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Income Polarization in the United States

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Western Hemisphere Department

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Abstract

The paper uses a combination of micro-level datasets to document the rise of income polarization—what some have referred to as the "hollowing out" of the income distribution—in the United States, since the 1970s. While in the initial decades more middle-income households moved up, rather than down, the income ladder, since the turn of the current century, most of polarization has been towards lower incomes. This result is striking and in contrast with findings of other recent contributions. In addition, the paper finds evidence that, after conditioning on income and household characteristics, the marginal propensity to consume from permanent changes in income has somewhat fallen in recent years. We assess the potential impacts of these trends on private consumption. During 1998-2013, the rise in income polarization and lower marginal propensity to consume have suppressed the level of real consumption at the aggregate level, by about 3½ percent—equivalent to more than one year of consumption.

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I. INTRODUCTION

Much attention has been given to the rise in income[2] inequality in the U.S. over the last four decades. Since the 1970s, the real incomes of households in the low to middle income brackets have stagnated (Figure 1). In contrast, real incomes of households in the highest brackets rose sharply during 1970–2000, though have not changed considerably since 2000. The divergence between long-term growth rates of incomes in the lower and higher brackets has spurred a large literature, which has documented the trends in income and wage inequality.[3] Explanations have pointed to technological progress, declining unionization, taxation, international trade, education, immigration, household structure, and demographics.[4] A literature has also developed to draw out the macroeconomic implications of rising income inequality.[5]

Figure 1. Average Scaled Household Income, 1970-2014 (thousand 2005 USD) /1
Low Income: Households with less than 50 percent of median income
Middle Income: Households with 50-150 percent of median income
High Income: Households with more than 150 percent of median income
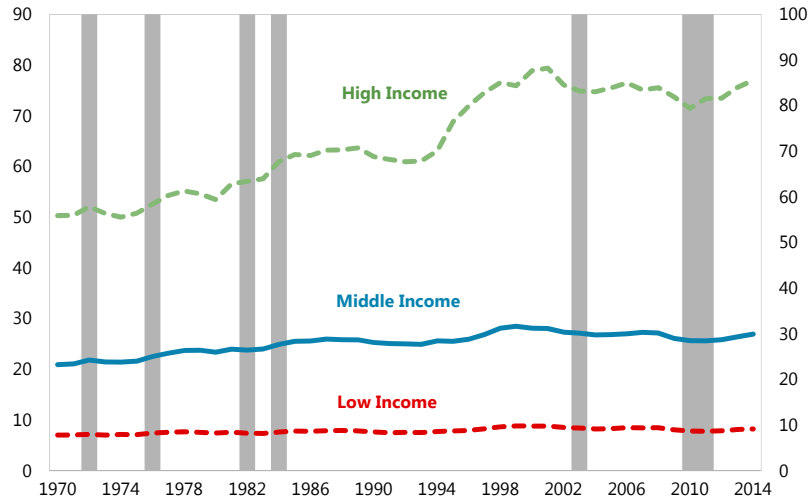
Source: Current Population Survey.
1/ Household Income is divided by its size using OECD's equivalence scale. See footnote 6 for details.

We add to this literature by focusing on income polarization. A more polarized income distribution is one that has relatively fewer middle-income and more low- and/or high-income households. Rising income polarization also relates to the oft-used phrase "hollowing out" of the middle class. In this paper, we document the rise in income polarization in the U.S. since the 1970s and explore its potential macroeconomic impact on aggregate consumption. Investigating the root causes of the rising income polarization is beyond the scope of this paper, but one could

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[2] Throughout the paper, income is defined as the household's final disposable income, including salaries, wages, interest, etc., after taxes and transfers.

[3] See Heathcote et al (2010a) for an overview of trends in income and wage inequality.

[4] See Autor et al (2008) for an overview of some of the explanations for rising wage inequality.

[5] E.g., Heathcote et al (2010b).

imagine, the aforementioned causes for the rising income inequality could also be candidate explanations for polarization.

A. Rising income polarization

Figure 2 shows that the population share of households whose incomes are within 50 to 150 percent of the median income—a proxy for the middle class—has shrunk from about 58 percent of total in 1970, to 47 percent in 2014. Such a shift, in part, represents economic progress, because roughly half of these households have been able to advance up through the income distribution, but the other half have moved down. Looking at the long trends, however, masks the deteriorating trends since the turn of the current century. While during 1970-2000, more of the middle-income households moved into high- rather than low-income ranks, since 2000, only a quarter of one percent of households have moved up to high income ranks, compared to an astonishing 3¼ percent of households who have moved down the income ladder (from middle to low income ranks.)

Figure 2. Number of Households, 1970-2014 (percent of total) /1
Low Income: Households with less than 50 percent of median income
Middle Income: Households with 50-150 percent of median income
High Income: Households with more than 150 percent of median income
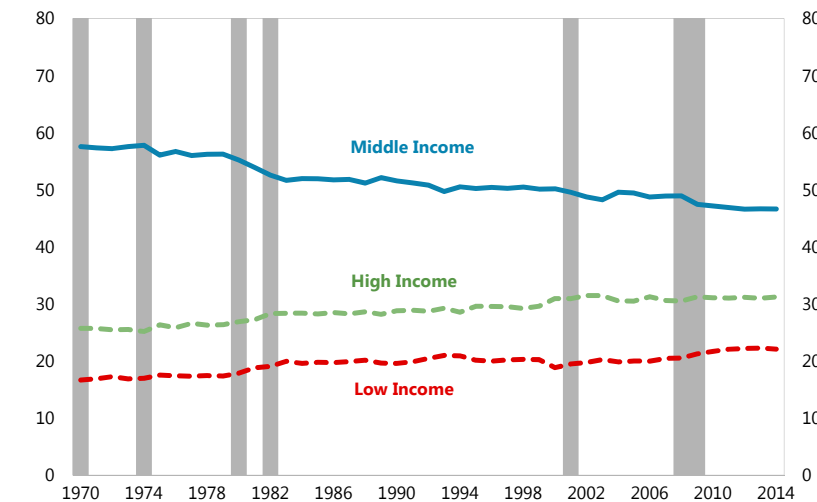
Source: Current Population Survey.
1/ Income is adjusted for household size using OECD's equivalence scale. See footnote 6 for details.

The hollowing out of the middle-income class is robust to different reasonable cut-offs of what defines the middle-income class. Figure 3 shows two examples of alternative definitions for the middle-income class, one consisting of households with 60-225 percent of median income, and another one consisting of households with 75-125 percent of median income. For both of these alternative definitions, the resulting polarization trends come out qualitatively similar to those from our analysis with the baseline definition of the middle-income class.

Figure 3. Number of Households; Alternative Middle-income Definitions 1970-2014
(percent of total) /1
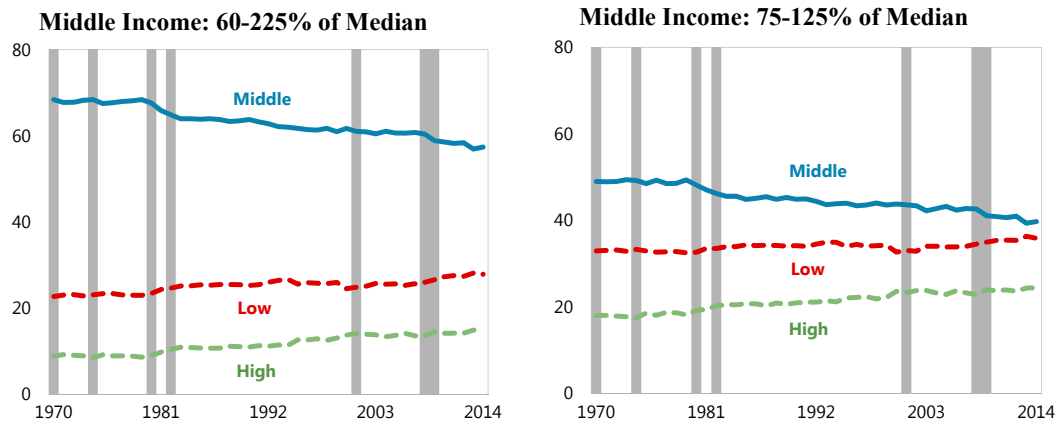
1/ Income is adjusted for household size, using OECD's equivalence scale. See footnote 6 for details.

Source: Current Population Survey.

Notice that all the income series used for Figures 2 and 3 are adjusted for household size, using OECD's equivalence scale.[6] Adjustment for household size is a norm in the literature based on the notion that there are economies of scale for household expenditures, e.g., the rental value of a two-bedroom apartment, ceteris paribus, is normally less than double the rental value of a one-bedroom apartment. Nonetheless, we also examined the series without adjustment for household size (not reported) and confirmed a similar qualitative general result that polarization has increased notably over the past four decades and most of polarization since the turn of the current century has been into the low-income class.

In addition, the hollowing out result is robust to which deflator is used to calculate the real series from nominal. While we have used the consumer price index (CPI), using the personal consumption expenditure (PCE) deflator instead, would not qualitatively change the result.

B.   Income polarization for different demographic groups

Income polarization has risen for households across characteristics, as shown in Figure 4. Across age cohorts, levels of education, and household head races[7], the share of middle-income households has decreased. However, polarization has somewhat decreased for households with female heads.[8]

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[6] This methodology assigns a value of 1 to the first household member, 0.7 to each additional adult, and 0.5 to each child.

[7] Data for only black and white races are available for the long sample.

[8] This last observation is interesting to study in future work.

Figure 4. Middle-Income Population 1970-2014 (percent of total population with the same characteristic) /1
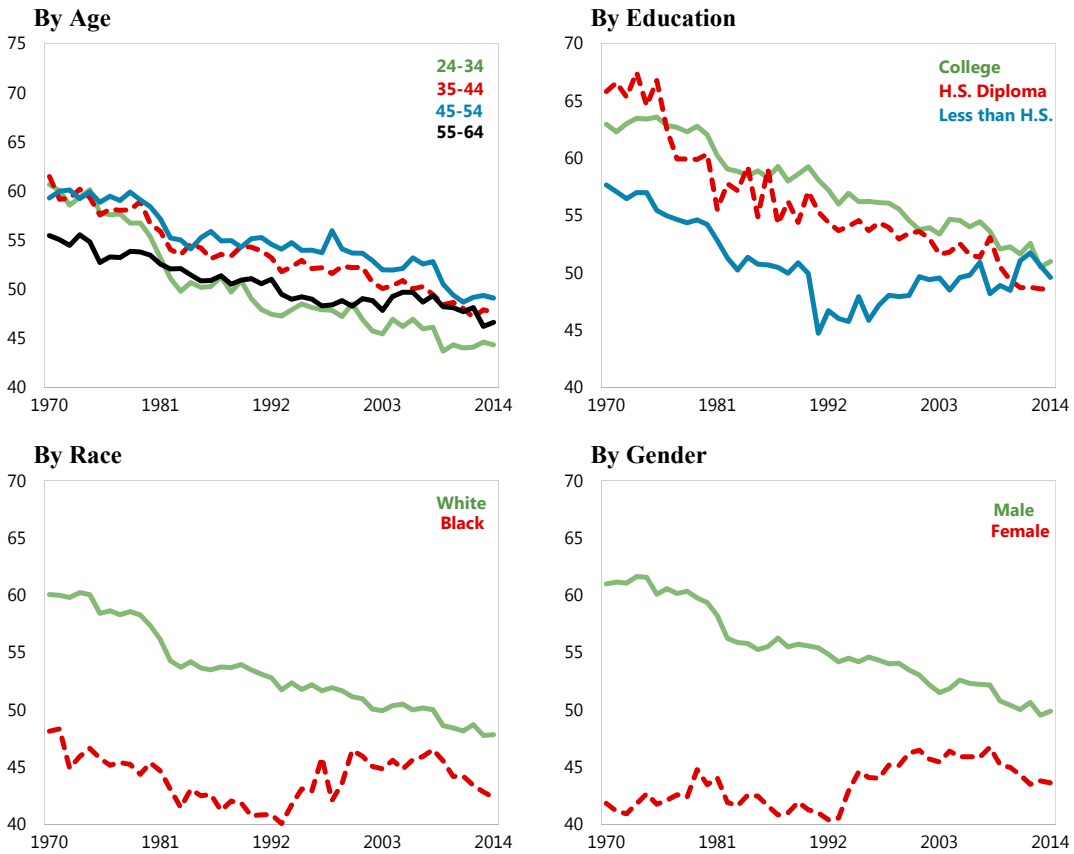
By Age

By Education

By Race

By Gender

1/ Income is adjusted for household size, using OECD's equivalence scale. See footnote 6 for details.

Source: Current Population Survey.

C. Combined trends of polarization and inequality

Polarization trends show distributional changes of the households across different income brackets, but not the evolution of their incomes. On the other hand, inequality trends show the evolution of incomes, but not distributional changes of households. One can combine these two trends by calculating income shares of each bracket. Income share could be interpreted as an important indicator of the economic power of each income bracket in the society. Figure 5 shows that income shares of the middle- and high-income classes were broadly similar at levels slightly shy of 50 percent of total until late 1970s. Since then, however, these shares have been diverging. Currently, the high-income class holds about 60 percent of total income, while the middle-income class holds only about 35 percent. The income share of the low-income class has been stable at about 5 percent of total for the entire sample of 1970-2014.

Figure 5. Income Shares, 1970-2014 (percent of total) /1
Low Income: Households with less than 50 percent of median income
Middle Income: Households with 50-150 percent of median income
High Income: Households with more than 150 percent of median income

Source: Current Population Survey.
1/ Income is adjusted for household size using OECD's equivalence scale. See footnote 6 for details.

Our work is not the first to document income polarization in the U.S., though the polarization literature is still very thin, when compared to other well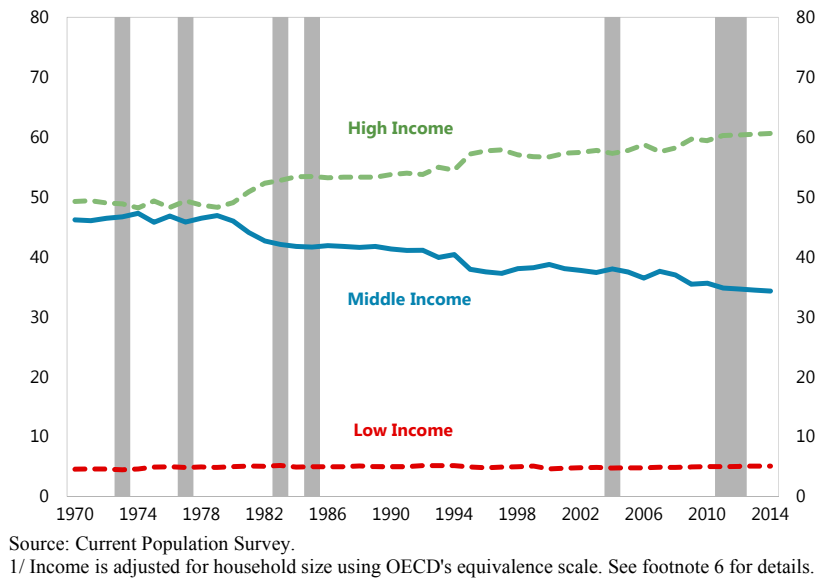-developed literatures such as that of income inequality. Foster and Wolfson (2010) have reviewed the earlier literature and Rose (2016) has reviewed the most recent studies. Most contributions have concluded that polarization has increased since the 1970s, and that the hollowing out of the middle-income class has been more into high- than low-income classes. We find the same result for 1970-2000, but not for the longer horizon of 1970-2014. For this longer period, we find that the middle-income class has polarized evenly into the low- and high-income classes. This is because most of the rise in polarization in the recent period of 2000-2014 has been into the low-income class, as was discussed in Section II.A. We hope that our paper brings more attention to the recent worrisome trends of income polarization to economists and economic policymakers.

D. Why are our polarization trends materially different from other contributions'?

Pew (2015) is a recent comprehensive report, which documents the rising trends in income polarization. The authors find that there has been more polarization into the high- than low-income class during 1970-2014.[9] Another interesting recent work is Rose (2016), who also finds that during 1981-2014 the middle class (and lower middle class) has hollowed out into the higher middle class and rich class. Rose, in addition, finds that the poor and near-poor classes have shrunk during this period. These trends are materially different from what we have found and explained in Section II.A. Below we provide two main reasons for why polarization trends in our study are so different from Pew's and Rose's:

- In our paper, polarization has been defined and trends are shown for households, while Pew's and Rose's polarization trends are shown for "adults in households." As Rose has acknowledged[10], because married couples have higher adjusted incomes than single-adult households, the double weighting of independent adults versus households shows a higher share for higher income adults. In contrast, our work, by studying households, rather than adults, is immune to this issue of double-weighting and biasing the trends for more high-income households in the distribution.

- While all three studies adjust income for household size, the methodologies differ. We use the OECD's equivalence scale for household size adjustment (explained in footnote 6), while Pew's and Rose's use an alternative method of size adjustment.[11] As a result, in general, Pew's and Rose's equivalence scale weights come out smaller than ours, except for single-member households, in which case the weight is 1 for all studies. Different size adjustments would not make a big difference in studies that have a relative definition for different income classes[12], such as ours and Pew's, but could make a larger difference in studies that use absolute levels of income for defining different classes, such as Rose's, especially given the fact that household sizes have decreased since 1970.[13]

- We restrict our samples to households whose heads are 24-64 years old, to have a heavier focus on working families.[14] We do not know if and what sample restrictions other studies have.

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[9] Notwithstanding different results, we see Pew (2015) complementary to our work and strongly recommend it to the readers. An advantage of Pew (2015) is that it has documented the increased polarization by far more details on the characteristics of households. Pew's work is also rich on the details of wealth polarization, which our paper does not cover.

[10] Rose (2016), footnote 7.

[11] Pew (2015) and Rose (2016) adjust for household size by dividing household income by the square root of the number of household members.

[12] Our and Pew's definition of different income classes are called relative because for each year income classes are defined relative to median income of that year, not an absolute dollar value of income.

[13] We do not report household sizes, but Figure 7 shows a close concept that is the number of children per household has decreased since 1970.

[14] See a full descriptions of our sample restrictions in the Data Appendix.

E.   Advantages of our work over prior studies

Consumption data is available at the household level, but not for adults alone. Therefore, we believe, for studying the macroeconomic effects of income polarization, our focus on households is more appropriate, though Pew's or Rose's focus on the trends for adults could potentially be useful for other purposes. Below we list other major advantages of our work over other studies:

- Another novelty of our paper is documenting the rising polarization trends using a polarization index, in addition to studying it through the prism of different income brackets. This index helps report the level of polarization at each point of time with a single number. It fills an important gap between the polarization and inequality literatures, as the latter has long had such an index (the Gini coefficient);

- We also estimate marginal propensities to consume for different income brackets; and

- Our paper provides estimates for the "lost aggregate consumption" in the U.S. due to the increased polarization during 1998-2013. While we only take a first step on this front, we expect the whole issue of macroeconomic effects of the rising income polarization increasingly receive more attention in the relevant academic and policy debates.

F.   Consequences of rising polarization

This paper also examines the macroeconomic consequences of increased polarization, notably on aggregate consumption. We first estimate the marginal propensity to consume out of permanent income changes (MPCP) for the low-, middle-, and high-income brackets and show that these have somewhat decreased in recent years, signaling less responsiveness of consumption to permanent income shocks. Then we apply these MPCPs to income brackets, keeping income growth the same (at the aggregate level) for all brackets. This aggregate consumption then is compared to the counterfactual of consumption with constant MPCPs and bracket sizes at the initial year's[15] levels. The cumulative difference of these two estimates of consumption, would be the lost consumption, which is partly due to changes in consumer behavior and partly due to higher polarization.

There is a large literature that calculates the marginal propensity to consume. Carroll (2009) uses a calibrated macro model and estimates the marginal propensity to consume out of permanent income changes (MPCP) at between 70-90 percent. Other studies also find MPCPs in the same range. Blundell et al. (2008) and Heathcote et al. (2010a) use household-level panel data to estimate MPCP. Souleles (1999) and Parker et al. (2013) use income tax refunds and stimulus receipts to estimate the marginal propensity to consume from anticipated but transitory income shocks. Jappelli and Pistaferri (2014) use Italian survey data to directly measure the MPC from unanticipated and transitory income shocks. McCarthy (1995) takes a similar approach on U.S. data but estimates variations in consumption behavior across the wealth distribution using the Michigan's Panel Survey of Income Dynamics (PSID).

In this paper, we use an instrumental variables approach that is methodologically closest to McCarthy (1995) but draws on a much broader measure of personal consumption expenditures,

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[15] Initial year is 1998. This exercise is done for 1998-2013.

available in the PSID from 1998. The main advantage of our MPCP estimates over many others is that using the micro data, we not only have much more observations than any macro study, but also our analysis does not suffer from potential aggregation issues.

Finally, while we document the rising income polarization and its lower consumption consequences at the macro level, we do not explain the root causes, nor other consequences of it. Autor et. al. (2006) and Goos and Manning (2007) provide some of the first evidence on job polarization while Boehm (2013) explores how job polarization links to wage and, consequently, income polarization.

The remainder of the paper is organized as follows. Section II lays out the definition of income polarization and contrasts it with income inequality. Section III briefly overviews the data. Section IV documents the trends of both income polarization and inequality. We study macroeconomic effects of income polarization and inequality in Section V, and Section VI concludes.

II. AN INDEX OF INCOME POLARIZATION

We adopt the Wolfson (1994) index[16] for polarization:

$$P = 4 \times \left(0.5 - Income\ Share\ of\ Bottom\ 50\% - \frac{Gini\ Coefficient}{2} \right) * \left(\frac{mean\ income}{median\ income} \right)$$

Wolfson constructs this index from the area under what he calls the "polarization curve," which is a rotation and rescaling of the Lorenz curve by median income.[17] This area is between the Lorenz curve and a tangent line at the 50th percentile of the population as shown in Figure 6, which is borrowed from Wolfson (1994).

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[16] This index of polarization is also used by Esteban and Ray (2007) and Wolfson and Foster (2010). Some literature has looked at polarization from the perspective of the 50/10 and 90/10 percentile ratios, mainly for wages. Examples for the latter measures could be found in Autor et al (2006) and Mishel et al (2013).

[17] Notice that introducing income share of bottom 50 percent does not cause any asymmetry in the index. The polarization index could be equivalently written as follows:

$$P = 4 \times \left(0.5 + Income\ Share\ of\ Top\ 50\% - \frac{Gini\ Coefficient}{2} \right) * \left(\frac{mean\ income}{median\ income} \right)$$

Figure 6. Polarization Index and Gini
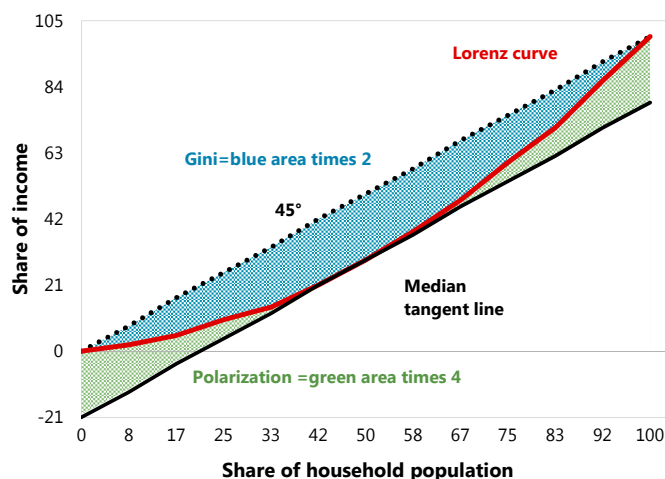
Source: Authors, based on Wolfson (1994).

This index gauges income polarization by measuring the relative size of the middle-income class (a more polarized economy has a relatively smaller middle-income class.) In Figure 6, the 45-degree line represents perfect equality, and the median tangent is the line of concentration around median income. The median tangent is parallel to the line of perfect equality, because zero polarization and zero inequality both correspond to everyone having the same income. The distance from the 45-degree line shows the degree of inequality while the distance from the median tangent shows the degree of polarization. Hence, the green and blue areas provide natural metrics for measuring polarization and inequality, respectively. The curve comes closer to the median tangent if there is a higher concentration of population in the middle of the distribution. The polarization index is constructed to be 4 times this area, so the index ranges from 0 (no polarity) to 1 (bipolarity).

Before continuing, it would be helpful to consider two illustrative examples for the extreme cases of no polarity and bipolarity:

- No polarity: consider a distribution of only 2 households, both of whom have income of $1. In this case the polarization index is equal to 0. This is because for this distribution, the income share of the bottom 50 percent is 0.5; Gini coefficient is 0; and the mean is equal to median (P=4*(0.5-0.5-0/2)*1=0).

- Bipolarity: now consider a distribution of only 2 households, one of whom with income of $0 and the other one with income of $1. In this case the polarization index is equal to 1. The income share of the bottom 50 percent is equal to 0; the Gini coefficient is 0.5; and the mean is equal to median (P=4*(0.5-0-0.5/2)*1=1).

A convenient feature of our polarization index is that it allows for construction of a polarization ranking over distributions and so is comparable across time and does not need to assume cut-offs to define the middle-income class. The measure also maps into the more familiar Gini coefficient. One criticism of the Gini coefficient is that it is insensitive to income growth at the bottom and top percentiles of the income distribution. This is undesirable when measuring inequality, because growth in the income of the top 1 percent is very informative about inequality (e.g. Alvaredo et al. 2015). While our polarization index also maps into the Gini

coefficient, it is much less subject to this criticism. This is because for measuring polarization, we focus on measuring the relative size of different income classes, not their incomes. Inclusion or exclusion of those who are at the top 1 percent of income growth would not make a difference in trends of the polarization index, because they constitute only a small percent of the distribution.

III. THE DATA

To analyze polarization and its potential impact we use micro household data that:

- Captures heterogeneity in consumption behaviors across income groupings;

- Controls for household characteristics that may be important to consumption patterns; and

- Allows for incorporation of information on household net worth as well as income.

We focus on the period 1970–2014, and work with the following variables: total disposable income after taxes and transfers, personal consumption expenditures, and net worth of households in the U.S. The data is drawn from the PSID. Figure 7 shows some stylized facts for the sample's low-, middle-, and high-income households. It suggests that most life styles have been broadly unchanged over the sample period, except that households have continued to have fewer children, following the baby boom of 1960s, and also households have increased borrowing to purchase homes, as financial deepening has continued. Home and car ownerships and health status of households have remained broadly unchanged over the past four decades. The paper also draws on data from the Current Population Survey (CPS), which is the most reliable micro-level income data source, for calculation of income trends. In addition, the Fed's Survey of Consumer Finances (SCF) is used to study robustness of some results to alternative data sources. See the Data Appendix for more details.

Figure 7: Summary Data Across Households with Different Incomes, 1970-2010

Low Income: Households with less than 50 percent of median income
Middle Income: Households with 50-150 percent of median income
High Income: Households with more than 150 percent of median income

Homeownership Rate (percent)

Mortgage to Income Ratio (percent)

Number of Children

Number of Vehicles Owned

Avg, Hours Worked per Week

Health Status (1: Excellent; 5: Poor)

Solid line: Head of Household
Dotted line: Spouse
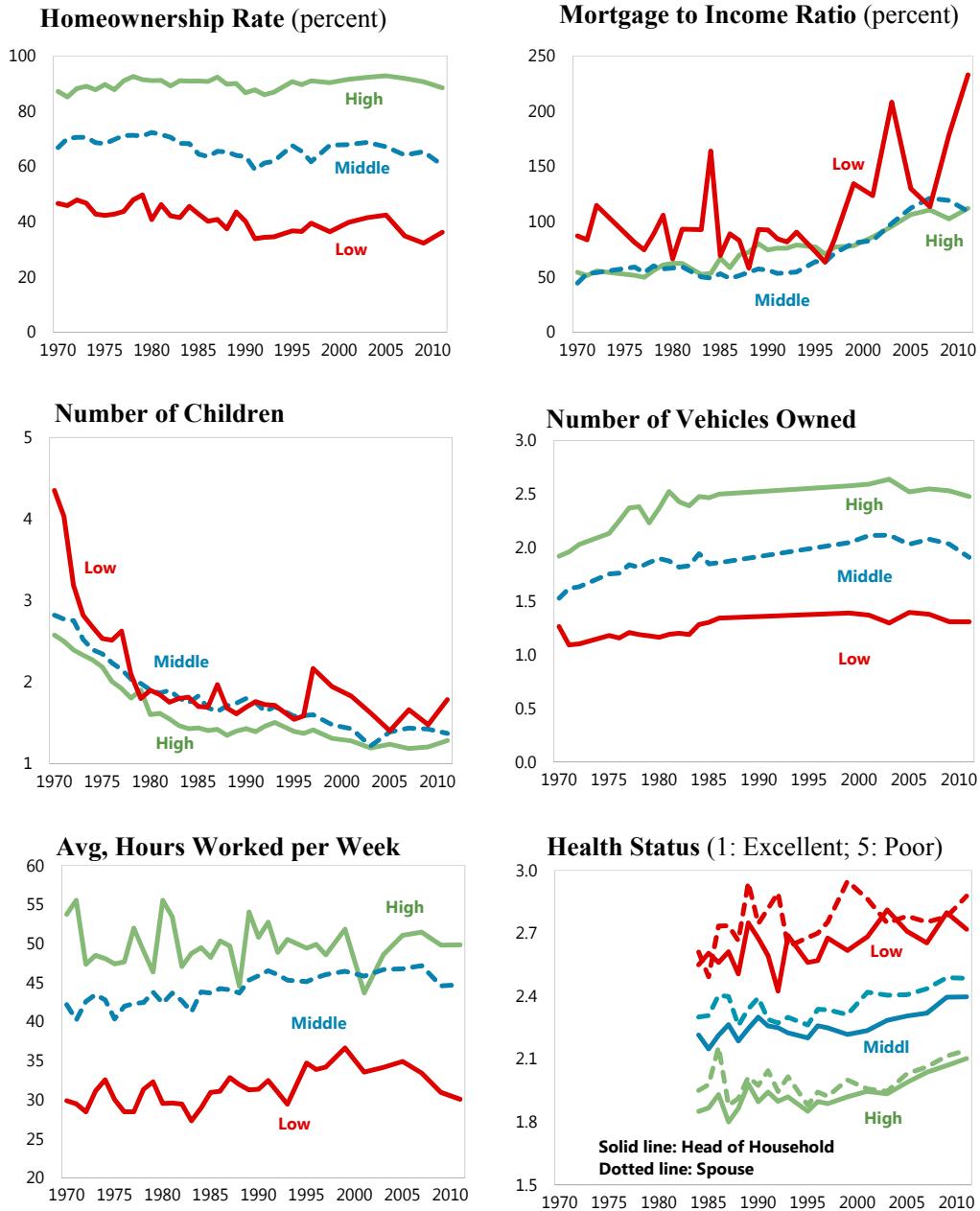
Source: Michigan's Panel Survey of Income Dynamics (PSID).

IV. POLARIZATION VERSUS INEQUALITY TRENDS IN THE U.S.

Both income inequality and polarization in the U.S. have seen a significant increase since 1970. Figure 8 shows that the polarization index has grown faster than the Gini coefficient during this period. Moreover, while the Gini coefficient has been broadly flat since 2000, the polarization index has notably increased following the Great Recession. This is why we believe the issue of hollowing out of the middle class has been more worrisome than inequality since in recent years.

Figure 8. Polarization Index and Gini Coefficient, 1970-2014
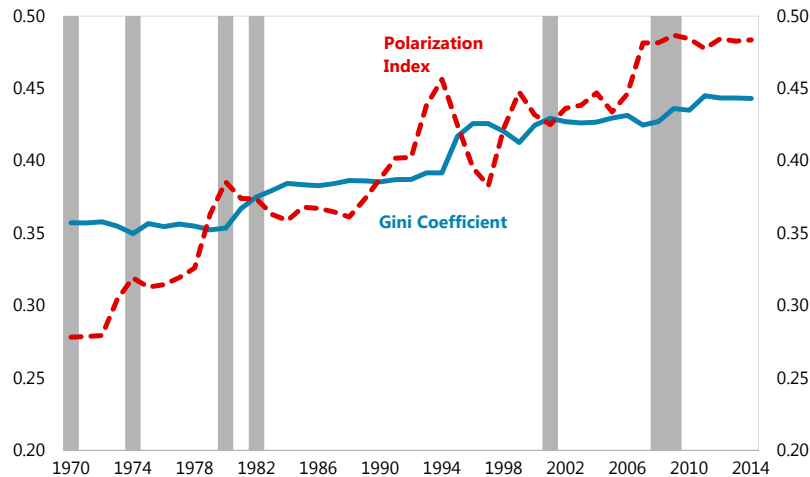
Source: Current Population Survey.
1/ Underlying income data adjusted for household size using OECD's equivalence scale. See footnote 6 for details.

There is a special focus in some policy circles on the very rich, when issues of polarization and inequality are discussed. Figure 9 shows the trend increase in polarization over the past four decades for the trimmed sample, which excludes households at the top 1 percent of income distribution. The result is similar to Figure 8 for the full sample. Therefore, it is not the very rich alone who are driving the increased polarization; the rising polarization is more broad-based.

Figure 9. Polarization Index and Gini Coefficient; Trimmed Sample, 1970-2014 /1
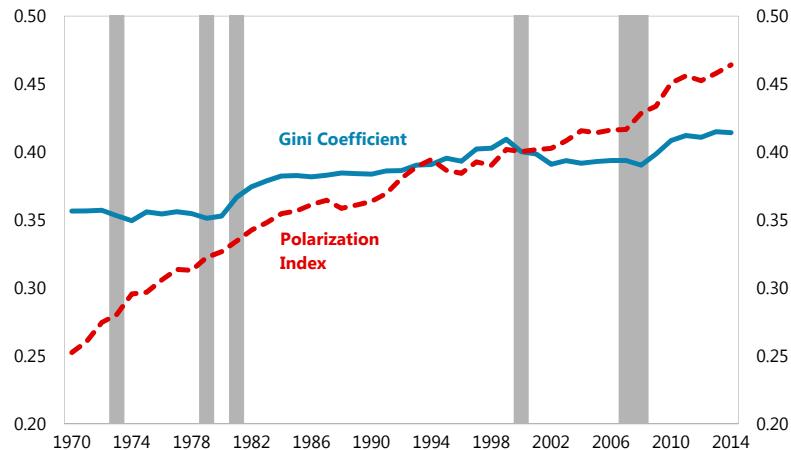
Source: Current Population Survey.
1/ Underlying income data adjusted for household size using OECD's equivalence scale. See footnote 6 for details. Sample excludes households at the top 1 percent of income distribution.

Also, the increase in income polarization has not merely been a result of rising female labor force participation, who might have occupied jobs on the lower side of the wage spectrum.[18] Figure 10 shows that for the employed men in the sample (as individuals; not members of households), polarization has risen sharply over the past four decades. Income polarization for women, however, has only slightly increased over this period.[19]

Figure 10. Polarization Index and Gini Coefficient by Gender; 1970–2014 /1
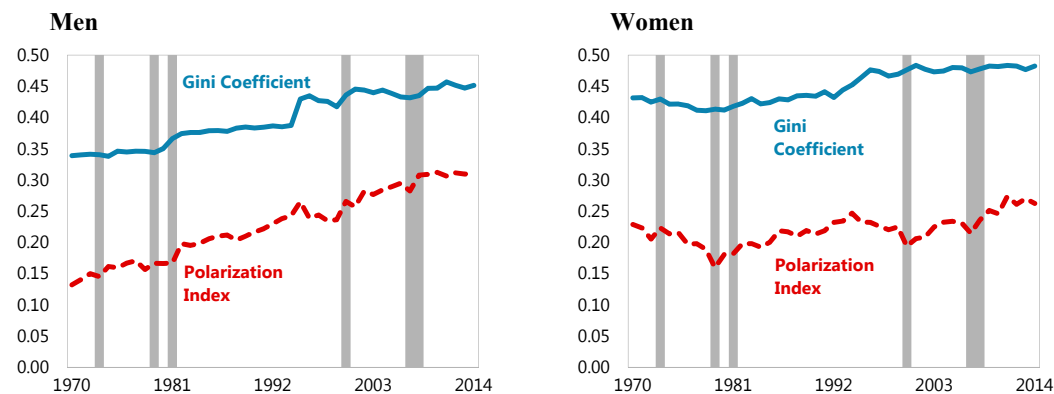
Source: Current Population Survey.

1/ These charts are for working men and women only; not for households they belong to.

[18] Some have argued that income inequality has risen partly due to an evolution in family structures. For example, Greenwood et al (2014) find that an increase in "assortative mating" has led to higher household income inequality. It is possible that such evidence could be found for the rising income polarization as well, but investigating this issue would be beyond the scope of the current paper.

[19] We do not know why income polarization for women has not changed much. This would be an interesting question for future research to study.

Finally, Figure 11 shows that the rise in polarization is not specific to one data source (CPS), as it is also borne out by other data sources (PSID and SCF).

Figure 11. Polarization Index and Gini Coefficient; Other Data Source, 1970–2014 /1

Source: University of Michigan's Panel Survey of Income Dynamics.

Source: Survey of Consumer Finances (SCF).
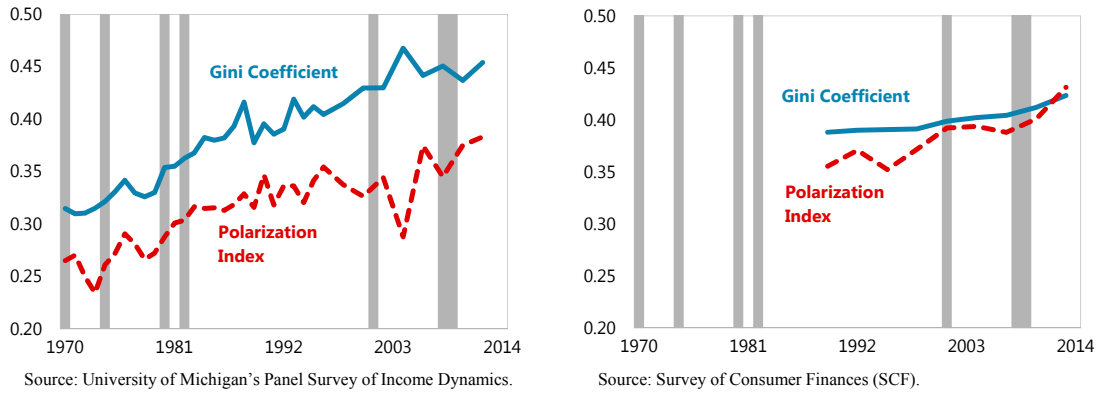
1/ Not adjusted for household size, due to the definition of household in these series, which is not the same as the definition of family. See the Data Appendix for more details.

V. MACROECONOMIC IMPLICATIONS

In this section, we are interested in determining the potential macroeconomic implications of the rising income polarization described in the previous section, in particular on aggregate consumption.[20] We know that different income groups exhibit different consumption behavior and so, changes in income polarization would have a direct effect on aggregate consumption by changing the relative weights of each group in the total. At the same time, it is possible that the significant wealth, employment and income dislocation that occurred (e.g., following the global financial crisis) could have changed the consumption behavior of households (after controlling for income and wealth) towards being less responsive to income shocks. This change in behavior, combined with more polarization could have lowered aggregate consumption.

A. MPCPs at Different Income Levels

The first question we address in this section is how income polarization has affected consumption behavior and the MPCPs for different income levels.[21] We estimate MPCPs for two reasons. First, income polarization is a long-standing secular trend, so we want to take a long-run perspective on the potential consequences of income polarization (which leads us to examining

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[20] Our analysis in this section is a simple partial equilibrium one. One obvious extension of our work would be to build a general equilibrium model, which would not only model consumption more comprehensively, but also bring in investment, etc.

[21] Notice that our main focus is on the effects of income polarization on consumption. The effects of wealth polarization on consumption would also be a very interesting question to study. We control for net worth when estimating the MPCP in our regressions by brackets, but also separately report our estimates of MPCP out of net worth.

permanent rather than contemporaneous incomes). Second, instruments that are correlated with changes in permanent income are readily available, and so we can circumvent the need to deploy methodologies to break apart permanent and transitory income changes.

While we would have preferred to perform our econometric analysis for the entire sample, we were unable to do so because consumption data for prior to 1998 is not available from PSID. Therefore, our econometric study would be only on data of 1998-2013.

Figure 12 shows a scatter plot of real consumption versus real income. A simple trend line of this data results in an MPCP of about 80 percent.

Figure 12: Real Consumption Expenditures (y axis) and Real Disposable Income (x axis) (2005$ thous.)

Sources: PSID 1998-2013; and authors' calculations.
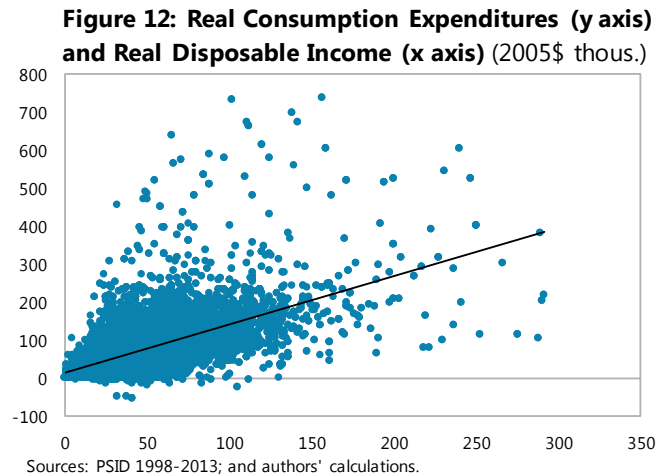
The results of OLS estimation with fixed effects are reported in column 1 of Table 1.[22] The MPCP of the entire sample is estimated at around 40 percent (lower than the 70-90 percent range found in the literature and 80 percent from the scatter plot above) [23] and net worth is not a significant factor in consumption decisions. The MPCPs of low-, middle-, and high-income households are estimated at 60, 40, and 30 percent, respectively and, again, the impact of net worth is not statistically significant.

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[22] From this section onwards, we do not adjust our regression data for household size, as we did for the descriptive trends in previous sections. Instead, we control for household size using dummies in all regressions. Other differences in household characteristics are also controlled for by using household fixed effects.

[23] These are for households who face liquidity constraints and have precautionary savings motives. See Carroll (2010) or Deaton (1991) for more details.

Table 1. Whole Sample and Bracketed-Income Regressions, 1998-2013

Dependent Variable: Real Private Consumption Expenditures (percent change)
Explanatory variables all in percent changes.

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	IV (2SLS)	OLS	IV (2SLS)	IV Pre-2007	IV Post-2007
Disposable Income of all households	0.36***	0.98***				
	(0.09)	(0.22)				
Net Worth of all households	(0.00)	(0.00)				
	(0.00)	(0.00)				
Disposable Income of individuals with more than 150 percent of Median Income			0.32***	0.52***	0.70***	0.51***
			(0.02)	(0.08)	(0.12)	(0.06)
Disposable Income of households with 50-150 percent of Median Income			0.43***	0.76***	1.06***	0.75***
			(0.02)	(0.18)	(0.25)	(0.12)
Disposable Income of households with less than 50 percent of Median Income			0.60***	1.77**	2.61***	1.81***
			(0.05)	(0.78)	(0.94)	(0.53)
Net Worth of households with more than 150 percent of Median Income			-0.01**	-0.01***	-0.00	-0.01***
			(0.00)	(0.00)	(0.00)	(0.00)
Net Worth Income of households with 50-150 percent of Median Income			0.00	-0.00	-0.00	0.00
			(0.00)	(0.00)	(0.00)	(0.00)
Net Worth of individuals with less than 50 percent of Median Income			0.00	0.00	0.01	0.02**
			(0.00)	(0.00)	(0.01)	(0.01)
Yearly Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Household Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
R-Squared	0.56	-	0.60	-	-	-
Kleibergen-Paap LM Statistic	-	84.11	-	16.65	71.57	40.63
Sagan-Hansen J Statistic	-	4.31	-	6.87	8.32	1.37
Number of Households	6,170	4,868	6,170	4,868	3,690	3,213
Number of Observations	19,291	17,806	19,291	17,806	9,594	6,426

*** p<0.01, ** p<0.05, * p<0.1

Notes: Changes in real disposable income (DI) and real net worth are normalized by initial consumption. Standard errors are clustered at the household level. Regressions control for changes in real net worth, household size, region, and age and age squared of the head of household fully interacted with year dummies. The main instrument is the average annual income of all other households in the same region-age-household-size cohort. Additional instruments are this variable squared and cubed.

Using Instrumental Variables (2SLS) methodology with fixed effects gives somewhat different results. We estimate the marginal effect of instrumented income on consumption to yield a direct estimate of the MPCP. Instruments include the average annual income of households in the same region-age-household-size cohort. The overall MPCP from 2SLS is much higher (about 100 percent for the whole sample) and 180, 80, and 50 percent for low-, middle-, and high-income brackets, respectively. The estimate for the low-income bracket is particularly surprising but with large standard errors, likely due to a lack of precision of the estimate for low income earners (measures of cohort income have proven to be not good instruments for lower income groups).

Next, we split the sample in 2007 to see if MPCPs have changed since the crisis. The results are reported in columns 5-6 of Table 1. The results suggest that MPCP's for low, middle, and high income brackets have been lower post crisis than pre crisis, although the estimates have large standard errors. [24]

Next, we switch to IV (2SLS) with polynomial identification to calculate MPCPs, which are allowed to vary across the income distribution. We do this through using a fractional polynomial, which is an expansion around the median income. This enables us to obtain the MPCP as a function of income, without being restricted to only three categories of low, middle, and high income. The results are reported in Figure 13. MPCPs are estimated close to 100 percent for low-income brackets (although estimated imprecisely due to high confidence bands) and gradually decline to around 70 percent for higher income groups.

Figure 13: MPCP (Percent; IV Fixed Effects; Polynomial Identification for Permanent Income)
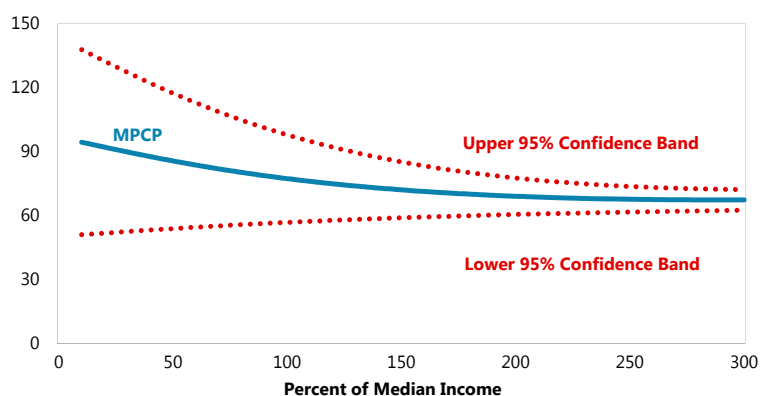
Source: Authors' estimates; data for 1998-2013.

Estimates of MPC out of net worth for different income levels, using a polynomial identification for permanent income, are shown in Figure 14. Again, consistent with the previous methodology (Table 1), there appears to be very little impact of net worth on consumption decisions, when we control for permanent income.

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[24] We also estimated MPCPs by income quartiles over these two periods. MPCP estimates at quartiles do not statistically differ over time. The fact that MPCPs differ across brackets, but not quartiles suggests that MPCP by bracket changes over this period are due to changes in relative positions in the income distribution (i.e. movers from middle to low or high income brackets) as opposed to changing consumption behavior across the income distribution.

Figure 14: MPC out of Net Worth (Percent; IV Fixed
Effects; Polynomial Identification for Permanent Income)
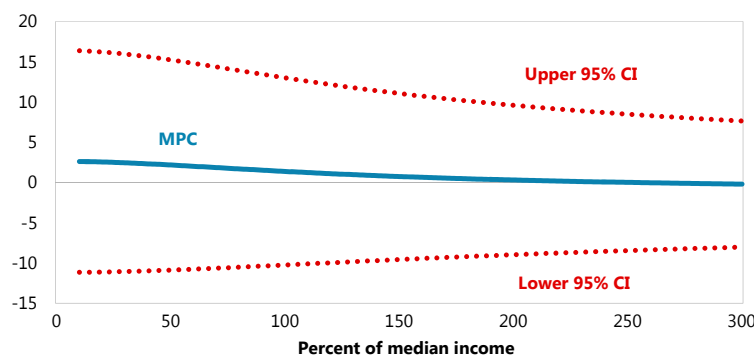
Source: Authors' estimates; data for 1998-2013.

B. Effect of Rising Polarization on Aggregate Consumption

We have established two main results in the previous sections for 1998-2013: the middle-income class has been gradually hollowing out, mostly into the low-income class; and conditional on income, the MPCPs have decreased. We have shown these two results, using the PSID data, in Figures 15-16.[25] In this section, we focus our attention, only to 1998-2013[26], which is divided into the pre-crisis period of 1998-2006 and the crisis and post-crisis period of 2007-2013.

Figure 15: Number of Households (percent of total)

Sources: PSID and authors' calculations.

Figure 16: MPCPs (percent)

Sources: PSID and authors' calculations.
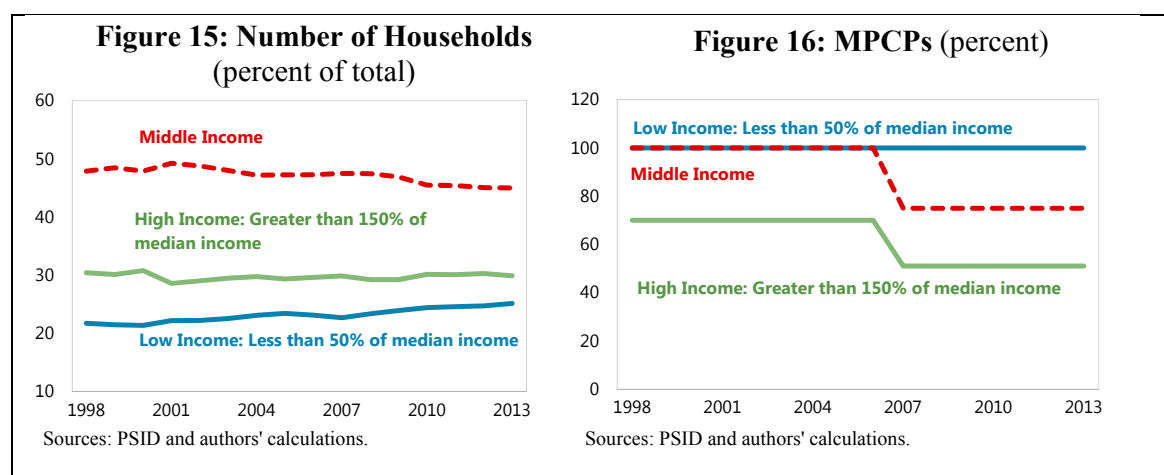
As far as aggregate consumption is concerned, Figures 15-16 show that three forces are at play: first, since almost all of the hollowing out of the middle-income class since 1998, has been into

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[25] Notice that Figure 15 is slightly different from Figure 2. This is due to two reasons: first data sources are different; and second the data in Figure 14 is not adjusted for family size, but data in Figure 2 is. We do not adjust the data for family size in any of our econometric work. Instead, our regressions have fixed effects to capture differences in family size.

[26] Ideally the analysis would have been done for the longer horizon of 1970-2013, but unfortunately consumption data are not available for years before 1998.

the low-income class, would suggest that, ceteris paribus, aggregate consumption has decreased over this period. Second, the migration of the middle-income to low-income class would imply higher MPCPs over this period. Third, the overall decrease in the MPCPs after controlling for income (Figure 16), has gone in the opposite direction of the second force above, raising aggregate consumption over this period.[27]

The results are shown in Figure 17. We have shown the effect of the first force on consumption in the blue bars and the net effect of the second and third forces in green bars. The total impact has been a lower level of aggregate consumption by around 3½ percent at the end of the sample (Figure 17). This effect is split equally between lower MPCPs and lower median income levels. The size of the lost consumption is relatively large. It is equivalent of more than one year of consumption, based on historical averages, in 15 years.

Figure 17: Cumulative Consumption Loss 1998-2013
(%pts off level of consumption)
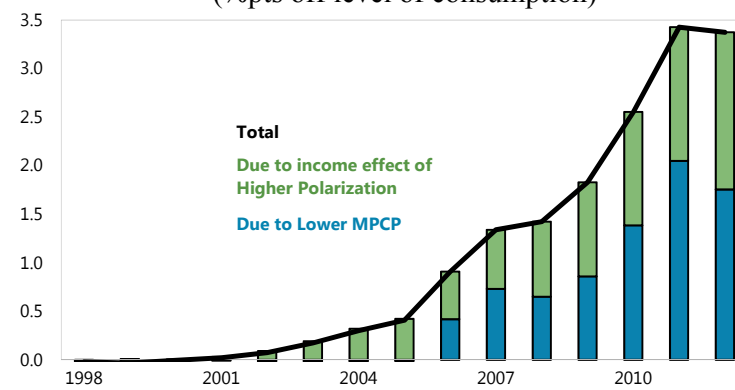
Sources: PSID and authors' calculations.

VI. CONCLUDING REMARKS

Our study has documented that income polarization has increased substantially over the last 4 decades and this is crucial to understanding aggregate consumption dynamics in the U.S. Our main conclusions, which are robust to different definitions of the middle-income and different household characteristics, are as follows:

- Income polarization has risen substantially in the past four decades—much the same, if not even faster than inequality. While in the initial decades more middle-income households moved up, rather than down the income ladder, since the turn of the current century, most of polarization has been towards lower incomes.
- Household consumption behavior exhibits significant heterogeneity across the income distribution, but over time, it has changed slightly—has become less responsive to permanent income shocks over time (lower MPCPs).

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[27] We have also accounted for population growth over this period.

- The hollowing out of the middle-income class and lower MPCPs have lowered consumption. The total effect has been a lower level of aggregate consumption by around 3½ percent (relative to the counterfactual where polarization had remained at 1998 levels) at the end of the sample. This is equivalent to more than one year of consumption.

Future work could:

- Study the root causes of rising income polarization. While it is likely that the same sources as for income inequality (such as technological progress, declining unionization, taxation, international trade, education, immigration, household structure and demographics) could be at play, a better understanding of root causes and their quantification would be key for tackling the rising income polarization.
- Develop a general equilibrium model to study the macroeconomic effects of higher income polarization with better confidence. Such a model would incorporate consumption, investment, labor supply, tax and transfer policies, etc., in a unified framework. In such a set up one can study the broader question of the relationship of income polarization and GDP growth. It would also be helpful to set up, e.g., VAR regression models to study income polarization and growth, as some have done in the literature of income inequality and growth.
- Analyze why MPCPs have decreased in recent years and whether these changes are temporary or permanent; or whether these are a result of the recent global crisis or a more secular trend. The answers to these questions would have strong implications for fiscal policies, and in particular tax/transfer multipliers.
- Calculate our polarization index for other countries, making it possible to compare polarization trends across countries.

VII. REFERENCES

Alvaredo, Facundo, Anthony B. Atkinson, Thomas Piketty and Emmanuel Saez, The World Top Incomes Database, http://topincomes.g-mond.parisschoolofeconomics.eu/, Accessed 9/3/2015.

Arrondel, Luc, Pierre Lamarche and Frédérique Savignac, 2015, "Wealth Effects on Consumption across the Wealth Distribution: Empirical Evidence," *Working Paper Series 1817*, European Central Bank.

Autor, David H., Lawrence F. Katz and Melissa S. Kearney, 2006, "The Polarization of the U.S. Labor Market," *American Economic Review*, 96(2), 189-194.

Autor, David H., Lawrence F. Katz and Melissa S. Kearney, 2008, "Trends in U.S. Wage Inequality: Revising the Revisionists," *The Review of Economics and Statistics*, 90(2), 300-323.

Blundell, Richard, Luigi Pistaferri, and Ian Preston, 2008, "Imputing Consumption in the PSID using Food Demand Estimates from the CEX," *IFS Working Papers* W04/27, Institute for Fiscal Studies.

Blundell, Richard, Luigi Pistaferri, and Ian Preston, 2008, "Consumption Inequality and Partial Insurance," *American Economic Review*, 98(5), 1887-1921.

Blundell, Richard, Luigi Pistaferri, and Itay Saporta-Eksten, 2014. "Consumption Inequality and Family Labor Supply," *Working Paper Series* 1656, European Central Bank.

Board of Governors of the Federal Reserve System, 2014, "Changes in U.S. Family Finances from 2010 to 2013: Evidence from the Survey of Consumer Finances," *Federal Reserve Bulletin*, 100(4).

Boehm, Michael J., 2013, "Has Job Polarization Squeezed the Middle Class? Evidence from the Allocation of Talents," *CEP Discussion Papers dp1215*, Centre for Economic Performance, LSE.

Browning, Martin, Mette Gørtz and Søren Leth-Petersen, 2013, "Housing Wealth and Consumption: A Micro Panel Study," *Economic Journal*, 401-428.

Carroll, Christopher D., 2009, "Precautionary Saving and the Marginal Propensity to Consume out of Permanent Income," *Journal of Monetary Economics*, 56(6), 780-790.

Carroll, Christopher D., Misuzu Otsuka, and Jiri Slacalek, 2011, "How Large Are Housing and Financial Wealth Effects? A New Approach," *Journal of Money, Credit and Banking*, 43(1), 55-79.

Carroll, Christopher D., Jiri Slacalek, and Kiichi Tokuoka, 2014, "The Distribution of Wealth and the Marginal Propensity to Consume," *Working Paper Series 1655*, European Central Bank.

Carroll, Christopher D., Jiri Slacalek, Kiichi Tokuoka, and Matthew White, 2015, "The Distribution of Wealth and the Marginal Propensity to Consume," *Working Paper*.

Christelis, Dimitris, Dimitris Georgarakos, and Tullio Jappelli, 2015, "Wealth shocks, unemployment shocks and consumption in the wake of the Great Recession," *Journal of Monetary Economics*, 72(C), 21-41.

Esteban, Joan and Debraj Ray, 2007, "A Comparison of Polarization Measures," *UFAE and IAE Working Papers* 700.07.

Foster, James and Michael Wolfson, 2010, "Polarization and the decline of the middle class: Canada and the U.S.," *Journal of Economic Inequality*, 8(2), 247-273.

Goos Maarten and Alan Manning, 2007, "Lousy and Lovely Jobs: The Rising Polarization of Work in Britain," *The Review of Economics and Statistics*, 89(1), 118-133.

Gouskova, Elena, Patricia Andreski, and Robert F. Schoeni, 2010, "Comparing Estimates of Family Income in the Panel Study of Income Dynamics and the March Current Population Survey, 1968-2007," *PSID Technical Series Paper #10-01*.

Greenwood, Jeremy, Nezih Guner, Georgi Kocharkov, and Cezar Santos, 2014, "Marry Your Like: Assortative Mating and Income Inequality," NBER Working Paper No. 19829

Heathcote, Jonathan, Fabrizio Perri and Giovanni L. Violante, 2010a, "Unequal We Stand: An Empirical Analysis of Economic Inequality in the United States: 1967-2006," *Review of Economic Dynamics*, 13(1), 15-51.

Heathcote, Jonathan, Kjetil Storesletten and Giovanni L. Violante, 2010b, "The Macroeconomic Implications of Rising Wage Inequality in the United States," *Journal of Political Economy*, 118(4), 681-722.

Jappelli, Tullio and Luigi Pistaferri, 2014, "Fiscal Policy and MPC Heterogeneity," *American Economic Journal: Macroeconomics*, 6(4), 107-136.

Li, Geng, Robert F. Schoeni, Sheldon Danziger, and Kerwin Kofi Charles, 2010, "New expenditure data in the PSID: comparisons with the CE," *Monthly Labor Review* 133(2): 335-360.

King, Miriam, Steven Ruggles, J. Trent Alexander, Sarah Flood, Katie Genadek, Matthew B. Schroeder, Brandon Trampe, and Rebecca Vick, 2010. Integrated Public Use Microdata Series, Current Population Survey: Version 3.0. [Machine-readable database]. Minneapolis: University of Minnesota.

Kohler Ulrich, 2015, "PSIDTOOLS: Stata module to facilitate access to Panel Study of Income Dynamics (PSID)," Statistical Software Components S457951, Boston College, Department of Economics.

Krueger, Dirk, Kurt Mitman, and Fabrizio Perri, 2015, "Macroeconomics and Heterogeneity, including Inequality," *Handbook of Macroeconomics* (*forthcoming*).

McCarthy, Jonathan, 1995, "Imperfect insurance and differing propensities to consume across households," *Journal of Monetary Economics*, 36(2), 301-327.

Mian, Atif, Kamalesh Rao and Amir Sufi, 2013, "Household Balance Sheets, Consumption, and the Economic Slump," *The Quarterly Journal of Economics*, 128(4), 1687-1726.

Mishel, Lawrence, John Schmitt, and Heidi Shierholz, 2013, "Assessing the job polarization explanation of growing wage inequality," *Economic Policy Institute, Working Paper*.

Panel Study of Income Dynamics, Public Use Dataset, 2015. Produced and distributed by the Survey Research Center, Institute for Social Research, University of Michigan, Ann Arbor.

Parker, Jonathan A., Nicholas S. Souleles, David S. Johnson, and Robert McClelland, 2013, "Consumer Spending and the Economic Stimulus Payments of 2008," *American Economic Review*, 103(6), 2530-2553.

Pew Research Center, 2015, "The American Middle Class Is Losing Ground: No longer the majority and falling behind financially." Washington, D.C.: December.

Rose, Stephen J., 2016, "The Growing Size and Incomes of the Upper Middle Class." Research Report, Urban Institute.

Schaffer, Mark E, 2005, "XTIVREG2: Stata module to perform extended IV/2SLS, GMM and AC/HAC, LIML and k-class regression for panel data models," Statistical Software Components S456501, Boston College Department of Economics.

Souleles, Nicholas S., 1999, "The Response of Household Consumption to Income Tax Refunds," A*merican Economic Review*, 89(4), 947-958.

Survey of Consumer Finances, 2015. Produced and distributed by the Board of Governors of the Federal Reserve System.

Wolfson, Michael C., 1994, "When Inequalities Diverge," *American Economic Review*, 84(2), 353-358.

VIII.   Appendix: Polarization index is different from the Gini index

The polarization index was defined in Section 2. A convenient feature of this index is that it allows for construction of a global ranking over distributions much like the Gini Coefficient. Therefore, it is comparable across time and does not impose cut-offs for what constitutes middle income.[28] It also maps into a function of the Gini Coefficients between high and low income groups, the Gini within these groups (high and low income groups are defined as those above and below the median, respectively), and the skewness of the distribution (measured by the mean-to-median ratio) as shown in Wolfson and Foster (2010). The mapping emerges from the duality between the Lorenz and polarization curves.

While inequality measures how far incomes of different groups are, polarization measures the relative size of the middle-income class in the population. An example below helps clarify this difference. Consider two income distributions, A and B (Figure 18). Distribution A represents a society with more inequality than distribution B, because the Lorenz curve of distribution A is farther from the 45-degree line than Lorenz curve of distribution B. On the other hand, income distribution A represents a less polarized economy than income distribution B. This can be seen in Figure 19, which shows the polarization curves for the two distributions.[29]Distribution A has lower polarization (area under the polarization curve) than B.

Figure 18. Lorenz Curves

Source: Authors' estimates.

Figure 19. Polarization Curve

Source: Authors' estimates.
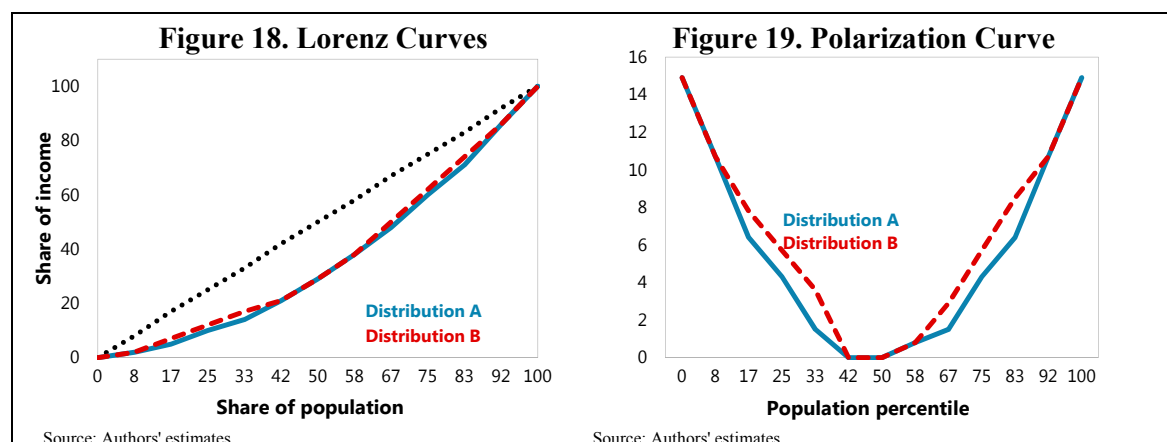
The distinction of inequality and polarization would be distinctly important for understanding macroeconomic variables, especially if they evolve differently. Two distributions with similar inequality levels but different polarization levels may have different aggregate consumption behavior, depending on how the marginal propensity to consume varies across the income distribution.

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[28] One criticism of the Gini Coefficient is that it is insensitive to income growth at the bottom and top percentiles of the income distribution. Since we focus on measuring the size of the middle class, insensitivity to the top 1% income growth is a desirable property. In contrast, it is undesirable when measuring inequality, because growth in the income of the top 1% is very informative about inequality (e.g. Alvaredo et al. 2015).

[29] This stylized example is constructed so that the Lorenz curve only needs to be rotated clockwise 45 degrees and not rescaled to obtain the polarization curve. This is because distributions A and B both have the sane mean and median.

IX. DATA APPENDIX

We use the Current Population Survey (CPS), Panel Study of Income Dynamics (PSID), and Survey of Consumer Finances (SCF) to document trends in income polarization at the annual level since 1970.[30] These household-level micro datasets provide detailed information on demographics, income, wealth and consumption for individual and households.

Overview

The CPS is monthly at national and state representative levels. Its sampling unit is all individuals in a dwelling, which they call a household. The CPS March Supplement (Annual Social and Economic Supplement) includes detailed income questions about the *previous* year from which annual income for the *previous* year is constructed. The CPS dates back to 1962 and samples about 50,000 households monthly. We use the CPS from 1970 to 2014. The CPS rotates households out of the survey for 8 months after 4 months in the survey and finally rotates them out of the survey after 4 more months in the survey. We do not exploit this short panel dimension for our econometric estimation of MPCPs, because the CPS does not contain information on expenditures, consumption, or net worth. Instead, we use the longest running national household panel—the Panel Study of Income Dynamics (PSID).

The PSID follows 5,000 plus families and their "split-off" families. It consists of an initial nationally representative sample of around 3,000 households. The other households are an oversampling of poor families from the Survey of Economic Opportunity (SEO). We drop this sample to obtain a nationally representative sample to the extent that it misses out on the wave of immigrants post-1968.[31] The PSID dates back to 1968 and became bi-annual starting in 1998. Prior to 1998, the PSID only documented food expenditures but expanded to cover up to 70% of total personal consumption expenditures thereafter (Li et al. 2010). Hence, we limit our econometric sample to 1998-2013 but use income data back to 1970 to document income polarization.[32] The PSID also includes detailed income information and wealth supplements that provide a breakdown of most categories comprising income and net worth.[33] These categories allow us to calculate taxes to obtain disposable income for families. Like the CPS, PSID's income, net worth, and expenditure variables refer to their values the *previous* year.

The Survey of Consumer Finances (SCF) provides the best publically available micro-level data on wealth in the U.S. It oversamples the wealthiest households, which we drop to obtain a comparative sample to the PSID and CPS. We use income from the SCF only to check the robustness of the trends from the CPS and PSID. It samples 3,000 to 4,000 different households. The 1983-1989 and 2007-2009 waves exhibit short panel dimensions, but the rest of the SCF is triannual and cross-sectional. We treat the survey as cross-sectional. The SCF dates back to 1983, but we only use data dating back to 1989 due to the availability of replication weights.

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[30] Heathcote et al (2010) provide an extensive summary of these datasets and their structure.

[31] The PSID attempted to correct for this misrepresentation by adding a Latino sample, but it was discontinued in 1995. Hence, we drop it from our general sample. An immigrant sample was added starting in 1997. We use weights to generate representative estimates of trends.

[32] Details on restrictions for the econometric sample can be found in Table 0 PSID Sample Selection.

[33] These categories as well as consumption categories and summary statistics can be found in Table 0 PSID Definitions.

Sampling Unit

The sampling unit differs from one survey to another. The CPS aims to be nationally and state-wide representative of all civilian, non-institutionalized individuals, so a housing unit or dwelling serves as the sampling unit. Formally, the U.S. Census Bureau states that for the CPS "[a] household consists of all people who occupy a housing unit regardless of relationship." The PSID follows families and there may be multiple families within a household. For example, an initial family and its "split-off" may live in the same household if the adult children move back with their parents. The SCF samples households as "primary economic units" with all individuals connected by financial interdependence. We document income polarization on the family unit (FU) level in the CPS and PSID, because we perform our estimation and analysis at this level. For the SCF, we use the "primary economic unit" or PEU.

The definition for the family unit differ in the CPS and PSID.[34] For the CPS "[a] family consists of two or more people related by birth, marriage, or adoption residing in the same housing unit." However, for PSID, a family is "a group of people living together […]. They are almost always related by blood, marriage, or adoption. […] Occasionally, unrelated persons can be part of an FU." Hence, unrelated persons may enter a PSID family, most notably through cohabitation. A cohabiting partner enters the data the same way as a spouse.[35] Similarly, the SCF considers married or cohabitating partners and their dependents as part of the PEU. These differences may confound the similarities we find between their family income trends. However, the inequality and polarization trends in CPS family income and CPS household income are quite similar.

In describing the sample that we use, we refer to the head of household. In the PSID, the head of household refers to male in the household older than 16 years with the most financial responsibility. If there is no male that fits this role, then the head of household is the female that fits this definition. The CPS interviews a "reference person" and defines all other relationships based on this person (see variable "RELATE"). In the SCF, the head of the PEU is the male in a mixed-gender partnership and the oldest partner in a same-gender partnership if a couple is "economically dominant." Otherwise, it is the most "economically dominant" individual in the PEU.

Income, Net Worth, and Consumption

For the CPS, we use the variable "FTOTVAL" which is reported total family income and includes transfers.[36] Prior to 1976, this variable is top-coded at 50,000 dollars, however this censoring affects less than 0.5% of observations each year in our sample.[37] Consequently, we do

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[34] Gouskova et al. (2010) compare income percentiles between the PSID and CPS on the household level (i.e. all available members in the housing unit). They find a strong correspondence between the two except in the tails of the income distribution (below 5th and above 95th percentile) with the PSID being consistently higher but by a stable magnitude across time.

[35] For cohabitating couples, we assign child dependents to the highest earner and compute their taxes separately as only married couples can file jointly. However, the PSID considers cohabitating couples as family units.

[36] The CPS March income questions changed in 1975 and 1987, but Heathcote, Perri and Violante (2010) find that these changes do not notably impact total income.

[37] Censoring may result in overestimating the polarization index, because the Gini coefficient and mean income are underestimated. We can still deduce polarization trends as long as the overestimation is consistent throughout time without having to impute censored values.

not correct for top-coding. The CPS also imputes missing values for income.[38] We do not drop imputed values as they are widely used. Dropping them significantly reduces the sample size and makes use of the weights problematic as pointed out by Heathcote, Perri, and Violante (2010). Encouragingly, the Gini Coefficient computed with annual CPS family income possesses the same trends as imputed, household income in Heathcote, Perri, and Violante (2010).[39] In the PSID, we construct family income. Top-coding in the PSID affects very few observations each year. We exclude these observations. Family income consists of taxable income for the head of household and partner and transfers to the head of household and partner. Taxable income is the sum of labor income (wages and salaries, bonuses, tips, etc.), asset income (rental income, farm income, unincorporated business income, dividends, and interest), and taxable pension income (annuities and IRAs, pensions, other retirement accounts). Transfers include alimony, child support, social security, worker's compensation and VA pensions. The PSID also provides information on unemployment compensation, property taxes, and rent paid. We use this additional information when computing federal and state taxes to construct disposable income.[40] The SCF reports total income for the PEU and imputes missing values, providing five imputed versions to account for the imputation when computing standard errors on statistics. We take the average of the Gini Coefficient and Polarization Index created from each version of the imputation for a final value.

The CPS provides no information on asset holdings aside from indicating home ownership and no information on consumption expenditures. The PSID wealth supplements from 1998 to 2013 provide information on assets and liabilities to compute a measure of net worth. On the asset side, the PSID has information on home equity, business/farm sale value, checking/savings/cash holdings, stocks value, vehicles, annuities and IRAs, and real estate sale value. For liabilities, we see information on business/farm debts, real estate debt, credit card debt, student loans, health care bills, and legal debts. Net worth is computed as the sum of these variables. The SCF covers wealth much more extensively, but it does not suit on estimation needs due to relative infrequency, lack of a long panel dimension, and no expenditure information.

The PSID only contains food expenditures prior to 1998, hence we start our econometric analysis using data from 1998. Table 2 (PSID Definitions) shows the various consumption categories that compose our measure of personal consumption expenditures, including durables and nondurables. The categories are education, childcare, transportation, housing, and food. Some studies construct a measure of total expenditures in the PSID using food expenditures alone, which date back to 1962. One procedure estimates food demand in the Consumer Expenditure Survey (CEX) and inverts the equation to estimate total personal consumption expenditures in the PSID (Blundell, Pistaferri, and Preston 2004). We annualize each expenditure reported and compare our estimates with those of Li et al. (2010) who show they track total expenditures in the CEX. Health care expenditures are omitted, because they only include out of pocket expenses and insurance premiums. Rental services for home owners are imputed using the value of the main residence times a 4% interest rate (Krueger, Mitman and Perri 2015). All missing values are imputed using a left-censored Tobit regression of log expenditures in each category on a cubic in age and family size spline fully interacted with year

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[38] We are not aware of a systematic study that evaluates the impact of imputing missing values in the CPS, so we cannot say how it influences the trends we observe.

[39] Heathcote, Perri, and Violante also present the Gini Coefficient of annual earnings in the OECD Equivalence. We obtain similar trends when using the Equivalence Scale to put earnings on a per-adult-equivalent basis.

[40] Federal and state taxes are computed using the NBER TAXSIM (v.9) program. We have no information on income from capital gains.

dummies as done in Li et al. (2010). The extent missing values and top-coding in the expenditure item in the PSID is also limited to a few observations each year.

Sample Restrictions

We impose some restrictions on our sample to access trends. For each survey, we take only observations where 1) information for the head of household (i.e. income, age) is present, 2) the head of household is aged 24 to 64 and 3) the head of household resides in the U.S. The latter restriction serves to make the sample representative of working U.S. families. We also drop extremely poor families as defined by less than 2 dollars per day in real 2005 terms. In the SCF, we drop households with income in the top 1%, because the survey oversamples wealthy households. Wherever noted, the "trimmed" sample for all surveys refers to this sample less observations exceeding the top 1% thresholds published by Alvaredo et al. (2015) and less observations in the bottom 1%. We use the thresholds estimated by Alvaredo et al. for the top percentile, because the CPS and PSID do not sample many high income households like the SCF. Trimming the top 1% in the data may lead to underestimation of the Gini Coefficient and consequently overestimation of the Polarization Index, hence we use a predetermined threshold. In the PSID, we also exclude the SEO sample and the Latino supplement sample (which only ran from 1990 to 1995). We also exclude PSID observations with large jumps in income (exceeding 500% or smaller than -80%), because we observe families over time.[41]

We impose more restrictions for our econometric sample, which only employs the PSID from 1998 onwards due to data availability. We drop families where the head of household is institutionalized, kept in house, or a student, because we only focus on "working" families. We treat families which composition change (e.g. divorce) as new families like Blundell et al. 2014. We drop observations where age, marital status, race, gender, education or state information is missing. We require the state in order to compute state-level taxes. We drop observations where the head of household's hourly earnings are less than half the federal minimum wage.[42] We drop observations where labor income is positive but hours worked are zero. We drop observations where the head of household is single with no children but has childcare expenses exceeding 1% of total income. After imputing missing expenditures, we drop observations with expenditures exceeding income and wealth by 300%. After computing taxes, we drop observations where the state tax burden is unavailable as we cannot compute disposable income for these observations. Finally, we drop families with only one observation remaining, because our panel regression analysis requires at least two observations per family. We show the sample attrition in Table (3) PSID Sample Selection. Our econometric sample has approximately 3000-4000 observations per year where the household is the unit of observation.

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[41] We borrow this definition of large jumps from Blundell, Pistaferri, and Preston (2008).

[42] We calculate hourly earnings as annual labor earnings divided by annual hours worked. See Autor et al. (2008) for a discussion of the importance of trimming the bottom of the income distribution.

TABLE 2. PSID DEFINITIONS

A. Total Expenditures[43] (Unconditional Weighted Mean)

	2000	2004	2008
Total Food	7,238	7,659	8,180
At home	5,119	5,291	5,854
Away from home	2,024	2,254	2,227
Delivered	129	140	120
Total Housing*	19,326	23,068	26,127
Mortgage*	8,411	9,294	10,540
Rent*	1,450	1,506	1,801
Insurance	432	591	706
Property Tax	1,626	2,053	2,564
Utilities	2,509	2,536	2,823
Total Transportation	7,114	8,208	7,487
Loan Payment	1,618	1,840	1,525
Down payment	1,624	1,750	1,510
Lease payment	491	306	265
Insurance	1,436	1,786	1,725
Gasoline	1,751	2,280	2,359
Repairs	129	133	150
Parking	60	55	59
Bus and Train	72	73	82
Taxicab	15	22	17
Other Transit	180	164	122
Education	1,895	2,249	2,609
Childcare	584	504	428
Total Expenditures	36,154	41,685	44,829
N	5,223	5,520	5,147

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[43] (*) categories are significantly higher than Li et al. 2010 as a result of the econometric sample selection.

B. Income, Wealth and Consumption

	1999	2002	2006	2010
Disposable Income				
p25	29,054	29,510	32,859	31,797
p50	46,500	49,683	56,786	60,098
p75	68,306	77,580	91,754	97,373
Mean	53,804	59,441	70,696	73,349
Net Worth without Home Equity				
p25	4,100	4,500	5,000	3,700
p50	22,025	28,000	35,000	30,000
p75	95,300	119,000	191,500	195,000
Mean	129,366	179,240	300,445	271,105
Net Worth with Home Equity				
p25	12,500	19,081	26,500	15,000
p50	64,000	89,500	139,000	98,300
p75	177,500	250,000	390,000	347,500
Mean	183,156	267,405	439,068	373,111
Expenditures[44]				
p25	18,668 (26,669)	21,430 (30,614)	24,970 (35,671)	26,266 (37,523)
p50	26,985 (38,500)	31,988 (45,697)	38,904 (55,557)	40,300 (57,571)
p75	37,849 (54,070)	46,674 (66,667)	56,614 (80,887)	57,668 (82,383)
Mean	30,897 (44,139)	36,868 (52,669)	45,991 (65,701)	46,356 (66,223)
N	4,254	4,443	4,771	4,553

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[44] Expenditures cover the categories mentioned. Li et al. (2010) show that these expenditures cover up to roughly 70% of total expenditures using the Consumer Expenditure Survey for validation. Expenditures divided by 0.7 are shown in parentheses for convenience.

TABLE 3. PSID SAMPLE SELECTION

Full Sample

Restriction	Observations Dropped	Remaining Observations
PSID 1998-2013		85,892
Drop 2013 (attrition weights have not been adjusted for 2013)	10,669	75,223
Drop SEO and Latino sample	21,575	53,648
Age 24-64	7,348	46,300
Living in US	339	45,961
Partnered but missing partner's age	61	45,900
Missing age, marital status, race, gender, education or state	1,777	44,123
Below half of federal minimum wage	2,050	42,073
Labor income positive but hours worked are zero	13	42,060
Income growth exceeds 500% and below -80%	241	41,819
Expenditures exceed income and wealth by 300%	37	41,782
Unmarried, No Children, Childcare Expenses > 1% of income	3	41,779
State tax burden unavailable	21	41,758
Student, Keeping house, Institutionalized	981	40,777
At least two observations	5,915	34,862

Regression Sample

Restriction	Observations Dropped	Remaining Observations
Full Sample		34,862
Non-missing DI, wealth and expenditures + normalization $1/c(t-2)$	16,378	19,291
Instrument Availability	1,485	17,806

X. REGRESSION APPENDIX

To examine the impact of polarization on aggregate consumption, we must first understand consumption behavior across the income distribution. We measure this behavior using the marginal propensity to consume (MPC) but focus on the MPC out of permanent income (MPCP). We do this for two reasons. First, income polarization is a long-standing secular trend, so we want to take a long-run perspective on the potential consequences of income polarization. Second, instruments to changes in permanent income are readily available, circumventing the need to tease apart permanent and transitory income changes.

We exploit the panel nature of the PSID and estimate the MPCP using an instrumental variables fixed effects specification, regressing normalized changes in personal consumption expenditures on instrumented normalized changes in income. We follow Carroll et al. (2011) and estimate the MPC directly using the ratio of the change in income relative to an initial level of consumption. For example, the changes in consumption, income, and net worth from 2005 to 2007 are normalized by consumption in 2003 and so forth. This approach differs from log-linear regressions which estimate log consumption on log income or log wealth. These regressions relate growth rates and consequently yield elasticities from which we must then calculate the implied MPC. Instead, the marginal effect on instrumented income here will give a direct estimate of the MPC as we use normalized changes rather than growth rates where the normalization is consumption in the prior year.

The fixed effects specification removes the influence of time invariant household characteristics related to changes in income. We also control for time varying household characteristics related to income changes (family size, region, and age and age squared of the head of household) and fully interact them with year dummies. Hence, we use within household time-variation to identify the MPCP.

Changes in income consists of changes in permanent, transitory, and measurement error components. Measurement error and transitory income shocks are observationally equivalent and may bias our estimates towards zero under classical measurement error assumptions. As mentioned, we use an instrument to identify exogenous variation in permanent income, which also purges the influence of measurement error and transitory income shocks. Our instrument for income consists of the average annual income of all other households in the same region-age-family-size cohort. Validity of this instrument in the fixed effect regression requires at least that 1) measurement error cannot be systematic across households and 2) the covariance of transitory income changes is constant across households and time. If common processes (e.g. regional macroeconomic conditions) underlying transitory income shocks do not change in the way it affects cohort households differently over the period we consider, then the second condition will be satisfied. Relevance of the instrument requires permanent income changes to be correlated across similar households where similar households are defined by region-age-family-size cohorts. Assuming validity for our constructed instrumented, quadratic and cubic terms of the same instrument also serve as valid instruments. A first stage regression of income on the instrument (average cohort income which excludes income of the household itself) yields an F-Statistic of 618.10, which shows relevance of the instrument. The Kleibergen-Paap under-identification test and Sargan-Hansen over-identification test provide evidence in favor of the validity of our instruments. Kleibergen-Paap tests the identification of the endogenous regressors, while Sargan-Hansen tests the joint null that the set of instruments is valid. We fail to reject the null of validity in the case of Sargan-Hansen and reject the null of under-identification for Kleibergen-Paap.

We allow the MPCPs to vary across the income distribution as theory predicts (Carroll 2009). We do this in two ways. First, we interact changes in income with indicator variables for the households' position in the income distribution. Second, we interact changes in income with continuous variables indicating the households' position in the income distribution. In particular, we use a polynomial expansion in the distance from median income. Median income differs by state, so median income in California may be high income in Oklahoma. However, the PSID is not representative at the state level, so we use the median income for all households in the sample each year. Defining median at the state level and restricting to at least 40 observations yields similar results in most cases.