Household wealth structures and position in the income distribution – econometric analysis for the USA, 1989-2013

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Abstract

This paper aims to empirically evaluate the relationship between differences in wealth composition among households and income inequality in the USA between 1989-2013. Interactions between the patterns of wealth accumulation and income are a vital driver of inequality in capitalist economies (Piketty 2014). But not enough is known about precisely which types of assets are more conducive to sustained improvements in household's position in the income distribution. This paper contributes to the inequality literature by estimating how accumulation of different forms of assets and debt impacts on income inequality. Specifically, we apply linear regression analysis and non-parametric median slope estimation to data from the U.S. Survey of Consumer Finances between 1989-2013 to test the relationship between the composition of household balance sheets and position in the distribution of income relative to the median in the period before and after the Great Recession. We establish that wealth composition has a statistically significant impact on relative inequality, but the effects differ for various types of wealth. We find that greater share of primary residence and low- yielding transaction accounts in total asset portfolio, as well as higher contribution of unsecured debt to overall debt holdings push households away from the median towards the bottom of the income distribution. In contrast, higher relative accumulation of business equity, high-yielding financial investment assets, secured debt, as well as retirement and insurance assets and other property pull households further away from the median towards the top of the income distribution. The latter effects are found not to be shared equally across gender, racial, and intergenerational groups.

1. Introduction

The aim of this paper is to empirically examine the interplay between wealth and income at the household level in generating inequality. Using aggregate data, Piketty (2014) argues that this mechanism is central in understanding historical trends and levels of inequality in capitalist economies. Due to compounding of interest, returns to wealth tend to outpace the growth of income. This leads to concentration of resources over time among wealth holders and their inheritors, which he identifies with the top 1-0.1% percent of the distribution. However, expansion of homeownership in the subprime lending boom and gradual privatisation of pensions opened

access to wealth accumulation and capital income earnings among low-to-middle income households (Barba/Pivetti 2009; Wright 2009; Wolff/Zacharias 2013; Fontana *et al*. 2014). The period before the 2007 crisis has been characterised by expansion of subprime lending, proliferation of securitised financial instruments based on loans to households, and increasing pressures on household finances due to stagnating wage growth and privatisation of public services (Dos Santos 2009; Goda/Lysandrou 2013; Karacimen 2013). In the aftermath of the Great Recession, bursting of the house price bubble led to destruction of wealth gains for numerous households relying on homeownership as their main asset. This process had a distinct intersectional dimension, as women, minorities and the young were targeted by subprime lenders, suffering from higher rates of foreclosures during the crisis which transformed into long-term losses in their net wealth after the Great Recession (Young 2010; Henry *et al*. 2013). In light of increasing heterogeneity of household wealth and disparate trajectories of wealth accumulation before and after the 2007 crisis across different households, what is the relationship between wealth holdings and income inequality?

This paper contributes to the inequality literature by studying how the precise structure of household wealth influences income distribution. We examine the impact of the composition of asset and debt holdings and the associated disparities in returns to wealth and leverage on household position in the income distribution using linear regression analysis and non-parametric slope estimation of data from the U.S. Survey of Consumer Finances between 1989-2013. The research hypothesis is that high contribution of assets such as business equity, retirement accounts, and high-yielding financial assets (such as bonds, pooled investment funds etc.) to the overall asset portfolio improve household's position in the income distribution to a greater extent than ownership of real estate, vehicles, and low-yielding financial assets such as bank deposits. This is because the former group of assets faces comparatively higher appreciation in value than the latter group (Williams 2016). Moreover, ownership of these high-yielding forms of wealth often necessitates large initial down payments, making them less accessible to low-to-middle income households than e.g. homeownership (with the help of mortgage financing). Similar can be observed in the case of debt. Households whose debt holdings consist mainly of secured debt can take advantage of tax break, and their debt payments contribute to building up of their net worth. Conversely, households relying primarily of unsecured debt face tougher repayment conditions, which acts to the detriment of their credit worthiness rather than to increase their wealth accumulation capacity. Relationship between debt and assets, as well as between debt payments and income, influences the trajectory of household economic wellbeing. Inequality is thus influenced by disparities in leverage and returns to assets generated by differences in the balance sheet composition.

This hypothesis is motivated by the empirically observed patterns of asset ownership along the distribution, with the top decile owning a diversified portfolio of real and financial assets, middle-income households reliant on housing, and wealth of low-income households dominated by vehicles (Wolff 2014:31). Consequently, we argue that returns to wealth depend on the absolute size of wealth held by the household (Szymborska 2017). However, while homeownership constitutes an important wealth-building vehicle, which is vital for long term improvements in household economic wellbeing, households whose balance sheets are dominated by primary residence are more volatile to economic shocks. This is because changes in house price movements lead to swings in the value of household net worth (defined as assets less liabilities), also owing to higher leverage of households for whom real estate is the only major asset. In fact, middle-income households suffered larger losses in their wealth in the aftermath of the Great Recession than households at the top of the distribution (Wolff 2014:34). Similarly, composition of debt influences income inequality by differences in debt repayment conditions across secured and unsecured forms of debt.

The paper is structured as follows. Section 2 describes method of the empirical analysis in this paper, describing the chosen specification and estimation method. Section 3 presents and discusses results of the linear regression analysis, looking in detail at the distribution of income and examining differences in estimates across gender, racial, and intergenerational groups. We also study how the estimated effects of wealth composition have changed overtime in the course of securitisation. Section 4 presents non-parametric sensitivity analysis of our results. Section 5 concludes.

2. Method

2.1. Specification

To test the relationship between household balance sheet composition and position in the income distribution linear regression analysis is employed. We estimate a linear regression model, where relative inequality, defined as the ratio of household income to the median income in each wave, is regressed on variables measuring the composition of asset and portfolio holdings. To capture the structure of wealth, balance sheet composition variables are presented in terms of their contribution to the total holdings of assets or debt. We control for the socio-economic characteristics of the household head. Despite the lack of a clear stochastic relationship between balance sheet composition and inequality, regression analysis is helpful in evaluating statistical significance of the impact of the interactions between wealth and income in generating inequality, which are related to the type of assets and debt owned.

Equation 1 presents the baseline regression specification. The dependent variable $z_{i,t}$ is the ratio of income of household i relative to the median income of the whole sample in wave t. $X_{i,t}$ is the matrix of regressors for each observation over time, and β is the matrix of estimated coefficients. T_t is a vector of year dummies with 1989 being the reference year. The error term $\varepsilon_{i,t}$ is assumed to be normally distributed.

$$z_{i,t} = X_{i,t}\beta + T_t\gamma + \varepsilon_{i,t} \qquad t = 1989, 1992, 1995, \ldots, 2013 \qquad (1)$$

Balance sheet composition variables include relative shares of financial and non-financial assets in total assets, the shares of secured and unsecured debt in total debt holdings, and leverage measures. This baseline specification only includes households with positive holdings of assets and debt. Table A2.1 in Appendix II presents descriptive statistics for the variables of interest, while Table A2.2 shows the correlation matrix of regressors.

The contribution of financial assets is broken down into the total asset share of transaction accounts, financial investment assets, and retirement and insurance assets[1]. The share of non-financial assets is decomposed into the contribution of primary residence, business equity, and vehicles and other non-financial assets to total asset holdings[2]. As all balance sheet share variables sum to 1, we exclude the share of other real estate in total assets due to perfect collinearity issues[3].

We expect that greater contribution of financial investment assets, business equity, and retirement and insurance assets to total asset holdings increases the median income ratio. This is because these assets yield comparatively higher returns and tend to be concentrated at the top of the distribution (cf. Wolff 2014). In contrast, greater share of primary residence, transaction accounts, and vehicles and other non-financial assets in total holdings is expected to have a decreasing effect on the median ratio. This is because the balance sheet shares of these assets tend to be the highest among households in the middle and the bottom of the income distribution.

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[1] Financial investment assets include certificates of deposits, savings bonds, bonds, stocks, other managed assets, pooled investment funds, i.e. non-money market mutual funds, and other financial assets. Retirement and insurance assets include the Individual Retirement Accounts, Keogh accounts, 401(k), and other retirement accounts, as well as the cash value of life insurance plans.

[2] Primary residence is defined by the reported market value. Business equity is measured in net terms. Transaction accounts include call, checking, and saving accounts, money market deposit accounts, and money market mutual funds.

[3] Further reason for excluding this variable from the regression analysis is low proportion of households owning this type of wealth (see Appendix I), and lack of a strong *a priori* theoretical rationale for its analysis (compared to e.g. business equity, which despite low ownership rate is theoretically important to analyse because of the definition of capitalists in the functional distribution literature). Nevertheless, to gauge the impact of other property holdings on relative inequality in the regression analysis, we include the share of mortgages secured by other real estate in total debt.

Relationship between debt and relative inequality is ambiguous. The association can be negative, as debt repayments reduce household disposable income. On the other hand, debt may have a positive impact on the median income ratio, as credit provides an additional source of financing which can be used for consumption and investment. This effect is defined by the composition of debt holdings[4]. We expect the relationship to be positive for the greater share of debt secured by housing in total holdings, as it allows for home equity withdrawal. In contrast, greater reliance on unsecured debt in total liabilities is expected to decrease the median income ratio, as this type of debt is predominant among the low-income households. We distinguish between mortgages secured by primary residence and by other property, to gauge the impact of the ownership of other real estate on relative inequality (which was excluded from the asset composition variables). Moreover, relative holdings of unsecured debt are broken down into instalment loans and credit card balances (other lines of credit and other debt are omitted due to multicollinearity issues).

Consideration of the impact of household balance sheet composition on relative inequality calls for inclusion of leverage measures. In the baseline specification, we include the monthly debt-service-to-income ratio (DSY), the debt-to-asset ratio, and the debt-to-income ratio. In addition, a dummy variable is included indicating whether household monthly debt payments exceed 40% of her monthly income. The rationale for including the dummy variable is to control for the position in the income distribution among highly indebted households. Specifically, we examine the intercept difference among those with the monthly debt-service-to-income ratio above 40% and less leveraged households. This approach differs from the inclusion of a squared term of the variable. This is because the squared term investigates the difference in the gradient of the relationship as debt-service-to-income ratio increases, affecting the slope of the regression line, while we are interested in analysing differences in the levels of the median income ratio across the degrees of indebtedness[5]. Higher debt-service-to-income ratio and debt-to-asset ratio are expected to be negatively associated with relative inequality as households with high values of these ratios tend to be towards the bottom of the distribution. Conversely, we expect the debt-to-income ratio

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[4] Secured debt is defined as the amount outstanding on mortgages and home equity lines of credit secured by primary residence and other property. Unsecured debt is measured as credit card balances and instalment loans (which include vehicle, student, and consumer loans). Other debt incudes other unsecured lines of credit and other miscellaneous forms of debt (e.g. debt to family members, borrowing against insurance policies or pension accounts, margin debt, etc.).

[5] In fact, inclusion of a squared term for the debt-service-to-income ratio instead of the dummy is insignificant in all specifications, which highlights different functions of the two methods. Thus, no non-linearity in the relationship between leverage and the median income ratio is found, and the focus is placed on the difference in the level of relative income (i.e. position in the income distribution) between extremely indebted households and the rest.

to be positively associated with relative inequality as households at the top of the distribution tend to have higher values of this ratio than the rest.

Among socio-economic controls, we include age of the household head and the value of age squared in order to account for the presence of the life-cycle effects. According to this theory, we would expect an inverted U-shaped relationship between age and the median income ratio. As households engage in consumption smoothing over their life-cycle, they experience the highest levels of relative income during their productive years, declining after retirement. Secondly, we consider human capital accumulation through education, measured as the index of the highest educational achievement of the household head, ranging from 1 – no grades completed, to 17 – graduate school.

Moreover, we include dummy variables for gender and race, equal to 1 for female-headed households and households headed by Blacks or Hispanics respectively. We expect that households headed by females and Blacks or Hispanics have lower incomes relative to the median as these households tend to be concentrated at the bottom quintile of the income distribution (U.S. Survey of Consumer Finances). Furthermore, we include a dummy variable for marital status, equal to 1 if the household head is single, and 0 otherwise. We expect single households to have a lower position in the income distribution relative to the median compared to households who are married or live in a partnership, who benefit from joint income streams (cf. Cohen/Haberfeld 1991). To control for household size, we include the number of children in the household. To capture the potentially non-linear relationship between household size and relative income, we include the squared value of the number of children. We expect a hump-shaped relationship between family size and relative income as after a certain point a greater number of dependents places a higher burden on household finances.

Furthermore, we account for labour force participation and type of employment of the household head. We include a dummy variable equal to 1 if the household head is out of labour force, expecting these households to be further down the distribution of income relative to the median compared to working households. We also include a dummy variable for the type of employment equal to 1 if the household head is self-employed. The impact of self-employment on relative inequality is ambiguous. On the one hand, small entrepreneurs have been documented to experience lower income increases than wage-earning households (cf. Hamilton 2000). On the other hand, if self-employed households exercise control over corporations, seize large operational profits, and accumulate sizeable wealth through business equity, they are expected to be positioned at the top of the income distribution relative to the median (Wolff/Zacharias 2013:1383).

To evaluate the relevance of wealth composition as an independent determinant of inequality, we compare the baseline regression with a reduced specification including only household characteristics.

2.2. Estimation method

Baseline specification is estimated using the pooled ordinary least squares (POLS) method. Choice of POLS is motivated by the complex multiply imputed design of the U.S. Survey of Consumer Finances (SCF), which limits applicability of more advanced econometric techniques. POLS regression is preferred to panel data estimation techniques commonly used in survey data analysis because the SCF is not a panel but a repeated cross-section. Consequently, fixed and random effects estimators are not applicable in this case. An additional advantage of POLS estimation over these methods is that it accounts for time-invariant variables such as dummies for gender and race, which are excluded from the fixed effects estimation (Wooldridge 2002:170). Moreover, POLS regression is preferred to the alternative estimation of the cross-sectional averaging of least squares as the latter does not account for the time series dimension of the data. This leads to a biased estimator as the unobserved time effects are correlated with regressors. Consequently, POLS estimation can account for time effects present in the SCF. Since the size of the cross-section in the SCF is larger than the time series, separate intercepts are included for every period (*ibid.*), corresponding to the dummy variables for each wave of the survey.

Due to the complex data design of the SCF, assumptions of unbiasedness and consistency may be violated. Moreover, the OLS methodology relying on mean averages in calculating the estimates may inflate some coefficients due to its sensitivity to the extreme values of wealth. There are also strong reasons to suspect mutual causality between relative income inequality and wealth composition. This is because high-wealth individuals receive greater capital income through the returns to wealth. In turn, high income generates opportunities for the accumulation of more profitable assets through saving and investment. In our sample, the correlation between the median income ratio and net wealth is relatively high at 0.51. Given the structure of the survey, it is not possible to employ the standard procedures dealing with endogeneity, such as the instrumental variable estimation techniques.

To test the robustness of the POLS results we compare them with quantile regression estimates and non-parametric Theil-Sen median slope estimates. Both of these methods are shown to be more robust to extreme values, which may inflate the mean-based POLS estimates. Quantile regression analysis allows for estimation of the proposed economic relationship at different points of the conditional distribution of the dependent variable (Baum 2013). We consider the conditional

median function of the median income ratio corresponding to the 50th percentile. Thus, in contrast to the OLS method which minimises the sum of squared errors, quantile regression minimises the sum of the absolute values of the error term, and is thus also called the least-absolute-deviation (LAD) regression (*ibid.*). Hence, the median quantile regression is more robust to outliers than the OLS. Moreover, it is semiparametric and avoids assumptions about the parametric distribution of the error term. Quantile regression is superior to the OLS if errors are highly non-normal, as is likely to be the case in the present dataset. To assess the sensitivity of results, we report quantile regression coefficients alongside results of the POLS estimation.

In addition, the non-parametric approach allows to empirically evaluate the impact of wealth heterogeneity on inequality without making assumptions about the distribution of the error term (Granato 2006), which are inherent in the regression approach and are likely to be violated in the SCF. The Theil-Sen median slope is defined as the median of all slopes calculated between each pairs of datapoints of any two variables[6,7] (Theil 1950; Sen 1968). Its interpretation is similar to the regression coefficient as the unit change in the outcome variable given a unit increment in the predictor variable. The difference between the non-parametric and the regression-based slope is that the non-parametric gradient is based on the calculation of a rank parameter rather than the conditional distribution estimation[8,9].

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[6] The analysis is conducted using STATA package *censlope* developed by Newson (2006).

[7] Given the outcome variable Y, the predictor variable X, and a proportion $q \in (0,1)$ The Theil-Sen median slope is defined as $\beta: \theta(Y - \beta X, X) = 1 - 2q$, Where θ is a rank correlation coefficient Somers' D (Somers 1962) and q=0.5. Given the definition of Somers' D *D(Y|X)*, the Theil-Sen median slope satisfies the following property:
$$1 - 2(0.5) = D(Y - \beta X | X)$$
$$0 = \Pr(Y_1 - \beta X_1 < Y_2 - \beta X_2) - \Pr(Y_1 - \beta X_1 > Y_2 - \beta X_2)$$
$$\Pr[(Y_2 - Y_1)/(X_2 - X_1) < \beta)] = \Pr[(Y_2 - Y_1)/(X_2 - X_1) > \beta)]$$
This means that a pairwise slope $(Y_2 - Y_1)/(X_2 - X_1)$, where $Y_1 < Y_2$ and $X_1 < X_2$, is equally likely to be above or below β. We assume that the Theil-Sen median slope follows the t-distribution.

[8] The alternative parameter which is more commonly used in the rank defining literature is the Spearman correlation coefficient (Spearman 1904). However, it is not suitable to be analysed in the survey data setting, and its confidence intervals are less reliable and interpretable (Kendall/Gibbons 1990). The main difference between the Spearman coefficient and Somers D is that the former is calculated as the product-moment correlation between the cumulative distribution functions of two variables rather than the probabilities of concordance/discordance (see next footnote; Newson 2001).

[9] Given two random variables U and V, Somers' D *D(U|V)* is a conditional probability of concordance or discordance between two ordered pairs of U and V (U_1, U_2) and (V_1, V_2), where $U_1 < U_2$ and $V_1 < V_2$ (Newson 2001:2). U and V are concordant if the larger of the two values of U is associated with a greater value of V, and they are discordant if the larger U-value is related to a smaller of the two values of V. Similarly to other correlation coefficients $D(U|V) \in (-1,1)$.

3. Results

3.1. Baseline specification

Table 1 presents results of the POLS estimation of the baseline balance sheet specification and reduced specification with socio-economic variables. The table also reports results of the median quantile regression estimation (QR) of the baseline specification[10]. As mentioned in the previous subsection, the rationale for comparing these specifications is to provide a robustness check for the estimated signs and significance of the balance sheet components and socio-economic controls. This is also the task of the quantile regression estimation.

In the baseline specification with detailed balance sheet composition variables, greater reliance on non-financial assets in total holdings is negatively associated with the median income ratio, except for the relative holdings of business equity. This negative effect is the strongest for households with large relative holdings of primary residence. A one-percentage point increase in the share of primary residence in total assets is associated with a 0.7 percentage point decline in the median income ratio, significant at 1% level. The impact of the relative holdings of vehicles and other non-financial assets is not statistically significant. In contrast, a one-percentage point rise in the share of business equity in total assets is associated with a 2.6 percentage point increase in the median income ratio, significant at 1% level.

Greater contribution of financial assets to total holdings is estimated to have a positive impact on relative inequality. The effect is observed to be the highest for financial investment assets. A one-percentage point rise in the relative holdings of financial investment assets is associated with a 2.9 percentage point increase in the median income ratio. In contrast, a corresponding increase in the shares of transaction accounts and retirement and insurance assets in total holdings is associated with a lower increase in the median income ratio of 0.42 and 0.37 percentage points respectively. All estimates are significant at 1% level.

Moreover, the expected positive effect of secured debt holdings on relative inequality turns out to be driven by other real estate in the detailed balance sheet specification. A one-percentage point increase in the relative holdings of debt secured by other property is estimated to raise the median income ratio by 2.2 percentage points, significant at 1% level. A corresponding increase in the share of mortgages secured by primary residence in total debt is associated with a 0.3 percentage point rise in the median income ratio, significant at 5% level. In contrast, greater relative share of

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[10] While we report the measure of the goodness of fit for the quantile regression, it is not directly comparable with the adjusted R^2 of the pooled OLS estimation due to methodological differences. This is because the indicators of the goodness of fit are not readily applicable in the quantile regression (cf. https://www.stata.com/manuals13/rqreg.pdf).

unsecured debt holdings is negatively associated with the relative position in the income distribution. A one-percentage point increase in the relative holdings of credit card balances is associated with a 0.97 percentage point decrease in the median income ratio, while a parallel increase in the share of instalment debt in total debt is related to a 0.8 percentage point decline in the median ratio.

As expected, leverage measures are negatively associated with relative inequality. A one-percentage point increase in the debt-payments-to-income ratio is associated with a 3.5 percentage point decline in the median income ratio, significant at 5% level. Extremely indebted households with the debt-payments-to-income ratio greater than 40% are estimated to have a 96.5 percentage point lower median income ratio compared to less indebted households, which is significant at 1% level. Both the debt-to-asset and the debt-to-income ratio are not statistically different from zero.

Among socio-economic controls, all variables have a statistically significant relationship with the median income ratio at 1% level. The highest positive impact is associated with educational attainment and self-employment status of the household head. An extra grade of educational achievement is estimated to increase the median income ratio by 17.7 percentage points, holding other variables constant. Self-employed households are estimated to have a 63.9 percentage points higher median income ratio than other households. Conversely, the highest negative association with the median income ratio follows from marital status and labour force participation. The median income ratio is estimated to be 69.7 and 38.1 percentage points lower for households whose head is single and out of labour force respectively. Moreover, we find support for the life-cycle effects, with an inverted-U shaped relationship between age and relative income. Based on the positive estimate of age and the negative coefficient of age squared, we find that the median income ratio reaches maximum at 65 years old[11]. Similarly, there is evidence of a statistically significant hump-shaped relationship between the number of children and the median income ratio. The maximum income ratio is recorded for families with four children (see previous footnote). Furthermore, race and gender have a statistically significant impact on relative inequality. Households whose head is female are estimated to have a 20.5 percentage point lower median income ratio than male-headed households, while households headed by Blacks or Hispanics are estimated to have a 5.8 percentage point lower income relative to the median compared to White households.

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[11] This is based on own calculations of a formula obtained from the partial derivative of the median income ratio with respect to age from the regression equation. If x* is the optimal value of age, then $x^* = -\hat{\beta}/2\gamma$ where $\hat{\beta}$ is the estimate of age and γ is the estimate of age squared. The decimal points are rounded upwards if equal to or exceeding 0.5.

Exclusion of the detailed balance sheet composition variables in the regression model alters some of the previously obtained estimates. In the reduced specification including only socio-economic controls, all socio-economic variables are statistically different at 5% level than in the baseline specification[12]. This suggests that balance sheet composition is a significant independent determinant of relative inequality even when controlling for household characteristics.

Comparison of the baseline specification results with the quantile regression estimation shows that the OLS estimates are robust in terms of significance and sign, with the exception of transaction accounts and instalment debt. We observe differences in the magnitudes of the estimated coefficients. The impact of the greater relative holdings of vehicles and other non-financial assets on the median income ratio in the quantile regression is statistically significant at 1% level compared to the OLS regression. Furthermore, a one-percentage point rise in the share of business equity and financial investment assets in total holdings is estimated to have a smaller increasing effect in the quantile regression, which suggests that the original results for these variables are sensitive to the extreme values of business equity and financial investment assets holdings. Furthermore, we find substantial differences in the estimates of transaction accounts across the two regressions. While in the OLS estimation a one-percentage point rise in the share of this asset in total holdings is associated with an increase of 0.4 percentage points in the median income ratio, the coefficient turns negative at -0.3 in the median regression. Both estimates are significant at 1% level. Similarly, while a one-percentage point rise in the share of instalment debt in total liabilities is associated with a 0.8 percentage point decline in the median income ratio in the OLS estimation, a parallel increase is estimated to raise the median ratio by 0.01 percentage points in the quantile regression. Both estimates are significant at 1% level. Moreover, the debt-to-asset and the debt-to-income ratio are statistically significant at the 10% and 1% level respectively in the median regression, although the magnitudes are very close to zero.

Figure 1 shows differences in the estimates of the balance sheet composition variables in the detailed specification across quintiles. It is evident that the mean-based estimates of the OLS regression disguise much of the heterogeneity of the impact of household balance sheet composition on relative inequality. Comparing the estimates of the median and the OLS regression with the quantile regression coefficients estimated at the 20th and 90th percentile we observe that there are disparities in the impact of the balance sheet composition variables across the distribution. The largest differences in the coefficient magnitudes are observed for business equity, financial

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[12] This is tested using chi-squared test implemented by the Stata command *suest*, which estimates the simultaneous variance of coefficients in two regressions with different sample size, and evaluates whether the two estimates are statistically different from each other based on a chi-squared test (See https://www.stata.com/manuals13/rsuest.pdf).

investment assets, retirement and insurance assets, as well as debt secured by other property, and the debt-service-to-income ratio.

Overall, results of the median regression indicate that estimates of the relative holdings of business equity, financial investment assets, transaction accounts, and instalment debt are particularly sensitive to extreme values. The results suggest that asset composition is a greater determinant of relative income for households towards the top of the distribution, which skews the mean-based estimates upwards. Simultaneously, debt composition emerges as a greater predictor of relative income for a typical median household, which is evident in the higher magnitudes of the estimates of unsecured debt and mortgages secured by primary residence in the quantile regression. The differences in the estimates of leverage measures indicate that the median household is more indebted and suffers greater declines in relative income due to increases in the debt-payments-to-income ratio than the average mean household.

Table 1 Pooled OLS and quantile regression results 1989-2013

Median income ratio	Socio-economic variables (POLS)	Detailed balance sheet specification (POLS)	Detailed balance sheet specification (QR)
Age	9.31***	7.75***	3.99***
	(0.273)	(0.407)	(0.001)
Age squared	-0.07***	-0.06***	-0.04***
	(0.003)	(0.004)	(0.000)
Educational attainment	23.37***	17.70***	8.74***
	(0.377)	(0.435)	(0.001)
Female	-29.96***	-20.47***	-14.60***
	(3.356)	(4.689)	(0.005)
Black/Hispanic	-27.28***	-5.79***	-5.77***
	(1.481)	(1.648)	(0.003)
Single	-80.24***	-69.71***	-47.70***
	(3.927)	(5.174)	(0.006)
Number of children	16.33***	18.23***	7.64***
	(1.989)	(2.047)	(0.003)
Number of children squared	-1.93***	-2.38***	-1.48***
	(0.446)	(0.473)	(0.001)
Self-employed	136.00***	63.91***	0.76***
	(6.777)	(7.178)	(0.011)
Out of labour force	-48.96***	-38.09***	-27.80***
	(2.968)	(3.551)	(0.005)
Debt-service-to-income ratio (DSY)		-3.50**	-11.40***
		(1.495)	(0.015)
DSY>40%		-96.49***	-47.10***
		(3.030)	(0.011)
Debt-to-asset ratio		-0.00	-0.00***
		(0.001)	(0.000)

	(1)	(2)	(3)
Debt-to-income ratio		-0.01	0.00*
		(0.444)	(0.001)
Primary residence		-0.67***	-0.42***
		(0.113)	(0.012)
Vehicles and other non-financial		-0.08	-0.40***
		(0.109)	(0.013)
Business equity		2.64***	0.31***
		(0.202)	(0.054)
Financial investment assets		2.87***	0.23***
		(0.184)	(0.017)
Transaction accounts		0.42***	-0.26***
		(0.130)	(0.012)
Retirement and insurance assets		0.37***	0.24***
		(0.113)	(0.014)
Debt secured by primary residence		0.33**	0.59***
		(0.158)	(0.011)
Debt secured by other real estate		2.16***	1.11***
		(0.238)	(0.014)
Instalment debt		-0.83***	0.01***
		(0.150)	(0.010)
Credit card balances		-0.97***	-0.04***
		(0.151)	(0.012)
1992	-18.43***	-18.44***	-2.74***
	(5.164)	(6.630)	(0.006)
1995	-24.70***	-22.91***	-10.70***
	(5.150)	(6.522)	(0.005)
1998	-17.82***	-20.75***	-11.50***
	(5.311)	(7.031)	(0.010)
2001	-8.022	-10.38	-12.00***
	(6.573)	(8.039)	(0.006)
2004	-20.29***	-19.06***	-14.50***
	(5.303)	(6.578)	(0.008)
2007	-5.277	-5.60	-14.00***
	(5.536)	(6.749)	(0.007)
2010	-17.01***	-10.56	-11.80***
	(5.390)	(6.671)	(0.007)
2013	-1.130	2.31	-10.30***
	(5.453)	(6.868)	(0.005)
Constant	-365.7***	-223.50***	-52.00***
	(9.583)	(22.160)	(0.021)
Observations	41,528	30,219	30,219
Adjusted R-squared*	0.036	0.065	0.219
Root Mean Squared Error	621.8	541.6	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Base year 1989. Primary residence, vehicles and other, business equity, liquid assets, retirement accounts, and financial investment assets are presented in terms of the percentage share of the value of these variables in total assets. Debt secured by primary residence and by other real estate, instalment debt, and credit card balances are expressed in terms of the percentage share of the value of these holdings in total debt. Balance sheet variable

shares and the income median ratio are given in percentage terms.*Due to methodological assumptions of the quantile regression, we report pseudo-R^2 for the quantile regression and adjusted R^2 for the POLS regression.

Figure 1 Coefficients by quantile, USA 1989-2013

A. Asset composition variables

B. Debt composition variables
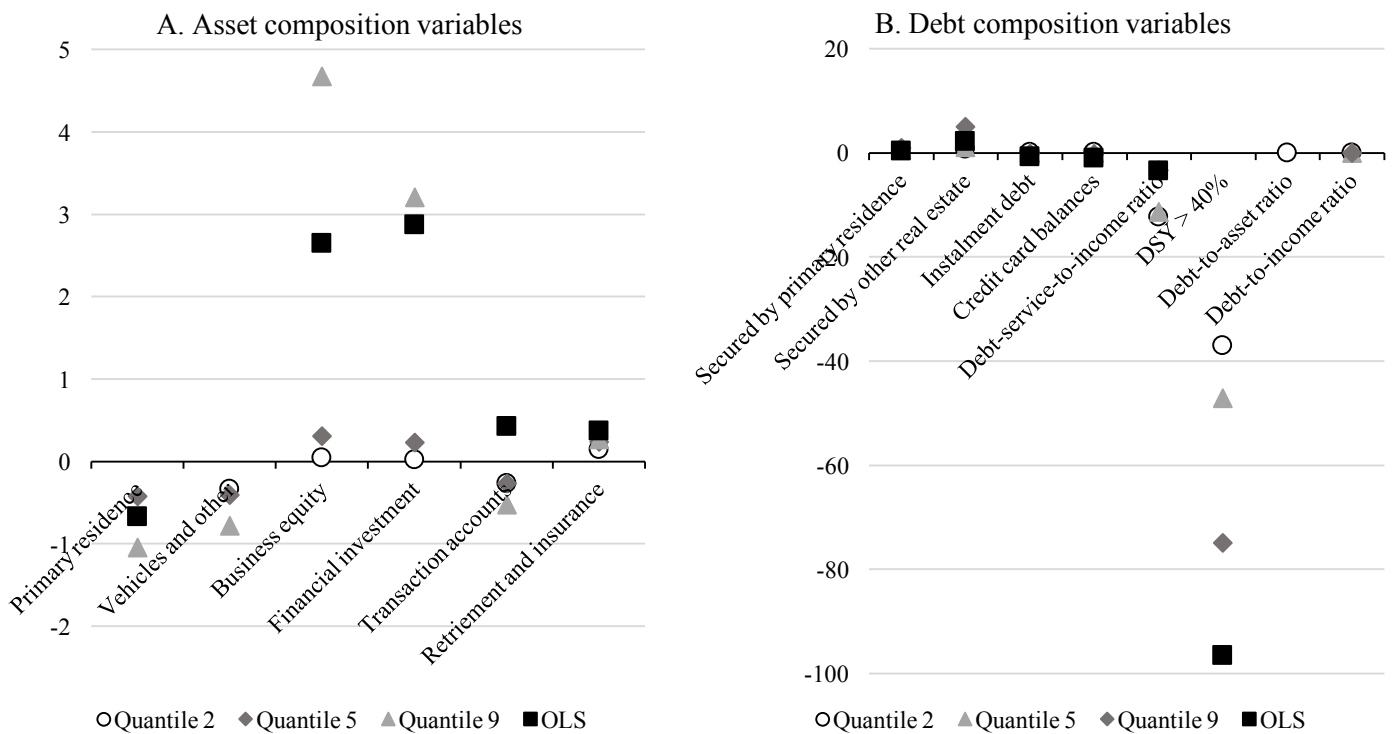
Analysis of the goodness of fit of the estimated regression models suggests that the detailed balance sheet regression explains the most of the variation in the median income ratio. The highest adjusted R^2 is obtained for the specification with detailed balance sheet variables. However, this statistic should be interpreted cautiously due to its low magnitudes of less than 10%. Low R^2 is expected given the large sample size, but it may signal omitted variable problems. For this reason, we also compare the Root Mean Squared Error (RMSE), which takes a square root of the ratio of the residual sum of squares in the regression to its degrees of freedom. The lower value of RMSE of 541.6 in the detailed balance sheet specification confirms that its accuracy is higher compared to the reduced specifications.

In addition to the potential omitted variable bias, a further limitation of our model may arise due to the endogeneity issues associated with the interplay between income and wealth, despite accounting for the relative shares of the balance sheet variables. For this reason, this econometric exercise should be treated as an illustration of the statistical significance of the proposed relationship between household balance sheet composition and relative inequality.

Overall, we find that households with higher levels of high-yielding financial investment assets, business equity, and debt secured by other real estate have relatively higher income levels

compared to the median in the period studied. In contrast, incomes of households whose asset holdings rely on primary residence are estimated to be further away from the median towards the bottom of the distribution. Although the estimated relationship between the relative holdings of debt secured by primary residence and the median income ratio is positive, the effect is lower than for debt secured by other real estate. Moreover, incomes of households relying on unsecured debt holdings are estimated to be lower relative to the median. Furthermore, highly indebted households with large monthly debt payments relative to monthly income, particularly those with debt-payment-to-income ratio exceeding 40%, are estimated to be further down the distribution of income relative to the median. While our study finds support for the significance of the socio-economic characteristics of households for relative inequality, their impact is reduced when wealth composition is considered.

These findings suggest that household wealth heterogeneity significantly affects relative income distribution, and thus needs to be considered as an independent determinant of inequality. In the next section we analyse the social dimension of inequality, examining how the estimated effects of household wealth composition on relative income differ across gender, race, and generations. Moreover, we break down the analysis across periods to account for the impact of the subprime lending boom.

3.2. Results by socio-demographic group

In order to account for the intersectional dimension of the impact of household wealth composition on inequality, the detailed balance sheet specification of the POLS regression is re-estimated including interaction dummy variables for the balance sheet composition variables. The slope dummies equal 1 for female-headed households, households headed by Blacks or Hispanics, and households aged less than 35, with households headed by males, Whites/other ethnicities, and over 35 taken as reference categories. We expect that due to the high opportunity cost of purchasing assets relative to financing everyday consumption, and because of discrimination issues in the credit markets associated with the predatory lending practices, these groups were exposed to more costly forms of borrowing and the impact of asset and debt composition on relative inequality is likely to be different for households headed by women, Blacks/Hispanics, and the young. For clarity, below we present tables with the estimated composite slopes and intercepts of the balance

sheet composition variables and the median income ratio for female, Black/Hispanic, and young-headed households[13].

Gender

Table 2 presents composite slope estimates of the balance sheet composition variables and the composite intercept for female-headed households. As our interest lies in assessing any potential differences in the impact of household wealth on relative income, we do not describe the differences in the socio-economic characteristics across the analysed subgroups in detail.

The estimated directions of the relationship between the median income ratio and asset composition variables are consistent across gender and with the baseline specification results. However, asset variables have generally no significant impact on the position in the income distribution for female-headed households. The estimated composite coefficients of the total asset shares of primary residence, vehicles and other non-financial assets, transaction accounts, and retirement and insurance assets are not statistically different from zero. Only the estimate of the relative holdings of financial investment assets is statistically significant at 1%. However, it's magnitude of 0.4 is substantially lower than the estimate of 3.9 for male-headed households. This suggests that the positive impact of higher relative holdings of financial investment assets and business equity is not shared equally across gender, with male households enjoying significantly higher increases in their incomes relative to the median compared to females.

Furthermore, there are significant differences in the impact of debt composition on relative income across gender. While the interaction dummy of gender and relative holdings of debt secured by primary residence is not statistically significant, based on the calculation of the composite standard error the overall coefficient is positively and significantly associated with the median income ratio for female-headed households. *Ceteris paribus*, a one-percentage point increase in the share of mortgages secured by primary residence in total debt is associated with a 0.2 percentage point rise in the median ratio for female households significant at 1% level, while the coefficient is not statistically different from zero for males. Moreover, male households holding debt secured by other property enjoy higher increases in their median income ratio of 2.2 percentage points for each one-percentage point rise in these relative holdings. In contrast, the effect for female-headed households is significantly lower at 0.8 percentage points.

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[13] Calculation of the composite slope and intercept is illustrated by the following example regression equation, where D is the dummy variable, Y is the dependent variable, X is a regressor, and ε is the error term: $Y = \beta_0 + \beta_1 X + \beta_2 D + \beta_3 DX + \varepsilon$. For $D=1$: $y = (\beta_0 + \beta_2) + (\beta_1 + \beta_3)X + \varepsilon$, where $(\beta_0 + \beta_2)$ is the composite intercept and $(\beta_1 + \beta_3)$ is the composite slope for subgroup for which the dummy is 1. For $D=0$ intercept and slope correspond to the original estimates β_0 and β_1.

Striking differences across gender emerge for the relative holdings of unsecured debt. While a one-percentage point increase in the share of instalment loans in total debt is associated with a 1.1 percentage point decline in the median ratio among males significant at 1% level, the estimated effect is not statistically significant for female households. Moreover, a one-percentage point increase in the share of credit card balances in total debt is related to a 1.4 percentage point decrease in the median income ratio for male households, while the coefficient is not statistically different from zero for females. Moreover, the negative effect of leverage is magnified for female households, with a one-percentage point increase in the debt-payments-to-income ratio decreasing the relative income of women by 7.6 percentage points (although the interaction dummy is not statistically significant), compared to a 3.5 percentage point decline for men. In addition, incomes of females whose debt-payments-to-income ratio exceeds 40% are estimated to be significantly closer to the median than incomes of the extremely indebted males. This indicates that female-headed households in the bottom half of the distribution tend to be more indebted compared to men. Furthermore, the insignificant estimates of the relative unsecured debt holdings suggest that this form of debt is not as detrimental for the relative income position among women compared to men. Lastly, we observe a significant difference in the intercept across gender, with female-headed households occupying a lower position in the income distribution in mean terms than male households.

Comparison of the POLS results with the quantile regression estimates shows robustness of the majority of these effects in terms of their sign, although the median regression estimation yields all regressors to be significant at 1% level. As in the full sample, the quantile regression coefficients tend to be lower in magnitude than the POLS estimates. Remarkably, coefficients of the share of transaction accounts and business equity are negative for the median female household. Moreover, estimates of the relative holdings of unsecured debt are positively associated with the median income ratio for female-headed households and statistically significant at 1% level. This suggests that greater accumulation of unsecured debt has a larger effect for the relative position in the income distribution for the median female-headed household compared to males.

Overall, we find that female-headed households do not enjoy the same increases in their relative income following the rise in the relative holdings of business equity, financial investment assets, and other real estate (gauged by the contribution of debt secured by other property to total holdings). Moreover, we observe that female households suffer greater relative income declines from higher leverage compared to males, and that their relative position in the income distribution is related to a larger extent to unsecured debt accumulation.

Table 2 Pooled OLS and quantile regression results with interaction dummies – gender and balance sheet composition variables, USA 1989-2013

Median income ratio	Composite slope (POLS)		Composite slope (QR)	
	Male	**Female**	**Male**	**Female**
Primary residence	-0.96***	**-0.05**	-0.57***	**-0.13***
	(0.136)	(0.091)	(0.015)	(0.009)
Vehicles	-0.28**	*-0.03*	-0.56***	-0.14***
	(0.131)	(0.093)	(0.013)	(0.010)
Business equity	2.74***	**0.07**	0.30***	**-0.04***
	(0.220)	(0.243)	(0.076)	(0.036)
Financial investment assets	3.94***	**0.42***	0.50***	**0.02***
	(0.252)	(0.116)	(0.035)	(0.013)
Transaction accounts	0.53***	**0.06**	-0.34***	**-0.09***
	(0.184)	(0.093)	(0.023)	(0.023)
Retirement and insurance assets	0.32**	*0.11*	0.34***	0.11***
	(0.136)	(0.096)	(0.016)	(0.023)
Debt secured by primary residence	0.26	*0.24***	0.63***	0.39***
	(0.209)	(0.064)	(0.017)	(0.014)
Debt secured by other real estate	2.22***	**0.83***	1.24***	**0.67***
	(0.299)	(0.167)	(0.029)	(0.224)
Instalment debt	-1.14***	**-0.02**	-0.05***	**0.04***
	(0.200)	(0.055)	(0.015)	(0.010)
Credit card balances	-1.37***	**-0.04**	-0.16***	**0.07***
	(0.205)	(0.059)	(0.014)	(0.011)
Debt-service-to-income ratio (DSY)	-3.45**	*-7.59***	-0.13***	**-0.04***
	(1.519)	(2.812)	(0.038)	(0.031)
DSY>40%	-119.38***	**-32.16***	-59.10***	**-22.90***
	(3.685)	(3.191)	(0.017)	(0.012)
Debt-to-asset ratio	-0.01	*0.00*	-0.00***	**-0.00***
	(0.013)	(0.001)	(0.000)	(0.000)
Debt-to-income ratio	-0.01	*-0.50*	0.00***	-0.01***
	(0.607)	(1.193)	(0.000)	(0.000)
Constant	-171.65***	**-269.45***	-27.70***	**-73.30***
	(27.063)	(17.911)	(0.000)	(0.018)
Observations	30,219		30,219	
Adjusted R-squared*	0.07		0.23	
Root Mean Squared Error	540.2			

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Full regression results (including socio-economic controls and time effects) are not reported because these estimates remain statistically the same in the regression including the interaction dummy variables. Full results available on request. Base year 1989. Estimates in bold indicate the Wald test yielding the interaction dummy statistically significant at 5% level. Standard errors calculated as $\sqrt{var(X) + var(XD) + 2cov(X,XD)}$ where XD is the interaction dummy. Italics indicate that the interaction dummy is not statistically significant. Asterisks reflect significance of the composite slope based on the calculated standard errors. *Due to methodological assumptions of the quantile regression, we report pseudo-R^2 for the quantile regression and adjusted R^2 for the POLS regression. Weighted Least Squares (WLS) iteration in quantile regression selected at 1 for convergence.

Race

Table 3 presents estimation results of the detailed balance sheet specification with interaction dummies across racial groups, comparing households headed by Whites/other ethnic groups and Blacks/Hispanics[14]. This categorisation is motivated by the similar patterns of wealth accumulation across these groups. The impact of asset composition on the median income ratio is significantly lower for Blacks/Hispanics, while debt accumulation is estimated to play a greater role than for Whites/other ethnic groups.

Firstly, the positive effects of the greater shares of business equity and high-yielding financial investment assets in total holdings are not shared equally between these ethnic groups. While a one-percentage point increase in the contribution of business equity to total assets is estimated to increase the median income ratio by 2.9 percentage points among White/Other households significant at 1% level, this effect is not statistically different from zero for Blacks/Hispanics. Similarly, a one-percentage point rise in the relative holdings of financial investment assets is associated with a 3.1 percentage point increase in the median income ratio for Whites/other ethnic groups significant at 1% level. However, the corresponding estimate is not statistically different from zero for Blacks/Hispanics.

Similarly, estimates of the relative holdings of transaction accounts and retirement and insurance assets are not statistically different from zero for Black/Hispanic households, while they are positive and statistically significant at 1% for Whites and other ethnicities. Moreover, relative holdings of vehicles and other non-financial assets are estimated to be negatively related to the median income ratio for Black/Hispanic households. A one-percentage point rise in the share of vehicles in total assets is associated with a 0.4 percentage point decrease in the median income ratio for this group, significant at 1% level. In contrast, the estimate is not statistically significant for White/Other households.

In contrast to assets, the estimates of debt composition variables tend to have a greater effect on the median income ratio for Blacks/Hispanics compared to Whites/other ethnic groups. A one-percentage point increase in the share of debt secured by primary residence is associated with a 0.3 percentage point rise in the median ratio among Blacks/Hispanics, significant at 1% level. Conversely, the estimate is not statistically significant for White/Other households. Gauging the impact of other property ownership, greater relative holdings of debt secured by other real estate are associated with higher increases in the median income ratio for Whites/other ethnic groups

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[14] Categorisation of racial groups is motivated by their availability in the dataset and similar patterns of wealth accumulation between 1989-2013 for household headed by Blacks and Hispanics vs. households headed by Whites and other ethnic groups (source: U.S. Survey of Consumer Finances).

compared to Blacks/Hispanics. A one-percentage point increase in the share of this type of debt in total liabilities is estimated to raise the median income ratio of White/Other households by 2.2 percentage points, compared to a 0.7 increase for Blacks/Hispanics. This suggests that ownership of property other than main residence has a greater effect on the relative incomes of Whites/other ethnic groups than for Blacks/Hispanics.

Furthermore, there are significant differences in the impact of relative holdings of unsecured debt on the median income ratio across race. While the impact of greater relative holdings of instalment debt is estimated to be negative across race, the magnitude is significantly lower in absolute terms for Blacks/Hispanics. A one-percentage point increase in the share of instalment debt in total liabilities is associated with a 1.1 percentage point decline in the median income ratio for Whites/other ethnic groups, significant at 1% level. In contrast, a corresponding rise is related to a decrease of 0.1 percentage points significant at 10% level for Blacks/Hispanics. Moreover, a one-percentage point rise in the share of credit card balances in total debt is estimated to decrease the median income ratio of White/Other households by 1.3 percentage points (significant at 1% level), while the coefficient is not significantly different from zero among Blacks/Hispanics.

A similar pattern is detected for the impact of the debt-service-to-income ratio on relative income across race. A one-percentage point rise in the ratio is estimated to decrease the median income ratio of Whites/other ethnic groups by 4.4 percentage points, significant at 1% level. In contrast, the coefficient is not statistically different from zero for Blacks/Hispanics. However, Black and Hispanic households whose debt-payments-to-income-ratio exceeds 40% are estimated to have a 49.4 percentage point lower median income ratio relative to the less indebted households. The median income ratio is estimated to be 108.3 percentage point lower for Whites/other ethnic groups. This indicates that Blacks and Hispanics in the bottom half of the distribution are more indebted compared to White and Other households. Lastly, on average Black/Hispanic households are lower in the income distribution relative to the median than Whites and other ethnicities, which is evidenced by statistically significant intercept dummy.

Comparing the above results with the quantile regression, we observe that most of the estimates are consistent in terms of significance and sign. As in the regression across gender, the quantile regression coefficients tend to be of lower magnitude than in the POLS estimation. Among exceptions, the estimate of the relative holdings of business equity is not statistically significant for the subsample of Whites. Moreover, the coefficients of the relative holdings of financial investment and retirement and insurance assets are negative and statistically significant in the quantile regression for the subsample of Blacks/Hispanics, while the POLS estimates are not statistically different from zero. This signifies that greater ownership of these assets does not improve the

relative position in the income distribution for the median Black or Hispanic household. Furthermore, the quantile regression estimates of the relative holdings of instalment debt and credit card balances are positive and statistically significant for Blacks/Hispanics. This indicates that the position in the income distribution of the median Black or Hispanic household relied to a greater extent on unsecured debt accumulation. In contrast, unlike in the POLS regression, the quantile regression estimates of the debt-service-to-income, debt-to-asset, and the debt-to-income ratio are statistically significant and negative for Blacks/Hispanics (and the latter two also for Whites/Other ethnicities), although their magnitude is close to zero.

Overall, these results suggest that while asset composition plays a greater role in influencing the relative incomes of Whites/other ethnic groups, debt and leverage are larger determinants of the relative position of Blacks/Hispanics along the income distribution. This indicates that minority households have become more dependent on debt in the process of financial sector transformation as their access to asset ownership was limited between 1989-2013. The resulting higher levels of leverage among minority households have significantly contributed to the deepening of racial inequality.

Table 3 Pooled OLS and quantile regression results with interaction dummies – race and balance sheet composition variables, USA 1989-2013

Median income ratio	Composite slope (POLS)		Composite slope (QR)	
	White/Other	**Black/Hispanic**	**White/Other**	**Black/Hispanic**
Primary residence	-0.82***	**-0.38****	-0.44***	**-0.33****
	(0.131)	(0.160)	(0.011)	(0.008)
Vehicles	-0.16	*-0.37***	-0.43***	**-0.39****
	(0.127)	(0.146)	(0.009)	(0.007)
Business equity	2.87***	**0.08**	0.34	*-0.02*
	(0.255)	(0.255)	(0)	(0)
Financial investment assets	3.13***	**0.30**	0.28***	**-0.12****
	(0.214)	(0.194)	(0.028)	(0.023)
Transaction accounts	0.51***	**-0.15**	-0.24	*-0.34*
	(0.164)	(0.171)	(0)	(0)
Retirement and insurance assets	0.40***	**-0.16**	0.36***	**-0.08****
	(0.133)	(0.155)	(0.015)	(0.011)
Debt secured by primary residence	0.23	*0.30****	0.58***	**0.42****
	(0.203)	(0.090)	(0.011)	(0.016)
Debt secured by other real estate	2.23***	**0.72****	1.20***	**0.63****
	(0.287)	(0.227)	(0.039)	(0.011)
Instalment debt	-1.08***	**-0.11***	-0.04***	*0.05****
	(0.194)	(0.064)	(0.007)	(0.007)
Credit card balances	-1.27***	**-0.10**	-0.10***	**0.07****
	(0.198)	(0.070)	(0.009)	(0.008)
Debt-service-to-income ratio (DSY)	-4.43**	*-0.72*	-0.10***	**-0.04****
	(1.823)	(3.513)	(0.001)	(0.023)

DSY>40%	-108.30***	**-49.38***	-49.20***	**-33.80***
	(3.434)	(8.291)	(0.003)	(0.027)
Debt-to-asset ratio	-0.01	*0.00*	0.01***	**-0.00***
	(0.007)	(0.001)	(0.000)	(0.000)
Debt-to-income ratio	-0.55	*0.00*	-0.01***	*-0.01***
	(0.477)	(2.956)	(0.000)	(0.000)
Constant	-201.78***	**-255.91***	-49.40***	**-58.64***
	(25.664)	(20.522)	(0.000)	(0.009)
Observations		30,219		30,219
Adjusted R-squared*		0.07		0.22
Root Mean Squared Error		540.9		

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Full regression results (including socio-economic controls and time effects) are not reported because these estimates remain statistically the same in the regression including the interaction dummy variables. Full results available on request. Base year 1989. Estimates in bold indicate the Wald test yielding the interaction dummy statistically significant at 5% level. Standard errors calculated as $\sqrt{var(X) + var(XD) + 2cov(X, XD)}$ where XD is the interaction dummy. Italics indicate that the interaction dummy is not statistically significant. Asterisks reflect significance of the composite slope based on the calculated standard errors. *Due to methodological assumptions of the quantile regression, we report pseudo-R^2 for the quantile regression and adjusted R^2 for the POLS regression. WLS iteration in quantile regression selected at 40 for convergence.

Generations

Table 4 presents results of the detailed balance sheet specification with interaction dummies across age groups, comparing households aged below 35 and those 35 years old and above. This categorisation is motivated by the observation that the youngest group of households fared consistently worse over time compared to the older households in terms of changes in their income and wealth (U.S. Survey of Consumer Finances)[15].

As in the case of gender and race, the positive effects of the greater relative holdings of business equity and financial investment assets on relative income are not shared equally across generations. A one-percentage point increase in the share of business equity in total assets is estimated to increase the median income ratio by 3.3 percentage points for households aged 35 and above, significant at 1% level. In contrast, the estimate for the youngest group is not statistically different from zero. Similarly, a one-percentage point increase in the share of financial investment assets in total holdings is estimated to raise the median income ratio of households aged 35 and above by 3.6 percentage points. Conversely, the estimate is significantly lower at 0.5 for households aged below 35. Both estimates are significant at 1% level.

Furthermore, we find an asymmetric impact of the relative holdings of transaction accounts on the median income ratio across generations. A one-percentage point rise in the share of

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[15] Moreover, this is the youngest age group provided in the dataset.

transaction accounts in total assets is estimated to increase the relative income of households aged 35 and above by 0.4 percentage points, significant at 5% level. In contrast, the estimate is not statistically different from zero among households below 35 years old. In addition, we estimate that there is no statistically significant difference between the coefficients of the relative holdings of primary residence, retirement and insurance assets, and vehicles and other non-financial assets between age groups, although the latter estimate is not statistically significant among households aged below 35.

Moreover, there are significant differences in the impact of debt composition on relative income across generations. Debt holdings are estimated to have a greater positive effect on the median income ratio for households younger than 35 compared to asset composition. A one-percentage point increase in the share of debt secured by primary residence is estimated to raise the median income ratio of the youngest group by 0.8 percentage points, while the estimated effect of 0.1 is significantly lower for households older than 35. Both estimates are significant at 1% level. We find no significant differences in the impact of mortgages secured by other property on the median income ratio between generations, although the magnitude of the estimate for young households is lower than for households aged 35 and above. Importantly, while the estimated effect of greater relative holdings of unsecured debt on the median income is negative for households aged 35 and above, the impact is found to be not statistically significant for the youngest group.

Furthermore, higher leverage levels have a more detrimental impact on the relative income among households below 35 years old compared to those aged 35 and above. A one-percentage point increase in the debt-service-to-income ratio is associated with a 16.8 percentage point decline in the median income ratio for the youngest group, significant at 1% level. In contrast, a parallel rise in the leverage ratio is estimated to decrease the median ratio of households aged 35 and above by 3.6 percentage points, significant at 5% level. Moreover, households below 35 years old whose monthly debt-payments-to-income ratio exceeds 40% percent are estimated to have 47.3 percentage points lower median ratio compared to less indebted households, while relative income is found to be 107.8 percentage points lower among extremely indebted households aged 35 and above. Both estimates are significant at 1% level. Additionally, we find that a one-percentage point rise in the debt-to-asset ratio is associated with a decline of 0.01 in the median income ratio significant at 1% level among households aged 35 and over. The estimates of the debt-to-asset and the debt-to-income ratios are not statistically different from zero for households below 35. Lastly, comparison of the intercept dummy indicates that young households have a lower position in the income distribution relative to the median than households aged 35 and over.

Contrasting the POLS and the quantile regression results shows that the majority of the estimates are robust in terms of their sign and significance, although the quantile regression coefficients tend to have lower magnitudes. Unlike in the POLS regression the estimate of the relative holdings of business equity is found to be positive and statistically significant for young households in the quantile regression, although its magnitude of 0.1 is substantially below the coefficient of 0.4 for households aged 35 and over. In contrast, the estimate of the relative holdings of financial investment assets is negative and significant for this group, compared to a positive POLS coefficient. This indicates that relative income of the median young household does not benefit to the same extent from ownership of these assets compared to households aged 35 and above. Furthermore, quantile regression estimates of the relative holdings of transaction accounts are negative for both age groups, while the POLS coefficients are positive. In addition, the quantile regression coefficient of the relative holdings of instalment debt for households below 35 is statistically significant and positive compared to the negative POLS result. Furthermore, the quantile regression estimates of the debt-to-asset and the debt-to-income ratio are statistically significant for both age groups, but the magnitudes are close to zero.

Overall, the above results indicate that debt accumulation is related to higher increases in relative income among households aged below 35 than asset composition, especially in terms of debt secured by main residence. In contrast, greater reliance on unsecured debt holdings is associated with lower relative income among households aged 35 and above. However, these older households enjoy significantly greater increases in the median income ratio than the youngest group, which is associated with their greater holdings of financial investment assets and business equity. Moreover, households below 35 years old are found to suffer greater relative income losses from higher debt-payments-to-income ratio relative to those aged 35 and above. Similarly to gender and race, the lower estimate for extremely indebted households among the youngest group indicates that they tend to be more indebted on average.

Table 4 Pooled OLS and quantile regression results with interaction dummies – age group and balance sheet composition variables, USA 1989-2013

Median income ratio	Composite slope (POLS)		Composite slope (QR)	
	Aged 35+	Aged <35	Aged 35+	Aged <35
Primary residence	-0.77***	*-0.41***	-0.43***	**-0.27***
	(0.129)	(0.178)	(0.006)	(0.018)
Vehicles	-0.47***	*-0.04*	-0.53	*-0.17*
	(0.129)	(0.135)	(0)	(0)
Business equity	3.33***	**-0.06**	0.42***	**0.08***
	(0.244)	(0.197)	(0.103)	(0.103)

Financial investment assets	3.63***	**0.52***	0.39***	**-0.01***
	(0.242)	(0.150)	(0.013)	(0.014)
Transaction accounts	0.35**	*0.12*	-0.31***	**-0.10***
	(0.179)	(0.129)	(0.011)	(0.008)
Retirement and insurance assets	0.28**	*0.23**	0.21***	*0.27****
	(0.131)	(0.139)	(0.006)	(0.006)
Debt secured by primary residence	0.10***	**0.81***	0.53***	**0.73***
	(0.203)	(0.092)	(0.004)	(0.020)
Debt secured by other real estate	2.00***	*1.40****	1.10***	**0.69***
	(0.285)	(0.280)	(0.074)	(0.012)
Instalment debt	-1.01***	**-0.04**	-0.00***	*0.07****
	(0.197)	(0.042)	(0.003)	(0.003)
Credit card balances	-1.21***	**0.00**	-0.10	*0.12*
	(0.196)	(0.046)	(0)	(0)
Debt-service-to-income ratio (DSY)	-3.60**	**-16.82***	-0.12***	*-0.09****
	(1.526)	(4.617)	(0.003)	(0.003)
DSY>40%	-107.81***	**-47.27***	-47.70	*-35.68*
	(8.292)	(3.117)	(0)	(0)
Debt-to-asset ratio	-0.01***	**-0.00**	-0.00***	**-0.00***
	(0.002)	(0.001)	(0.000)	(0.000)
Debt-to-income ratio	-0.01	**-0.14**	0.00***	**-0.00***
	(2.276)	(0.294)	(0.000)	(0.000)
Constant	-200.2***	**-278.20***	-34.50***	**-73.63***
	(30.364)	(20.206)	(0.000)	(0.004)

Observations	30,219	30,219
Adjusted R-squared*	0.07	0.22
Root Mean Squared Error	540.7	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Full regression results (including socio-economic controls and time effects) are not reported because these estimates remain statistically the same in the regression including the interaction dummy variables. Full results available on request. Base year 1989. Estimates in bold indicate the Wald test yielding the interaction dummy statistically significant at 5% level. Standard errors calculated as $\sqrt{var(X) + var(XD) + 2cov(X,XD)}$ where XD is the interaction dummy. Italics indicate that the interaction dummy is not statistically significant. Asterisks reflect significance of the composite slope based on the calculated standard errors. *Due to methodological assumptions of the quantile regression, we report pseudo-R^2 for the quantile regression and adjusted R^2 for POLS. WLS iteration in quantile regression selected at 30 for convergence.

3.3. Discussion

The above findings show that relative incomes of women, Blacks, Hispanics, and households aged below 35 are determined to a larger extent by debt composition rather than assets. The magnitude of the positive effects of the greater share of business equity and financial investment assets in total holdings is significantly smaller for these groups. Moreover, unsecured debt is found to have a less detrimental association with their median income ratios than for the other groups, although at varying levels of significance.

We also find evidence for an asymmetric impact of leverage on relative income, with greater declines in the median income ratio for female and young households. Moreover, lower estimates of extremely indebted households in the subsamples of women, Blacks, Hispanics, and the young suggest that these groups tend to be more indebted on average than their counterparts. Households headed by females, Blacks, Hispanics, and aged below 35 also faced higher leverage levels on average, which pushed them further down the income distribution.

Our results indicate that female, Black, Hispanic, and young households have become more dependent on debt and did not share the same improvements in their relative position in the income distribution arising from the ownership of assets as households headed by Whites, males, and those over 35. This gauges the impact of the absolute size of wealth holdings among these groups on generating higher returns to wealth compared to their counterparts. The statistical significance of the estimated effects suggests that disparities in asset ownership and the resulting levels of indebtedness and leverage have significantly contributed to the deepening of the gender, racial, and intergenerational inequality.

To further understand the estimated relationships between wealth components and relative income inequality across socio-demographic characteristics, we break down the POLS analysis by period. Table A3.1 in Appendix III presents results of the detailed balance sheet specification of the POLS regression estimated separately between 1989-1998, 2001-2007, and 2010-2013. The first period corresponds to the pre-subprime lending years, when growth in the private household debt was rising steadily. The second period is associated with the acceleration of the subprime lending in the USA and the corresponding housing bubble. The third period captures the post-crisis conditions, namely the fall in the aggregate household debt relative to the GDP. We expect that the impact of the relative holdings of the different types of assets and liabilities has changed over time, investigating statistically significant differences across estimates at 5% level between 1989-1998 and 2001-2007, as well as between 2001-2007 and 2010-2013. We only describe results for the wealth composition variables and leverage, although the remaining estimates are reported.

Among the asset composition variables, we observe the positive impact of a greater share of business equity and financial investment assets in total holdings has increased significantly in the subprime period. These estimates are estimated to be significantly higher at 5% level 2001-2007 compared to 1989-1998. This reflects how the expansion and securitisation of subprime lending translated into higher returns and capital income increases for the holders of business equity and high-yielding financial assets.

Furthermore, the positive effect of the greater share of debt secured by other real estate in total liabilities rose significantly in the subprime boom era. While we observe a parallel rise in the

estimate of the relative holdings of mortgages secured by primary residence between these two periods, the difference is estimated not to be statistically significant at 5% level. This reflects the looser lending conditions in the subprime period, particularly in terms of mortgage lending.

The post-crisis period between 2010-2013 marks a statistically significant decline in the negative impact of leverage on relative income. This is paralleled by a rise in the relative income gap between extremely indebted households and those with the debt-service-to-income ratio below 40%. In addition, we find that the estimated lower level of the median income ratio for Black and Hispanic households is explained by a large negative effect after the Great Recession, which is statistically greater in absolute terms than in 1989-1989 and 2001-2007.

Overall, analysis of the POLS regression results across subperiods shows that while most of the estimates remain consistent in terms of their sign and significance across subperiods, the impact of balance sheet composition on relative inequality has changed over time. This is particularly vivid in terms of the increased effect of the relative holdings of business equity, financial investment assets, and debt secured by other real estate on the median income ratio in the subprime era.

4. Non-parametric sensitivity analysis

The additional advantage of a non-parametric sensitivity analysis of our results is evaluation of the relationship between relative inequality and the relative holdings of assets and liabilities which had to be excluded from the regression model due to the multicollinearity issues associated with the construction of the balance sheet composition variables. These include the share of other property in total assets, as well as the shares of other unsecured lines of credit and other debt in total liabilities. To gauge the preciseness of the median slope estimates, we report confidence intervals[16] which are robust to differences in the conditional population distribution of the median income ratio given the different values of our explanatory variables (Newson 2012).

Table 5 compares results of the Theil-Sen median slope estimation for balance sheet composition variables with the OLS and the quantile regression estimates. The robustness analysis reveals consistency in the direction of the relationship estimated in the POLS regression across majority of the balance sheet composition variables. Exceptions include estimates for the relative holdings of primary residence, debt-service-to-income ratio, debt-to-asset ratio, and debt-to-

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[16] Due to the construction of the *censlope* module, confidence intervals for the Theil-Sen median slope are calculated using the jackknife standard errors. The main difference between the two methods is that the jackknife procedure is less computationally intensive compared to the bootstrapping technique as it uses less replicates (cf. Schiel 2011).

income ratio, which are positive. Similarly, the median slope of the relative transaction asset holdings is positive (unlike in the quantile regression).

In terms of variables which are excluded from the regression analysis, the median slope estimate of the relative holdings of other property shows that a one-percentage point rise in the share of this asset in total holdings is associated with a 2.9 percentage point increase in the median income ratio. The magnitude of this effect is higher compared to the greater relative holdings of primary residence and vehicles, and is closer to the impact of business equity and financial investment assets. In addition, debt variables excluded from the regression analysis are found to be positively related to the median income ratio in terms of the median slope. A one-percentage point rise in the share of other unsecured lines of credit it total debt is associated with a 1.2 percentage point increase in the median income ratio, while a parallel increase in the relative holdings of other debt is estimated to raise the median ratio by 0.2 percentage points.

In addition to the whole sample, we analyse robustness of the linear regression analysis by subgroup. Table A3.2 in Appendix III compares the Theil-Sen median slopes across gender, race, generations, and subperiods. We find that most of the estimates are robust in terms of their sign and significance, and the relative size between subgroups. Similarly to the whole sample median slopes, we find that the coefficients of the debt-service-to-income ratio, the debt-to-asset ratio, the debt-to-income ratio, and the relative holdings of primary residence are positive in the non-parametric estimation, compared to the negative regression coefficients. Moreover, the Theil-Sen median slope of the relative holdings of retirement and insurance assets is positive for the subsample of Blacks/Hispanics and in each subperiod (compared to the generally negative regression coefficients). Similarly, the median slope of the relative holdings of transaction accounts is positive across gender and generations compared to negative regression estimates. We also find that the median slope of the relative holdings of vehicles is positive for the subsample of women, while the regression estimates are negative. Furthermore, unlike the regression coefficients, the estimated median slopes of the relative holdings of financial investment assets and transaction accounts are found to be greater among Blacks/Hispanics than for Whites/Other ethnicities. We also observe non-parametric estimates of the relative holdings of instalment debt, as well as credit card balances for gender and subperiods to be negative compared to the positive regression coefficients. Moreover, among the socio-economic controls, we find the median slope of age to be negative across race, for households younger than 35, and over 1989-1998 and 2001-2007, compared to the positive regression coefficients.

Among variables not included in the regression analysis, we find that a one-percentage point increase in the relative holdings of other property has a larger impact on the relative position in the

income distribution of 3 percentage points for males, Whites/Other ethnicities, and households aged 35 and above. This effect is estimated to be lower at 1.1 percentage points for female households, 2 percentage points for Blacks/Hispanics, and 1.5 percentage points for households younger than 35. Moreover, we observe overall positive effects of the greater relative holdings of the other types of debt on the median income ratio. These are estimated to be higher at approximately 1-2 percentage points for the other unsecured lines of credit, and 0.3-0.5 for other debt in the subsamples of males, Whites/Other ethnicities, households aged 35 and above, and over 1989-1998, while the median slopes for the remaining subgroups are estimated to be below 1.

Table 5 Theil-Sen median slope

Median income ratio	Theil-Sen median slope	95% confidence interval		POLS	Quantile regression
		Lower	*Upper*		
Socio-economic controls					
Age	-0.11	*-0.12*	*-0.01*	7.75	3.99
Age squared	-0.00	*-0.00*	*-0.00*	-0.06	-0.04
Educational attainment	14.15	*14.06*	*14.23*	17.70	8.74
Female	-65.05	*-65.56*	*-64.47*	-20.47	-14.60
Black/Hispanic	-40.71	*-40.98*	*-40.51*	-5.79	-5.77
Single	-76.38	*-76.95*	*-75.87*	-69.71	-47.70
Number of children	13.19	*13.13*	*13.27*	18.23	7.64
Number of children squared	5.15	*5.11*	*5.17*	-2.38	-1.48
Self-employed	50.04	*49.81*	*50.47*	63.91	0.76
Out of labour force	-54.40	*-54.53*	*-54.30*	-38.09	-27.80
Share of total assets					
Primary residence	0.23	*0.23*	*0.24*	-0.67	-0.42
Other property	2.95	*2.93*	*2.97*	*(omitted)*	
Vehicles and other non-financial assets	-0.48	*-0.49*	*-0.47*	-0.08	-0.40
Business equity	3.05	*3.02*	*3.08*	2.64	0.31
Financial investment assets	2.66	*2.61*	*2.71*	2.87	0.23
Transaction accounts	0.20	*0.19*	*0.21*	0.42	-0.26
Retirement and insurance assets	2.88	*2.84*	*2.91*	0.37	0.24
Share of total debt					
Debt secured by primary residence	0.74	*0.73*	*0.74*	0.33	0.59
Debt secured by other property	2.38	*2.35*	*2.40*	2.16	1.11
Instalment debt	-0.43	*-0.44*	*-0.43*	-0.83	0.01
Credit card balances	-0.39	*-0.40*	*-0.39*	-0.97	-0.04
Other unsecured lines of credit	1.23	*1.19*	*1.27*	*(omitted)*	
Other debt	0.24	*0.21*	*0.27*	*(omitted)*	
Leverage measures					
Debt-service-to-income ratio (DSY)	109.99	*109.50*	*110.49*	-3.50	-11.40
DSY > 40%	-31.38	*-31.83*	*-31.01*	-96.49	-47.10
Debt-to-asset ratio	27.59	*27.19*	*27.99*	-0.00	0.00
Debt-to-income ratio	22.91	*22.80*	*23.01*	-0.01	-0.00

Note: Confidence intervals are constructed using the jackknife standard errors.

In sum, the sensitivity analysis using the non-parametric estimation of the Theil-Sen median slope supports our main finding regarding the asymmetric impact of the balance sheet composition on relative income inequality. We observe larger differences in the estimated values between the OLS and the quantile regression results, while the median slope coefficients of the non-parametric approach are more consistent with the OLS estimates. The greatest disparities between these two methods are found for the share of primary residence in total assets and the debt-service-to-income ratio, both of which have opposite signs to the regression estimates. In addition, the non-parametric median slope estimation allows us to account for the impact of the relative holdings of other property, other unsecured lines of credit, and other debt, which are excluded from the regression analysis due to multicollinearity issues. We find that these balance sheet items are positively associated with the median income ratio.

5. Conclusion

The linear regression analysis established a statistically significant relationship between household wealth heterogeneity and relative income inequality using the nine waves of the U.S. Survey of Consumer Finances between 1989 and 2013. We found that debt composition and leverage contribute more than asset holdings to the relative position of households headed by women, Blacks/Hispanics, and the young in the income distribution. The originality of our analysis was to apply the existing estimation methods in a new way to establish a significant empirical link between balance sheet composition and relative income inequality, highlighting its intersectional dimension. Nevertheless, the issues of endogeneity, omitted variable bias, and non-spherical residuals may pose problems to the consistency and unbiasedness of our estimates.

We showed that greater reliance on primary residence, unsecured debt, and higher leverage in household balance sheets was significantly associated with lower position in the income distribution relative to the median. In contrast, greater contribution of financial investment assets, business equity, and secured debt to total asset and debt holdings respectively was significantly associated with higher relative position in the income distribution. However, these effects were significantly smaller for households headed by women, Blacks/Hispanics, and the young. We found that the magnitude of the positive effects of the relative holdings of business equity and financial investment assets increased in the subprime lending boom era between 2001-2007 compared to the period 1989-1998.

Most of these results were found to be robust in terms of significance and sign when compared to the estimates of the non-parametric Theil-Sen median slope and the quantile regression. Results of the Theil-Sen median slope estimation showed that the magnitudes of the

majority of the POLS estimates were not substantially influenced by extreme values or problems with the regression assumptions about the error term. Some notable exceptions included the relative holdings of primary residence, mortgages secured by primary residence, and the debt-service-to-income ratio, whose effects on relative inequality were higher when estimated by the median slopes.

Moreover, lower values of the asset composition variables estimated in the quantile regression suggested that the magnitudes of the positive effects of greater relative asset holdings were stronger for households towards the top of the income distribution. Conversely, relative income in the quantile regression was found to be significantly increased by the greater relative holdings of instalment loans, which lowered the household position in the income distribution in the POLS estimation. Moreover, the negative effect of higher leverage on relative income was magnified in the quantile regression, being particularly detrimental for the bottom quintile.

Overall, our findings show that balance sheet composition is a significant independent determinant of relative income inequality. The estimated asymmetric magnitudes of the balance sheet composition variables indicate that the increases in relative income due to the greater relative holdings of assets (particularly business equity and financial investment assets) were higher among households headed by men, Whites, and those over 35 years old. These groups owned higher levels of wealth between 1989-2013 (U.S. Survey of Consumer Finances). This suggests that the size of the payoffs from owning particular types of wealth are related to the absolute value of wealth holdings. This is also evident in the higher magnitudes of the mean-based OLS estimates compared to the median quantile regression, and the higher quantile regression coefficients of asset composition for the 90th percentile.

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Appendix I

Table A1.1 Asset and debt holdings, whole sample, USA 1989-2013

Wave	Assets			Debt		
	Holders	Conditional median	Conditional mean	Holders	Conditional median	Conditional mean
1989	94.7%	147,859.3	411,492.0	72.3%	27,113.6	65,321.5
1992	95.8%	137,536.2	370,759.1	73.2%	28,270.9	70,136.6
1995	96.4%	155,127.4	392,925.6	74.5%	33,089.8	74,031.3
1998	96.8%	177,117.8	488,003.5	74.1%	46,888.3	90,695.4
2001	96.7%	195,078.3	613,634.5	75.1%	51,215.4	95,284.8
2004	97.9%	214,628.4	665,152.9	76.4%	68,316.1	127,591.9
2007	97.7%	249,575.0	751,170.0	77%	75,732.6	141,503.0
2010	97.4%	201,157.3	651,688.6	74.9%	76,090.4	139,622.5
2013	97.9%	178,200.0	632,560.0	74.5%	60,700.0	122,268.0
Growth rate (percent)						
1989-2013	*3.4*	*20.5*	*53.7*	*3.0*	*123.9*	*87.2*
1989-2007	*3.2*	*68.8*	*82.5*	*6.5*	*179.3*	*116.6*
2007-2013	*0.2*	*-28.6*	*-15.8*	*-3.2*	*-19.8*	*-13.6*

	Non-financial assets								Financial assets					
	Primary residence		Other property		Business equity		Vehicles and other non-financial		Transaction accounts		Financial investment assets		Retirement and insurance assets	
	Holders	Mean	Holders	Mean	Holders	Mean	Holders	Mean	Holders	Mean	Holders	Mean	Holders	Mean
1989	63.9%	129,548.5	20.3%	55,040.2	13.3%	76,833.3	84.5%	21,958.5	85.6%	23,699.7	52.8%	69,824.5	53.5%	34,587.2
1992	63.9%	119,031.7	19.4%	49,134.2	14.4%	66,814.2	86.4%	18,174.0	86.9%	20,365.1	50.5%	59,867.7	55.7%	37,372.1
1995	64.7%	117,289.4	18.0%	39,075.9	12.8%	68,570.1	84.9%	23,061.7	87.4%	20,109.0	50.5%	73,612.2	58.6%	51,207.3
1998	66.3%	135,598.0	18.6%	47,030.3	12.7%	82,554.2	83.5%	23,200.1	90.6%	22,496.2	51.9%	109,483.4	59.7%	67,641.3
2001	67.7%	166,489.2	16.8%	57,899.3	13.6%	101,399.2	85.5%	26,507.6	91.4%	30,218.7	51.7%	142,242.2	61.6%	88,878.3
2004	69.1%	214,661.2	18.1%	73,819.9	13.3%	110,033.5	87.0%	28,196.4	91.3%	31,268.0	49.9%	122,852.6	58.4%	84,321.3
2007	68.6%	238,572.0	19.0%	81,964.9	13.6%	146,287.8	87.7%	27,038.9	92.1%	28,051.6	47.5%	131,388.2	60.8%	97,866.7
2010	67.3%	193,185.9	18.6%	72,726.9	13.2%	113,705.2	87.2%	25,647.8	92.5%	32,809.1	39.8%	112,817.8	57.6%	100,795.9
2013	65.2%	174,658.3	17.5%	62,413.3	11.7%	112,348.7	86.7%	24,641.7	93.2%	34,390.7	35.9%	116,100.2	56.5%	108,007.2

	Secured debt				Unsecured debt						Other	
	By primary residence		By other property		Instalment debt		Credit card balances		Other unsecured lines of credit		Other debt	
	Holders	Mean	Holders	Mean	Holders	Mean	Holders	Mean	Holders	Mean	Holders	Mean
1989	39.5%	44,827.6	5.2%	5,016.6	49.4%	10,878.6	39.7%	1,873.0	3.2%	1,209.7	6.7%	1,516.0
1992	39.1%	50,468.0	5.7%	7,181.3	46.0%	7,954.7	43.7%	2,242.5	2.4%	584.0	8.4%	1,706.1
1995	41.0%	53,949.1	4.8%	5,830.5	46.0%	8,838.7	47.3%	2,878.5	1.9%	422.7	8.5%	2,111.8
1998	43.1%	64,633.1	5.0%	6,840.6	43.8%	12,025.3	44.1%	3,508.3	2.3%	302.2	8.8%	3,385.9
2001	44.6%	71,679.9	4.6%	5,904.9	45.2%	11,781.0	44.4%	3,211.2	1.5%	483.3	7.2%	2,224.5
2004	47.9%	95,774.1	4.0%	11,086.3	46.0%	13,930.6	46.2%	3,826.5	1.6%	915.6	7.6%	2,058.8
2007	48.7%	105,610.6	5.5%	14,359.6	46.9%	14,478.1	46.1%	4,922.0	1.7%	606.6	6.8%	1,526.1
2010	47.0%	103,540.5	5.4%	13,651.4	46.4%	15,566.9	39.4%	3,991.7	2.1%	1,409.4	6.4%	1,462.6
2013	42.9%	90,180.1	5.3%	10,987.6	47.2%	15,999.4	38.1%	2,931.6	1.9%	880.9	6.6%	1,288.4

Note: All median and mean values in 2013 USD. Holders represents the proportion of all households holding asset or debt. All values are conditional on holding assets or debt.

Appendix II

Table A2.1 Descriptive statistics of the linear regression model variables

Variable	Number of observations	Mean	Standard deviation	Minimum	Maximum
Median income ratio	38,078	165.99	633.437	0	790361.6
Age	41,523	49.40	17.300	17	95
Education	41,484	13.126	2.936	1	17
Female	41,528	0.279	0.448	0	1
Black or Hispanic	41,528	0.217	0.412	0	1
Single	41,528	0.417	0.493	0	1
Self-employed	41,528	0.109	0.312	0	1
Out of labour force	41,528	0.270	0.444	0	1
Number of children	41,528	0.835	1.159	0	10
Financial assets/Assets	35,205	31.180	30.785	-254.9	8839.2
Primary residence/Assets	35,205	39.826	34.640	-1111.8	2162.2
Vehicles and other/Assets	35,204	20.610	29.497	-222.9	213.7
Business Equity/Assets	35,204	3.617	13.561	-400.1	4331.5
Liquid assets/Assets	35,205	10.024	20.666	-28.6	129
Financial investment/Assets	35,205	8.523	17.773	-110.5	8308.5
Retirement accounts/Assets	35,205	12.633	19.954	-158.7	831.9
Unsecured debt/Debt	28,146	45.138	43.733	0	100
Secured Debt/Debt	28,146	51.997	44.153	0	100
Secured by primary residence/Debt	28,146	48.776	43.705	0	100
Secured by other real estate/Debt	28,147	3.221	14.533	0	100
Instalment Debt/Debt	28,147	29.524	38.705	0	100
Credit Card Balances/Debt	28,147	14.945	30.552	0	100
Debt-service-to-income ratio (DSY)	38,280	0.198	1.875	0	2152.6
DSY>40%	41,316	0.092	0.289	0	1

Note: Shares of balance sheet variables in total assets or total debt are calculated only for respondents with positive values of assets and debt. Balance sheet shares and the income median ratio are given in percentage terms.

Table A2.2 Correlation matrix

	Median income ratio	Age	Education	Female	Black/Hispanic	Single	Self-employed	Out of labour force
Median income ratio	1.000							
Age	0.0660	1.000						
Education	0.0891	-0.0024	1.000					
Female	-0.0522	-0.0002	-0.0928	1.000				
Black/Hispanic	-0.0459	-0.1166	-0.2372	0.1680	1.000			
Single	-0.0547	-0.0572	-0.0804	0.7053	0.1457	1.000		
Self-employed	0.1108	0.1303	0.2006	-0.1859	-0.1490	-0.1721	1.000	
Out of labour force	-0.0225	0.4321	-0.1756	0.1234	0.0102	0.1087	-0.2396	1.000
Number of children	0.0079	-0.2759	-0.0265	-0.1013	0.0841	-0.2428	0.019	-0.222
Financial assets/Assets	0.0254	0.0540	0.1567	0.0312	-0.0380	0.0506	-0.0689	0.0356
Primary residence/Assets	-0.0859	0.0765	-0.1248	0.0005	0.0010	-0.0600	-0.1667	0.0547
Vehicles and other/Assets	-0.0633	-0.3343	-0.2471	0.1401	0.1902	0.1751	-0.2270	-0.0227
Business Equity/assets	0.1351	0.0897	0.1373	-0.1426	-0.1152	-0.1357	0.4729	-0.1104
Liquid assets/Assets	-0.0230	-0.1188	-0.0178	0.1268	0.0918	0.1693	-0.0971	0.0539
Financial investment/Assets	0.0776	0.1138	0.1352	-0.0247	-0.0913	-0.0197	0.0509	0.0606
Retirement accounts/Assets	-0.0463	0.0310	0.1133	-0.0058	-0.0120	-0.0102	-0.1267	-0.0635
Unsecured debt/debt	-0.0544	-0.1849	-0.2496	0.2048	0.1928	0.2465	-0.2079	0.0841
Secured Debt/Debt	0.0277	0.1477	0.2393	-0.1926	-0.1830	-0.2435	0.1853	-0.0977
Secured by primary residence	-0.0149	0.0812	0.1726	-0.1535	-0.1475	-0.2050	0.1069	-0.0957
Secured by other real estate	0.0898	0.1432	0.1466	-0.0875	-0.0797	-0.0878	0.1693	-0.0071
Instalment Debt/Debt	-0.0443	-0.2519	-0.1821	0.1197	0.1543	0.1567	-0.1666	0.0077
Credit Card Balances/Debt	-0.0400	0.0369	-0.1483	0.1611	0.0967	0.1721	-0.1137	0.1183
Debt-service-to-income ratio (DSY)	-0.0045	0.0107	0.0116	-0.0101	-0.0066	-0.0102	0.0310	0.0043
DSY>40%	-0.0370	0.0003	-0.0552	0.0551	0.0407	0.0590	0.0522	0.0272

	Number of children	Financial assets/Assets	Primary residence /Assets	Vehicles and other /Assets	Business Equity/Assets	Liquid assets/Assets	Financial investment /Assets	Retirement accounts/Assets
Number of children	1.000							
Financial assets/Assets	-0.0986	1.000						
Primary residence/Assets	0.0892	-0.2383	1.000					
Vehicles and other/Assets	0.0153	-0.1752	-0.3716	1.000				
Business Equity/assets	0.0390	0.1470	-0.1901	-0.1938	1.000			
Liquid assets/Assets	-0.0815	0.3538	-0.2563	0.0027	-0.1089	1.000		
Financial investment/Assets	-0.0514	0.7581	-0.0563	-0.1168	0.3157	-0.0346	1.000	
Retirement accounts/Assets	-0.0466	0.5048	-0.164	-0.1629	-0.0943	-0.0751	0.0067	1.000
Unsecured debt/debt	-0.0920	0.1011	-0.4052	0.5537	-0.1249	0.2753	-0.0398	0.0301
Secured Debt/Debt	0.1072	-0.1408	0.4543	-0.5453	0.0998	-0.2738	-0.0031	-0.0440
Secured by primary residence	0.1296	-0.1400	0.5498	-0.4743	0.0400	-0.2478	-0.0321	-0.0211
Secured by other real estate	-0.0434	-0.0060	-0.1854	-0.1650	0.1279	-0.0627	0.0604	-0.0491
Instalment Debt/Debt	-0.0264	0.0285	-0.3269	0.5260	-0.1021	0.1576	-0.0525	0.0051
Credit Card Balances/Debt	-0.0976	0.1122	-0.1581	0.1501	-0.0778	0.2127	-0.0020	0.0457
DSY ratio	0.0000	-0.0084	-0.0139	-0.0148	0.0312	-0.0116	0.0061	-0.0155
DSY>40%	0.0194	-0.1480	0.1791	-0.0720	0.0127	-0.0918	-0.0543	-0.1275

	Unsecured debt/debt	Secured Debt/Debt	Secured by other real estate	Instalment Debt/Debt	Credit Card Balances/Debt	DSY ratio	DSY>40%	
Unsecured debt/debt	1.000							
Secured Debt/Debt	-0.9258	1.000						
Secured by primary residence	-0.8186	0.8870						
Secured by other real estate	-0.2523	0.2666	1.000					
Instalment Debt/Debt	0.7463	-0.6900	-0.1923	1.000				
Credit Card Balances/Debt	0.5033	-0.4666	-0.1277	-0.1646	1.000			
DSY ratio	0.0014	-0.0031	0.0174	0.0007	-0.0138	1.000		
DSY>40%	-0.1162	0.1310	0.0446	-0.0682	-0.0872	0.0846	1.000	

Note: Shares of balance sheet variables in total assets or total debt are calculated only for respondents with positive values of assets and debt.

Appendix III

Table A3.1 Pooled OLS and quantile regression results by period

Median income ratio	1989-2013 (POLS)	1989-1998 (POLS)	2001-2007 (POLS)	2010-2013 (POLS)	1989-2013 (QR)	1989-1998 (QR)	2001-2007 (QR)	2010-2013 (QR)
Age	7.75***	6.79***	8.18***	8.57***	3.99***	4.35***	3.64	3.89***
	(0.407)	(0.763)	(0.771)	(0.686)	(0.001)	(0.000)	(0)	(0.001)
Age squared	-0.06***	-0.05***	-0.07***	-0.07***	-0.04***	-0.038***	-0.03***	-0.03***
	(0.004)	(0.009)	(0.007)	(0.007)	(0.000)	(0.000)	(0.000)	(0.000)
Educational attainment	17.70***	15.51***	19.05***	20.75***	8.74***	8.16	9.01	9.48***
	(0.435)	(0.715)	(0.762)	(0.806)	(0.001)	(0)	(0)	(0.003)
Female	-20.47***	-21.81***	-20.68**	-18.98***	-14.60***	-17.10***	-13.50***	-10.70***
	(4.689)	(7.557)	(10.080)	(4.581)	(0.005)	(0.003)	(0.080)	(0.014)
Black/Hispanic	-5.79***	-1.02	-1.76	-17.79***	-5.77***	-7.24***	-3.61***	-7.83***
	(1.648)	(2.669)	(2.989)	(3.429)	(0.003)	(0.005)	(0.117)	(0.009)
Single	-69.71***	-61.24***	-72.83***	-74.32***	-47.70***	-45.00	-48.80	-51.00***
	(5.174)	(8.262)	(10.770)	(5.869)	(0.006)	(0)	(0)	(0.014)
Number of children	18.23***	8.72***	23.97***	27.02***	7.64***	5.23***	11.10	6.85***
	(2.047)	(3.008)	(3.671)	(4.649)	(0.003)	(0.006)	(0)	(0.011)
Number of children squared	-2.38***	-0.87	-3.72***	-3.23***	-1.48***	-1.06***	-02.23	-1.04***
	(0.473)	(0.673)	(0.860)	(0.966)	(0.001)	(0.001)	(0)	(0.003)
Self-employed	63.91***	68.90***	52.51***	68.64***	0.76***	3.20***	4.46***	-4.05***
	(7.178)	(11.210)	(10.740)	(15.750)	(0.011)	(0.020)	(0.432)	(0.032)
Out of labour force	-38.09***	-36.71***	-33.65***	-43.10***	-27.80***	-25.80	-28.00***	-28.50***
	(3.551)	(5.264)	(7.444)	(5.741)	(0.005)	(0)	(0.112)	(0.008)
Primary residence	-0.67***	-0.66***	-0.64***	-0.61**	-0.42***	-0.40***	-0.39	-0.45***
	(0.113)	(0.150)	(0.230)	(0.263)	(0.012)	(0.009)	(0)	(0.023)
Vehicles	-0.08	-0.23	0.06	0.14	-0.40***	-0.36	-0.36	-0.45***
	(0.109)	(0.144)	(0.228)	(0.270)	(0.013)	(0)	(0)	(0.028)
Business equity	2.64***	1.80***	3.23***	3.63***	0.31***	0.15***	0.42***	0.54***
	(0.202)	(0.297)	(0.350)	(0.471)	(0.054)	(0.050)	(1.01)	(0.146)
Financial investment assets	2.87***	1.85***	3.64***	3.77***	0.23***	0.16	0.35***	0.39***
	(0.184)	(0.248)	(0.409)	(0.393)	(0.017)	(0)	(0.345)	(0.039)
Transaction accounts	0.42***	0.02	0.60**	0.95***	-0.26***	-0.25***	-0.17***	-0.31***
	(0.130)	(0.144)	(0.269)	(0.329)	(0.012)	(0.010)	(0.358)	(0.028)
Retirement and insurance assets	0.37***	0.26*	0.33	0.61**	0.24***	0.16	0.30***	0.35***
	(0.113)	(0.154)	(0.241)	(0.254)	(0.014)	(0)	(0.288)	(0.033)
Debt secured by primary residence	0.33**	0.08	0.49**	0.63***	0.59***	0.64***	0.57	0.67***
	(0.158)	(0.270)	(0.192)	(0.234)	(0.011)	(0.008)	(0)	(0.040)
Debt secured by other real estate	2.16***	1.36***	2.91***	2.59***	1.11***	1.12***	1.29***	1.04***
	(0.238)	(0.353)	(0.469)	(0.407)	(0.014)	(0.086)	(0.567)	(0.045)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Instalment debt	-0.83***	-0.93***	-0.74***	-0.77***	0.01***	0.05	-0.03	0.05***
	(0.150)	(0.264)	(0.161)	(0.202)	(0.010)	(0)	(0)	(0.039)
Credit card balances	-0.97***	-1.07***	-0.92***	-0.90***	-0.04***	-0.01	-0.08	0.04***
	(0.151)	(0.268)	(0.161)	(0.208)	(0.012)	(0)	(0)	(0.040)
Debt-service-to-income ratio (DSY)	-3.50**	-10.91**	-16.07***	**-1.93****	-11.40***	-15.70	-13.50	-4.07***
	(1.495)	(4.798)	(3.254)	(0.985)	(0.015)	(0)	(0)	(0.012)
DSY>40%	-96.49***	-85.63***	-82.47***	**-105.90******	-47.10***	-45.50	-43.30***	-43.20***
	(3.030)	(5.133)	(7.949)	(6.937)	(0.011)	(0)	(0.141)	(0.015)
Debt-to-asset ratio	-0.00	**-0.04**	**-0.00**	-0.00	-0.00***	0.00***	-1.01***	-1.86***
	(0.001)	(0.033)	(0.003)	(0.002)	(0.000)	(0.000)	(0.037)	(0.004)
Debt-to-income ratio	-0.01	-0.00	-0.69	-1.05	0.00*	-0.0172***	0.00***	-0.00***
	(0.444)	(0.928)	(2.395)	(1.381)	(0.001)	(0.000)	(0.000)	(0.000)
1989 (base year)	(base)	(base)			(base)	(base)		
1992	-18.44***	-18.02***			-2.74***	-1.75***		
	(6.630)	(6.617)			(0.006)	(0.006)		
1995	-22.91***	-23.90***			-10.70***	-9.71		
	(6.522)	(6.521)			(0.005)	(0)		
1998	-20.75***	-18.87***			-11.50***	-9.75***		
	(7.031)	(7.135)			(0.010)	(0.005)		
2001	-10.38		(base)		-12.00***		(base)	
	(8.039)				(0.006)			
2004	-19.06***		-7.56		-14.50***		-2.01***	
	(6.578)		(5.654)		(0.008)		(0.113)	
2007	-5.60		5.64		-14.00***		-1.30***	
	(6.749)		(6.272)		(0.007)		(0.125)	
2010	-10.56			(base)	-11.80***			(base)
	(6.671)				(0.007)			
2013	2.31			13.42***	-10.30***			1.03***
	(6.868)			(4.883)	(0.005)			(0.007)
Constant	-223.50***	-134.20***	-285.00***	-338.30***	-52.00***	-56.6	-59.4	-73.5***
	(22.160)	(32.680)	(35.920)	(39.310)	(0.021)	(0)	(0)	(0.071)
Observations	30,219	11,322	9,856	9,041	30,219	11,322	9,856	9,041
Adjusted R-squared*	0.065	0.045	0.091	0.075	0.219	0.226	0.221	0.214
Root Mean Squared Error	541.6	570.4	484.0	569.7				

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.190

Note: Pairs of estimates in bold indicate that the difference between coefficients of 1989-98 and 2001-07 as well as 2001-07 and 2010-13 regressions is statistically significant at 5% level according to the χ^2 test. *Due to methodological assumptions of the quantile regression, we report the pseudo-R^2 for the quantile regression and the adjusted R^2 for the pooled OLS regression.

Table A3.2 Theil-Sen median slope by subgroups

Median income ratio	Gender		Race		Generations		Subperiod		
	Male	Female	White/Other	Black/Hispanic	Aged ≥ 35	Aged < 35	1989-1998	2001-2007	2010-2013
Socio-economic controls									
Age	0.26	-0.10	-0.36	-0.01	-1.39	5.80	-0.20	-0.10	0.04
Age squared	0.00	0.00	0.00	0.00	-0.01	0.11	0.00	0.00	0.00
Educational attainment	16.60	7.87	15.78	7.14	16.02	8.79	12.89	*15.23*	*15.21*
Female	*(omitted)*		-70.62	-37.91	-72.92	-48.07	*-66.71*	*-66.26*	-60.64
Black/Hispanic	-46.38	-14.12	*(omitted)*		-42.47	-31.86	-43.97	-38.75	-39.98
Single	-65.30	-33.36	-82.34	-45.76	-83.99	-55.58	*-75.81*	*-76.47*	*-77.72*
Number of children	15.18	0.09	21.65	5.17	19.24	3.32	14.77	12.68	11.59
Number of children squared	5.71	0.03	9.07	1.64	7.81	1.13	5.77	4.92	4.45
Self-employed	42.99	16.62	52.31	16.67	58.62	12.58	50.02	54.43	44.46
Out of labour force	-55.61	-28.70	-63.16	-37.32	-69.36	-48.91	-58.93	-54.62	-46.71
Share of total assets									
Primary residence	0.22	0.10	0.16	0.23	-0.05	0.73	*0.23*	*0.22*	0.26
Other property	2.98	1.05	2.95	1.99	2.95	1.47	2.46	3.33	3.46
Vehicles and other non-financial assets	-1.11	0.03	-0.68	-0.05	*-0.46*	*-0.47*	-0.33	-0.56	-0.59
Business equity	2.49	1.88	2.91	2.40	3.48	1.15	2.44	3.55	3.59
Financial investment assets	3.62	0.79	2.06	3.97	2.70	1.96	2.08	2.99	3.83
Transaction accounts	0.66	0.07	0.04	0.29	0.42	0.04	0.26	0.13	0.18
Retirement and insurance assets	2.99	1.36	3.00	1.58	2.86	2.55	*2.86*	*2.88*	*2.88*
Share of total debt									
Debt secured by primary residence	0.75	0.38	0.75	0.49	0.67	0.76	0.79	0.72	0.68
Debt secured by other property	2.41	0.97	2.39	1.79	2.35	1.46	2.14	*2.56*	*2.58*
Instalment debt	-0.56	-0.16	-0.48	-0.21	-0.31	-0.48	-0.46	-0.37	-0.47
Credit card balances	-0.50	-0.04	-0.59	0.11	-0.56	0.02	-0.37	-0.53	-0.21
Other unsecured lines of credit	1.55	0.37	1.23	0.59	2.10	0.32	2.37	0.26	0.80
Other debt	0.35	-0.05	0.34	0.09	0.46	-0.24	0.22	0.14	0.46
Leverage measures									
Debt-service-to-income ratio (DSY)	*74.90*	*73.97*	94.11	124.74	107.73	125.70	124.08	95.84	108.43
DSY > 40%	-44.79	-8.60	-39.29	-8.33	-36.49	-18.33	-33.35	-30.92	-29.40
Debt-to-asset ratio	19.30	14.51	28.61	27.72	54.22	8.43	41.52	24.13	14.14
Debt-to-income ratio	19.58	12.99	20.99	22.88	24.82	19.68	32.99	20.20	15.89

Note: Values in italics indicate overlapping confidence intervals across subgroup