although there is not a direct comparison to national accounts for the rental value of owned vehicles, there is evidence that vehicle ownership is reported well in the CE from direct comparisons for new purchases and comparisons of vehicle counts to registrations.

As discussed in Section 3, there are two key requirements for well-measured consumption to serve as an accurate proxy for total consumption: the well-measured components should have a total consumption elasticity of one and their prices should not change over time relative to those of all items consumed. We first examine if well-measured consumption is roughly a constant share of total consumption, as total consumption rises.[4] In Table A.1 in the online appendix we report average consumption for three different measures: total consumption, well-measured consumption, and well-measured consumption less food consumed at home. We also calculate the means for these measures by quintile of total consumption, excluding the bottom and top five percent of overall consumption because those observations are disproportionately likely to be in error. Overall, we see in Table A.1 that the well-measured components account for 59 percent of total reported consumption in 1980 and 64 percent in 2017. When food at home is excluded, the well-measured components account for 43 percent of the total in 1980 and 52 percent in 2017. The higher share in the more recent year is partly or wholly attributable to the increased under-reporting of the poorly measured components of consumption over time.

The ratio of means by quintile provide evidence on whether well-measured consumption is roughly a constant share of total consumption. In 1980, the well-measured share falls from 0.68 in the bottom quintile to 0.55 in the top quintile. In 2017, the fall is less pronounced, from 0.72 to 0.60. That the well-measured share falls a bit as total consumption

[3] Even though it is well-measured, we exclude communication because this category of expenditures changes greatly over time with the introduction of cell phones and other changes.

[4] While well-measured consumption being a constant share is not required if the expenditure elasticity is only locally one, we are implicitly testing if it is globally equal to one.

rises occurs partly by construction. Because we are dividing observations into groups on the basis of the denominator, when we examine a higher quintile it will naturally have a lower ratio because the classification will partly be due to cases where the denominator has a large positive reported (but not necessarily true) value. In Table A.2 in the online appendix we classify consumer units into consumption quintiles based on well-measured consumption and find that the share is nearly the same in the top and bottom quintiles in 1980 and falls only from 0.62 to 0.60 in 2017. Thus, it appears that much of the decline is due to this bias. We find similar evidence when we examine the ratio of well-measured less food to the total. The ratio falls from 0.44 to 0.40 in 1980, and from 0.54 to 0.51 in 2017 when going from the bottom quintile of overall consumption to the highest. Again, we would expect at least some tendency for the ratio to fall due to the division into quintiles based on the denominator. In fact, when we define the quintiles based on well-measure consumption less food, the share rises in both years as total consumption rises.

While Table A.1 clearly shows the reported shares do not change much as total consumption rises, there is still a concern, but little evidence, that under-reporting rises with income. Most of this concern seems to be focused on the very top percentiles of income and expenditures that we exclude. Furthermore, there is a remarkable similarity over time in the relationship between reported income and reported expenditures. Sabelhaus et al. (2015) show that the ratio of expenditures to income at very high incomes is virtually the same in 2010 as in the early 1970s.

We also directly estimate the total consumption elasticity of well-measured consumption. The concern is that if well-measured consumption has an elasticity much below one then it would understate the growth in inequality as total consumption rose. Conversely, if well-measured consumption is elastic, inequality based on this measure would overstate the rise in inequality as total consumption rose. In the top panel of Table 1, we report the coefficient on total consumption from an OLS regression of the logarithm of well-measured consumption on the logarithm of total consumption. We have separate rows for 1980 and 1988, but focus on 1980 because of the declining reporting over time of some of the

components of total consumption.[5] The elasticity estimate in the first column of the first row is 0.93, close to one, but statistically significantly below one given the precision of the estimate. In the second column, we consider estimates for well-measured consumption less food at home, our alternative version of well-measured consumption. Given that food at home is often taken to be the prototypical necessity, it is not surprising that the resulting elasticity estimate is above one, in this case 1.17, even further above one than the earlier estimate was below one. For 1988, the estimates in both cases are slightly lower, 0.81 for well-measured consumption and 0.97 for well-measured consumption excluding food at home.

There are potential issues with these OLS regressions because total consumption contains the dependent variable and because it is subject to substantial error since it includes the poorly measured components of consumption. We thus instrument total consumption with income, recognizing that income is measured with error as well, particularly in the tails. We include only consumer units designated complete income reporters and those who are not in the tails of the income distribution (dropping the top and bottom five percent). The resulting IV estimates indicate similar but usually slightly higher elasticities than those reported in the top panel. Again, the estimates for well-measured consumption including food at home are under one, while those for well-measured consumption excluding food at home are either above or equal to one. Thus, it appears that one of our well-measured consumption series is slightly inelastic, while the other is slightly elastic, so that they bracket the behavior of total consumption as income and total consumption rise.

Given constant shares, the remaining assumption sufficient for well-measured consumption to be an accurate indicator of trends in total consumption, is that the prices for the well-measured components do not change over time relative to the prices of overall consumption. To examine changes in relative prices, we examine several different price indices (Figure A.1 in the online appendix) including the CPI-All Items, which should reflect price changes for total spending, and a CPI for well-measured consumption, which we construct by taking the weighted average of the CPI indices for each component, where the

[5] We could examine the 1960/61 or 1972/73 data, but total consumption measures from those years are incomplete and noncomparable in certain ways to later years. Starting in 1988, the CE collected information on insurance coverage, which is needed to impute a value of health insurance that we use in some of our alternative consumption measures.

weights are defined as the share of well-measured consumption represented by each component in 1980.[6] We construct a similar index for well-measured consumption less food.

As shown in Figure A.1, there are only trivial differences from 1960 through the mid-2000s across these three indices, implying that relative price changes are of negligible importance for the vast majority of our time period. Starting in the mid-2000s there are larger differences between the price of well-measured consumption, either including or excluding food at home, and the price of total consumption. These differences are modest, and nearly disappear for well-measured consumption by 2017. In any case, the price differences would require a very large price elasticity of well-measured consumption to sharply alter the relationship between well-measured and total consumption.

7. Results for Income and Consumption Inequality

In Table 2, we report income and consumption inequality between 1961 and 2017, as measured by ratios of percentiles including the 90/10 ratio, the 50/10 ratio, and the 90/50 ratio (also see Figure 1 and Figures A.2-A.6 in the online appendix). These ratios are less sensitive to the poorly measured extreme tails of the distributions of income and consumption than measures such as the variance of the logarithm or the Gini coefficient. Our results indicate that after-tax income inequality grew by 25 percent between 1963 and 2017. The 90/10 ratio fell in the 1960s, changed very little in the 1970s, rose sharply in the 1980s, and then mostly held steady through the early-2000s, but rose noticeably from 2007 to 2011.[7] For the years since 1980, we also have information on noncash benefits. Adding non-cash benefits to after-tax money income (Figure A.2) leads to slightly lower inequality, but the changes over time

[6] The results are similar when we use 2017 as the base year.

[7] This evidence is consistent with previous studies of income inequality (Heathcote, Perri and Violante, 2010; Fisher, Johnson, and Smeeding, 2015; Armour, Burkhauser, and Larrimore, 2014; Piketty et al., 2018; Burkhauser, Feng and Jenkins, 2009). In a previous version of this paper, we also examine changes in inequality for other measures of income such as pre-tax money income. Consistent with previous studies, we show that after-tax income inequality grows much more slowly than pre-tax income inequality since the 1970s. We also consider how sensitive our income inequality results are to adjustments we make that differ from the approach used for official measures of income inequality (Semega et al. 2020) such as measuring resources at the family rather than household level; weighting at the person rather than household level; and adjusting for differences in family size and composition. In general, these changes significantly lower the level of inequality. These adjustments had a modest effect on changes over time in pre-tax income inequality, although a person weighted measure of pre-tax money income inequality rose more in the late 1970s and early 1980s than did the official measure.This evidence is consistent with previous studies of income inequality (Heathcote et al. , Perri and Violante, 2010; Fisher et al. 2015; Armour et al. 2014; Piketty et al., 2018; Burkhauser et al. 2009).

are similar to those for after-tax money income.

The rise in inequality in the bottom half of the income distribution is much less pronounced than for the overall distribution. Between 1963 and 2017, the 50/10 ratio rose by only 5 percent. The 50/10 ratio rose less than the 90/10 ratio in the 1980s and 2000s. Including non-cash benefits (Figure A.3) results in a slightly lower level of inequality in the 1980-2017 period, because these benefits affect the 10th percentile more than the median, but this has little effect on changes over time. That these noncash benefits have only a small effect on the 90/10 or 50/10 ratios, may partly be because many of these benefits go to individuals below the 10th percentile. Adding noncash benefits to after-tax income noticeably reduces the 50/5 ratio (Figure A.7). However, even for these results that focus on the very bottom of the distribution, the inclusion of noncash benefits does little to alter the pattern of inequality, except for a few short periods. Importantly, our measure of noncash benefits does not adjust for the significant and increasing under-reporting of these benefits in surveys. Given that these benefits are significantly under-reported in the CPS and that this under-reporting has increased over time (Meyer, Mok, and Sullivan, 2015), it is likely that our results understate the true impact of noncash benefits on the level and changes in income inequality.[8] For the top half of the distribution, income inequality rose by nearly 19 percent between 1963 and 2017, with nearly all of this rise occurring since 1980.

As shown in Table 2 and Figure 1, the patterns for consumption inequality are quite different from those for income inequality. The consumption distribution is less dispersed. In 2017, the 90/10 ratio for after-tax income was nearly double that of well-measured consumption. Moreover, the trends differ considerably across these measures. While overall income inequality (as measured by the 90/10) rose over the past five decades by 25 percent, the rise in well-measured consumption inequality was much smaller at 9.5 percent.[9] Differences are even more noticeable for some shorter periods. Income inequality fell in the

[8] Meyer and Mittag (2019) find that transfer under-reporting leads the uncorrected CPS to understate the reduction in inequality over time in New York CPS data, but the time period available is only six years.
[9] In addition to ratios of percentiles, we also examine changes in the shares of income and consumption by decile. In general, there results are consistent with the ratios to percentiles presented here. We find noticeable growth in the share of after-tax income going to the top decile, particularly after 1980. There is some growth in the top decile of consumption, but it is much more modest than that for income. For the bottom decile, we find little change when looking at either income or consumption. We do not emphasize these results because of the well-documented concerns with measurement error in the tails of the distributions.

1970s (the 90/10 ratio declined 4 percent) while consumption inequality rose (by 5 percent). In the 1980s, inequality for both measures rose, but the increase was much greater for income (26 percent) than for consumption (5 percent). Both consumption and income inequality changed little over the course of the 1990s, but after 2005 these measures moved in opposite directions as income inequality rose sharply while consumption inequality fell.

For reasons discussed in Section 6, we focus on the consumption measures that rely on the well-measured components, but the patterns for inequality based on the different measures of consumption are similar.[10] Over the entire period, total consumption inequality rose only slightly less than well-measured consumption inequality (9.1 percent vs. 9.5 percent), and the patterns for these two measures of inequality were quite similar over the past five decades.

The similarity of the results for the well-measured and total consumption measures is not surprising. Since well-measured consumption has a total consumption elasticity of approximately one, poorly measured consumption, its complement, should as well. In other words, since the well-measured components of consumption are roughly a constant share of consumption as total consumption rises, poorly measured components must also be roughly a constant share of the total. A decline over time in the reporting of these components (if constant across income for each component) would not bias inequality measures. We should emphasize that although some previous work has suggested that expenditure under-reporting varies with income, this same work shows that this under-reporting has remained remarkably constant over time (see Figure 8.4 of Sabelhaus et al. 2015).[11]

Consumption inequality in the bottom half of the distribution rose less over the sample period than did overall inequality—between 1961 and 2017 the 50/10 ratio declined by nearly 3 percent while the 90/10 ratio rose by 9.5 percent. Much of this difference occurred during

[10] While there is substantial evidence that certain components of consumption are poorly reported and this reporting has degraded over time, whether these reporting errors biases changes in ratios of percentiles of consumption is an empirical question without knowing more about the nature of the errors.

[11] The evidence of under-reporting from Sabelhaus et al. (2015) is for expenditures rather than service flows for housing and vehicles, which amount to about 40% of consumption. It is hard to know to what extent the pattern of differential under-reporting at a point in time reflects measurement error in income and deviations of annual income from permanent income as opposed to differential under-reporting by income. These results do not provide conclusive evidence of differential under-reporting. Sabelhaus et al. (2015) also find that there is an under-representation of people from the ZIP codes in the top five percentiles of average income. The degree of under-representation is small and furthermore Brummet et al. (2017) find differences in response rates by income from linked CE Survey and tax data that imply only small biases in the consumption distribution that are likely to be unimportant at the 10^{th} and 90^{th} percentiles.

the 1980s, when the 90/10 ratio for consumption rose by more than 5 percent while the 50/10 ratio was flat. The patterns for consumption inequality in the bottom half of the distribution are noticeably different from those for income. For example, between the early 1960s and 2017 the 50/10 ratio for after-tax income rose by 5 percent while the ratio for consumption fell by 3 percent. These results also show that the difference in the levels of consumption and income inequality are particularly large for the bottom half of the distribution. In 2017, the 50/10 ratio for after-tax income was 50 percent greater than the 50/10 ratio for consumption, which is likely due, in part, to income being understated at the bottom. Previous research has argued that spending exceeds income at the bottom of the distribution in large part due to under-reporting of income (Meyer and Sullivan 2011, Meyer and Mittag 2019).

In the top half of the distribution, income and consumption inequality both rose over the past five decades— the 90/50 ratio for after-tax income rose by 19 percent and that for consumption rose 13 percent. After 2005, however, these measures moved in opposite directions when the 90/50 ratio for after-tax income continued to rise while the 90/50 ratio for consumption fell. These measures also moved in opposite directions in the 1960s and 1970s when income inequality fell but consumption inequality was flat or rose.

In summary, our main results show that while overall income inequality (90/10 ratios) rose over the past five decades, the rise in overall consumption inequality was small. The patterns for income and consumption inequality differ sharply within each decade, and most notably, these measures have moved in opposite directions since 2005. Income inequality rose for the top (90/50 ratio) and bottom (50/10 ratio) of the distribution, but an increase in consumption inequality is only evident for the top. That the patterns for consumption and income inequality at the top are fairly similar from the early 1960s through 2005 suggests that under-reporting of consumption by the rich cannot account for the differences.

In Table 3 we report the 90/10, 50/10 and 90/50 ratios for other measures of consumption and for expenditures. When we exclude food at home, an inelastic component of consumption, we see that inequality rises less (or falls more) than the measure that includes food at home. Over the past five decades the 90/10 ratio for well-measured consumption less food fell by 9 percent. When we also exclude utilities—another relatively inelastic component of consumption—the patterns for inequality look very similar to those for well-measured

consumption less food. We also considered a measure of consumption excluding housing to see the extent to which our inequality patterns might be driven by housing consumption. Prior to 1990, the patterns for this measure that excludes housing tended to move in the opposite direction from that for well-measured consumption. However, between 1990 and 2017, a period during which housing prices fluctuated considerably, the inequality patterns for these two measures are quite similar. Dispersion in expenditures is greater than that of consumption because expenditures include lumpy spending on owner occupied housing and vehicles, while consumption includes the service flow from ownership of these durables. The 90/10 ratio for expenditures rose much more than that for well-measured consumption between 1972 and 1986, but from the mid-1980s to the mid-2000s this ratio was flat for both measures. After 2006, inequality in both of these measures fell.[12]

In results not reported here, we also examine how inequality changes for specific demographic groups. Examining such changes is important for explaining trends and for thinking about designing or understanding the impact of targeted policies. Changes in inequality may be uneven across demographic groups because one group is the target of a redistributive policy or because of differences in employment patterns across groups. For example, tax and transfer policies often target specific family types; welfare and EITC dollars predominantly go to single parent families.

The consumption inequality patterns are very different across demographic groups. See Tables A.3-A.5 and Figures A.8 and A.9 in the online appendix. For single mothers and single individuals consumption inequality (since 1980) generally fell, while consumption inequality for married families (both with and without children) rose noticeably, and consumption inequality for elderly households rose slightly. The patterns are very different for income, where the 90/10 ratio rose sharply for all groups over the past 25 years. In fact, income inequality rose the most for the groups that saw consumption inequality fall, and nearly all of this difference is due to the difference between income and consumption in the

[12] We also considered a measure of total consumption that includes the imputed value of health insurance. We impute a measure of the value of public and private health insurance using the coverage information in the CE and data on insurance costs. See the Data Appendix for more details on this imputation. We do not report changes in this measure of inequality for all periods, because health insurance coverage information is not available in all years in the CE. The pattern in inequality for this consumption measure that includes health insurance is very similar to that for total consumption.

bottom half of the distribution. The sharp difference in the patterns for income and consumption inequality for single parents and single individuals is consistent with the evidence that income, in particular, is significantly under-reported at the bottom and that under-reporting of government transfers can explain a substantial part of the differences between income and consumption for households with few resources (Meyer and Sullivan 2012a, 2012b, 2014; Meyer and Mittag 2019).

8. Demand System Estimates

In our main results for consumption inequality reported above we address concerns about measurement error in consumption by focusing on its well-measured components. In this section, we consider whether our results are robust to addressing systematic measurement error using the demand system approach of Aguiar and Bils (2015) described in Section 3.

In Table 4 we report estimates for changes in after-tax income inequality as well as our demand system estimates of changes in consumption inequality for various measures of consumption. We report results for the same statistics and time periods as Aguiar and Bils in order to help reconcile differences between our results and theirs. In particular, for Panel A, we report the ratio of consumption or income among high income households to consumption or income among low income households, where high income is between the 80th and 95th percentiles and low income is between the 5th and 20th percentiles. In addition, we report estimates of the changes in inequality separately for the top (between the 80th and 95th percentiles and the 40th and 60th percentiles, Panel B) and the bottom (between the 60th and 40th percentiles and the 20th and 5th percentiles, Panel C) of the distribution. We present the level of inequality in the base period (1980-1982) and changes in inequality for the full period from 1980-1982 through 2008-2010 as well as for several subperiods. See Tables 1 and 3 of Aguiar and Bils (2015) for comparison.

Column 1 of Panel A reports the change in log after-tax income inequality as calculated in Aguiar and Bils—the ratio of average income for high income households to the average for low-income households. We are able to reproduce their results exactly from their archived files. These results indicate that over the period from 1980-1982 to 2008-2010 after-tax income inequality rose 34 percent. This result is very similar to our estimates for the

change in the 90/10 ratio using income data from the CPS instead of the CE; for this same period, we find that the 90/10 ratio for after-tax income rose by 32 percent.

In columns 2 through 8 of Table 4 we report demand system estimates for the levels and changes in consumption inequality. Given the concern about Aguiar and Bil's assumptions for goods that have substantial under-reporting or frequently are at the lower limit of zero, we apply their approach using those categories of spending that have been shown to be well-reported and are large categories with relatively few zeros, progressively adding less suitable data. Our approach is to solely decide on the suitable categories based on the reporting rate and the frequency of zero expenditures. We begin with the seven categories that have a reporting rate of at least 0.75 when comparing CE expenditures to NIPA expenditures (Bee et al. 2015). These categories are all among the nine largest; together constitute nearly three-quarters of all spending; and fewer than 5 percent of households report zero spending for each of them. The change in consumption inequality estimated using these seven categories (column 2) indicates that consumption inequality has fallen by 5.8 percent over the three decades from 1980-1982 to 2008-2010.

We then consider broader groups of expenditure categories. Because their model examines log consumption, Aguiar and Bils globally linearize the log function when expenditures are zero. This approach might not be a good fit for categories where a large fraction of respondents reports zero spending. The biases due to this adjustment are unclear, but the model is clearly less appropriate when one cannot take logarithms of half of the observations. We thus include only those categories with a small percentage of zero expenditures in a year. We report results for all categories with fewer than 5 percent zeros in column 3; the fraction reporting zero spending for each category of consumption is reported in Table A.6 in the online appendix. These categories include all of the well-measured ones from column 2 and account for 78.4 percent of total consumption. We now find that the overall rise in consumption inequality over three decades is positive, but just barely at 0.3 percent. Adding those categories with up to ten percent of households without any expenditures in a year (column 4), which accounts for 83.4 percent of consumption, barely changes the estimate.

In column 8, we present our replication of Aguiar and Bils' main results for changes in consumption inequality that indicates that over the period from 1980-1982 to 2008-2010

consumption inequality rose 42.5 percent, which is 27 percent greater than the rise in income inequality over this period. These results are in sharp contrast to our main results as well as our demand system estimates in columns 2-4. Their estimates indicate that all of the rise in consumption inequality for the full period occurred in the 1980-1982 to 1991-1993 and 1998-2000 to 2005-2007 periods. In the latter period, Aguiar and Bils' estimates suggest that consumption inequality rose four times more than income inequality. The greater rise in inequality for consumption is surprising because households should be able to insure some income shocks (e.g. Blundell, Pistaferri and Preston 2008), leading consumption inequality to rise less than any rise for income inequality over time.

The key difference between our demand system estimates and those of Aguiar and Bils is that their estimates are based on total consumption rather than its well-measured components. To understand which categories, in particular, are driving these very sharp differences, we consider broader definitions of consumption. For example, when we include in consumption the thirteen largest categories, which accounts for more than 90 percent of total spending (column 5), consumption inequality between 1980-1982 and 2008-2010 rose by 13.1 percent, now higher, but still one-third the size of the rise in consumption inequality reported in Aguiar and Bils (column 8) and less than 40 percent of the rise in income inequality (column 1). The results in columns 6 and 7 show that what leads to a larger estimate of the rise in consumption inequality is including a few small and very poorly measured categories. Adding domestic services and childcare (at 1.5 percent of expenditures) and then education (at 1.3 percent of expenditures) increases the estimated rise in consumption inequality to 35.3 percent, greater than the rise in income, but still 7 percent below the Aguiar and Bils estimate using all categories.

Domestic service, childcare, and education are the categories with the very highest rate of reported zeros. Over forty percent of households report no spending on domestic service or childcare and sixty percent of households report no spending on education (Table A.6), so these categories are not a good fit for Aguiar and Bils' log model. In general, the smaller categories with less than two percent of consumption each, are reported very poorly in the Consumer Expenditure Interview Survey. The share of national account consumption that is recorded in the survey for these categories in 2010 never exceeds 0.46 and in most cases is

below 0.32 when a comparison is available (Table A.6). Many of the categories are sufficiently idiosyncratic that they cannot be easily compared to the national accounts.

Thus, the difference between our consumption inequality results and those of Aguiar and Bils, is that their measure of consumption includes a few very small consumption categories that have been shown to be poorly measured. And it turns out that the demand system approach is highly sensitive to the inclusion of these small categories. The choice of categories should depend on the bias and precision of the resulting estimates, with bias introduced by including the poorly measured categories that are unlikely to fit their model, weighted against the possible reduction in precision from excluding certain categories. There is not a tradeoff in practice in this case, however. Using a subset of consumption components that are well-measured and fit the log model does not lead to appreciably lower precision. The standard errors are lower for our estimates in column 4 than in Aguiar and Bils' estimates reported in column 8, and not appreciably different in our columns 3 and 5.

In Panels B and C of Table 4 we consider demand system estimates of inequality for the top and bottom of the distribution. Our main results (Section 7) indicate that increases in consumption inequality are only evident in the top half of the distribution, with little evidence of a rise in inequality for the bottom half. The results using a demand system approach are similar. For the bottom half (Panel C) there is little evidence of a rise in consumption inequality over the full period, while income inequality rises noticeably (11 percent). In the top half (Panel B) we find little evidence of a rise in consumption inequality for measures that only include the most well-measured components, but if you consider the thirteen largest consumption categories (column 5 of Panel B) the estimated rise in consumption inequality using the demand system approach is 16.3 percent. It is in the top half of the income distribution where Aguiar and Bils' consumption inequality results differ sharply from ours. The demand system estimates using total consumption suggests that inequality in the top half of the consumption distribution rose by 40 percent during the full period (Panel B, column 8), an increase that is significantly larger than that for income. In the bottom half of the distribution there is little difference between the demand system estimates using the well-measured components and those using total consumption. In the top half, the estimates are very sensitive to the inclusion of the small poorly measured categories. Furthermore, the

inclusion of the poorly measured data leads to the counterintuitive result that consumption inequality rose almost twice as much as income inequality.

9. Potential Explanations for Inequality Patterns

To understand some of the reasons for changes in income and consumption inequality, we consider the role of changes in demographic characteristics, measurement error in income, as well as the potential for households to consumption smooth. It is worth noting that the past work arguing that consumption inequality has mirrored income inequality is contradicted by a broad theoretical and empirical literature on smoothing of consumption. This literature (see Blundell, Pistaferri and Preston 2008 for a structurally informed example or Arellano, Blundell and Bonhomme 2017 for a fully structural example) allows for shocks to income to be smoothed through consumption. The former finds that temporary shocks are largely smoothed, while permanent ones are not. Thus, if shocks to income explain part of the rise in income inequality, smoothing behavior would imply that consumption inequality would rise less than income inequality.

9.A. Changes in Demographic Characteristics

Changing demographics may contribute to changes in inequality as well as explain why patterns differ for income and consumption. For example, rising college completion rates, or rising wages for college relative to high school graduates, may lead to greater inequality. If education is related to borrowing and saving behavior, or to reporting of income and consumption, then greater educational attainment or a rising college premium would affect income and consumption inequality differently. To determine the impact of changing demographics, we decompose changes in inequality into two components: explained changes (due to either changes in observable characteristics or in the return to these characteristics) and unexplained changes (due to changes in unobservables). This decomposition can be done for each quantile, following the approach of Melly (2005) and Autor et al. (2005).

For this decomposition, we first estimate a model of the conditional quantiles of income or consumption, and then generate a close approximation to the unconditional distribution by numerically integrating the conditional distribution over the range of the

distribution of observable characteristics and over all quantiles. Using this estimated unconditional distribution, we can construct counterfactual distributions. For example, we can construct a hypothetical distribution of income for 1980 if observable characteristics are the same as those in 1990. We describe this approach in detail in the online appendix (Section E).

The results from these decompositions for the changes in the 90/10, 50/10, and 90/50 ratios for each decade are presented in Table 5. For the 1960s, changes in the return on observable characteristics account for much of the change in overall consumption inequality, while the effect of changing demographic characteristics explains much of the rise in overall consumption inequality in the 1970s. For the 1980s, the rise in consumption inequality can be accounted for by changes in both demographic characteristics and the return on these characteristics. For example, between 1980 and 1990, the 90/10 ratio rose by 0.062 and changes in demographic characteristics during this period account for a rise in the 90/10 ratio of 0.025. Since 1990, changing demographics can explain very little of the overall pattern in consumption inequality, although this was a period when consumption inequality was fairly flat. In the 1970s and 1990s the fraction of the total change that is unexplained is close to 1.

For income inequality, changes in demographic characteristics suggest a rise in inequality throughout the period from 1963 to 2017. Given that income inequality fell in the 1960s and 1970s, changing demographics cannot account for actual changes in income inequality during these periods. For each of the periods, changes in the return on observable characteristics account for a sizeable fraction of the actual change in overall income inequality, but much of the change remains unexplained—changes in residuals account for more than a third of the overall change in every decade except the 1990s.

9.B. Intertemporal Substitution of Resources

Borrowing and saving could potentially explain some of the differences between the patterns for income and consumption inequality, particularly if, due to greater access to credit, some families can now more easily smooth consumption. Krueger and Perri (2006) suggest this as an explanation for why consumption inequality rose less than income inequality in recent decades. The divergent trends between income and consumption inequality that we find, however, are concentrated in the bottom of the distribution, and these differences are

due, in large part, to differences in the trends at the 10th percentile—the 10th percentile of consumption rose more than the 10th percentile of income. As we show in Table A.7 in the online appendix, which reports assets and debt information for families in the bottom income quintile in the Survey of Consumer Finances (SCF), average credit card balances for low-income households were very low—only $624 in 2016—and most of these households (71%) had no balances. The 75th percentile of credit card debt for these households was only $150. Furthermore, these balances did not rise noticeably after the early 1990s—in 1992, average credit card balances for households in the bottom quintile were $499 (in 2016 $).

In addition, these low-income households did not appear to be using other forms of debt to finance consumption. The average total outstanding debt that was used to purchase goods and services was only $1,284 and the 75th percentile of such debt was only $300 in 2016. These levels of debt for low-income households were small relative to the average reported income for these groups of about $15,100 in 2016, with actual income certainly much higher. This evidence is consistent with findings from other studies using other data sources (Meyer and Sullivan, 2003, 2011, 2019; Sullivan 2008). Use of payday loans, another way low-income households may have gained expanded access to credit, was also fairly limited. In 2016, only 4% of households in the bottom income quintile had taken a payday loan in the past year, which is only slightly higher than the 3% rate for 2007, the first year payday loan data are available in the SCF.

Instead of debt, low-income families could pay for consumption by spending down assets. Here again, data from the SCF suggests this was unlikely. The 75th percentile of liquid assets for the bottom quintile households was only $1,540. Furthermore, in results not reported, but available upon request, we see divergent trends between income and consumption inequality further down the distribution, such as for the 25/5 ratio, where the divergence is even more pronounced. These households with very low income or consumption were very unlikely to have significant assets or debts.

Standard dynamic models, where households can fully insure themselves against consumption risk, imply that consumption does not respond to transitory changes in asset values. In the absence of full risk sharing, however, consumption may be sensitive to changes in wealth. Empirical studies typically reject full risk sharing (i.e. Cochrane 1991; Attanasio

and Davis 1996; Mian, Sufi, and Rao 2013). Campbell and Cocco (2007) show with micro data that changing asset prices have a noticeable effect on consumption for groups with considerable wealth, such as older homeowners, but little effect on consumption for groups with few assets, such as young renters. Thus, the sharp decline in asset prices after 2006, first housing and then financial assets, could explain why consumption inequality fell in some recent years even though income inequality did not.

If declining asset prices had a significant impact on consumption inequality, then we would expect to see a more noticeable decline in consumption for households with more significant asset holdings. To see if this pattern is evident in the data, we sort households by the value of their total asset holdings, including both financial and housing assets. In Table 6, we report the mean of well-measured consumption by quintile of total household assets from 1991 to 2017. This analysis shows that that consumption growth for the lowest asset households was different from that for higher asset households. Between 1991 and 2006—a period when housing prices and financial asset values rose considerably—consumption grew for all quintiles of the asset distribution, but the growth was bit more pronounced for the higher quintiles. Between 2006 and 2010 asset prices fell sharply. The Case-Shiller index of house prices fell by 21 percent and the S&P 500 index fell by 12 percent. These declines coincided with a drop in real consumption of between 3 and 13 percent for the second through fifth quintiles of the asset distribution. But for the bottom quintile, consumption actually rose by 12 percent—see Petev, Pistaferri and Eksten (2012) for similar evidence. In separate analyses we find that homeowners tended to reduce their consumption more than non-homeowners between 2006 and 2010. Between 2010 and 2017 the S&P 500 rose by more than 200 percent and the Case-Shiller index rose by about 30 percent. During this period of sharply rising asset values, consumption rose by 10 to 17 percent for all quintiles, with the growth for the bottom quintile only slightly smaller than for the other quintiles.

9.C. Measurement Error

Declining survey data quality is another potential explanation for the income and consumption differences. The evidence described earlier of declining relative quality of income data at low percentiles is consistent with our results that show a much more noticeable

rise in the 50/10 ratio for income than the 50/10 ratio for consumption over the past three decades. It is also consistent with the fact that we find pronounced differences between income and consumption inequality changes for single mothers—a group that receives a disproportionate share of these income transfers.

One might also be concerned with the declining quality of consumption data. However, as discussed in Section 5, many of the important components of consumption, and those that comprise our measure of well-measured consumption, compare favorably to administrative aggregates both at a point in time and over time. Moreover, if under-reporting of expenditures were increasingly concentrated in the top of the distribution, such under-reporting might bias measures of inequality for the top half of the distribution but not the bottom half. However, for most of our sample period we find that differences between income and consumption inequality changes are most noticeable in the bottom half of the distribution, but at the bottom income and consumption inequality moved in opposite directions. Also, it is unlikely that increased under-reporting of consumption is the primary explanation for why the 90/50 ratio for consumption fell while the 90/50 ratio for income rose after 2005, because our measure of consumption is composed of well-measured components that did not experience an increase in under-reporting after 2005.

10. Conclusions

The perception of a growing divide in economic well-being in the U.S. has fueled debates over whether the benefits of economic growth are shared by all and has played prominently in efforts to reform tax, immigration, and trade policy. These concerns are supported by well-documented evidence of rising income inequality over the past forty years, particularly, but not exclusively, at the top of the distribution. Evidence on the patterns for consumption inequality has been mixed.

Our study revisits this question of the trends in income and consumption inequality. To address concerns about measurement error we construct a measure of consumption that relies on components that are consistently reported well in surveys. These components represent an important share of overall consumption, and the validity of our use of them as a proxy for total consumption is robust to income and price changes. Our results show that

consumption inequality rose considerably less than income inequality over the past five decades. Between the early 1960s and 2017 income inequality measured as the 90/10 ratio grew by 25 percent while inequality in consumption rose just 9.5 percent. The patterns differ sharply for certain subperiods, with the most noticeable differences occurring during the 1980s, when income inequality rose much more than consumption inequality, and since 2005, when these measures moved in opposite directions. Income inequality rose at the top (90/50 ratio) and bottom of the distribution (50/10 ratio), but increases in consumption inequality are only evident in the top. The differences between income and consumption inequality changes through 2005 are almost exclusively in the bottom half of the distribution.

Our main findings are robust to using different measures of consumption and to using a demand system approach to correct for systematic measurement error. We also show that the sharp differences between our results and those in Aguiar and Bils (2015) can be explained by demand system estimates of consumption inequality being very sensitive to the inclusion of small, poorly measured components of consumption. We consider various explanations for differences in the patterns of income and consumption inequality. Our findings are consistent with a broad theoretical and empirical literature that suggests that consumption inequality should not fully reflect increases in income inequality due to transitory income shocks. Although changing demographic characteristics can account for some of the changes in consumption inequality, they do not account for changes in income inequality. Sharp changes in asset prices may explain some of the differences in the patterns for income and consumption inequality in the top half of the distributions. Evidence on changes in consumption by asset quintile suggests that falling asset prices in recent years contributed to the decline in consumption inequality in a period when income inequality was rising.

Measurement error likely explains much of the differences in the bottom part of the distribution. Government transfers are considerably under-reported in income surveys, and the extent of this under-reporting has grown overtime. Such under-reporting could lead to significant bias in the level and pattern of income inequality particularly at the bottom, which is where we find the most significant differences between income and consumption inequality changes. That most of the differences between income and consumption inequality changes

prior to 2005 are in the bottom half of the distribution indicates that the under-reporting of consumption by the rich is not an explanation for the differences.

Our evidence of only a modest rise in consumption inequality over the past five decades contrasts sharply with evidence from tax data that an increasing share of the nation's income is going to the very highest income families (Piketty and Saez, 2003). It is important to qualify, however, that our analyses do not capture dispersion in the extreme tails of the distribution. Rather, we focus on the bulk of the distribution, between the 90^{th} and 10^{th} percentiles, because these percentiles will be less sensitive to the poorly measured extreme tails in survey data than other measures of inequality that consider the full distribution.

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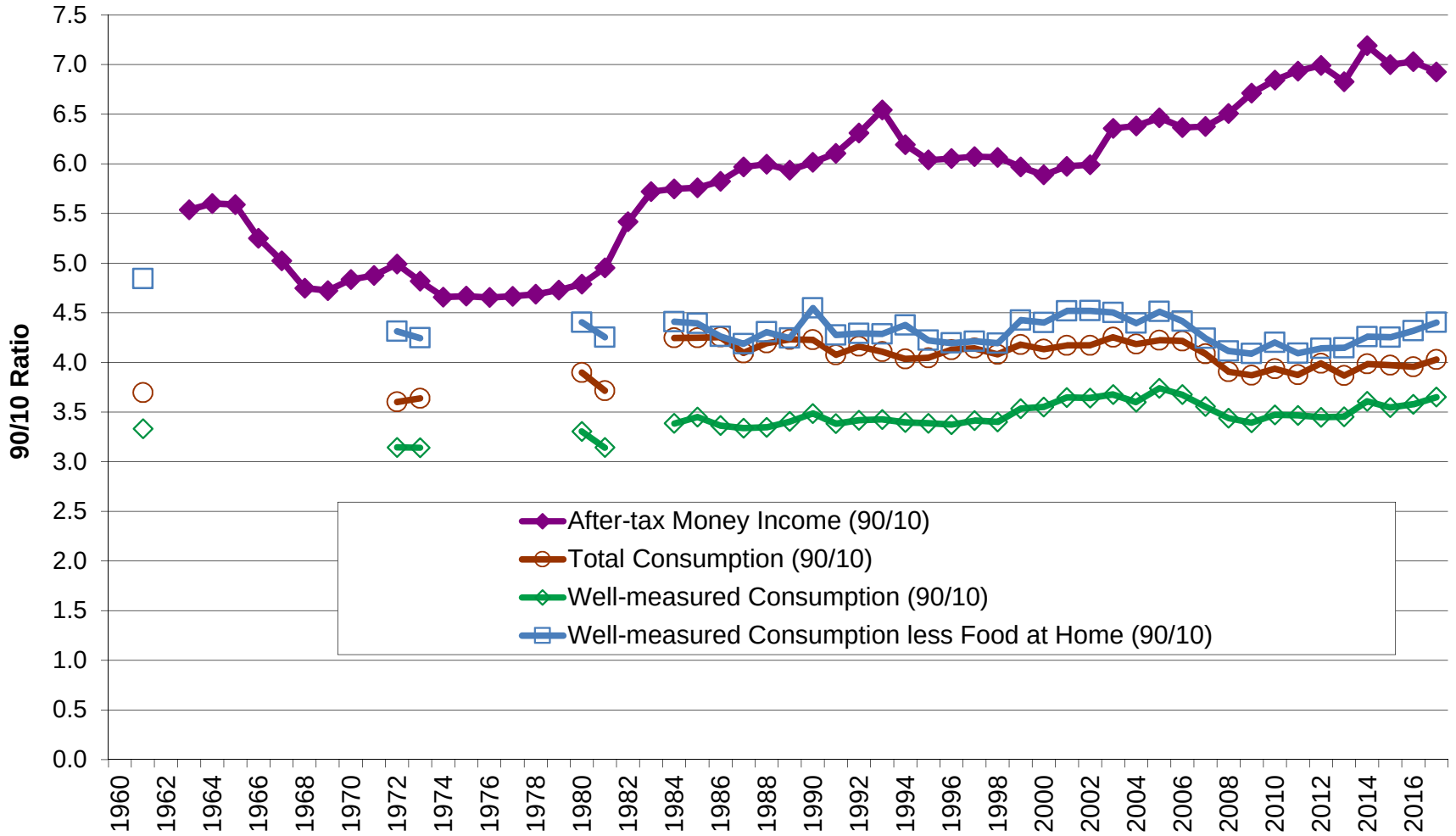
Figure 1: Consumption Inequality 1961-2017



Notes: Consumption data are from the CE and income data are from the CPS. Well-measured consumption includes spending on food at home, rent (for renters), rental equivalent (for homeowners or those in government or subsidized housing), utilities, service flows from owned vehicles, and spending on gasoline and motor oil. See text for more details.

Table 1: Total Consumption Elasticities of Well-Measured Consumption

Model Sample Restriction Year and Sample Size Independent Variable	Dependent Variable Log Well-measured Consumption	Dependent Variable Log Well-measured Consumption Less Food at Home
OLS		
None		
1980, N= 19,073		
Log Total Consumption	0.928	1.169
	(0.001)	(0.001)
1988, N= 20,294		
Log Total Consumption	0.810	0.967
	(0.005)	(0.008)
IV, instrument = Log income		
Complete income reporters between the 5th and 95th percentile of income		
1980, N= 14,531		
Log Total Consumption	0.944	1.167
	(0.001)	(0.002)
1988, N= 15,596		
Log Total Consumption	0.829	0.997
	(0.009)	(0.013)

Notes: All data are from the Consumer Expenditure Interview Survey. Well-measured consumption includes spending on food at home, rent (for renters), rental equivalent (for homeowners or those in government or subsidized housing), utilities, service flows from owned vehicles, and spending on gasoline and motor oil. Income and consumption are adjusted for differences in family size using the NAS recommended equivalence scale.

Table 2: Changes in Consumption and Income Inequality, 1961-2017

	Initial Level in 1960	Percentage Changes						
		1961*-1972	1972-1980	1980-1990	1990-2000	2000-2017	1984-2017	1961*-2017
90-10 Ratio								
After tax income	5.54	-9.86%	-4.08%	25.63%	-2.11%	17.59%	20.49%	25.05%
Total consumption	3.70	-2.52%	8.24%	8.43%	-2.21%	-2.51%	-5.10%	9.07%
Well-measured consumption	3.33	-5.67%	5.12%	5.47%	1.87%	2.81%	7.84%	9.54%
Well-measured consumption less food at home	4.84	-10.92%	2.07%	3.28%	-3.21%	0.02%	-0.15%	-9.09%
50-10 Ratio								
After tax income	2.79	-7.44%	1.40%	12.38%	-6.76%	7.10%	1.12%	5.33%
Total consumption	2.09	-3.63%	4.69%	-0.75%	-3.11%	-2.21%	-7.60%	-5.11%
Well-measured consumption	2.02	-6.05%	3.94%	-0.41%	-0.21%	0.02%	-1.84%	-2.94%
Well-measured consumption less food at home	2.54	-8.35%	3.74%	-2.68%	-5.19%	-1.26%	-7.31%	-13.38%
90-50 Ratio								
After tax income	1.99	-2.61%	-5.40%	11.80%	4.99%	9.80%	19.15%	18.72%
Total consumption	1.76	1.15%	3.39%	9.24%	0.92%	-0.31%	2.71%	14.94%
Well-measured consumption	1.65	0.41%	1.13%	5.91%	2.09%	2.79%	9.86%	12.85%
Well-measured consumption less food at home	1.91	-2.80%	-1.60%	6.12%	2.09%	1.29%	7.72%	4.96%

Notes: Consumption data are from the CE and income data are from the CPS. Well-measured consumption includes spending on food at home, rent (for renters), rental equivalent (for homeowners or those in government or subsidized housing), utilities, service flows from owned vehicles, and spending on gasoline and motor oil. See text for more details. 1961* refers to 1961 for consumption but 1963 for income.

Table 3: Changes in Consumption and Income Inequality for Other Measures of Consumption, 1961-2017

	Initial Level in 1960	Percentage Changes						
		1961*-1972	1972-1980	1980-1990	1990-2000	2000-2017	1984-2017	1961*-2017
90-10 Ratio								
Well-measured consumption	3.33	-5.67%	5.12%	5.47%	1.87%	2.81%	7.84%	9.54%
Well-measured consumption less food at home	4.84	-10.92%	2.07%	3.28%	-3.21%	0.02%	-0.15%	-9.09%
Well-measured consumption less food at home and utilities	5.62	-5.52%	0.04%	5.54%	-7.66%	1.04%	-1.37%	-6.92%
Well-measured consumption less housing	3.15	11.29%	-4.25%	-6.48%	-0.89%	1.90%	-0.12%	0.65%
Expenditures	3.86	0.36%	19.94%	17.22%	1.60%	-3.98%	-0.70%	37.66%
Total consumption	3.70	-2.52%	8.24%	8.43%	-2.21%	-2.51%	-5.10%	9.07%
Total consumption including health insurance				9.25%	0.62%	3.04%		
50-10 Ratio								
Well-measured consumption	2.02	-6.05%	3.94%	-0.41%	-0.21%	0.02%	-1.84%	-2.94%
Well-measured consumption less food at home	2.54	-8.35%	3.74%	-2.68%	-5.19%	-1.26%	-7.31%	-13.38%
Well-measured consumption less food at home and utilities	2.81	-3.91%	1.84%	-2.57%	-7.92%	-0.74%	-8.60%	-12.87%
Well-measured consumption less housing	2.02	7.71%	-8.93%	-4.83%	-2.00%	0.22%	-3.41%	-8.31%
Expenditures	1.80	2.64%	12.77%	12.87%	3.46%	-2.11%	4.33%	32.31%
Total consumption	2.09	-3.63%	4.69%	-0.75%	-3.11%	-2.21%	-7.60%	-5.11%
Total consumption including health insurance				1.75%	0.18%	-2.83%		
90-50 Ratio								
Well-measured consumption	1.65	0.41%	1.13%	5.91%	2.09%	2.79%	9.86%	12.85%
Well-measured consumption less food at home	1.91	-2.80%	-1.60%	6.12%	2.09%	1.29%	7.72%	4.96%
Well-measured consumption less food at home and utilities	2.00	-1.67%	-1.76%	8.33%	0.28%	1.80%	7.91%	6.83%
Well-measured consumption less housing	1.56	3.32%	5.14%	-1.74%	1.13%	1.68%	3.41%	9.76%
Expenditures	2.15	-2.22%	6.36%	3.86%	-1.80%	-1.91%	-4.81%	4.04%
Total consumption	1.76	1.15%	3.39%	9.24%	0.92%	-0.31%	2.71%	14.94%
Total consumption including health insurance				7.37%	0.44%	6.05%		

Notes: See notes to Table 2 and the Data Appendix for details on the measures of consumption and expenditures reported here.

Table 4: Demand System Estimates of Consumption and Income Inequality, 1980-2010

	After-Tax Income Aguiar and Bils (2015)	Categories with High Reporting Rates	Categories with < 5% Zero for Year	Categories with < 10% Zero for Year	Thirteen Largest Consumption Categories	Column 4 Plus Domestic Services and Childcare	Column 5 Plus Education	Total Consumption Aguiar and Bils (2015)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: High-Low Income								
Log Inequality, 1980-82	1.041	1.004	0.964	1.004	0.958	0.879	0.871	0.855
	(0.023)	(0.096)	(0.073)	(0.072)	(0.079)	(0.077)	(0.076)	(0.066)
Log Change, 1980-82/1991-93	0.167	-0.030	0.046	0.021	0.168	0.278	0.257	0.275
	(0.030)	(0.113)	(0.084)	(0.076)	(0.088)	(0.099)	(0.100)	(0.080)
Log Change, 1991-93/98-00	0.102	-0.074	-0.076	-0.075	-0.111	-0.108	-0.091	-0.030
	(0.024)	(0.077)	(0.060)	(0.065)	(0.083)	(0.088)	(0.082)	(0.066)
Log Change, 1998-00/2005-07	0.062	0.017	0.002	0.041	0.127	0.121	0.232	0.240
	(0.020)	(0.073)	(0.057)	(0.060)	(0.065)	(0.070)	(0.091)	(0.071)
Log Change, 2005-07/2008-10	0.004	0.029	0.031	0.012	-0.054	-0.022	-0.045	-0.059
	(0.018)	(0.072)	(0.055)	(0.052)	(0.071)	(0.074)	(0.090)	(0.077)
Total Log Change, 1980-82/2005-07	0.331	-0.087	-0.029	-0.014	0.185	0.290	0.398	0.485
	(0.027)	(0.105)	(0.105)	(0.074)	(0.077)	(0.090)	(0.101)	(0.084)
Total Log Change, 1980-82/2008-10	0.335	-0.058	0.003	-0.002	0.131	0.268	0.353	0.425
	(0.025)	(0.109)	(0.081)	(0.078)	(0.081)	(0.090)	(0.094)	(0.080)
Panel B: High-Middle Income								
Log Inequality, 1980-82	0.528	0.601	0.638	0.705	0.652	0.575	0.579	0.571
	(0.019)	(0.103)	(0.080)	(0.069)	(0.077)	(0.070)	(0.080)	(0.070)
Log Change, 1980-82/1991-93	0.116	-0.023	0.006	-0.006	0.166	0.279	0.302	0.298
	(0.022)	(0.128)	(0.103)	(0.082)	(0.093)	(0.106)	(0.106)	(0.086)
Log Change, 1991-93/98-00	0.020	-0.114	-0.095	-0.079	-0.108	-0.113	-0.129	-0.123
	(0.017)	(0.079)	(0.067)	(0.064)	(0.084)	(0.091)	(0.086)	(0.068)
Log Change, 1998-00/2005-07	0.077	0.096	0.065	0.292	0.171	0.187	0.313	0.292
	(0.015)	(0.080)	(0.059)	(0.061)	(0.069)	(0.074)	(0.096)	(0.074)
Log Change, 2005-07/2008-10	0.012	-0.044	-0.008	-0.011	-0.066	-0.054	-0.065	-0.071
	(0.014)	(0.086)	(0.059)	(0.053)	(0.071)	(0.070)	(0.089)	(0.072)
Total Log Change, 1980-82/2005-07	0.213	-0.041	-0.025	-0.011	0.229	0.353	0.485	0.467
	(0.020)	(0.121)	(0.092)	(0.075)	(0.081)	(0.100)	(0.111)	(0.088)
Total Log Change, 1980-82/2008-10	0.225	-0.085	-0.033	-0.022	0.163	0.299	0.420	0.396
	(0.021)	(0.130)	(0.097)	(0.079)	(0.084)	(0.096)	(0.106)	(0.084)
Panel C: Middle-Low Income								
Log Inequality, 1980-82	0.514	0.404	0.326	0.299	0.306	0.305	0.293	0.284
	(0.022)	(0.061)	(0.049)	(0.040)	(0.046)	(0.056)	(0.052)	(0.045)
Log Change, 1980-82/1991-93	0.051	-0.006	0.040	0.027	0.002	-0.002	-0.045	-0.023
	(0.029)	(0.066)	(0.060)	(0.049)	(0.054)	(0.063)	(0.057)	(0.052)
Log Change, 1991-93/98-00	0.082	0.039	0.020	0.004	-0.003	0.005	0.038	0.093
	(0.026)	(0.049)	(0.046)	(0.039)	(0.040)	(0.040)	(0.045)	(0.039)
Log Change, 1998-00/2005-07	-0.015	-0.079	-0.064	-0.034	-0.044	-0.066	-0.081	-0.052
	(0.023)	(0.055)	(0.040)	(0.036)	(0.035)	(0.033)	(0.034)	(0.042)
Log Change, 2005-07/2008-10	-0.008	0.073	0.039	0.023	0.013	0.032	0.021	0.012
	(0.019)	(0.050)	(0.039)	(0.037)	(0.034)	(0.034)	(0.032)	(0.043)
Total Log Change, 1980-82/2005-07	0.118	-0.046	-0.004	-0.003	-0.044	-0.063	-0.087	0.018
	(0.026)	(0.071)	(0.057)	(0.046)	(0.052)	(0.059)	(0.054)	(0.051)
Total Log Change, 1980-82/2008-10	0.110	0.027	0.035	0.020	-0.032	-0.031	-0.067	0.030
	(0.025)	(0.068)	(0.056)	(0.049)	(0.048)	(0.058)	(0.051)	(0.050)
Share of Total Consumption	n/a	73.8	78.4	83.4	91.9	93.4	94.7	100.0

Notes: The reported estimates are for the change in income or consumption inequality for the top versus bottom income quintiles (Panel A), the top versus middle income quintiles (Panel B), or the middle versus bottom income quintiles (Panel C), where the top, middle, and bottom income quintiles are defined as the 80th-95th percentiles, the 40th-60th percentiles, and the 5th-20th percentiles respectively. Column 1 reports the change in after-tax income inequality as reported in Table 1 of Aguiar and Bils (2015). Column 2 includes categories with a reporting rate greater than 0.75 in 2010 as reported in Appendix Table 5. These categories include: Housing; Food at home; Vehicle purchasing, leasing and insurance, All other transportation; Utilities; Appliances, phones, computers with associated services; and Entertainment Equipment and Subscription TV. Column 3 includes all the categories in column 2 plus Food away from home. Column 4 includes all the categories in Column 3 plus Health Expenditures and Men's and Women's Clothing. Column 5 includes all the categories in column 4 plus Entertainment Fees, Admissions, Reading; Cash Contributions; and Furniture and Fixtures. Column 6 includes all categories in column 5 plus Domestic Services and Childcare. Column 7 includes all categories in column 6 plus Education. Column 8, which is a replication of estimates of the change in consumption inequality from Table 3 of Aguiar and Bils (2015), includes all spending categories which are reported in Table A.3 in the online appendix.

Table 5: Decomposition of Changes in Consumption Inequality

	Total Change		Unexplained Residuals		Explained Coefficients		Explained Characteristics	
	Consumption	Income	Consumption	Income	Consumption	Income	Consumption	Income
1961-1972								
90-10	-0.062	-0.073	-0.015	-0.100	-0.065	-0.070	0.018	0.096
			24.5%	136.2%	104.9%	95.5%	-29.4%	-131.7%
50-10	-0.060	-0.047	-0.018	-0.064	-0.054	-0.048	0.011	0.065
			29.2%	136.3%	89.8%	102.8%	-19.0%	-139.1%
90-50	-0.001	-0.026	0.002	-0.036	-0.011	-0.022	0.007	0.031
			-177.4%	136.0%	755.4%	82.4%	-477.9%	-118.4%
1972-1980								
90-10	0.037	-0.048	0.039	-0.072	-0.042	-0.039	0.040	0.063
			104.4%	149.4%	-112.4%	81.1%	108.1%	-130.5%
50-10	0.025	0.010	0.024	-0.005	-0.024	-0.025	0.025	0.040
			96.2%	-43.2%	-95.9%	-237.9%	99.7%	381.1%
90-50	0.013	-0.059	0.015	-0.067	-0.018	-0.014	0.016	0.023
			120.2%	115.0%	-144.7%	24.1%	124.5%	-39.1%
1980-1990								
90-10	0.062	0.249	-0.004	0.114	0.041	0.112	0.025	0.023
			-6.1%	45.9%	66.3%	44.8%	39.8%	9.3%
50-10	0.007	0.128	-0.020	0.056	0.010	0.054	0.017	0.018
			-286.8%	43.9%	148.4%	42.3%	238.5%	13.8%
90-50	0.055	0.121	0.016	0.058	0.031	0.057	0.008	0.005
			29.8%	47.9%	55.8%	47.6%	14.4%	4.5%
1990-2000								
90-10	0.015	-0.030	0.015	0.024	-0.002	-0.072	0.002	0.019
			100.7%	-79.0%	-11.3%	241.4%	10.5%	-62.4%
50-10	-0.010	-0.062	-0.009	-0.033	-0.002	-0.050	0.002	0.020
			97.5%	52.9%	22.0%	79.4%	-19.5%	-32.2%
90-50	0.024	0.033	0.024	0.057	0.000	-0.022	0.000	-0.002
			99.4%	173.1%	2.0%	-68.3%	-1.5%	-4.8%
2000-2017								
90-10	0.024	0.125	0.002	0.073	0.009	0.037	0.013	0.015
			8.8%	57.9%	35.7%	29.8%	55.5%	12.3%
50-10	0.011	0.050	0.004	0.035	-0.001	0.008	0.008	0.007
			36.9%	70.2%	-5.5%	15.3%	68.6%	14.5%
90-50	0.013	0.075	-0.002	0.037	0.009	0.030	0.006	0.008
			-15.2%	49.8%	70.9%	39.4%	44.2%	10.8%

Notes: Data are from the CE (consumption) and CPS (income) surveys. These estimates are for log well-measured consumption and log income. See text for more details.

Table 6: Real Well-Measured Consumption Growth, 1991-2017 by Asset Quintile

Year	1991 (1)	2000 (2)	2006 (3)	2010 (4)	2017 (5)	Percent Change: 1991-2000 (6)	Percent Change: 2000-2006 (7)	Percent Change: 2006-2017 (8)	Percent Change: 2006-2010 (9)	Percent Change: 2010-2017 (10)
Total Asset Quintile										
First	16,002	17,995	20,930	23,343	25,597	12.5%	16.3%	22.3%	11.5%	9.7%
Second	19,425	21,090	25,125	22,806	25,662	8.6%	19.1%	2.1%	-9.2%	12.5%
Third	21,504	24,315	29,166	28,169	31,156	13.1%	20.0%	6.8%	-3.4%	10.6%
Fourth	24,511	29,621	36,702	32,097	37,644	20.8%	23.9%	2.6%	-12.5%	17.3%
Fifth	32,413	40,388	49,823	47,388	52,996	24.6%	23.4%	6.4%	-4.9%	11.8%

Notes: Data are from the CE Survey. Well-measured consumption includes spending on food at home, rent (for renters), rental equivalent (for homeowners or those in government or subsidized housing), utilities, service flows from owned vehicles, and spending on gasoline and motor oil. See text for more details.The amounts are in 2017 dollars using the adjusted CPI-U-RS, are equivalence scale adjusted and scaled to a 2-adult, 2 child family. Total assets are measured as total financial assets (stocks, bonds, checking and savings) plus housing equity (current house value less housing debt including mortgages, home equity loans, and home equity lines of credit). Information on housing equity loans and lines of credit are not available in the CE prior to 1991.

Online Appendix

A. CE and CPS Samples

Income data primarily come from the Current Population Survey Annual Social and Economic Supplement (CPS), which is the source for official measures of poverty and inequality in the U.S. This survey interviews approximately 75,000 households annually (60,000 households prior to 2002).[1] For the previous calendar year, respondents report the income amounts for a number of different sources that are included in the money income measure used to determine official income distribution statistics. In addition, the survey collects information on the dollar value of food stamps received by the household, as well as whether household members received other noncash benefits including housing subsidies and subsidies for reduced or free school lunch. Starting in 1980, the survey also provides imputed values for these and other noncash benefits including Medicaid and Medicare, the value of housing equity converted into an annuity, and the value of employer health benefits. We use data from the 1964-2018 surveys which provide data on income for the previous calendar year.

For our analysis of after-tax income, Federal income tax liabilities and credits and FICA taxes are calculated for all years using TAXSIM (Feenberg and Coutts 1993). State taxes and credits are also calculated using TAXSIM for the years 1977-2017. Prior to 1977 we calculate state taxes using IncTaxCalc (Bakija, 2008). We confirm that in 1977 net state tax liabilities generated using IncTaxCalc match very closely those generated using TAXSIM.[2]

All expenditure and consumption data come from the Interview component of the Consumer Expenditure (CE) Survey. The CE provides annual or annualized data for 13,728 families in 1960-1961 and 19,975 families in 1972-1973. From 1980-2011 the survey is a rotating panel that includes about 5,000 families each quarter until 1998 and about 7,500 families thereafter. Each family, or what the CE refers to as the consumer unit, reports spending on a large number of expenditure categories for up to four consecutive quarters. We use data from the 1960-1961 and 1972-1973 surveys and all quarterly waves from the first quarter of 1980 through the third quarter of 1981 and from 1984 through 2017 (some of the fourth quarter of 2017 data comes from surveys conducted in the first quarter of 2018). The 1960-1961 surveys provide data on annual expenditures collected in a single interview, while the 1972-1973 surveys provide data on annualized expenditures collected from quarterly interviews. Since 1980, quarterly expenditures have been provided. To obtain annual measures we multiply these quarterly measures by four. We do not use the data from the fourth quarter of 1981 through the fourth quarter of 1983 because the surveys for these quarters only include respondents from urban areas. We report inequality for years 1960 and 1961 together because

[1] The Annual Social and Economic Supplement (formerly known as the March Current Population Survey or the Annual Demographic File) is currently administered to the March sample of the Current Population Survey as well as a subsample of the respondents in the February and April surveys. Prior to reference year 2002 (survey year 2003), the supplement was only included in the March survey.

[2] The CPS also includes an imputed value for taxes and credits, but this information is only available starting with the 1980 survey, and the methodology for imputing taxes has changed over time.

the data are only representative of the full population when the samples from these two years are combined.

Unit of Analysis

We measure income from the CPS data at the family level, counting the resources of all individuals within a housing unit who are related by blood or marriage. Measuring resources at the family level follows the approach used for official poverty statistics. This approach excludes from family income the resources of unrelated individuals, such as a cohabiting partner. Analytically, the unit should be based on those who share resources. However, in the CPS we do not observe whether the cohabitor is sharing resources with other family members. In the CE we have more information about who shares resources. The consumer unit in the CE is defined as either a group of individuals who are related by blood or marriage, a single or financially independent individual, or two or more persons who share resources. Individuals are considered to be sharing resources if expenses are not independent for at least two of the three major expense categories: housing, food, and other living expenses.

To adjust for differences in family size and composition we scale all income and consumption measures in the paper using an NAS recommended equivalence scale (Citro and Michael, 1995) that allows for differences in costs between adults and children and exhibits diminishing marginal cost with each additional adult equivalent. In particular, we scale our measures by $(A + 0.7K)^{0.7}$, where A is the number of adults in the family and K is the number of children.

Sample Frame

Both surveys are designed to be representative of the U.S. civilian noninstitutionalized population. This sample frame excludes military personnel (at least those living overseas or on a base), nursing home residents, and people in prisons, but it includes those in group quarters such as college dormitories. Although our sample frame omits deprived groups such as the incarcerated and those in nursing homes, these excluded groups are small relative to the overall population, and although there has been some fluctuation in the size of these groups, these changes are not large enough to substantively affect the changes in inequality that we measure. To demonstrate this, we examined data from the decennial Census, and more recently from the American Community Survey, on the size of the institutionalized group quarters population relative to the total U.S. population. These data indicate that the fraction of the U.S. population that is in this group excluded from our sample frame grew from 1.11% in 1980 to 1.44% in 2000, but fell back to 1.18% in 2019.

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relative to the total U.S. population. These data indicate that the fraction of the U.S. population that is in this group excluded from our sample frame grew from 1.11% in 1980 to 1.44% in 2000, but fell back to 1.18% in 2019. If, in the worst case, all of those living in institutionalized group quarters are in households that have consumption below the 10th percentile of consumption of our sample, and if we consider the years where the change in the excluded population is greatest—i.e. between 1980 and 2000—then we could account for this growth by comparing the 89.89/9.01 ratio in 1980 to the 89.86/8.70 ratio in 2000 (derived using the formula that the percentiles accounting for an omitted share α below the qth percentile gives new percentiles: $q - [\alpha(1-q) / (1 - \alpha)]$). Comparing those ratios would indicate a 6.39% growth in consumption inequality between 1980 and 2000, which is trivially different from (and even smaller than) the 7.44% growth in the 90/10 ratio during this period that we report (Table 2 and Figure 1).

B. Measuring Consumption and Spending in the CE

The main measures of consumption presented in this paper are total consumption and well-measured consumption, but we also present inequality for subcomponents of well-measured consumption, for total consumption plus health insurance, and for expenditures. We provide more details on these measures here, and highlight how some components of these measures have changed over time.

Expenditures: This summary measure includes all expenditures reported in the CE Interview Survey except miscellaneous expenditures and cash contributions because some of these expenditures are not collected in all interviews. Since 1980 a subset of miscellaneous expenditures has been collected only in the fifth interview, and cash contributions are only collected in the fifth interview for surveys conducted from the first quarter of 1980 through the first quarter of 2001.

Total Consumption: Consumption includes all spending in our measure of total expenditures less spending on out of pocket health care expenses, education, and payments to retirement accounts, pension plans, and social security. We also exclude spending on charitable contributions and spending on cash gifts to non-family members, which are very small relative to total consumption. In addition, housing and vehicle expenditures are converted to service flows. For homeowners we subtract spending on mortgage interest, property taxes, maintenance, repairs, insurance, and other expenses, and add the reported rental equivalent of the home. For years when the rental equivalent is not reported (1960-1961 and 1980-1981 surveys), we impute a value as explained below. For those in public or subsidized housing, we impute a rental value using the procedure outlined below. For vehicle owners we subtract spending on recent purchases of new and used vehicles as well vehicle finance charges. We then added the service flow value of all vehicles owned by the family, as described below.

Well-Measured Consumption: We construct a measure of economic well-being that is based on "well-measured consumption," which is composed of the components that have been shown to be measured well: food at home, rent plus utilities, gasoline and motor oil, the reported rental value of owner-occupied housing, and the imputed service flow value of all

vehicles owned by the family. An alternative to directly reporting percentiles of well-measured consumption would be to predict percentiles of total consumption using well-measured consumption and other household characteristics. We considered such an approach, but in the end found the approach to be too sensitive to the methods used and less obvious and direct than the approach we take here. One of the main difficulties with such approaches is that there is less consistency over time in the collection of other consumption items, income, and other variables than there is of the well-measured consumption items.

Estimating Vehicle Service Flows

Our measure of consumption replaces the purchase price of vehicles and vehicle maintenance costs with the service flow value from owned vehicles. Our improved measure of vehicle service flows follows the approach we used in Meyer and Sullivan (2012,b). Previous studies have imputed flows based only on recent spending on vehicles and descriptive characteristics of the family (Cutler and Katz 1991), recent spending on vehicles, vehicle age, and descriptive characteristics of the family (Meyer and Sullivan 2003, 2004), or reported purchase prices and vehicle age (Slesnick 1993). Our approach provides two important improvements upon previous work. First, in addition to vehicle age, our approach uses detailed information for each vehicle (such as make, model, year, automatic transmission, and other characteristics) to determine the market price. Second, we estimate depreciation rates by comparing the reported purchase prices for similar vehicles of different ages. We use the detailed expenditure data for owned vehicles from the 1980-2017 CE.

We determine a current market price for each of the 1.6 million vehicles in the data from 1980-2017 in one of three ways. First, for vehicles that were purchased within twelve months of the interview and that have a reported purchase price (the estimation sample), we take the current market price to be the reported purchase price. This estimation sample accounts for about 14 percent of all vehicles in the 1980-2017 surveys. Second, for vehicles that were purchased more than twelve months prior to the interview and that have a reported purchase price (about 15 percent of all vehicles), we specify the current market price as a function of the reported purchase price and an estimated depreciation rate as explained below.

For the remaining 71 percent of vehicles, we impute a current market price because the purchase price is not reported. Using the estimation sample, we regress the log real purchase price on a cubic in vehicle age, vehicle characteristics, family characteristics, and make-model-year fixed effects.[3] The vehicle characteristics include indicators for whether the vehicle has automatic transmission, power brakes, power steering, air conditioning, a diesel engine, a sunroof, four-wheel drive, or is turbo charged. Family characteristics include log

[3] 76 percent of the vehicles without a reported purchase price can be matched to at least one vehicle in the estimation sample with the same make, model, and year, and 69 percent of the remaining 24 percent do not have a match because they are not a car, truck, or van so make and model are not observed. Starting in 2006, vehicles can be matched on make, but not model, because the CE stopped providing information on vehicle model after 2005. For those vehicles without a reported purchase price that do not have the same make, model, and year as at least one vehicle in the estimation sample, but do have the same make and year as a vehicle in the estimation sample, a separate regression is estimated that includes make-year fixed effects instead of make-model-year fixed effects.

real expenditures (excluding vehicles and health), family size, region, and the age and education of the family head. Coefficient estimates from this regression are then used to calculate a predicted log real purchase price for the i[th] vehicle ($x_i\hat{\beta}$). The predicted current market value for each vehicle without a reported purchase price is then equal to $\hat{\alpha} * \exp(x_i\hat{\beta})$, where $\hat{\alpha}$ is the coefficient on $\exp(x_i\hat{\beta})$ in a regression of y_i on $\exp(x_i\hat{\beta})$ without a constant term.[4]

To estimate a depreciation rate for vehicles, we compare prices across vehicles of different age, but with the same make, model, and year. In particular, from the estimation sample we construct a subsample of vehicles that are in a make-model-year cell with at least two vehicles that are not the same age. Using this sample, we regress the log real purchase price of the vehicle on vehicle age and make-model-year fixed effects.[5] From the coefficient on vehicle age (β), we calculate the depreciation rate (δ): $\delta = 1 - EXP(\beta)$. The service flow is then the product of this depreciation rate and the current market price. If the vehicle has a reported purchase price but was not purchased within 12 months of the interview we calculate the service flow as: (real reported purchase price)*$\delta(1-\delta)^t$, where t is the number of years since the car was purchased.

Although the 1972-1973 CE data files include an inventory of vehicles owned, we do not use these data to calculate service flows from vehicles for several reasons. First, we do not observe the year the car was manufactured, only whether it was manufactured before or after 1967. Second, we do not observe the model for vehicles manufactured during or before 1967, and for those manufactured after 1967 we only observe a broadly defined model group: subcompact domestic, compact domestic, etc. Thus, rather than using the vehicle inventory data, we impute service flows for owned automobiles using data on reported spending on new and used automobile purchases during the survey year and the reported number of automobiles owned during the year. Specifically, for a sample with positive spending on automobiles, we regress annual spending for new and used automobiles on a quadratic in total (non-automobile) spending and observable characteristics of the family including family income, family size, and the age, sex, and education of the family head. Parameter estimates from these regressions are used to predict spending on new and used car purchases for all families that own automobiles. We calculate the service flow from automobiles as the product of predicted automobile spending, the number of owned automobiles and a depreciation rate. This approach will understate total automobile flows for some families because the number of automobiles is topcoded at 2. This approach will overstate vehicle flows for families that dispose of an automobile during the survey year if this automobile is included in the total count of automobiles owned. This approach will also overstate vehicle flows for families that have owned their vehicles for an extended time, because we are predicting the value based on recent automobile purchases. Note that unlike our approach for 1980-2017, we calculate

[4] This adjustment is made because $\exp(x_i\hat{\beta})$ will tend to underestimate y_i.

[5] The distribution of service flows does not differ noticeably when alternative specifications for depreciation are estimated. For example, specifications that allow the depreciation rate to vary by age of the vehicle (by including a cubic in vehicle age in the regression) yield similar results.

service flows only for automobiles, not for other vehicles such as trucks, motorcycles, campers, etc., because we do not have reliable information on the total number of each of these types of vehicles owned.

We validate our procedure for predicting the current market value of vehicles for those observations where we do not have a purchase price by comparing the predicted values to published values in National Automobile Dealers Association (NADA) guides. For a given year of the CE we take a random sample of 100 vehicles for which a purchase price was not observed. We then find the average retail price of the vehicle reported in the NADA Official Used Car Guide, using observable vehicle characteristics including make, model, year, number of cylinders, and number of doors. In cases where a unique match is not found in the NADA guide (for example, there might be multiple sub-models listed in the NADA guide), we use the midpoint of the range of prices for the vehicles that match the description of the vehicle from the CE. For the sample of vehicles randomly drawn from the 2000 CE, the correlation between our imputed price and the 2000 NADA price was 0.88. Similarly, for a sample of 100 cars with a reported purchase price, the correlation between the reported price and the NADA price was 0.91.

Estimating a Rental Equivalent for Families Living in Government or Subsidized Housing

We impute a rental equivalent for families in the CE living in government or subsidized housing using reported information on their living unit including the number of rooms, bedrooms and bathrooms, and the presence of appliances such as a microwave, disposal, refrigerator, washer, and dryer. Specifically, for renters who are not in public or subsidized housing we estimate quantile regressions for log rent using the CE housing characteristics mentioned above as well as a number of geographic identifiers including state, region, urbanicity, and SMSA status, as well as interactions of a nonlinear time trend with appliances (to account for changes over time in their price and quality). We then use the estimated coefficients to predict the 40th percentile of rent for the sample of families that do not report full rent because they reside in public or subsidized housing. We use the 40th percentile because public housing tends to be of lower quality than private housing in dimensions we do not directly observe. Evidence from the PSID indicates that the average reported rental equivalent of public or subsidized housing is just under the predicted 40th percentile for these units using parameters estimated from those outside public or subsidized housing.

Estimating the Value of Health Insurance

We impute a measure of the value of public and private health insurance using the coverage information in the CE and data on insurance costs. The worker and firm cost of employer provided insurance is obtained from a combination of sources including the National Medical Care Expenditure Survey and the Mercer/Foster Higgins National Survey of Employer Sponsored Health Plans. From these surveys we calculate a cost of employer provided health insurance that varies by year and nine geographic regions. The cost of Medicaid and Medicare is taken from expenditures per person in a given state and year. For Medicaid we calculate these expenditures separately for children, adults under 65, and adults 65 and over.

The value a family places on health coverage may exceed its cost because of its insurance value. On the other hand, this in-kind transfer may be valued at much less than cost given the one size fits all nature of insurance and the lower value of purchases of most goods by the poor. The compromise that we consider here is to count desired health expenditures. Assuming that desired health expenditures by those with few resources can be characterized by Cobb-Douglas preferences with a coefficient of 0.33 on health and 0.67 on other goods, only health expenditures up to one-third of total expenditures are included. This compromise values health coverage at cost for those with substantial resources as they likely spend less than one-third of consumption on health, but at much less than cost for those with few other resources. Because information on health insurance coverage is not available in 1960-1961, 1972-1973 and from 1984 to 1987, we do not report consumption measures that include health insurance for these years.

Imputing Rental Equivalent

In survey years 1960-61 and 1980-81 we do not observe the reported rental equivalent of the home. To construct an imputed value of housing consumption for homeowners for these years, we rely on data from subsequent waves of the CE Survey where rental equivalent is reported. Using data from 1984, for example, we estimate the relationship between reported rental equivalent and the reported house value and other characteristics. Specifically, for a sample of homeowners we estimate quantile regressions of the following form:

$$\text{(A.1)} \quad Q_\alpha(\ln rent_i) = \beta_1 \ln hval_i + \beta_2 \ln nh_i + \beta_3 X_i + \beta_2 W_i ,$$

where $rent_i$ denotes the reported rental equivalent for consumer unit i; $hval_i$ is the reported market value of the home; nh_i is total non-housing consumption; X_i is a vector of characteristics including age and education of the head, family size, and family type (single parent, married parents, single individual, and other); and W_i is a vector of living unit characteristics including whether the unit has central or window air conditioning, the number of rooms and whether the unit is located within a SMSA. We then use the coefficient estimates of Equation A.1 to predict the α quantile of rental equivalent for consumer units in the 1980-81 surveys. We estimate Equation A.1 for 99 different percentiles, yielding 99 predicted values of rental equivalent for each homeowner. For non-homeowners in 1980-81 we generate 99 duplicate observations. Stacking these two datasets together yields a sample with 99 X N consumer units, where N is the number of consumer units in the 1980-81 data.

We calculate our various consumption measures for this expanded 99 X N sample using predicted rental equivalent as our measure of service flow from owned homes. Our measures of consumption inequality are then calculated for the various measures of consumption using this expanded 99 X N sample. When predicting within sample (i.e. when the estimation and prediction samples are the same) the distribution of predicted rental equivalent lines up very closely with the actual reported rental equivalent.

We follow a similar procedure to impute rental equivalent for the 1960-61 sample, except we estimate the coefficients in Equation A.1 using the 1972-73 CE Survey. Also, the 1960s surveys provide information on the range within which the value of the home falls, rather than a continuous value. So when estimating Equation A.1 using the 1972-73 surveys, we map the reported value of the home into the same ranges (in real terms) as are available in the 1960-61 surveys, and then include indicator variables for these home value ranges in place of the reported home value (*hval*).

Comparability over Time

We make two minor adjustments to the measure of total expenditures provided in the CE to maintain a comparable definition of expenditures across our sample period. First, we add in insurance payments and retirement contributions for the 1960-1961 and 1972-1973 surveys because these categories were not treated as expenditures in these years. This adjustment does not affect consumption measures because these categories are excluded from consumption. Second, the wording for the question regarding spending on food at home in surveys conducted between 1982 and 1987 differed from other years. Several studies have noted that this wording change resulted in a decrease in reported spending on food at home (Battistin 2003; Browning et al. 2003). To correct for the effect of this change in the questionnaire, for the years 1984-1987 we multiply spending on food at home by an adjustment factor which is equal to the ratio of average spending on food at home from 1988 through 1990 to average spending on food at home from 1984 through 1987. These adjustment factors, which we estimate separately for different family types, range from 1.12 to 1.30. Starting with the second quarter of 2007, the question on food away from home changed from a query about usual monthly spending to usual weekly spending. This change resulted in a noticeable increase in reported food away spending. We estimate the effect of the question change by regressing food away spending on a new question indicator, controlling for interview month and reference month (respondents report spending for the previous three months) for survey years 2005 through 2007. Based on these estimates we adjust spending on food away down by 55 percent for the most recent years. This adjustment does not affect our well-measured consumption measure because this measure excludes food away. Reported food away spending is a small fraction of total spending, accounting for about 6 percent of total spending for all consumer units in 2017.[6]

The values for certain spending components are top coded in the public use files, and the threshold values for the top code changes over time. For example, the top code threshold for the monthly rental equivalent value of an owned home increased from $1,000 in 1988 to $1,500 in 1989. Over longer periods the real values of the top code thresholds have typically risen. For example, the value of the rental equivalent threshold in 2014 ($3,900) is 37% greater in real terms than the value of this threshold in 1980 ($1,000).

Also, we do not observe whether a consumer unit resides in public or subsidized housing prior to 1982, so a rental equivalent value for those in such housing is not included in consumption prior to 1982. Estimates of the rental equivalent for those in public or subsidized housing in

[6] https://www.bls.gov/cex/tables.htm#avgexp.

the mid-1980s are small relative to total consumption, suggesting that this exclusion is not likely to significantly bias our estimates for changes in inequality. Finally, the availability of information on vehicles also changes during our sample period as we noted above.

C. Measures of Income in the CPS

CPS respondents report annual measures of money income for the previous calendar year. Respondents also report the dollar value of food stamps received by the household, as well as whether household members received other noncash benefits including housing subsidies and subsidies for reduced or free school lunch. Starting with the 1980 survey, the Census also provides imputed values for these and other noncash benefits. For more details see U.S. Census (various years-a,b), Appendices B and C.

The income inequality results reported in this study focus on three main measures of income: Pre-Tax Money, After-Tax Money Income, and After-Tax Money Income Plus Noncash Benefits. We also examined alternative income-based measures of resources that include the imputed value of Medicaid and Medicare, employer health benefits, and the net return on housing equity. These measures of income are defined as follows:

Pre-Tax Money Income: The Census definition of money income that is used to measure poverty and inequality. This definition of income, as reported in the ASEC codebook, includes: earnings; net income from self-employment; Social Security, pension, and retirement income; public transfer income including Supplemental Security Income, welfare payments, veterans' payment or unemployment and workmen's compensation; interest and investment income; rental income; and alimony or child support, regular contributions from persons outside the household, and other periodic income.

After-Tax Money Income: To calculate after-tax money income we add to pre-tax money income the value of tax credits such as the EITC, and subtracts state and federal income taxes and payroll taxes. Federal income tax liabilities and credits and FICA taxes are calculated for all years using TAXSIM (Feenberg and Coutts 1993). State taxes and credits are also calculated using TAXSIM for the years 1977-2005. Prior to 1977, we calculate state taxes using IncTaxCalc (Bakija, 2008). We confirm that in 1977 net state tax liabilities generated using IncTaxCalc match very closely those generated using TAXSIM.

After-tax Money Income Plus Noncash Benefits: Our measure of after-tax money income plus noncash benefits adds to after-tax money income the cash value of food stamps, and the Census' imputed value of housing subsidies and school lunch programs. While it is possible to account for under-reporting of transfers and to simulate non-cash benefits for the 1960s and 1970s prior to the Census imputations, we have not taken this route given the lack of information in the survey to impute these benefits and limited information on the correlates of under-reporting in the earlier years.

Face Value of Food Stamps: The value of food stamps for each family is determined by the Census using reported information on the number of persons receiving food stamps in the household and the reported total value of food stamps received.

Income Value of School Lunch Program: The Census imputes a value for lunch subsidies for families that report having children who receive free or reduced price school lunch. The value is determined using information on the dollar amount of subsidy per meal as reported by the USDA. If a child participates in school lunch, it is assumed that the child receives that subsidy type (reduced price or free) for the entire year.

Housing Subsidies: The Census imputes a value of housing subsidies for households that report living in public housing or receiving a public rent subsidy. The value of the subsidy is calculated as follows. Using data from the 1985 American Housing Survey (AHS), reported rent for unsubsidized two-bedroom housing units is regressed on housing characteristics. Separate regressions are estimated for each of four regions, and the coefficients from these models are used to predict rent for those living in subsidized units in the AHS. The subsidy for those in subsidized housing in the AHS sample is then calculated as the difference between out of pocket rent and imputed total rent. Region-specific adjustment factors for smaller and larger units are estimated using data on rent for units with different numbers of bedrooms in the 1985 AHS. Thirty-six different subsidy values are calculated which vary by four regions, three income brackets, and three different unit sizes. Because unit size is not observed in the CPS, this is imputed from family composition. Subsidy values for each year are based on estimates using the 1985 data, but are updated to reflect changes in shelter costs using the CPI residential rent index. Before 1985 housing subsidies in the CPS were imputed using the 1979 or 1981 Annual Housing Survey. The Census imputed values for housing subsidies are only available through 2015.

D. Econometric Model Appendix

Two potentially important measurement issues are often ignored in analyses of income or consumption inequality. First, a subset of income or consumption, such as pre-tax money income or nondurable consumption, is only an approximation to an ideal measure of income or consumption.[7] Second, measurement error independent of the true values makes the measured dispersion of both income and consumption higher than the true dispersion. We explicitly address both of these issues in our analysis. First, we use well-measured consumption to approximate true total consumption. Second, even well-measured consumption is measured with some error. Here, we discuss the assumptions necessary for changes in the dispersion of observed, well-measured consumption to be a reasonable approximation to changes in the dispersion of true total consumption. Equation (3) from the

[7] For example, Piketty and Saez (2003) and DeNavas-Walt and Proctor (2015) examine a subset of income, pre-tax money income, excluding taxes and tax credits, as well as in-kind transfers. Attanasio, Battistin and Ichimura (2007), Heathcote, Perri, and Violante (2010), Attanasio, Hurst, and Pistaferri 2015), and Coibion et al. (2017) all examine a subset of consumption, focusing on non-durable consumption, though the exact definition differs across the papers.

main text, reproduced below, expresses observed well-measured consumption as the product of true total consumption and two error functions.

$$x_{hwt} = x^*_{ht} e^{\alpha + \psi^w_t} \, e^{\varepsilon_{hwt} + \nu_{hwt}} \tag{3}$$

The first exponentiated error function does not vary across households and cancels out when considering statistics such as ratios of percentiles or changes in log variances. The second exponentiated error function differs across households and requires further analysis.

To simplify this discussion, we express Equation (3) in terms of logs and consider changes between two representative time periods, t = 1 and t = 2. We want to know how changes in distributional statistics, such as percentiles or the variance of lnx_{hw2} relative to lnx_{hw1}, compare to changes in the same distributional statistics for lnx^*_{h2} relative to lnx^*_{h1}. To do this, we make two additional assumptions regarding the error terms, ε_{hwt} and ν_{hwt}: 1) that they are independent of x^*_{ht}, and 2) that their distributions do not change over time. A version of these assumptions is implicit, but not acknowledged, in all papers that have examined changes in income or consumption inequality over time, because the studies in this literature typically do not address the implications of measurement error. Analogous assumptions are also implicit in papers that consider the implications of measurement error such as Aguiar and Bils (2015). Their study, which examines expenditures by reported income quintile, ignores the effect of measurement error in income on the classification of households into income quintiles as well as any change over time in the bivariate relationship between true income and consumption.

In the case where one is using variances to measure dispersion, it is straightforward to show, given the assumptions we note above, that the observed change in the variance of the logarithm of reported well-measured consumption is the same as the change in the variance of the logarithm of true total consumption. To see this, note that our assumptions imply that the variance in well-measured consumption across households can be expressed as

$$\begin{aligned} Var(lnx_{hwt}) &= Var(\, lnx^*_{ht} + \alpha + \psi^w_t + \varepsilon_{hwt} + \nu_{hwt} \,) \\ &= Var(lnx^*_{ht}) + 0 + a\ constant. \end{aligned}$$

Thus, when we take the differences in the variances between two periods, we have

$$Var(lnx_{hw2}) - Var(lnx_{hw1}) = Var(lnx^*_{h2}) - Var(lnx^*_{h1}),$$

which indicates that changes in the variance of reported well-measured consumption are equal to changes in the variance of true total consumption.

In our analyses, we focus on ratios of percentiles rather than variances. In general, we expect observed values equal to true values plus measurement error independent of true values will have ratios of percentiles greater than those in the true distribution. However, changes over time in the ratios of percentiles would be reduced by the presence of measurement error even when the distribution of that measurement error does not change over time. Given that, for

ratios of percentiles, $e^{\alpha+\psi_t^w}$ cancels out, we can re-write our changes in ratios—in this example, the 90/10 ratio—in terms of the log of the ratio, or equivalently differences in percentiles of the logarithms of the underlying variables at two points in time:

$$ln\left[\frac{Q_{90}(x_{h2})}{Q_{10}(x_{h2})}\right] - ln\left[\frac{Q_{90}(x_{h1})}{Q_{10}(x_{h1})}\right] = \left[Q_{90}(lnx_{h2}) - Q_{10}(lnx_{h2})\right] - \left[Q_{90}(lnx_{h1}) - Q_{10}(lnx_{h1})\right]$$
$$= [Q_{90}(lnx_{h2}^* + \lambda_{hw2}) - Q_{10}(lnx_{h2}^* + \lambda_{hw2})] - [Q_{90}(lnx_{h1}^* + \lambda_{hw1}) - Q_{10}(lnx_{h1}^* + \lambda_{hw1})]$$

where $\lambda_{hwt} = \varepsilon_{hwt} + \nu_{hwt}$. To see the implications of the error for changes over time in differences (within time) in percentiles of the logarithms of the variables, consider adding to the two assumptions noted above the assumption that all variables are normally distributed. This distributional assumption is neither ideal—it restricts all percentiles of true and observed consumption to differ proportionately and change over time proportionately—nor necessarily true, but it is helpful for understanding the plausibility and limits of our approach.[8] Given these assumptions, the distribution we observe, lnx_{hw2}, is a normal distribution with a somewhat larger variance than the true distribution, lnx_{hw2}^*, due to the error. Using the result that the sum of independent normal distributions is normal, now consider what we can learn from changes over time in the 90/10 ratio for a normal distribution of log consumption with a somewhat higher variance than the true distribution. Ratios of percentiles in the observed distribution would just be scaled up versions of the ratio in the true distribution, with the scale factor equal to the ratio of the standard deviation of the observed distribution to the standard distribution of the true one. This result is just a consequence of the observed distribution being the same as the true distribution, but proportionately more dispersed. Changes over time in differences of within time percentiles, though are biased downward for both income and consumption if measurement error does not increase over time but the true distributions become more dispersed, as the percentage increase in the variance will be diminished by the error. Non-normal distributions would not necessarily have all percentiles scaled up proportionately by measurement error, but it is plausible that both within time differences in percentiles would be exaggerated and changes over time in those differences would be attenuated.

E. Quantile Decomposition

The first step in the quantile decomposition is to estimate a model of the conditional quantiles of income or consumption. Then, we generate a close approximation to the unconditional distribution by numerically integrating the conditional distribution over the range of the distribution of observable characteristics and over all quantiles. Using this estimated unconditional distribution, we can construct counterfactual distributions. For example, we

[8] Without loss of generality, we can assume that the errors that differ across households are mean zero as the overall mean can be subsumed in the part of the error that does not vary across households.

can construct a hypothetical distribution of income for 1980 in the case where observable characteristics are the same as those in 1990.

It is helpful to first provide some notation (we follow Autor, Katz and Kearney 2005 here). Let y be income or consumption and let g(X) be the empirical distribution of a set of explanatory variables X that can account for demographic changes or define groups of households. Let $\hat{\beta}(\theta)$ be the vector of coefficients on X from a θ quantile regression of y on X, where θ is an element of (0,1). $\hat{\beta}^m = \hat{\beta}(.5)$ is the vector of coefficients from a median regression, while $\hat{\beta}^w(\theta) \equiv [\hat{\beta}(\theta) - \hat{\beta}^m]$ is the difference between the coefficient for a θ quantile regression and those for the median. Let $\hat{\beta}^w$ be a matrix of $\hat{\beta}^w(\theta)$ values as θ varies over a grid of values such as 0.01, 0.02… up to 0.99. Then, the approximation to the unconditional distribution of y in time period t can be written as $f_t(y) \equiv f(g_t(X),\ \hat{\beta}_t^m,\ \hat{\beta}_t^w)$ where we have added the t subscripts for the time period. Finally, we denote the change in the θ quantile of the distributions between two different time periods, t and τ, as $\Delta Q_\theta = Q_\theta(f_\tau(y)) - Q_\theta(f_t(y))$.

We can then decompose this change into three parts.

$$\Delta Q_\theta = Q_\theta\left(f(g_\tau(X), \quad \hat{\beta}_\tau^m, \quad \hat{\beta}_\tau^w)\right) - Q_\theta\left(f(g_t(X), \quad \hat{\beta}_t^m, \quad \hat{\beta}_t^w)\right)$$
$$= \Delta Q_\theta^X + \Delta Q_\theta^m + \Delta Q_\theta^w, \text{where}$$
$$\Delta Q_\theta^X = \left[Q_\theta\left(f(g_\tau(X), \quad \hat{\beta}_t^m, \quad \hat{\beta}_t^w)\right) - Q_\theta\left(f(g_t(X), \quad \hat{\beta}_t^m, \quad \hat{\beta}_t^w)\right)\right],$$
$$\Delta Q_\theta^m = \left[Q_\theta\left(f(g_\tau(X), \quad \hat{\beta}_\tau^m, \quad \hat{\beta}_t^w)\right) - Q_\theta\left(f(g_\tau(X), \quad \hat{\beta}_t^m, \quad \hat{\beta}_t^w)\right)\right], \text{and}$$
$$\Delta Q_\theta^w = \left[Q_\theta\left(f(g_\tau(X),\ \hat{\beta}_\tau^m,\ \hat{\beta}_\tau^w)\right) - Q_\theta\left(f(g_\tau(X),\ \hat{\beta}_t^m,\ \hat{\beta}_t^w)\right)\right].$$

ΔQ_θ^X is the contribution of changes in observable characteristics *X* to the change in the θ quantile, ΔQ_θ^m is the contribution of changes in the return to these characteristics at the median, and ΔQ_θ^w is the contribution of changes in dispersion within groups over time (where the groups are defined by different values of *X*).

We further decompose the log of consumption and income so that changes in ratios of quantiles, such as the 90/10 ratio, can be written as differences between expressions like that above for two different quantiles. We rely on the result that the natural logarithm is a monotonic function so that the logarithm of a quantile is just the quantile of the logarithm. Then, because the ratio of two quantiles, ln(Q_θ / $Q_{\theta'}$) is just ln(Q_θ) – ln($Q_{\theta'}$), we have that the change in the ln of the 100*θ /100*θ' ratio between t and τ is $\Delta Q_\theta - \Delta Q_{\theta'}$ for ln(y) rather than y. Thus, to decompose changes in ratios, we simply expand $\Delta Q_\theta - \Delta Q_{\theta'}$ into its parts for ln(y).

$$\Delta Q_\theta - \Delta Q_{\theta'} = \Delta Q_\theta^X + \Delta Q_\theta^m + \Delta Q_\theta^w - \Delta Q_{\theta'}^X - \Delta Q_{\theta'}^m - \Delta Q_{\theta'}^w$$

Grouping like terms, we have

$$\Delta Q_\theta - \Delta Q_{\theta'} = \left[\Delta Q_\theta^X - \Delta Q_{\theta'}^X\right] + \left[\Delta Q_\theta^m - \Delta Q_{\theta'}^m\right] + \left[\Delta Q_\theta^w - \Delta Q_{\theta'}^w\right].$$

Each term in brackets is the contribution of one determinant of the change in the distribution of ln(y) to the change in the ratio of percentiles. For example, $\left[\Delta Q_\theta^X - \Delta Q_{\theta'}^X\right]$ is the contribution of changing characteristics, *X*, to the change in the ratio of percentiles.

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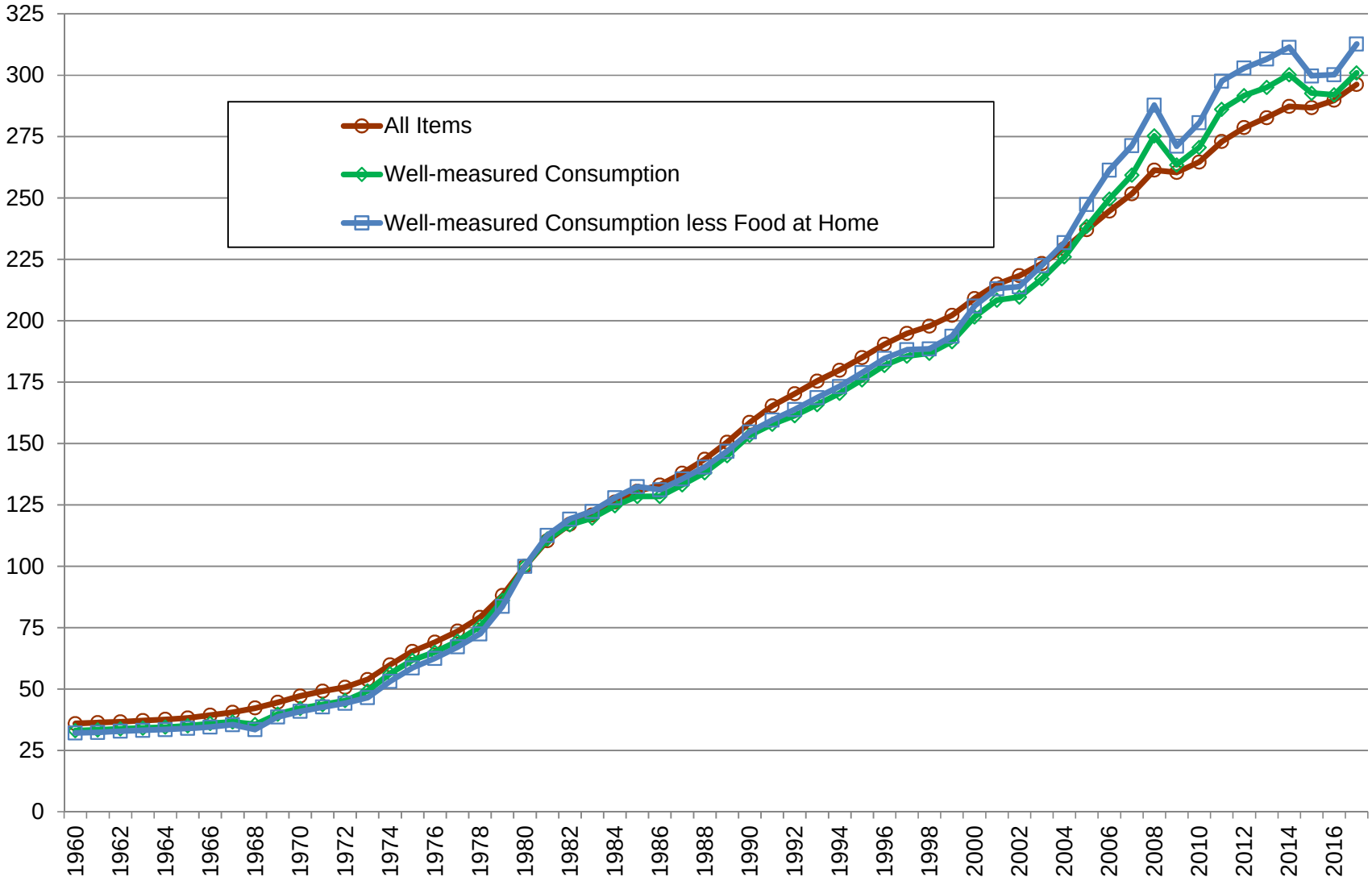
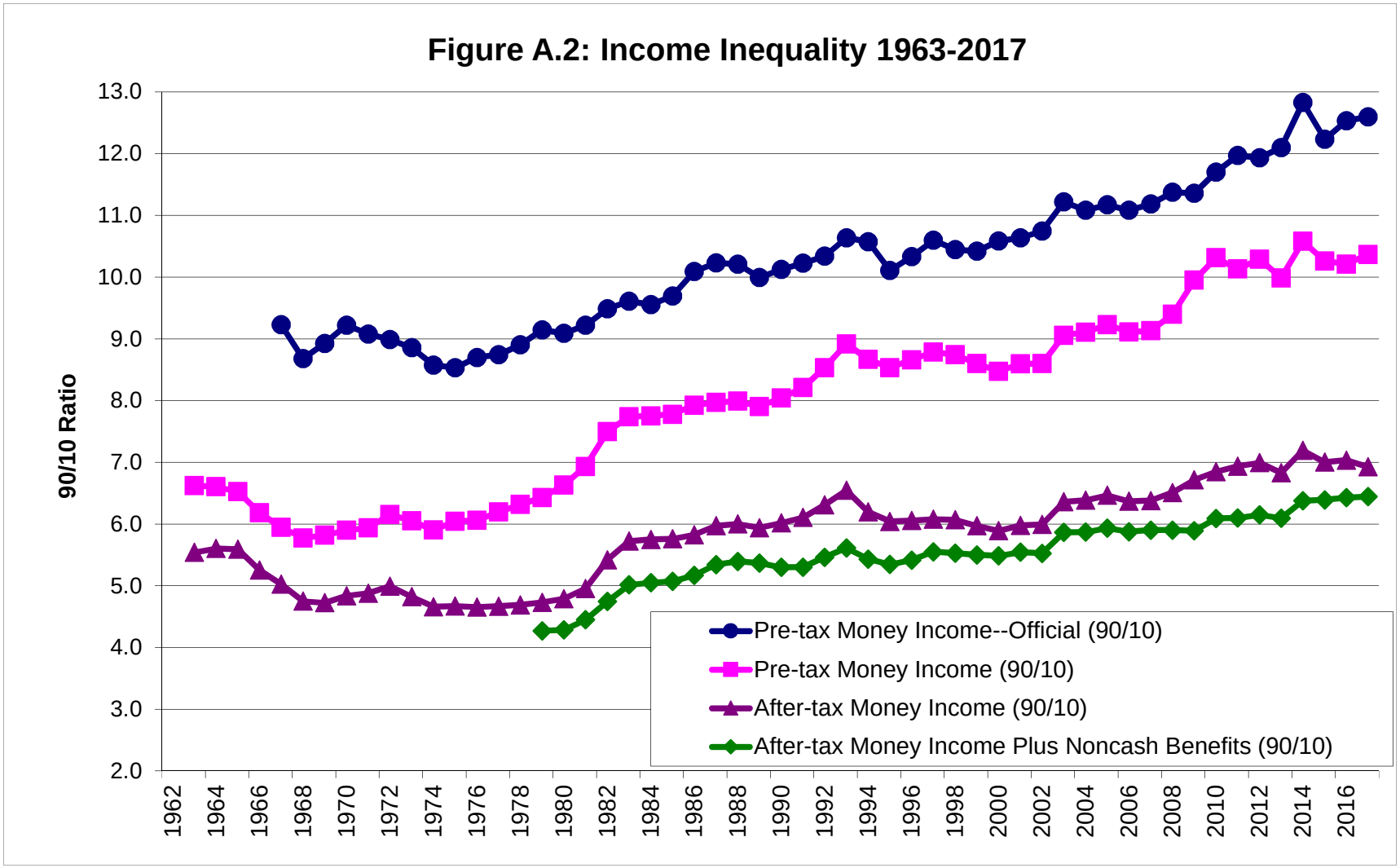
Figure A.1: CPI for All Items and Well-Measured Consumption --1980 Shares (1980=100)

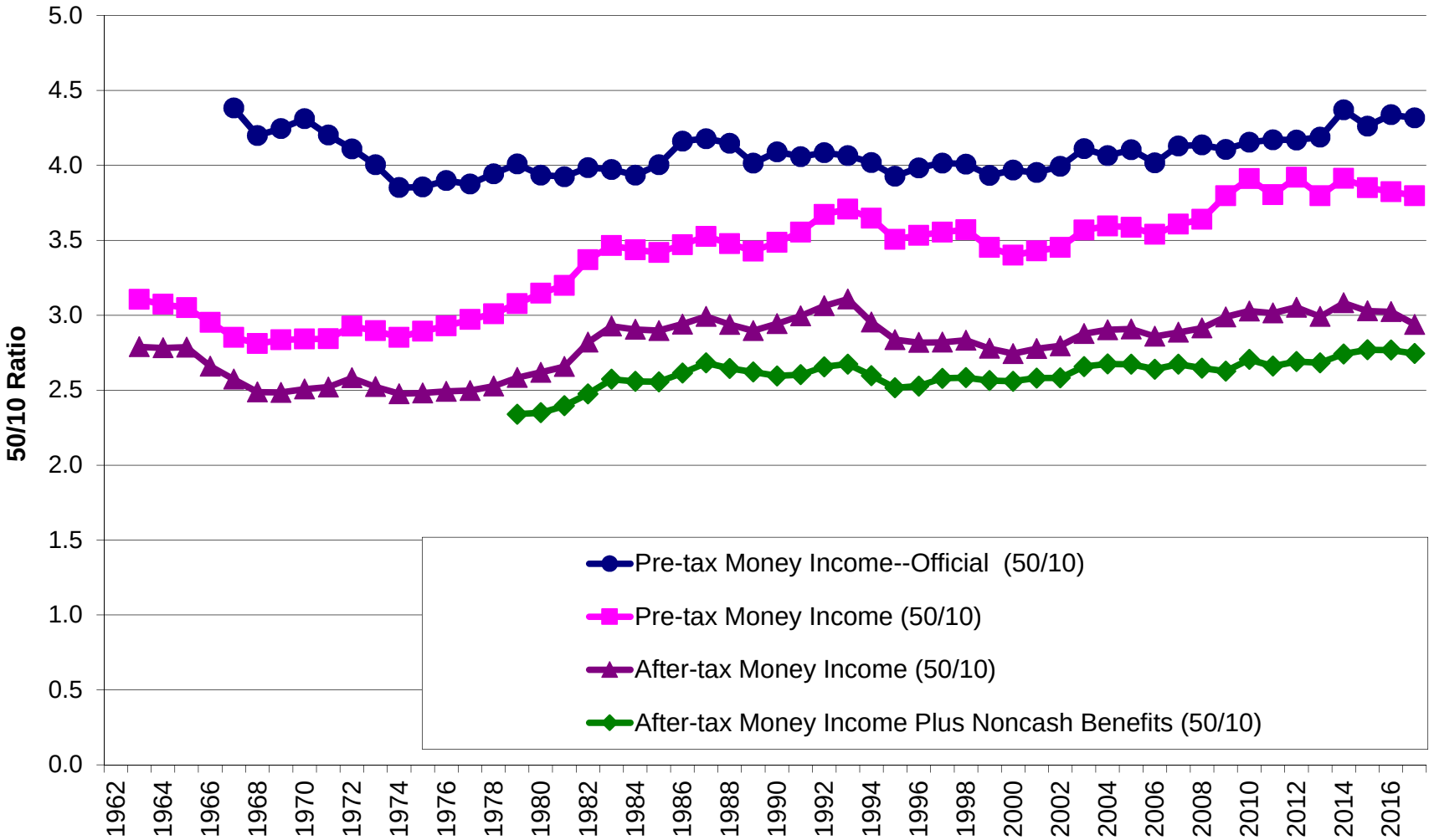


Notes: All items is the U.S. City Average for All Items. The other price indices are constructed by taking the weighted avearge of the component specific CPIs provided by the BLS using as weights the share of well-measured consumption accounted for by each component in 1980.



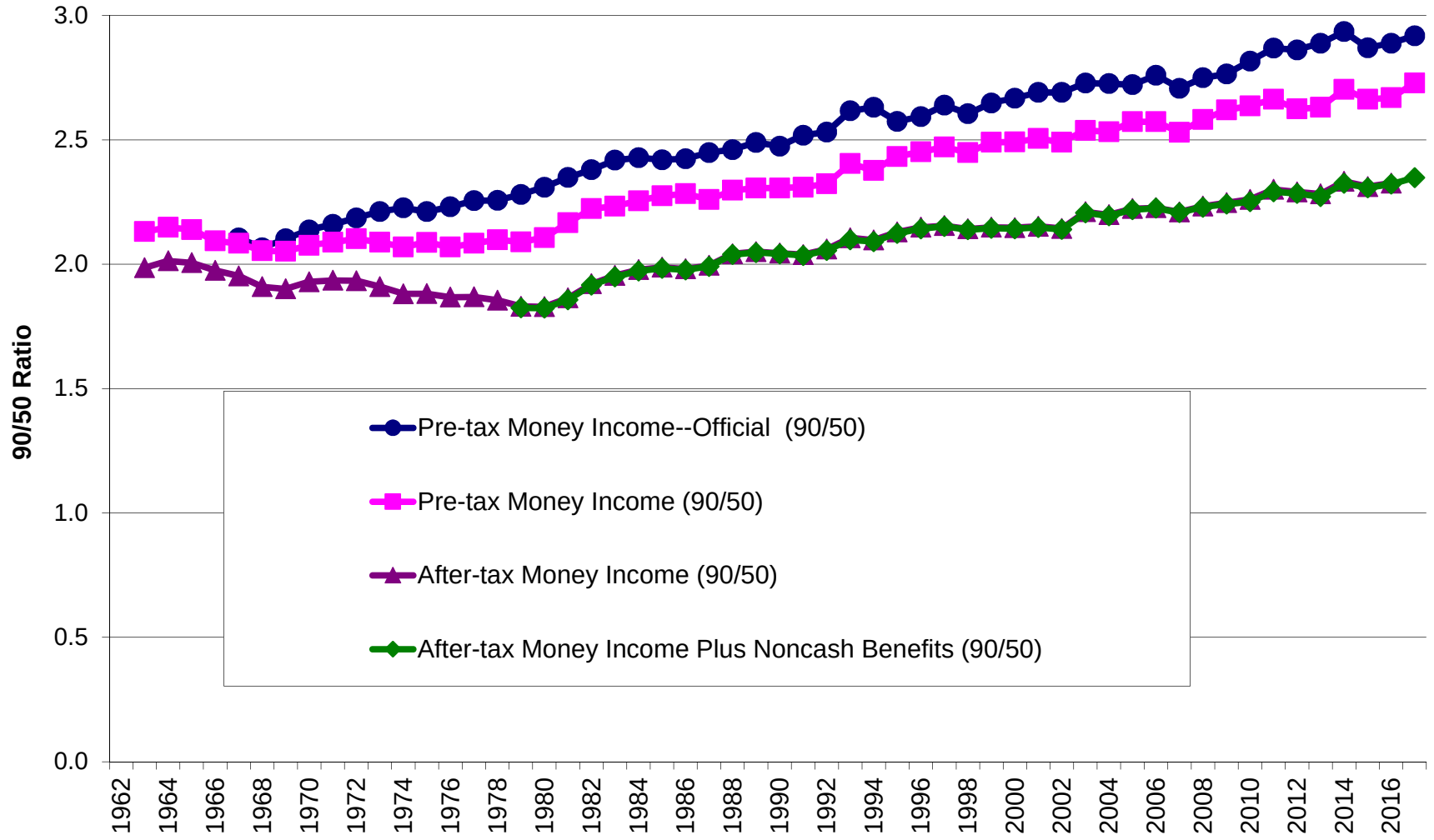
Notes: All data are from the CPS. All measures other than the official measure, are adjusted for differences in family size using the NAS recommended equivalence scale. The unit of observation for the official measure is the household, while it is the family for the other income measures. After-tax Money Income is calculated as Pre-tax Money Income plus the value of tax credits such as the EITC, less state and federal income taxes and payroll taxes. Noncash benefits include the cash value of food stamps, and the Census' imputed values of housing and school lunch subsidies.

Figure A.3: Income Inequality 1963-2017



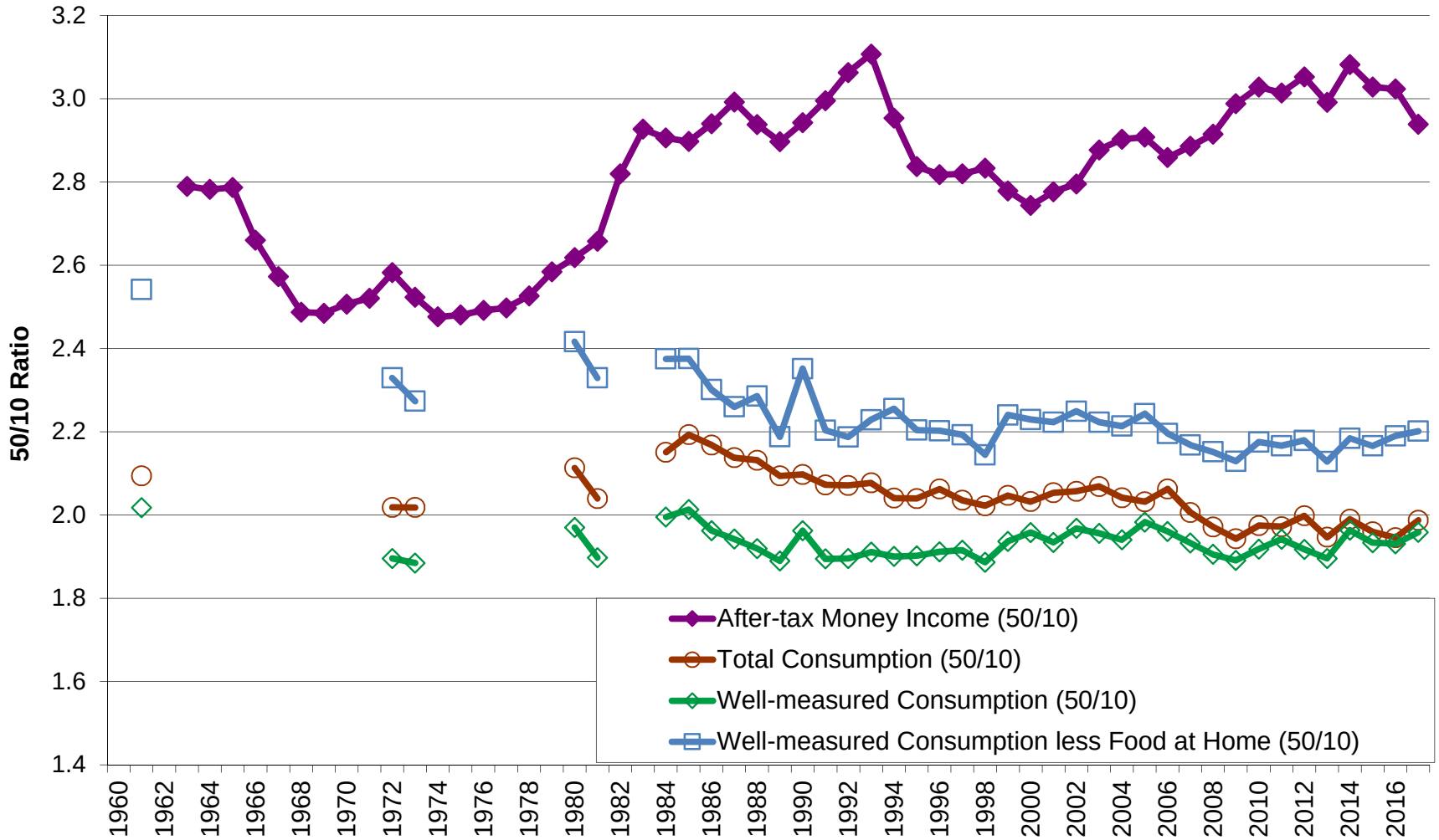
Notes: See notes to Figure A.2.

Figure A.4: Income Inequality 1963-2017



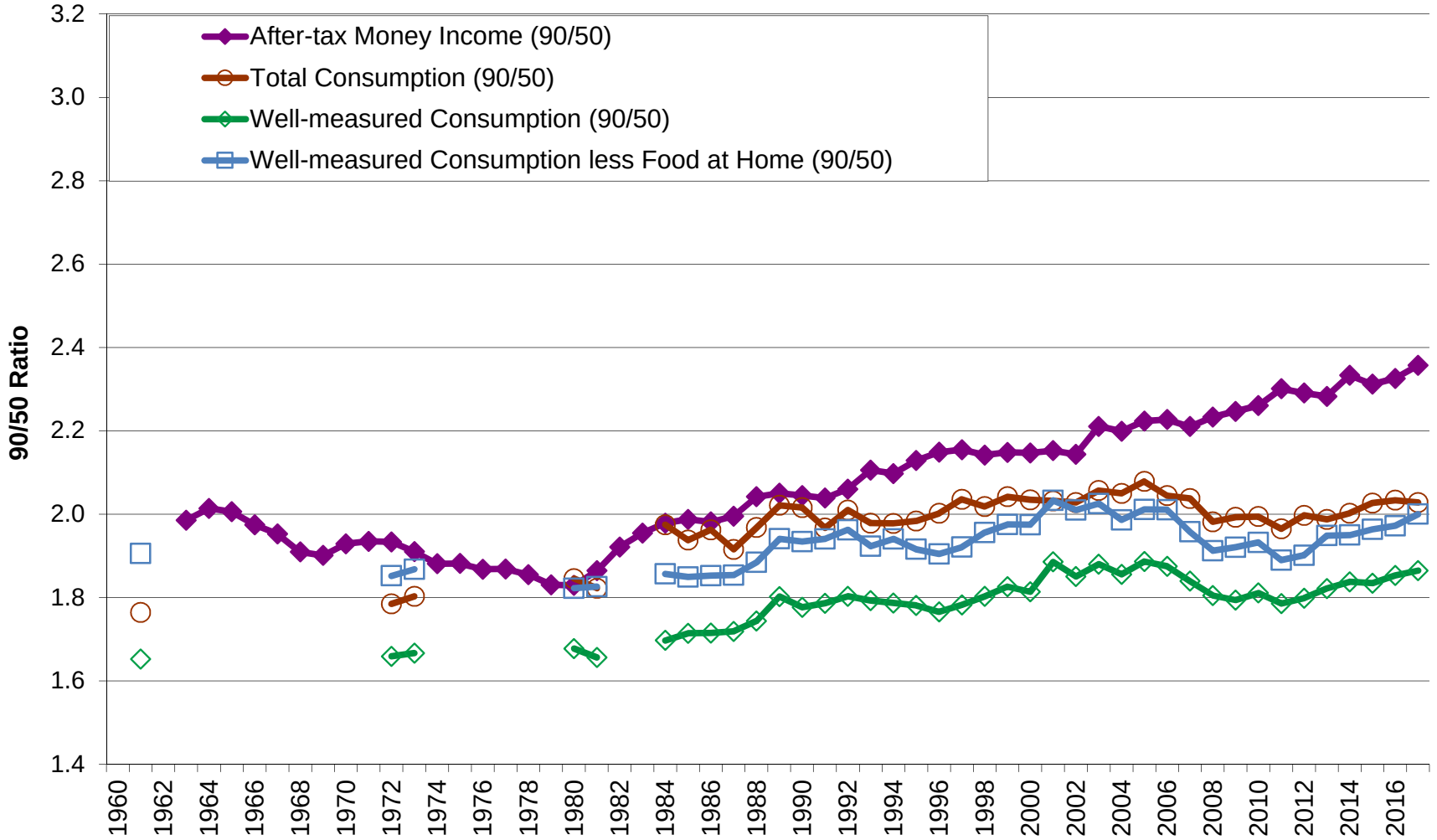
Notes: See notes to Figure A.2.

Figure A.5: Consumption Inequality 1961-2017



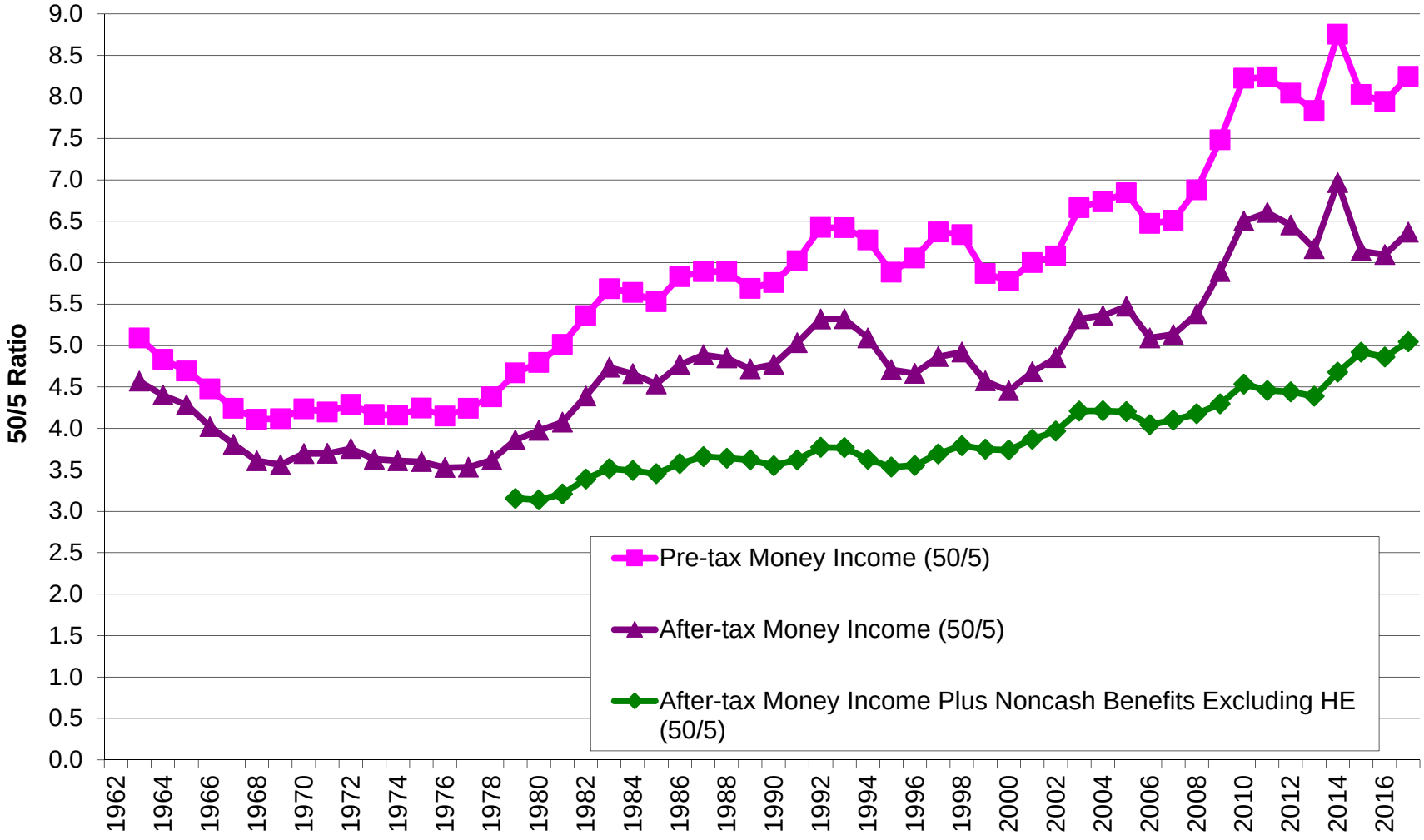
Notes: See notes to Figure 1.

Figure A.6: Consumption Inequality 1961-2017



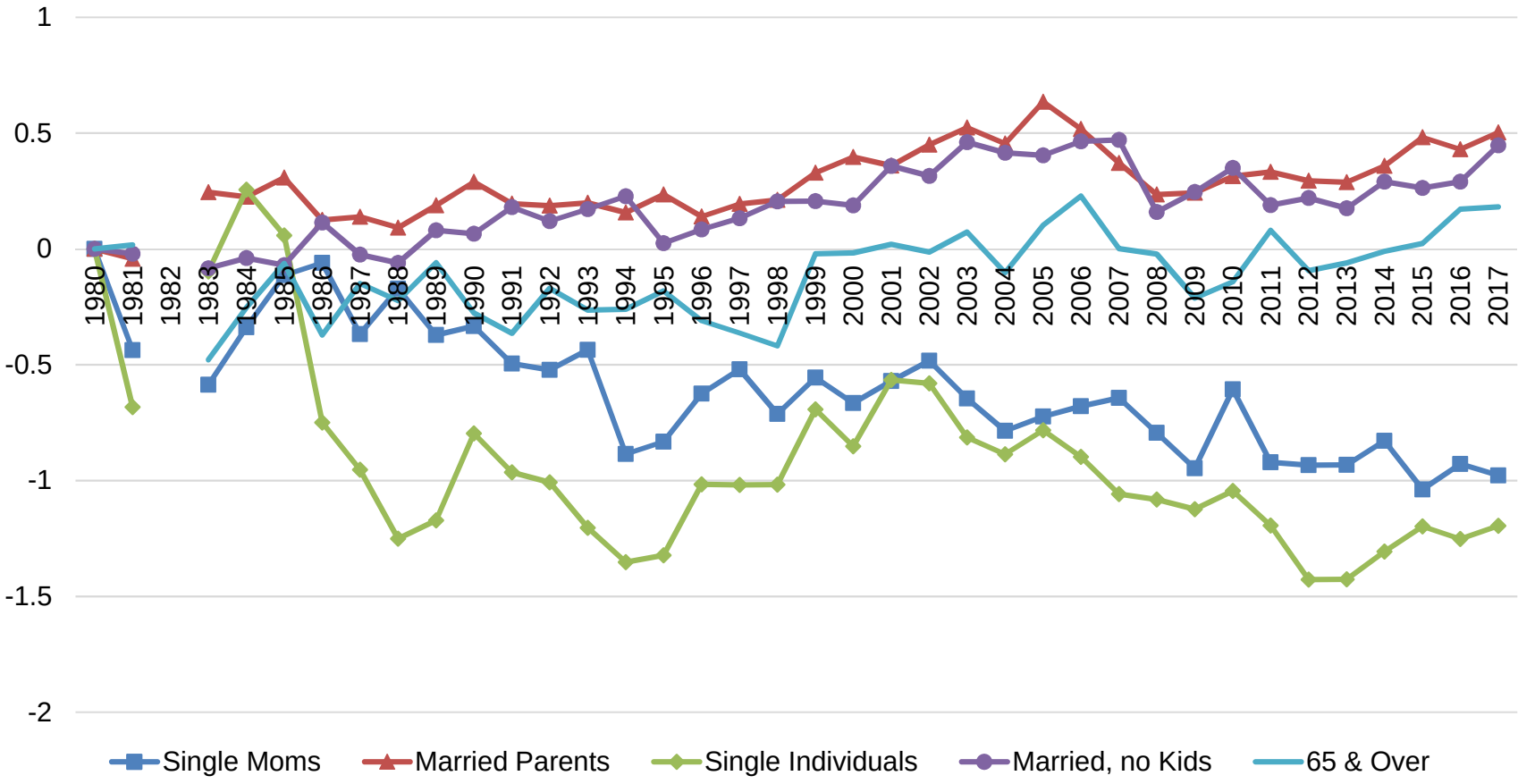
Notes: See notes to Figure 1.

Figure A.7: Income Inequality 1963-2017



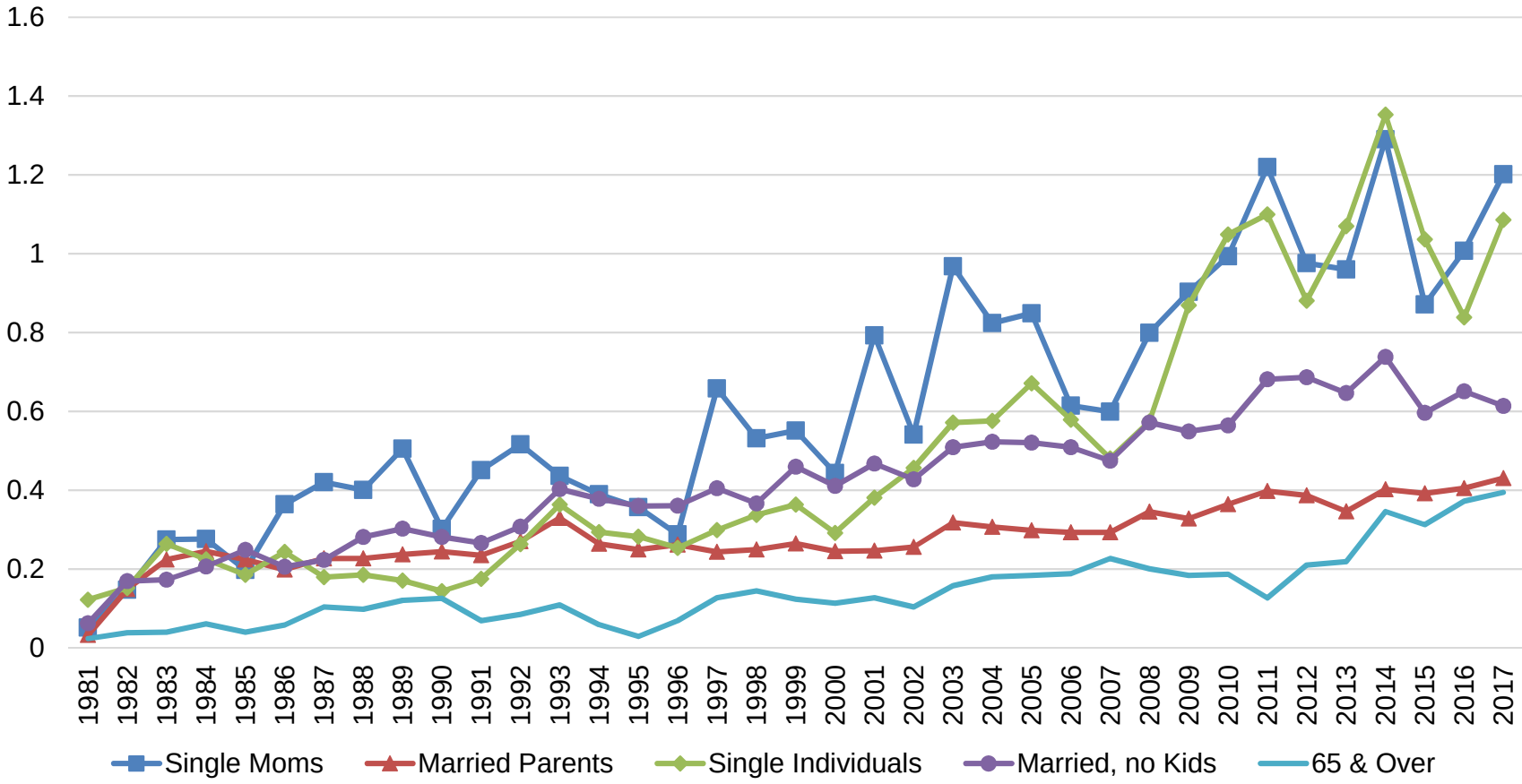
Notes: See notes to Figure A.2.

Figure A.8: Percent Change in the 90/10 Ratio of Consumption Since 1980 by Family Type



Notes: Data are for well-measured consumption using data the CE.

Figure A.9: Percent Change in the 90/10 Ratio of After-Tax Income Since 1980 by Family Type



Notes: Data are from the CPS.

Table A.1: Mean Well-measured Consumption and Total Consumption

	Well-Measured Consumption	Well-Measured Consumption Less Food at Home	Total Consumption (Cons3)	Well-Measured / Total	Well-Measured Less Food / Total
All					
1980	2,496	1,808	4,205	0.594	0.430
2017	4,174	3,400	6,485	0.644	0.524
5th-20th Percentiles of Consumption					
1980	1,400	903	2,072	0.676	0.436
2017	2,323	1,746	3,234	0.718	0.540
Second Quintile of Consumption					
1980	1,999	1,396	3,039	0.658	0.459
2017	3,195	2,504	4,600	0.695	0.544
Third Quintile of Consumption					
1980	2,523	1,836	3,988	0.633	0.460
2017	4,132	3,339	6,110	0.676	0.547
Fourth Quintile of Consumption					
1980	3,082	2,288	5,137	0.600	0.445
2017	5,265	4,366	8,060	0.653	0.542
80th-95th Percentiles of Consumption					
1980	3,848	2,914	6,985	0.551	0.417
2017	6,967	5,919	11,564	0.602	0.512

Notes: Well-measured consumption includes spending on food at home, rent (for renters), rental equivalent (for homeowners or those in government or subsidized housing), utilities, service flows from owned vehicles, and spending on gasoline and motor oil. Quintiles of consumption are for total consumption. All figures are expressed in 2017$ using the adjusted CPI-U-RS, which subtracts 1.1 percentage points from the CPI-U-RS each year from 1960 to 1977 and 0.8 percentage points each year after 1977. See Meyer and Sullivan (2012) for more details on the adjusted CPI-U-RS.

Table A.2: Mean Well-measured Consumption and Total Consumption, Sorted by Well-Measured Consumption

	Well-Measured Consumption	Well-Measured Consumption Less Food at Home	Total Consumption	Well-Measured / Total	Well-Measured Less Food / Total
All					
1980	2,496	1,808	4,205	0.594	0.430
2017	4,174	3,400	6,485	0.644	0.524
5th-20th Percentiles of Consumption					
1980	1,259	802	2,148	0.586	0.374
2017	2,187	1,625	3,311	0.661	0.491
Second Quintile of Consumption					
1980	1,888	1,309	3,171	0.595	0.413
2017	3,139	2,454	4,777	0.657	0.514
Third Quintile of Consumption					
1980	2,448	1,767	4,083	0.600	0.433
2017	4,116	3,324	6,380	0.645	0.521
Fourth Quintile of Consumption					
1980	3,099	2,302	5,171	0.599	0.445
2017	5,339	4,425	8,320	0.642	0.532
80th-95th Percentiles of Consumption					
1980	4,045	3,074	6,791	0.596	0.453
2017	7,313	6,219	11,521	0.635	0.540

Notes: Well-measured consumption includes spending on food at home, rent (for renters), rental equivalent (for homeowners or those in government or subsidized housing), utilities, service flows from owned vehicles, and spending on gasoline and motor oil. Quintiles of consumption are for well-measured consumption. All figures are expressed in 2017$ using the adjusted CPI-U-RS, which subtracts 1.1 percentage points from the CPI-U-RS each year from 1960 to 1977 and 0.8 percentage points each year after 1977. See Meyer and Sullivan (2012) for more details on the adjusted CPI-U-RS.

Appendix Table A.3: 90/10 Ratios for Consumption and Income, By Family Type, 1961-2017

	Single Parents		Married Parents		Single Individuals		Married no Children		Column 7 Plus Education	
	Consumption	Income	Consumption	Income	Consumption	Income	Consumption	Income	Consumption	Income
Year	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1960-61/1963	3.938	13.722	3.095	4.220	4.006	10.927	2.872	4.685	3.790	6.684
1972	4.129	7.069	2.845	3.640	3.667	7.840	2.715	3.777	3.662	5.663
1973	3.652	6.812	2.807	3.508	3.628	7.099	2.787	3.682	3.950	5.249
1980	4.151	7.456	2.760	3.501	5.145	5.834	2.697	3.208	3.526	4.804
1981	3.714	7.843	2.718	3.615	4.463	6.547	2.676	3.409	3.544	4.918
1982		8.554		4.022		6.723		3.751		4.989
1983		9.506		4.286		7.375		3.763		4.994
1984	3.813	9.519	2.986	4.358	5.401	7.145	2.658	3.869	3.273	5.097
1985	4.038	8.928	3.069	4.286	5.203	6.914	2.628	4.006	3.464	4.997
1986	4.091	10.174	2.886	4.196	4.396	7.255	2.812	3.867	3.155	5.085
1987	3.784	10.592	2.898	4.295	4.192	6.883	2.673	3.925	3.377	5.305
1988	3.980	10.441	2.852	4.296	3.895	6.914	2.637	4.110	3.303	5.275
1989	3.779	11.224	2.949	4.330	3.973	6.830	2.778	4.179	3.467	5.383
1990	3.819	9.704	3.050	4.357	4.349	6.672	2.764	4.110	3.250	5.409
1991	3.656	10.819	2.955	4.323	4.181	6.858	2.878	4.062	3.162	5.136
1992	3.629	11.308	2.947	4.449	4.138	7.369	2.818	4.195	3.356	5.212
1993	3.716	10.712	2.959	4.653	3.941	7.955	2.870	4.500	3.263	5.327
1994	3.267	10.365	2.918	4.424	3.793	7.549	2.925	4.421	3.267	5.088
1995	3.320	10.116	2.996	4.375	3.823	7.481	2.723	4.362	3.345	4.944
1996	3.527	9.602	2.900	4.418	4.130	7.315	2.781	4.365	3.216	5.136
1997	3.632	12.361	2.955	4.354	4.126	7.576	2.830	4.508	3.163	5.416
1998	3.439	11.423	2.972	4.374	4.128	7.803	2.903	4.383	3.108	5.498
1999	3.597	11.564	3.089	4.428	4.453	7.954	2.904	4.682	3.506	5.398
2000	3.487	10.762	3.157	4.358	4.293	7.536	2.885	4.527	3.509	5.350
2001	3.581	13.367	3.121	4.365	4.580	8.056	3.056	4.709	3.546	5.414
2002	3.669	11.489	3.210	4.397	4.565	8.500	3.013	4.580	3.513	5.304
2003	3.506	14.677	3.285	4.614	4.332	9.168	3.158	4.842	3.600	5.562
2004	3.366	13.600	3.215	4.576	4.259	9.195	3.113	4.886	3.425	5.672
2005	3.428	13.785	3.396	4.546	4.362	9.752	3.102	4.879	3.629	5.688
2006	3.473	12.039	3.278	4.526	4.248	9.212	3.162	4.842	3.755	5.708
2007	3.508	11.927	3.131	4.528	4.087	8.637	3.168	4.731	3.528	5.893
2008	3.357	13.418	2.996	4.711	4.064	9.186	2.857	5.041	3.504	5.767
2009	3.205	14.190	3.003	4.649	4.022	10.906	2.944	4.970	3.314	5.686
2010	3.545	14.865	3.075	4.776	4.101	11.954	3.047	5.018	3.385	5.701
2011	3.231	16.551	3.093	4.895	3.951	12.252	2.886	5.395	3.607	5.412
2012	3.218	14.736	3.054	4.857	3.718	10.973	2.917	5.412	3.433	5.813
2013	3.219	14.612	3.048	4.713	3.720	12.077	2.873	5.282	3.466	5.855
2014	3.323	17.076	3.119	4.909	3.839	13.727	2.988	5.577	3.516	6.466
2015	3.114	13.953	3.242	4.874	3.948	11.882	2.961	5.122	3.550	6.305
2016	3.223	14.967	3.190	4.920	3.894	10.727	2.989	5.296	3.698	6.592
2017	3.174	16.415	3.264	5.009	3.949	12.169	3.145	5.177	3.708	6.700
Change:										
1961-1972	4.84%	-48.48%	-8.08%	-13.76%	-8.48%	-28.25%	-5.46%	-19.38%	-3.37%	-15.27%
1972-1980	0.54%	5.47%	-2.99%	-3.82%	40.32%	-25.58%	-0.65%	-15.06%	-3.70%	-15.17%
1980-1990	-8.02%	30.15%	10.50%	24.45%	-15.47%	14.36%	2.45%	28.11%	-7.84%	12.59%
1990-2000	-8.69%	10.90%	3.51%	0.02%	-1.29%	12.96%	4.41%	10.14%	7.97%	-1.09%
2000-2017	-9.0%	52.53%	3.38%	14.93%	-8.01%	61.47%	8.99%	14.36%	5.67%	25.22%
2010-2017	-10.5%	10.43%	6.15%	4.87%	-3.69%	1.79%	3.19%	3.17%	9.55%	17.52%
1980-2017	-23.5%	120.16%	18.24%	43.07%	-23.24%	108.58%	16.58%	61.38%	5.16%	39.46%
1972-2017	-23.1%	132.21%	14.71%	37.61%	7.71%	55.22%	15.82%	37.07%	1.26%	18.30%

Notes: Consumption data are from the CE and income data are from the CPS. Income refers to after-tax money income as defined in Figure A.2. Consumption measure is well-measured consumption. All numbers are in 2017 $ using the adjusted CPI-U-RS; are equivalence scale adjusted and multiplied by 2.157, the value of the scale for a 2-adult, 2 child family; and are measured at the family level but are person weighted.

Appendix Table A.4: 90/50 Ratios for Consumption and Income, By Family Type, 1961-2017

	Single Parents		Married Parents		Single Individuals		Married no Children		Column 7 Plus Education	
	Consumption	Income	Consumption	Income	Consumption	Income	Consumption	Income	Consumption	Income
Year	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1960-61/1963	1.907	2.732	1.596	1.791	1.780	2.213	1.599	1.801	1.739	2.552
1972	1.841	2.485	1.585	1.739	1.797	2.069	1.585	1.749	1.791	2.370
1973	1.794	2.349	1.601	1.719	1.779	2.073	1.625	1.724	1.844	2.341
1980	1.991	2.320	1.571	1.636	1.924	1.907	1.559	1.578	1.768	2.172
1981	1.823	2.299	1.546	1.653	1.838	1.943	1.588	1.626	1.797	2.212
1982		2.531		1.731		1.960		1.680		2.190
1983		2.549		1.766		2.019		1.705		2.175
1984	1.968	2.575	1.622	1.786	1.848	2.044	1.590	1.716	1.737	2.218
1985	1.867	2.520	1.648	1.797	1.878	2.024	1.564	1.753	1.785	2.181
1986	1.902	2.630	1.623	1.799	1.857	1.988	1.641	1.724	1.718	2.159
1987	1.861	2.698	1.633	1.798	1.872	2.035	1.604	1.722	1.759	2.194
1988	1.970	2.580	1.607	1.836	1.877	2.052	1.582	1.762	1.744	2.273
1989	1.767	2.571	1.707	1.837	1.891	2.043	1.694	1.813	1.889	2.296
1990	1.849	2.470	1.690	1.863	1.892	2.017	1.657	1.791	1.775	2.245
1991	1.956	2.626	1.686	1.834	1.820	2.050	1.713	1.813	1.753	2.205
1992	1.852	2.552	1.705	1.855	1.894	2.059	1.714	1.792	1.765	2.203
1993	1.867	2.493	1.688	1.909	1.872	2.098	1.688	1.834	1.770	2.299
1994	1.757	2.438	1.672	1.890	1.784	2.134	1.652	1.847	1.758	2.257
1995	1.778	2.292	1.700	1.931	1.759	2.168	1.625	1.871	1.804	2.216
1996	1.876	2.251	1.672	1.938	1.837	2.165	1.637	1.859	1.763	2.248
1997	1.848	2.316	1.693	1.953	1.822	2.171	1.707	1.903	1.726	2.331
1998	1.802	2.244	1.731	1.923	1.872	2.131	1.668	1.914	1.720	2.342
1999	1.857	2.319	1.735	1.953	1.914	2.173	1.704	1.926	1.844	2.334
2000	1.853	2.206	1.747	1.946	1.893	2.189	1.705	1.917	1.816	2.316
2001	1.856	2.178	1.766	1.949	1.973	2.202	1.753	1.950	1.879	2.354
2002	1.881	2.091	1.764	1.939	2.016	2.187	1.727	1.932	1.870	2.287
2003	1.919	2.174	1.792	2.002	1.956	2.256	1.749	1.939	1.863	2.408
2004	1.830	2.236	1.748	2.006	1.954	2.233	1.758	1.950	1.842	2.429
2005	1.781	2.215	1.805	2.015	1.956	2.277	1.743	2.010	1.848	2.424
2006	1.789	2.209	1.776	2.019	1.999	2.264	1.773	2.013	1.894	2.440
2007	1.837	2.235	1.745	1.959	1.868	2.203	1.736	1.996	1.864	2.493
2008	1.783	2.223	1.710	2.030	1.920	2.253	1.670	2.002	1.785	2.410
2009	1.761	2.221	1.710	2.036	1.849	2.363	1.694	2.000	1.795	2.383
2010	1.841	2.211	1.716	2.041	1.858	2.335	1.747	1.993	1.759	2.380
2011	1.780	2.195	1.705	2.081	1.856	2.365	1.672	2.043	1.789	2.323
2012	1.800	2.246	1.698	2.053	1.858	2.365	1.636	2.031	1.785	2.419
2013	1.799	2.317	1.720	2.095	1.862	2.421	1.691	2.049	1.808	2.323
2014	1.772	2.234	1.741	2.117	1.860	2.361	1.693	2.059	1.779	2.456
2015	1.765	2.271	1.779	2.090	1.889	2.356	1.712	2.017	1.819	2.416
2016	1.772	2.246	1.766	2.117	1.904	2.326	1.740	2.098	1.915	2.438
2017	1.748	2.285	1.791	2.160	1.865	2.411	1.736	2.048	1.895	2.477
Change:										
1961-1972	-3.47%	-9.03%	-0.67%	-2.92%	0.99%	-6.49%	-0.89%	-2.91%	3.03%	-7.12%
1972-1980	8.13%	-6.64%	-0.92%	-5.92%	7.09%	-7.83%	-1.63%	-9.73%	-1.29%	-8.34%
1980-1990	-1.74%	6.47%	7.61%	13.86%	-1.66%	5.77%	6.31%	13.46%	0.39%	3.37%
1990-2000	-5.09%	-10.69%	3.36%	4.48%	0.02%	8.54%	2.90%	7.03%	2.32%	3.15%
2000-2017	-5.8%	4.91%	1.37%	10.83%	-5.51%	9.45%	-0.98%	5.01%	0.81%	5.23%
2010-2017	-1.8%	4.10%	5.03%	3.81%	0.45%	1.93%	3.84%	0.21%	5.92%	6.62%
1980-2017	-12.2%	-1.49%	13.99%	32.05%	-3.10%	26.40%	11.34%	29.73%	7.15%	14.02%
1972-2017	-5.1%	-8.03%	12.94%	24.23%	3.77%	16.51%	9.53%	17.11%	5.77%	4.51%

Notes: See notes to Table A3.

Appendix Table A.5: 50/10 Ratios for Consumption and Income, By Family Type, 1961-2017

	Single Parents		Married Parents		Single Individuals		Married no Children		Column 7 Plus Education	
	Consumption	Income	Consumption	Income	Consumption	Income	Consumption	Income	Consumption	Income
Year	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1960-61/1963	2.065	2.732	1.939	1.791	2.251	2.213	1.796	1.801	2.180	2.552
1972	2.243	2.485	1.795	1.739	2.040	2.069	1.713	1.749	2.044	2.370
1973	2.036	2.349	1.754	1.719	2.040	2.073	1.715	1.724	2.142	2.341
1980	2.086	2.320	1.757	1.636	2.674	1.907	1.730	1.578	1.994	2.172
1981	2.037	2.299	1.758	1.653	2.428	1.943	1.685	1.626	1.972	2.212
1982		2.531		1.731		1.960		1.680		2.190
1983		2.549		1.766		2.019		1.705		2.175
1984	1.938	2.575	1.841	1.786	2.923	2.044	1.672	1.716	1.885	2.218
1985	2.162	2.520	1.862	1.797	2.770	2.024	1.680	1.753	1.940	2.181
1986	2.151	2.630	1.778	1.799	2.368	1.988	1.713	1.724	1.836	2.159
1987	2.033	2.698	1.775	1.798	2.239	2.035	1.666	1.722	1.920	2.194
1988	2.021	2.580	1.774	1.836	2.075	2.052	1.667	1.762	1.894	2.273
1989	2.138	2.571	1.727	1.837	2.101	2.043	1.640	1.813	1.835	2.296
1990	2.065	2.470	1.804	1.863	2.298	2.017	1.668	1.791	1.831	2.245
1991	1.869	2.626	1.753	1.834	2.297	2.050	1.680	1.813	1.803	2.205
1992	1.959	2.552	1.729	1.855	2.184	2.059	1.645	1.792	1.901	2.203
1993	1.990	2.493	1.753	1.909	2.105	2.098	1.700	1.834	1.843	2.299
1994	1.859	2.438	1.745	1.890	2.126	2.134	1.771	1.847	1.858	2.257
1995	1.867	2.292	1.762	1.931	2.173	2.168	1.676	1.871	1.854	2.216
1996	1.880	2.251	1.734	1.938	2.248	2.165	1.699	1.859	1.825	2.248
1997	1.966	2.316	1.746	1.953	2.265	2.171	1.658	1.903	1.832	2.331
1998	1.908	2.244	1.717	1.923	2.204	2.131	1.740	1.914	1.806	2.342
1999	1.936	2.319	1.780	1.953	2.327	2.173	1.704	1.926	1.902	2.334
2000	1.882	2.206	1.807	1.946	2.268	2.189	1.692	1.917	1.932	2.316
2001	1.929	2.178	1.767	1.949	2.321	2.202	1.743	1.950	1.887	2.354
2002	1.950	2.091	1.819	1.939	2.264	2.187	1.744	1.932	1.878	2.287
2003	1.827	2.174	1.834	2.002	2.215	2.256	1.805	1.939	1.933	2.408
2004	1.839	2.236	1.840	2.006	2.180	2.233	1.771	1.950	1.859	2.429
2005	1.925	2.215	1.881	2.015	2.230	2.277	1.780	2.010	1.964	2.424
2006	1.942	2.209	1.846	2.019	2.125	2.264	1.783	2.013	1.983	2.440
2007	1.910	2.235	1.795	1.959	2.188	2.203	1.825	1.996	1.892	2.493
2008	1.883	2.223	1.752	2.030	2.117	2.253	1.711	2.002	1.964	2.410
2009	1.820	2.221	1.756	2.036	2.175	2.363	1.738	2.000	1.846	2.383
2010	1.926	2.211	1.792	2.041	2.207	2.335	1.745	1.993	1.925	2.380
2011	1.816	2.195	1.815	2.081	2.128	2.365	1.727	2.043	2.017	2.323
2012	1.788	2.246	1.799	2.053	2.001	2.365	1.783	2.031	1.923	2.419
2013	1.789	2.317	1.772	2.095	1.997	2.421	1.699	2.049	1.917	2.323
2014	1.875	2.234	1.792	2.117	2.064	2.361	1.765	2.059	1.976	2.456
2015	1.764	2.271	1.822	2.090	2.090	2.356	1.730	2.017	1.952	2.416
2016	1.819	2.246	1.806	2.117	2.045	2.326	1.717	2.098	1.931	2.438
2017	1.816	2.285	1.823	2.160	2.118	2.411	1.812	2.048	1.957	2.477
Change:										
1961-1972	8.62%	-9.03%	-7.46%	-2.92%	-9.37%	-6.49%	-4.61%	-2.91%	-6.22%	-7.12%
1972-1980	-7.01%	-6.64%	-2.08%	-5.92%	31.03%	-7.83%	1.00%	-9.73%	-2.44%	-8.34%
1980-1990	-10.36%	6.47%	2.69%	13.86%	-14.04%	5.77%	-3.63%	13.46%	-8.20%	3.37%
1990-2000	3.21%	-10.69%	0.14%	4.48%	-1.31%	8.54%	1.47%	7.03%	5.53%	3.15%
2000-2017	-5.9%	4.91%	3.18%	10.83%	-8.74%	9.45%	3.94%	5.01%	3.73%	5.23%
2010-2017	0.0%	4.10%	0.45%	3.81%	-0.48%	1.93%	4.92%	0.21%	-2.96%	6.62%
1980-2017	-12.9%	-1.49%	3.73%	32.05%	-20.78%	26.40%	4.70%	29.73%	-1.86%	14.02%
1972-2017	-19.0%	-8.03%	1.57%	24.23%	3.80%	16.51%	5.75%	17.11%	-4.26%	4.51%

Notes: See notes to Table A.3.

Table A.6: Characteristics of Expenditure Categories in the Consumer Expenditure Survey as Defined in Aguiar and Bils (2015)

	Share	Elasticity	Reporting Rate		Fraction Zero		Coeff of Variation	
Spending Category	2010	2010	1986	2010	1980	2010	1980	2010
Housing[1]	27.3	0.92	1.052	1.022	0.004	0.001	0.460	0.592
Food at Home	11.7	0.37	0.790	0.862	0.000	0.000	0.502	0.478
Vehicle Purchasing, Leasing, and Insurance	13.2	1.02	1.150	0.961	0.052	0.047	1.601	1.854
All other Public Transportation[2]	7.4	0.89	1.060	0.780	0.001	0.003	0.623	0.681
Utilities[1]	5.2	0.47	1.052	1.022	0.042	0.015	0.574	0.510
Health Expenditures including Insurance	5.0	0.91	-	-	0.036	0.077	1.059	1.079
Appliances, Phones, Computers with Associated Services	4.9	0.87	0.950	0.800	0.003	0.003	0.720	0.622
Food Away from Home[3]	4.6	1.33	0.650	0.529	0.017	0.034	0.982	0.938
Entertainment Equipment and Subscription Television[4]	4.1	1.26	0.756	0.781	0.032	0.018	1.560	1.050
Men's and Women's Clothing[5]	2.6	1.35	0.567	0.317	0.017	0.097	0.941	1.276
Entertainment Fees, Admissions, Reading	2.2	1.74	-	-	0.012	0.130	0.966	1.629
Cash Contributions (Not for Alimony/Support)	2.2	1.81	-	-	0.298	0.242	2.171	2.528
Furniture and Fixtures	1.5	1.39	0.770	0.440	0.168	0.334	1.692	2.635
Education	1.3	1.63	-	-	0.567	0.617	3.000	3.836
Shoes and other Apparel[6]	1.5	1.09	0.490	0.300	0.016	0.116	1.055	2.174
Domestic Services and Childcare	1.5	1.6	-	-	0.433	0.444	2.420	2.799
Alcoholic Beverages[3]	1.0	1.14	0.340	0.220	0.180	0.346	1.367	1.803
Children's Clothing (up to age 15)[5]	1.0	0.67	0.567	0.317	0.247	0.405	1.443	1.653
Personal Care	1.0	0.96	-	-	0.074	0.141	0.904	1.178
Tobacco, other Smoking	1.0	-0.26	0.670	0.460	0.374	0.711	1.174	2.376

Notes: Shares and elasticities are from Table 2 of Aguiar and Bils (2015). The elasticities are from Specification (I) in Table 2, which are calculated using annual household expenditures. The reporting rates, which are from Bee, Meyer, and Sullivan (2015), are calculated as the weighted sum of all expenditures in a category in the CE divided by the aggregate Personal Consumption Expenditure total for that category. Some adjustments are made for cases where expenditure categories do not align as noted below. The other statistics are based on the authors' calculations using the data from Aguiar and Bils (2015).

[1] PCE aggregates combine rent and utilities, so for the categories Housing and Utilities from Aguiar and Bils (2015) reported above we report the weighted average of the reporting rates for the categories: "Rent and utilities" and the "Imputed rental of owner-occupied nonfarm housing"

[2] This is the reporting rate for "gasoline and motor oil".

[3] This is the reporting rate for "off premises consumption" (i.e. alcohol consumed at home), while the Alcoholic Beverages category used in Aguiar and Bils (2015) includes both on premise and off premise consumption.

[4] This is the weighted average of the reporting rates for the following categories in Bee, Meyer and Sullivan (2015): "Televisions" and "Cable and satellite television and radio services".

[5] Bee, Meyer and Sullivan (2015) distinguishes between male and female clothing expenditures, while Aguiar and Bils (2015) distinguishes between adult and child expenditures. For the reporting rate, we use the weighted average of clothing for both.

[6] The PCE category used to calculate the reporting rate is "shoes and other footwear."

Table A.7: Debts and Assets for Households in the Bottom Income Quintile by Year, Survey of Consumer Finances, 1989-2016 (2016 $)

	1989	1992	1995	1998	2001	2004	2007	2010	2013	2016
Credit Card Debt										
Mean	$148	$499	$741	$755	$859	$998	$1,009	$963	$603	$624
Median	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
75th percentile	$0	$0	$110	$0	$298	$254	$12	$0	$0	$150
90th percentile	$355	$1,006	$1,723	$1,800	$2,574	$2,416	$1,494	$1,658	$1,031	$1,450
All Debt Used to Purchase Goods and Services										
Mean	$271	$671	$903	$1,027	$1,069	$1,548	$1,875	$2,301	$1,036	$1,284
Median	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
75th percentile	$37	$201	$313	$221	$434	$534	$232	$343	$0	$300
90th percentile	$952	$1,677	$2,036	$2,508	$2,981	$2,925	$2,420	$3,316	$1,856	$2,500
Payday Loans										
Had a payday loan in past year	N/A	N/A	N/A	N/A	N/A	N/A	3.0%	5.0%	5.0%	4.0%
Liquid Assets										
Mean	$3,588	$3,373	$4,035	$3,939	$4,942	$5,097	$4,739	$6,372	$4,888	$4,430
Median	$93	$168	$219	$295	$406	$293	$347	$254	$309	$540
75th percentile	$1,175	$1,593	$1,615	$1,992	$2,303	$1,908	$1,969	$1,713	$1,650	$1,540
90th percentile	$5,598	$6,708	$7,047	$7,377	$10,839	$6,613	$12,738	$8,401	$6,805	$6,100

Notes: Liquid assets includes the total amount from checking, savings, money market, call and prepaid accounts. Dollar figures are adjusted for inflation using the CPI-U-RS, and expressed in 2016 dollars.