Determinants of US Household Debt: New Evidence from the SCF

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Abstract

With the 2007 Financial Crisis the destructive potential of private debt bubbles took a prominent role on the macroeconomic research agenda. As a result the consequences of debt accumulation are better understood now, while the driving forces leading to that accumulation are less clear. This paper investigates and contrasts two popular explanations of soaring household liabilities in the United States: The expenditure cascade hypothesis based on the assumption of debt-financed consumption driven by a polarising distribution of income, and the housing-driven-debt hypothesis which emphasizes re-mortgaging as a means to realize real estate capital gains and home purchases as drivers of household liabilities. The paper is the first to investigate an expenditure and an asset based hypothesis simultaneously instead of analysing only one and ignoring the other. Thus potentially severe omitted variable problems are avoided. The analysis is based on data from the Survey of Consumer Finances (SCF) and thus the paper exploits the only US household survey which relies on information from the tax authority to adequately capture the upper tail of the income and wealth distribution. This latter feature is of particular importance when investigating explanations of household debt accumulation based on rising income inequality like the expenditure cascade hypothesis. The results do not support the argument that increasing income inequality led to rising household debt levels prior to the Financial Crisis. Instead the findings suggest that there is a strong effect of real estate wealth both due to the purchase of new homes as well as due to the realization of capital gains. The interpretation of these findings is that collateral in the form of real estate is the binding constraint for household debt accumulation which dominates inequality driven expenditure motives.

1 Introduction

The Financial Crisis demonstrated the important role of debt and especially private debt for macroeconomic dynamics. Up to that point it was widely believed in neoclassical economics that money and credit are mere nominal phenomena and that the fluctuations of real quantities such as GDP can be studied by abstracting from the nominal sphere of the economy. Since then the "credit cycle" has gained lots of attention in academic and policy debates. Empirical research carried out since the crisis showed that there is an important link between debt and macroeconomic fluctuations. In particular, credit booms are a valuable predictor for financial crises (Schularick & Taylor 2012; Borio 2014; Eichengreen & Mitchener 2003). The chaos of 2007 did not only demonstrate that credit is an important macroeconomic aggregate but it also demonstrated that it makes a difference which sectors are taking on debt and that an overly indebted household sector eventually collapses and triggers a recession (Bezemer et al. 2014; Mian & Sufi 2009). So while there is some consensus on the role private debt in general and household debt in particular has to play in macroeconomic analysis, there is less consensus about the key drivers of credit booms. Especially why do households decide to take on liabilities which they ultimately fail to handle? The textbook version of the life-cycle consumer would use debt only to smooth consumption over her lifespan and never default on it. Thus explanations going beyond the standard consumption model are needed. This paper will investigate two popular explanations of why US households became heavily indebted prior to the recent Financial Crisis. The first emphasizes debt-financed consumption spending due to rising income inequality and the second focusses on real estate equity extraction and debt accumulation due to home purchases in an environment of fast climbing property prices.

The first explanation will be labelled the "expenditure cascades hypothesis". Based on work of Frank (1985) and Frank et al. (2014) and backed by empirical evidence (Carr & Jayadev 2014) the claim is that rising income inequality over the last 3 decades drove households into debt. The argument these authors rely on is that spending decisions are heavily influenced by the desire to show one's social status. In an environment of rising income inequality those income groups which fall behind in income growth will take on debt in order to keep up in spending with those at the top of the distribution in order to protect their status as it is perceived through their expenditures. This effect begins at the top and eventually cascades down the income distribution leading to vast amounts of debt taken on in order to compensate for a lack of income growth. The second explanation emphasizes the link between rising property prices and household indebtedness and will be labelled the "housing-driven-debt hypothesis". In a country like the United States, with homeownership rates well above 60%, rising property prices create the opportunity to extract capital gains by taking on debt while first time homebuyers either delay buying property or take out a bigger mortgage. Mian & Sufi (2011) are a recent example for empirical evidence backing this line of argument.

Being able to discriminate between these two hypothesis and determining the more relevant one is important because the policy conclusions following from them are very different. The expenditure cascades hypothesis implies that rising income inequality bears potential dangers for financial stability and thus keeping inequality in check becomes vital. Potential measures to do so might be raising minimum wages, strengthening the bargaining power of workers and declaring low unemployment rates a priority goal for fiscal and monetary policy. On the other hand, if property price bubbles were the core mechanism leading to soaring household debt levels, restricting equity extraction and introducing benchmark loan-to-income ratios as well as increasing the supply of public housing in order to prevent price rallies, would be more adequate policies to achieve and maintain a sustainable balance sheet structure of the household sector.

The aim of the paper is to compare the explanatory power of these two hypothesis. In order to do that we will investigate the determinants of household debt growth rates between 1998 and 2007 using data from the Survey of Consumer Finances (SCF). While the SCF represents a unique source of information on household balance sheets, one of its main drawbacks is its design as a repeated cross section. A panel version only exists for the 2007-2009 period. Thus in order to analyse household debt dynamics, i.e. the growth of household debt, one has to construct a measure of last period's liabilities for each household in the sample. The paper presents a method of achieving that goal by paying close attention to the detailed information on individual households' credit histories. Thus the paper tackles one of the key shortcomings of the SCF, which until now was a major obstacle for using the high quality information the survey provides in econometric analysis. In a next step the newly created measure of debt growth is used as the dependent variable in a regression on various measures of income inequality and household wealth to test the explanatory power of the two hypothesis of interest. The findings presented in section 5 are strongly in favour of the housing-driven-debt hypothesis. The paper finds statistically positive effects of real estate wealth and real estate purchases on household debt growth rates while it fails to confirm the existence of expenditure cascades as a driver of household liabilities.

The contribution of the paper is twofold: First, it tests two explanations for why US households took on high levels of debt in a unified framework which allows for both explanations without ignoring the other. While both hypothesis have found empirical support, none of the recent studies takes the other explanation explicitly into account. Thus by developing a framework which is able to account for both effects potentially severe omitted variable problems are avoided. Second, since the expenditure cascade argument is based on the condition of rising income inequality driven by top income growth, it is of particular importance to use a data set which is able to adequately represent the highly skewed distribution of US income. Due to the construction of a measure of last period's liabilities the paper is able to use SCF data in the analysis. This is of great importance because the SCF provides a much more detailed picture of the top of the income distribution compared to other surveys due to its use of tax records in designing the sample. (optimally cite top decile from SCF and PSID!).

The rest of the paper is organized as following: section 2 develops a theoretical framework to analyse household debt, section 3 discussed the relevant empirical literature, section 4 introduces the data set and develops the method used to compute the change in household liabilities. Section 5 presents the econometric model as well as the results and section 6 concludes.

2 Determinants of Household Debt

A simple accounting identity provides a useful starting point for thinking about the determinants of household debt growth. Under the assumption that income includes realized capital gains (which is the case in SCF) and households only consume, the change of household i's liabilities equals the difference between its consumption expenditures and income.

$$\Delta D_{it}^{C} = \alpha_1 (C_{it} - Y_{it}) \tag{1.1}$$

The coefficient α_1 indicates to what extent savings are used to pay down debt and equals 1 in the case of a non-saving household and less than 1 for saving households ($0 \leq \alpha_1 \leq 1$). However households do not only consume but potentially also buy or improve real estate, invest in non-incorporated businesses or buy financial assets using credit. Thus in order to get a more adequate accounting definition of the change in an individual household's liabilities within a given period t, one has to take these activities into account as well. We will rely on the following definitions:

$$\Delta D_{it}^{RE} = \alpha_2 \, REP_{it} \tag{1.2}$$

$$\Delta D_{it}^{FA} = FAP_{it} \tag{1.3}$$

$$\Delta D_{it}^{I} = \alpha_3 I_{it} \tag{1.4}$$

where the change in debt due to real estate purchases (ΔD_{it}^{RE}) equals the value of these purchases (REP_{it}) times the degree to which the acquisition is debt-financed ($0 \leq \alpha_2 \leq 1$). The change in debt due to purchases of financial assets (ΔD_{it}^{FA}) equals the value of debt-financed asset purchases (FAP_{it}). The change in debt due to investment in non-incorporated businesses (ΔD_{it}^{I}) equals the degree of debt financing ($0 \leq \alpha_2 \leq 1$) times investment spending (I_{it}). Combining these definitions yields the total change in household *i*'s debt in period t:

$$\Delta D_{it} = \alpha_1 (C_{it} - Y_{it}) + \alpha_2 \, REP_{it} + FAP_{it} + \alpha_3 I_{it} \tag{1.5}$$

While equation (1.5) looks like a behavioural relationship it is important to realize that it is an ex-post accounting identity. The main reason why it cannot serve as a direct starting point for establishing a behavioural equation which can be used in regression analysis is that the right hand side variables are not exogenous. Consumption expenditures for example will heavily depend on the current period's income. However the estimated effect of a change in income on household debt using equation (1.5) directly would wrongly be based on a ceteris paribus assumption of consumption staying constant. Thus we will use equation (1.5) only as a starting point to think which variables to include in a behavioural debt equation. Relying on (1.5) as a logical starting point yields a first major insight: The change of the stock variable debt, is determined by flow variables such as income, asset purchases and investment expenditures. Since in a fully coherent accounting system all flows must accumulate into stocks at the end of the period, we will be mainly thinking about flow variables as determinants in our behavioural equation.

To begin, it is fairly straight forward to think that income (Y_{it}) will play a role in how much debt households take on. However there are various theoretical models demonstrating that if households compare their expenditures with those of a peer group and want to have similar expenditure levels as that peer group, rising income inequality leads to an accumulation of debt in the household sector. The idea itself might be traced back to authors such as Veblen (1899) or Duesenberry (1949) and was popularized by (Frank 1985) and Frank et al. (2014). None of these provide a formal model however and since these authors mainly present a rough idea there is a rich literature dealing with so called "Veblen effects" which is often not clearly related to our concept of expenditure cascades. We are interested in a particular idea presented by these initial authors: Social status comparison is an important factor in households' spending decisions. Beyond that we argue that social status is heavily determined by income. Both statements together imply that status comparison is upward looking. The relevant peer group for household i most likely consists of on average more affluent households. It is important to note that only if households are upward looking increasing income inequality due to quickly growing top incomes will trigger debt financed consumption sprees. Recent papers which formally model the relationship of such upward looking status comparison behaviour and household debt accumulation and financial fragility include Belabed et al. (2013) and Kapeller and Schütz (2014). In both cases the authors predict that rising income inequality leads to higher indebtedness at the lower parts of the income distribution and increases the risk of a financial crisis. Based on that theoretical framework the expenditures of a richer reference group ($\tilde{C}_{it}$) should help explain a household's debt accumulation and thus should be part of our behavioural debt equation. We will elaborate on the details of how that reference group and its expenditures are modelled in section 5.

There is a broad consensus about the idea that changes in household wealth have a positive impact on household consumption and thus also on the debt situation of households. Buiter (2010) is one of the few exceptions who argues that fluctuations in housing wealth should not lead to observable aggregate wealth effects. The argument is that increasing property prices will indeed increase the wealth of homeowners but at the same time for the soon-to-be homeowners rising property prices represent rising costs of living. The latter group would have to save more in order to afford a home in the future. While theoretically the increased consumption by homeowners and the reduction in consumption spending by future homeowners may offset each other, it is not at all clear why this should be the case in general. Especially in the United States with homeownership rates well above 60% one would think that the positive effects dominate or at least does not simply cancel out. There is a very rich empirical literature aiming at quantifying these wealth effects and while reaching different conclusions about the size of the effect the overwhelming evidence is that there are positive wealth effects. We will review that literature in the next section. For now we conclude that the change in the value of household assets might importantly influence spending and thus also borrowing decisions and thus one should include the change in housing wealth (ΔHW_{it}) as well as the change in financial wealth (ΔFW_{it}) in a behavioural function describing household borrowing decisions. The reason for distinguishing between housing and financial wealth is the in general higher liquidity of financial wealth. However the accounting identity (1.5) also reveals that one has to take into account asset transactions such as the value of real estate purchases in the current year (REP_{it}) and the value of business[1] (I_{it}) and financial investment (FAP_{it}) undertaken in the current year. Also these three factors are influencing the outstanding liabilities of households.

In equation (1.5) we implicitly assumed a rather broad concept of consumption which also includes interest payments. Since interest payments depend on the interest rate charged and the amount outstanding, the stock of debt accrued in the past also influences current changes in the household balance sheet. The textbook model of consumption as in Romer (2012) only partially acknowledges that channel by including interest rates in the consumption function. Authors rooted in the tradition of stock-flow-consistent modelling such as Lavoie and Godley (2007) provide a coherent approach which demonstrates the role of past stocks especially with respect to debt. Thus since differences in interest rates should already be explained by household characteristics such as income and assets, only the past stock of debt (D_{t-1}) is added to the behavioural equation. It is the lagged level of debt rather than the current one which is relevant because debt reported in period t represents liabilities outstanding at the end of the year[2]. Thus D_{t-1} determines the interest payments the household will

[1] Investment in non-incorporated businesses, since these are part of the household sector.
[2] To be precise, liabilities outstanding at the time of the interview. Interviews were conducted mainly between May and December in each survey year (Bricker et al. 2014, p.39).

face in period t. The amount a household can borrow also depends on whether it has access to credit. Even if a household wanted to borrow, credit constraints could prevent it from doing so. Thus the question whether a household suffers from such credit constraints for whichever reason will be important in determining the borrowing activity of that household. For this reason a behavioural equation of household borrowing needs to include a measure of credit constraints ($credcons_{it}$).

Finally characteristics of the household such as the number of children, age, educational attainment and the ethnic background the household head identifies with are relevant factors for spending and borrowing decisions. Taking all these into consideration, household debt is explained by a function of household income (Y_{it}), consumption of a reference group ($\tilde{C}_{it}$), the change in housing wealth (ΔHW_{it}), real estate purchases in the current period (REP_{it}), the change in financial wealth (ΔFW_{it}), the value of business (I_{it}) and financial investment (FAP_{it}) undertaken in the current period, the number of children, age, education level and ethnicity of the household head:

$$\Delta D_{it} = f(Y_{it}, \tilde{C}_{it}, \Delta HW_{it}, REP_{it}, D_{it-1}, \Delta FW_{it}, I_{it}, FAP_{it}, kids, age, edu, race) \tag{1.6}$$

Equation (1.6) will be the starting point for the empirical model developed in section 5. Before presenting that we will briefly review the existing empirical literature which estimates expenditure cascade and property price effects on household borrowing and consumption behaviour.

3 The Related Empirical Literature

There is plenty of literature which is relevant for the discussion of household debt. On the one hand there are several papers which explicitly investigate to what extent the expenditure cascade hypothesis is able to explain household debt accumulation. The key explanatory variable used in these studies is some measure of income inequality if based on macroeconomic data or some measure of a reference group's income or consumption if survey data is used. A second relevant strand of literature investigates to what extent the cascade hypothesis is able to determine consumption expenditures and does not deal with household debt or just implicitly assumes that in an environment of rising income equality consumption spending triggered by status comparison is debt financed. These strands of the literature are discussed in the next two subsections. The remaining two groups of relevant publications are those investigating the role of real estate prices on household debt and those investigating the role of real estate prices on consumption. These are discussed in the third subsection. A common pattern will emerge in the discussion of the existing literature: papers which are interested in income inequality and the cascade hypothesis do not pay attention to asset dynamics and papers interested in the effects of assets on household debt or consumption do not pay attention to the role of income distribution. Additionally most of those papers investigating the expenditure cascade hypothesis use data which only provides limited detail about the top of the income distribution. In particular there is no investigation of the expenditure cascade hypothesis using the SCF. This is an important drawback of existing studies since income inequality in the US rose due to strongly growing top incomes (see section 4.1). Not including those top households in one's sample will yield misleading results.

3.1 Income Inequality and Household Debt

There are not many empirical studies dealing with the role of income inequality for household borrowing outcomes. Carr and Jayadev (2014) focus on the relative position of the individual household in the income distribution. They are interested to what extent expenditure cascade effects led to higher debt-to-income ratios of US households and thus have a similar research agenda as we do. The data used is the Panel Study of Income Dynamics (PSID) from 1999 to 2009. Carr and Jayadev (2014) use the proportion of households which are richer than household *i* as an indicator of relative income. They find positive and statistically significant effects and claim that their findings support the expenditure cascades hypothesis of Frank et al. (2014). However strictly speaking due to the way Carr and Jayadev define relative income, income inequality might go up while their measure of relative income stays constant. Put differently, their behavioural assumption is that a household cares about how many other families out there are richer than itself rather than worrying about how much richer are the Jonses next door.

Cynamon and Fazzari (2015) use decomposed national accounts data for the US and investigate whether rising income inequality led to an increase in household debt levels. So while their research question is very similar, their method is rather different and purely descriptive. The decomposition of aggregate income and expenditures they use allows to look at the top 5% and the bottom 95% of the income distribution separately. The authors argue that income growth for the bottom 95% slowed down beginning in the 1980s while expenditure growth did not slow down, leading to deteriorating balance sheets. According to Cynamon and Fazzari (2015) the bottom 95%'s balance sheets deteriorated because on the one hand households engage in social status comparison à la Frank et al. and on the other hand easier access to credit due to financial innovation and deregulation enabled borrowing. The authors argue that a consumption cascade based explanation of higher household debt is compatible with their data and that growing income inequality has to be a major factor in explaining rising US household debt ratios.

Behringer and van Treeck (2013) are explicitly interested in the macroeconomic effects of income inequality in general and expenditure cascades in particular. They use aggregate data for the G7 countries, over the period 1972 to 2007 and use the current account as well as the household financial balance as the dependent variable in their regressions. The idea is that as households engage in debt financed consumption spending due to expenditure cascade effects, the current account deteriorates.

In particular it is the household sector financial balance which deteriorates. They do find a negative and statistically significant relationship between the top 5% income share as well as an income Gini and the current account balance. For the household financial balance only the negative effect of the top income share is statistically significant. The authors interpret their findings as evidence for an expenditure cascade effect at work prior to the Financial Crisis. Beyond explaining household indebtedness Behringer and van Treeck (2013) also argue that rising inequality contributed to mounting international imbalances because the expenditure cascade effect was not present or in the important current account surplus countries like Germany and China.

Christen and Morgan (2005) also explicitly address the hypothesis that in the US rising income inequality led to growing household debt-to-income ratios due to expenditure cascade effects. Using a sample of quarterly time series from 1980q3 to 2003q they find positive effects of income inequality and non-financial assets on household debt. The authors claim to have found evidence in the spirit of Frank et al. (2014). However a closer look at the estimated effect size reveals that their model only explains 8 percentage points out of the actual 47 percentage point increase in the US debt-to-income ratio over the sample period. Moreover income inequality only explains 2.9 percentage points while non-financial assets explain 3.5 percentage points of the increased debt to income ratio. Thus even if they find positive effects of inequality the explanatory power of those effects and their entire model seems to be limited.

3.2 Income Inequality and Consumption Expenditures

So while the literature dealing with the role of income inequality as a determinant of household debt is scarce, there exists a large literature estimating the effects of inequality on consumption[3]. A closer look at this literature reveals however a striking degree of heterogeneity, especially with respect of how inequality and peer groups are defined. The current paper is interested in peer group definitions which involve income as a key variable due to the hypothesis that households compare themselves with richer peers. Unfortunately a large part of this literature defines peer groups based on household characteristics such as age and education (Maurer & Meier 2008), the region the household lives in (Alvarez-Cuadrado et al. 2012; Ravina 2007), or compares different categories of consumption goods (Heffetz 2011). All of these studies do find evidence of (at least) modest positive effects of peer group

[3] Even more work is done on the effects of inequality on self-reported happiness. Ferrer-i-Barbonell and Ramos (2014) provide an excellent survey of this literature which finds strong evidence of a negative relationship between inequality and happiness. Thus one can argue that if there is a negative link between inequality and happiness and consumption is positively related with happiness, people will try to prevent rising income inequality from materializing by keeping consumption expenditure growth high via debt-financing. There is empirical evidence documenting consumption inequality rising (slightly) slower than income inequality in the US (Fisher et al. 2014), however relying on data not covering the top of the income distribution. Nevertheless it is worthwhile to investigate the direct link between consumption and income inequality.

consumption on household consumption decisions. So while these papers have a relatively similar research target namely testing the explanatory power of consumption cascade effects, their focus on consumption as the dependent variable and even more importantly defining peer groups without taking the income distribution into account makes them less relevant as a benchmark.

However there are papers which try to explicitly measure consumption peer effects based on upward looking status comparisons. Bertrand and Morse (2013) for example estimate consumption of US household *i* living in state *s* as a function of the average consumption of the richest 10% of households in state *s*, household income and further controls such as age and education. They do find a positive effect and argue that an expenditure cascades based explanation is well in line with their data. Drechsel-Grau and Schmid (2014) produce a similar result but use German survey data. Stockhammer and Wildauer (2015) estimate a Bhaduri and Marglin (1990) inspired growth model where they also account for the effects of personal income inequality by including top income shares and income Gini coefficients in their estimated consumption function. They do not find positive effects of any of the used income inequality measures and conclude that their data is not compatible with an expenditure cascades interpretation.

3.3 The Effect of Property Prices on Household Debt and Consumption

With respect to the effect of property prices on household borrowing the empirical evidence is scarce. Mian and Sufi (2009) investigate the within county variation of mortgage borrowing growth in the US between 2002 and 2005. According to the authors the facts that mortgage borrowing growth was high in ZIP codes with negative income growth as well as in ZIP codes with flat house prices, falsify any income-expectation or property-price-expectation based explanation. Both of these hypothesis rely on households or lenders to expect high future income or property price growth respectively, to justify the heavy borrowing. Since both conditions are rejected by their data they claim that a shift in credit supply conditions was the major reason why mortgage borrowing took off between 2002 and 2005. However Mian and Sufi (2009) almost completely restrict their analysis to mortgage originations for home purchases and thus by design ignore equity extraction for consumption purposes. Mian and Sufi (2011) fill this gap from their previous research and focus on across MSA variation in total household debt growth of homeowners between 2002 and 2006. Relying on measures of housing supply elasticity as instruments for house price growth they find large and significant effects of house prices on total household borrowing. Their findings are most pronounced for homeowners with low credit scores and high propensities to borrow on credit cards (which they interpret as credit constraints and/or self-control problems).

Include Dynan & Kohn 2007. Also include studies which deal with total credit but include assets (and state that in the US the main bulk is household debt! If it is nonfinancial credit)

What about Slacalek, Muellbauer, etc. See the lit folder in the INET folder

With respect to the effects of property prices on consumption there are plenty of attempts to quantify them, the literature on wealth effects is very rich. Cooper and Dynan (2014) and Paiella (2009) provide recent surveys. In general this literature finds evidence of positive wealth effects with a marginal propensity to consume of about 5%. Real estate wealth effects are often larger than wealth effects related to financial assets. Results vary based on whether micro, macro or regional data is used. Most of these studies focus purely on wealth effects however and do not take into account the role of income inequality.

See for example Calomiris et al. 2012. Just report the more interesting studies dealing with the US!

3.4 Summing Up

Even though the empirical literature on the effects of inequality on household debt is quite diverse, especially with respect to the data and specifications used, this literature in general finds positive effects. There is also (mild) empirical evidence in favour of positive effects of income inequality on consumption. It is important to note however that none of the studies did take the role of assets explicitly into account. Those studies which investigate the role of property prices for household borrowing as well as for consumption expenditures do find overwhelming evidence of a positive relationship, especially for consumption. There is no empirical study using survey data which takes into account the role of property prices and income inequality simultaneously. Thus it might be the case that the positive effects of income inequality reported in the literature are driven by omitting household assets from the analysis. Beyond that all papers investigating the expenditure cascade hypothesis using US survey data rely on the Panel Study of Income Dynamics (PSID) or the Consumer Expenditure Survey (CEX) for their income and expenditure measures. While especially the CEX provides very detailed information about expenditures, the coverage of the top of the income distribution is limited. Due to the fundamental role income inequality and thus the tail of the income distribution plays for the expenditure cascade hypothesis, using a dataset which captures the tail of the distribution, like the SCF, seems to be crucial.

4 Data: The Survey of Consumer Finances

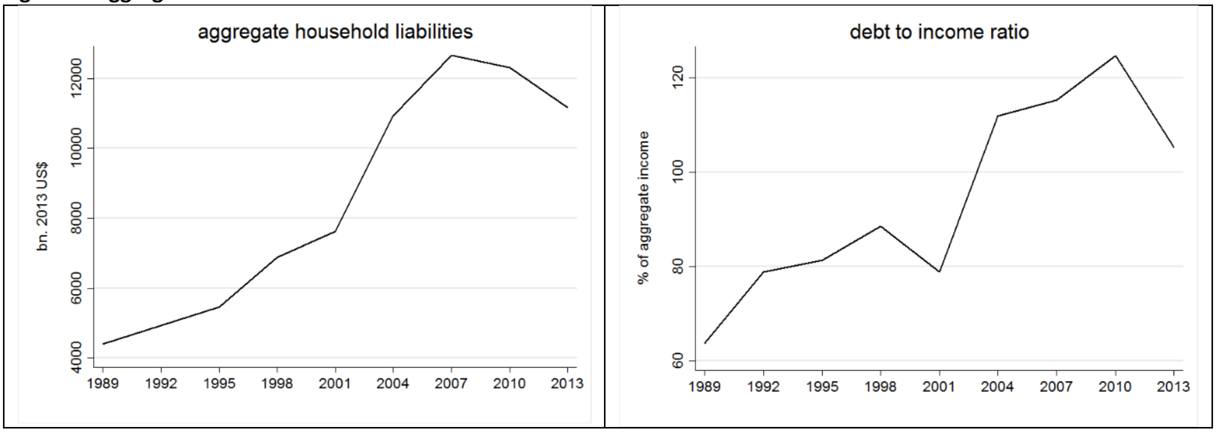
The paper relies on data from the Survey of Consumer Finances between 1995 and 2007. The SCF is a triannual survey conducted on behalf of the US Federal Reserve System. In each wave between 4,299 (1995) and 4,519 (2004) observations are included. The SCF focuses on household income, assets and liabilities and represents the most detailed source of information about household balance sheets and especially high income household balance sheets. This latter benefit of the SCF stems from the fact that the sample design is only partially based on random sampling. About half of the observations included are not randomly sampled but identified as high income households based on information provided by the Internal Revenue Service (IRS), the US tax authority. Thus income information provided by the tax authority enables the Fed to construct a sample including a large number of high income households despite the fact that rich households tend to be less willing to participate in such surveys while at the same time relying on a reasonable small (and thus affordable) sample size. This technique called "oversampling" allows to minimize the problems stemming from non-observation (Eckerstorfer et al. 2015) and non-response bias (Kennickell & McManus 1993; Singer 2006). Non-observation becomes an issue if the sample size is small in relation to the underlying population. The 2004 SCF wave for example contains 4,519 observations representing 112.11 million households, corresponding to a sample size of 0.04‰. With such a small sample it is impossible to adequately represent the highly skewed income distribution because most likely there are not enough observations from the top end of the distribution part of the sample. By oversampling the rich one collects enough such observations, even with a relatively small sample. In comparison non-response[4] problems arise if richer households are less likely to participate in the survey and thus are underrepresented in the sample (even if one had a big enough sample to circumvent non-observation problems). By means of oversampling more rich individuals are included in the gross sample (relying on tax data to identify them) and therefor oversampling enables the Fed to obtain a net sample with a high enough number of high income households to represent the underlying population. Due to non-observation and non-response problems, surveys which pay less attention to their sample design and do not apply oversampling techniques suffer from serious shortcomings and are in general not able to provide an adequate picture of the income or wealth distribution. Vermeulen (2014) and Eckerstorfer et al. (2015) demonstrate the impact of such a shortcoming. The latter paper estimates that aggregate net wealth is underestimated by about one quarter due to non-observation and non-response problems. Since the aim of this paper is to investigate the relative importance of the expenditure cascades argument, which in turn relies on the condition of a polarized distribution of income due to strong income growth dynamics at the top end of the distribution, taking non-observation and non-response problems serious is important to test the expenditure cascades hypothesis. The SCF represents the data source for the US which deals with both problems in the most convincing way and thus should be the first choice when investigating phenomena related to the distribution of income.

[4] Here non-response refers to unit-non-response in the sense that the household refuses to participate at all in the survey. There is also the problem of item-non-response which occurs when households refuse or are not able to answer individual questions. The SCF takes care of item-non-response via multiple imputation. For more information on the latter see Kennickell (1998).

4.1 Insights from a Descriptive Analysis

Simple descriptive statistics will shed some light on the question about which parts of the income distribution took on debt and which parts of the income distribution gained the most over the sample period of 1989 to 2013. Figure 1 demonstrates the extent of rising household debt from 1989 onwards. The liabilities of the household sector did not only rise in real terms from about $4 trillion in 1989 to their peak of more than $12 trillion in 2007 (left panel of Figure 1) but also in relation to disposable income (right panel). Aggregate household liabilities as a percentage of aggregate disposable income[5] increased from about 60% in 1989 to about 115% in 2007. The most pronounced increase occurred between 2001 and 2004 when total liabilities soared by more than 30 percentage points of aggregate income. Thus this period will be of special importance in understanding the rise in US household debt.

Figure 1: Aggregate Liabilities



Source: own computations based on SCF waves 1989 to 2013.

If one digs deeper and asks at which parts of the income distribution this surge in debt occurred, two patterns emerge. First, in absolute volumes the top 30% of the income distribution account steadily for 75% of total household liabilities (Table 1). The middle 50% account for almost a quarter and the bottom 20% contribute about 3% to total aggregate outstanding liabilities. The picture changes slightly if one looks at the changes from one survey year to the other. For example from 2001 to 2004 the first two deciles accounted for 4.2% of the total increase in household liabilities over that period. Nevertheless the top 3 deciles account steadily for almost 70% of the changes.

[5] It is important to keep in mind that disposable income as defined in the NIPA tables and aggregate disposable income reported in the SCF differ in three important ways. First only the SCF income measure includes realized capital gains. Second, the SCF measure does not include social security benefits provided by government or employers and third the SCF captures retirement income only as it is being received not as it is being accrued. See the Appendix in Bricker et al. (2015) and the references therein.

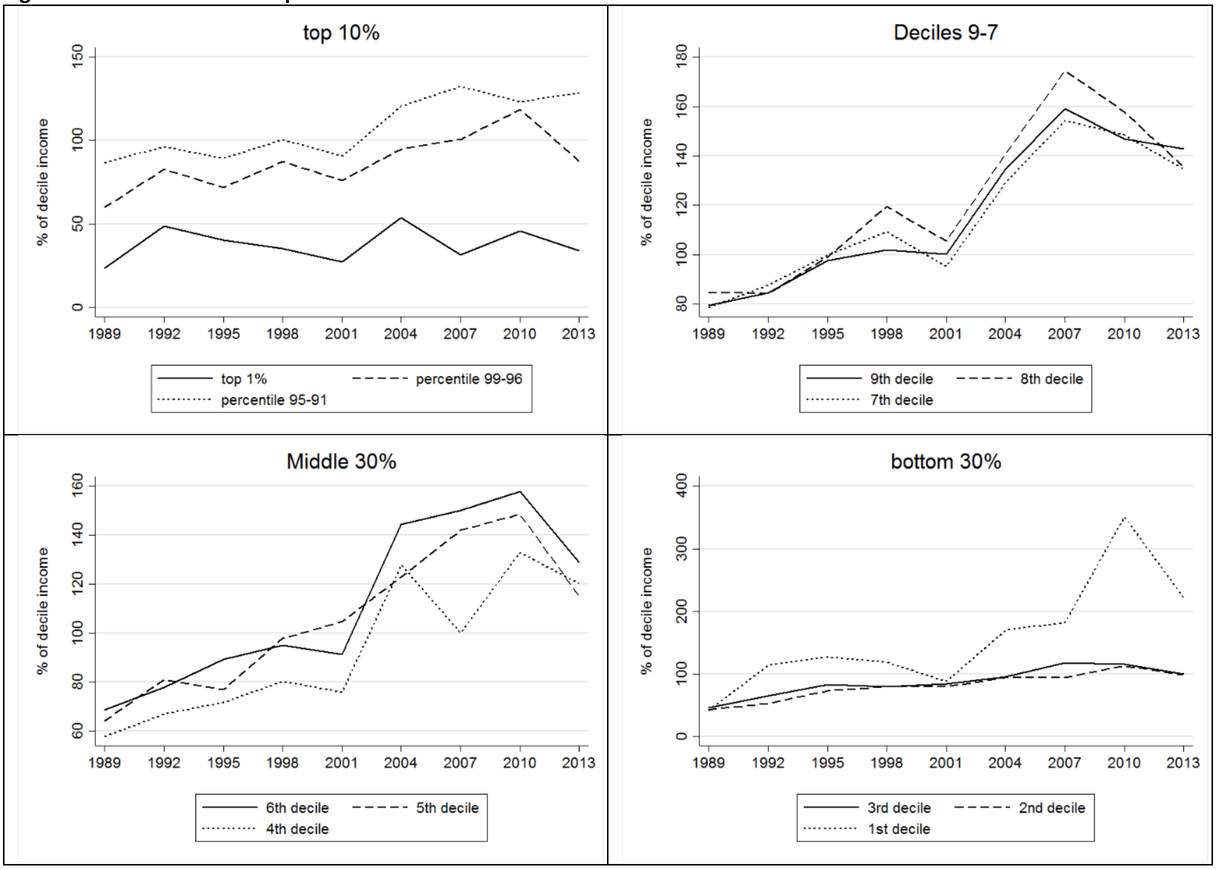
Table 1: Distribution of US Household Liabilities

	total liabilities (bn. 2013 US$)	total liabilities in bn. 2013 US$			change to previous survey year (% of total change)		
		dec 10-8	dec 7-3	dec 1&2	dec 10-8	dec 7-3	dec 1&2
1989	4,391	78%	19%	2.2%			
1992	4,928	76%	20%	3.3%	53%	35%	12%
1995	5,462	75%	22%	3.5%	38%	57%	5.0%
1998	6,886	76%	21%	3.4%	69%	28%	2.9%
2001	7,624	75%	22%	3.2%	70%	28%	1.2%
2004	10,933	74%	22%	3.5%	62%	34%	4.2%
2007	12,656	76%	21%	3.5%	73%	24%	3.3%
2010	12,306	73%	22%	5.4%	-151%	-15%	66%
2013	11,168	76%	20%	4.4%	-35%	-49%	-15%

Source: own computations based on SCF waves 1989 to 2013.

Second, while the top of the distribution accumulated large amounts of debt in absolute terms, these increases were much more modest when expressed relative to income levels. Figure 2 reveals that in the top 1% of the income distribution debt relative to income stayed relatively flat over the long run but especially between 2001 and 2007 when it rose only by 4 percentage points relative to income.

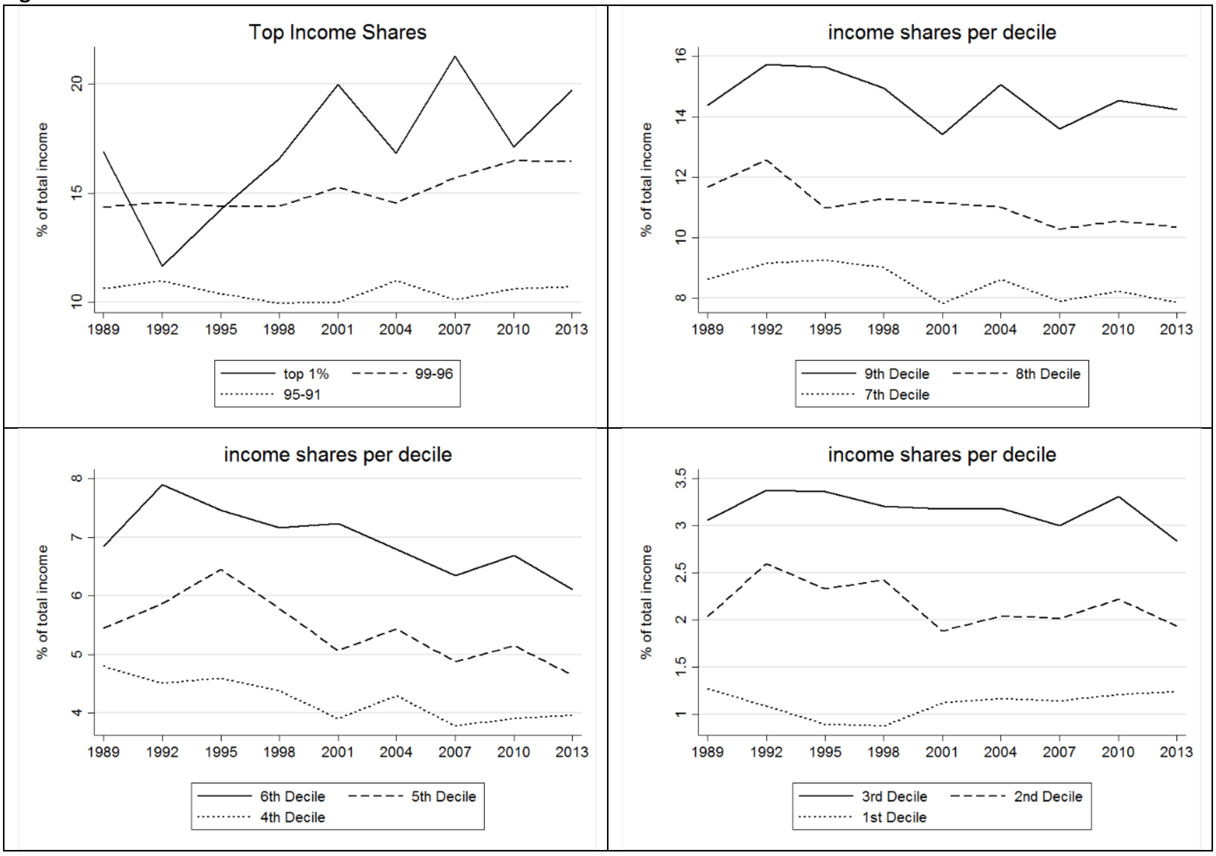
Figure 2: Debt relative to disposable income



Source: own computations based on SCF waves 1989 to 2013.

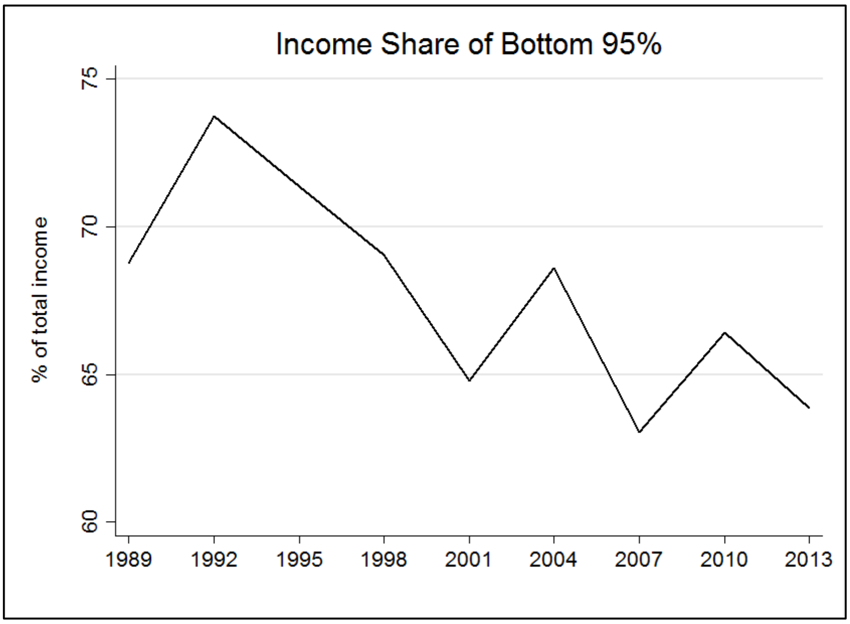
The reason for such an, at first sight, counterintuitive result is the development of the income distribution itself. Figure 3 shows how income shares of different quantiles emerged from 1989 to 2013. The important conclusion to draw from this analysis is that only the top 5% of the distribution experienced income gains in relation to the rest of the distribution. The top left panel of Figure 3 reveals that for the top 1% while income is quite volatile its income share steadily increased until 2001 and peaked in 2007. The next 4%, those households in percentiles 99 to 96, experienced a more steady increase beginning in 1998 and peaking in 2010. The striking result is that the rest of the income distribution lost relative to these two groups which form the top 5%. This result is drastically demonstrated by Figure 4. During the period 1989 to 2013 and also in the sub period 2001 to 2007 it was only the second half of the top decile which was able to improve its relative position in the income distribution.

Figure 3: Income shares from 1989 to 2013



Source: own computations based on SCF waves 1989 to 2013.

Figure 4: Income share bottom 95%



Source: own computations based on SCF waves 1989 to 2013.

4.2 The Problem of The Missing Time Dimension in The SCF

The key limitation of the SCF for assessing the explanatory power of the expenditure cascades argument and the housing-driven-debt hypothesis is the missing time dimension in the sense that the SCF is a repeated cross section and not a panel. This means each wave is based on a new sample and households are not observed in consecutive waves. It implies that one cannot simply compute the change in debt for household i by subtracting debt in period $t-1$ from debt in period t. However since it is crucial to investigate the change in households' liabilities and not the level because only the change and not the stock is determined by current period flows like income and consumption, we had to overcome this problem. The detailed information the survey collects about the credit history of each observed household was key in doing so. In order to understand how the change of an individual household's debt level is constructed one has to keep in mind that the SCF covers 10 different debt categories. Participating households are asked about their outstanding liabilities with respect to mortgages (primary residence as well as other properties), lines of credit, credit on land contracts, consumer loans, credit cards, car and vehicle loans, education loans, loans against pension plans and other loans. Based on the specific information the survey collects about all these categories, the paper is able to construct a measure of how much that liability changed within the last year. For two categories there is not enough information to make such an inference: loans against land contracts and loans against pension plans. For each household the changes in each category are aggregated to obtain the total change in household i's level of debt.

An example will be the best way to demonstrate how it was done. Let's consider the first mortgage on the primary residence for household i, which will be denoted $D_{i,t}^{M1}$. In order to understand by how much the outstanding amount on that mortgage changed, households are characterised in three steps. The first step distinguishes whether the mortgage was taken out in the current year ($tB = year$) or prior to the year of the interview ($tB < year$) and how the money was used (use). For that latter question the SCF allows three different answers: it was used to refinance an earlier mortgage ($use = ref$), it was taken out in order to extract equity from the property or to extract equity and refinance an earlier loan ($use = ex$) or none of these two reasons applies and there was no prior loan or mortgage ($use = 0$).

In case the mortgage was taken out in the year of the interview ($tB = year$) the information how the money was used becomes crucial. If the mortgage was just used to refinance an earlier credit ($use = ref$, case 1), the change of that mortgage is defined as the difference between the amount currently outstanding ($D_{i,t}^{M1}$) and the amount initially borrowed (B_i^{M1}): $\Delta D_{i,t}^{M1} = D_{i,t}^{M1} - B_i^{M1}$. The rationale for this definition is that since the mortgage was taken out in the current year, any change in the outstanding amount occurred in the current period. It is important to note that depending on whether the amount initially borrowed is smaller, bigger or equal compared to the amount currently outstanding, the resulting change in the amount outstanding will be positive, negative or zero. The case of $B_i^{M1} < D_{i,t}^{M1}$ is interpreted as household i being behind on payments and accumulating overdue interest payments as well as potential penalties for falling behind in payments.

In contrast if the mortgage was used to extract equity from the residence or to extract equity and refinance an earlier loan ($use = ex$, case 2)[6], the change in the amount outstanding is defined as the amount extracted (ex_{it}) plus the difference between the amount currently outstanding and initially borrowed: $\Delta D_{i,t}^{M1} = ex_{it} + D_{i,t}^{M1} - B_i^{M1}$. The reason for including ex_{it} is obvious since it represents newly accumulated debt. The difference between the current amount and the initial amount is added because this difference represent to what extent (new as well as already existing debt) was paid down. Since both figures, the amount initially borrowed and the amount outstanding, include ex_{it}, this difference accounts for any repayment either of debt taken out to extract equity or to refinance an earlier loan.

If the household had no prior loan or mortgage ($use = 0$, case 3) the change in debt is simply defined as the amount currently outstanding because the amount currently outstanding represents debt

[6] Note that the way the SCF asks this question (item X7137) also allows for extracting equity and refinancing. Thus case 2 in this example includes households only extracting equity as well as households extracting equity and refinance an earlier loan/mortgage.

accumulated in the current period: $\Delta D_{i,t}^{M1} = D_{i,t}^{M1}$. The reasoning is that in this case $D_{i,t-1}^{M1} = 0$ and thus the change in debt equals the amount currently outstanding.

In most cases however the households did not take out their mortgage in the current year ($tB < year$). Under these circumstances the difference between the amount currently outstanding and the amount initially borrowed is not informative anymore. Thus in a second step the paper distinguishes between those households whose current annual payments, including interest and principal (re)payments ($P_{i,t}^{M!}$) are smaller or equal to their annual interest payments ($rD_{i,t}^{M!}$) and those whose annual payments exceed their interest. Total annual payments are computed based on a direct question in the SCF and the interest payments are computed as the reported interest rate times the amount currently outstanding. If $P_{i,t}^{M!} \leq rD_{i,t}^{M!}$ (case 4.1) the change in the primary mortgage is defined as zero: $\Delta D_{i,t}^{M1} = 0$ and the reason is that the information provided by these households is not trusted because $P_{i,t}^{M!}$ is based on a question about "the typical payment". It is unlikely that a household does not even pay the interest on an outstanding mortgage over a long period of time such that it becomes "typical".

In contrast if the typical payment exceeds the interest payments, the paper further distinguishes in a third step whether the initial amount borrowed is equal to the amount outstanding or not. If these amounts are not equal (case 4.2.1) the change of the primary mortgage is defined as the difference between the typical payment and the interest payments: $\Delta D_{i,t}^{M1} = -(P_{i,t}^{M!} - rD_{i,t}^{M!})$. The rationale for this definition is that interest payments per se do not change the amount outstanding and thus need to be subtracted from a general measure including principal and interest payments. Since $P_{i,t}^{M!}$ is reported as a positive number, but represents a reduction of liabilities, the whole expression is multiplied by -1.

The final case is related to those households whose outstanding liabilities equal the amount initially borrowed (case 4.2.2). So in that case on the one hand the regular total payments exceed the interest payments, implying a reduction in the outstanding mortgage, however at the same time the amount currently outstanding and the amount initially borrowed are the same. Under these contradictory circumstances the change of the outstanding amount is defined as 0, since it seems reasonable to assume that households are better able to remember the amounts borrowed and currently outstanding than a fluctuating interest rate on which the calculations of $rD_{i,t}^{M!}$ crucially depend. Therefor the information that $B_{i}^{M1} = D_{i,t}^{M1}$ is interpreted as more trustworthy and correspondingly the change is defined as 0.

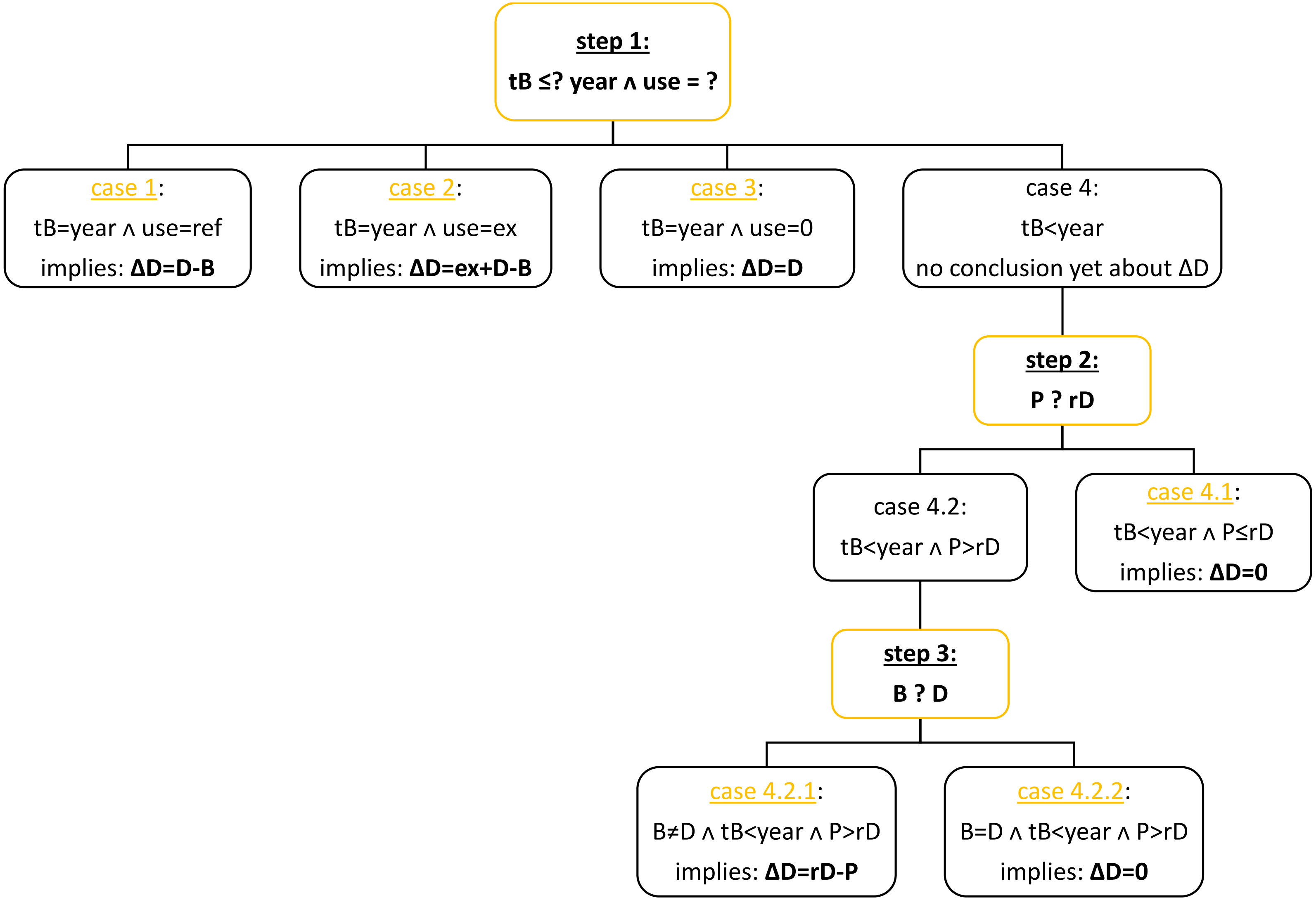
Table 2 summarises the 6 cases identified above. Table A3 in the Appendix provides a more detailed breakdown and Figure 5 illustrates the decision tree which was described in the previous paragraphs.

Out of the 1,984 households which reported an outstanding first mortgage on the primary residence in the 2004 wave in implicate 3 (out of 4,519 households per implicate), 1,448 belong to case 4.2.1 and thus form the biggest group. Overall it becomes clear that the majority of households is paying down debt and only a small group of households is taking on debt in the current year. While this is not a surprising result one has to keep it in mind when estimating the econometric model. By applying a similar logic as in the example about the primary mortgage to all the other debt categories (consumer loans, car loans, education loans etc.), the paper constructs a measure of the total change in household i's liabilities by summing up the changes of the individual categories.

Table 2: Case distinction first mortgage primary residence

case	step 1	step 2	step 3	definition	N (2004, m=3)
1	tB=year ∧ use = ref	-	-	ΔD=D-B	168
2	tB=year ∧ use = ex	-	-	ΔD=ex+D-B	58
3	tB=year ∧ use = 0	-	-	ΔD=D	109
4.1	tB<year	P ≤ rD	-	ΔD=0	54
4.2.1	tB<year	P > rD	B > D ∨ B < D	ΔD=rD-P	1,448
4.2.2	tB<year	P > rD	B = D	ΔD=0	147
					1,984

Figure 5: Decision tree, first mortgage on primary residence



5 Econometric Model and Results

In section 2 equation (1.6) was derived as a starting point for defining a regression specification. The model which is going to be estimated is defined as follows:

$$\Delta \ln(D_{it}) = \alpha + \beta_1 \ln(Y_{it}) + \beta_2 \ln\left(\tilde{C}_{it}\right) + \beta_3 \ln(HW_{it}) + \beta_4 \ln(REP_{it}) + \ \beta_5 \ln(D_{it-1})$$

$$+ \beta_6 \ln(FW_{it}) + \beta_7 BUSd_{it} + \beta_8 CCd_{it} + \beta_9 normY_{it} + \beta_{10} X_{it} + year_t + \varepsilon_{it} \qquad (5.1)$$

D_{it} represents the total level of outstanding liabilities, Y_{it} is household income (including realized capital gains) and $\tilde{C}_{it}$ is a proxy for consumption expenditures of the reference group of household i. The way $\tilde{C}_{it}$ is defined is discussed in detail in the next subsection. HW_{it} represents real estate wealth (mainly the primary residence, excluding real estate for investment purposes), REP_{it} is the value of any real estate purchased in the current period and FW_{it} is the financial wealth of the household. $BUSd_{it}$ is a dummy variable which equals one if household i founded a business in the year of the interview, CCd_{it} is a dummy variable which equals one if household i was rejected when applying for credit within the last 5 years and also unable to obtain credit later or did not reapply and $normY_{it}$ is the ratio of the current income of household i to that income household i expects in a normal year. Finally X_{it} is a matrix of household characteristics including, the age, education level and ethnical background of the household head as well as the number of children living in the household. $year_t$ is a set of year dummy variables to capture homogeneous year specific shocks.

Equation (5.1) differs in four aspects from equation (1.6). First, instead of the changes in asset values (ΔHW_{it} and ΔFW_{it}) the levels are used. The reason for that is that the SCF does not provide enough information to infer the value of these assets in the previous period and thus it is impossible to compute ΔHW_{it} or ΔFW_{it}. However including the stock of liabilities at the end of the previous year (D_{it-1}) in the model, creates some form of net wealth measure which is closely related to ΔHW_{it} or ΔFW_{it} as long as net wealth in the previous period was low which will hold in particular for those households which bought assets recently. Second, instead of the precise amount of business investment, a dummy for founding a business in the current year is used ($BUSd_{it}$). While it is not a precise measure it provides important information and allows to skip many difficult issues about how the business and the household's finances are related. Third, debt-financed purchases of financial assets are neglected. The reason is to keep the model manageable and the assumption that such transactions are negligible for most households. Fourth, including CCd_{it} provides some information about how credit supply circumstances changed. One important shortcoming of this measure is that it does not provide information to what extent financial institutions become more willing to grant higher loans/mortgages based on a given level of household income and/or assets. Adding $normY_{it}$ picks up information on income shocks and can shed some light on the question whether unexpected income shocks played an important role in rising household debt levels.

Equation (5.1) is estimated by OLS using probability weights provided by the SCF and standard errors of the coefficients are obtained by means of a bootstrap procedure relying on the set of replicate weights part of the SCF. In order to compute standard errors the regression is re-estimated for each of the 999 sets of replicate weights and the observed distribution of the estimators is used to form standard errors and confidence intervals. Since the SCF is a multiply imputed data set, each step of the analysis is carried out for each of the 5 imputations, which are combined based on Rubin's rule (Rubin 1987) to obtain a single result. Thus while results for individual regressions are reported, each of these is based on 5,000 individual regressions.

5.1 Defining Reference Group Consumption $\tilde{C}_{it}$

According to the expenditure cascades hypothesis, household i will engage in debt-financed consumption spending and will increase its liabilities in a situation of increased income inequality where household i's reference group increases its status driven consumption expenditures. In order to investigate the effect of the reference group's consumption on the change in outstanding liabilities of household i two problems need to be solved. First, one needs to come up with a definition of the peer group and second, the SCF does not provide adequate information on household consumption and thus one needs to define a proxy of the peer group's consumption. Since the expenditure cascades hypothesis explicitly rests on the assumption that households compare themselves to richer peers the reference groups are defined along income quantiles. The reference group of a household in a particular quantile of the income distribution, is defined as the next highest quantile. The paper uses three different sets of quantiles to define the reference groups. Definition A simply consists of deciles and each decile is the reference group for the next lower decile. The top group, the 10^{th} decile, does not have a reference group but serves as a reference group for the 9^{th} decile. The 9^{th} decile is the reference group for the 8^{th} decile and so on. Definition B distinguishes more carefully within the top decile and uses the top 5% (percentiles 100 to 96) and households belonging to percentiles 95-91 instead of the 10^{th} decile. Households in the top group (percentiles 100 to 96) do not have a reference group but serve as a reference group for households between the 95^{th} and 91^{st} percentile. This latter group serves as a reference group for the 9^{th} decile and the 9^{th} decile for the 8^{th} and so on. Definition C, which is the preferred measure, distinguishes further between the top 1% and percentiles 99-96 and thus in comparison to definition B further splits up the top 5%. The three versions are summarised in Table 3.

Table 3: Reference group definitions

definition A	definition B	definition C
		100
	100-96	99-96
100-91	95-91	95-91
9th decile	9th decile	9th decile
8th decile	8th decile	8th decile
7th decile	7th decile	7th decile
6th decile	6th decile	6th decile
5th decile	5th decile	5th decile
4th decile	4th decile	4th decile
3rd decile	3rd decile	3rd decile
2nd decile	2nd decile	2nd decile
1st decile	1st decile	1st decile

Definition C is the preferred one because it is closest in line with the results from the descriptive analysis in section 4.1 which demonstrates that the income share of the top 1% (i.e. the 100th percentile) is much more volatile than the income share of the next 4% (99th to 96th percentile). Also the lower half of the top decile (95th to 91st decile) does not show a similar increase in their income share as do the two groups. Thus treating the top 10% as a homogeneous group as definition A does or amalgamating the top 1% and the next 4% in a single group despite their different trends in how their relative position in the income distribution evolved as definition B does, ignores important heterogeneity. Results for definitions A and B are still reported because their structure is simpler and they serve as a robustness check. It is also important to keep in mind that since the top group is removed from the sample because it has no reference group, definition A yields a much smaller sample than definition C because when using definition C only the observations in the top 1% are dropped compared to all the observations comprising the top 10% with definition A.

The second problem is that of finding a proxy for the consumption expenditures of these reference groups. The proxy is labelled $\tilde{C}_{it}$ and defines as the average income of the reference group plus the average change in debt of that group. Thus when using definition B, $\tilde{C}_{it}$ for all household in the 9th decile will consist of the average income of households between the 95th and 91st percentile as well as their average change in debt. The reason for proxying consumption with income is straight forward. However since under the hypothesis of expenditure cascades, households should also heavily engage in debt-financed consumption spending, also newly accumulated liabilities need to be taken into account in addition to income.

5.2 Estimation Results

When estimating equation (5.1) lagged liabilities (D_{it-1}) and financial wealth (FW_{it}) are interacted with income group dummies. In doing so the likely non-linear relationship between these variables and changes in household liabilities across the income distribution are taken into account. Depending on which reference group definition is used, the distribution of income is separated into 5 or 6 groups for which the effects of the interacted variables can vary. Table 4 summarizes the interactions used. For example, when using reference group definition A, D_{it-1} and FW_{it} are allowed to have different effects for households in the 10th decile (d=5), households between the 90th and 71st percentile (d=4), households between the 70th and 51st decile (d=3), households between the 50th and 11th percentile (d=2) and households in the bottom decile (d=1). This means that still the 7th decile is the reference group for the 6th decile and the 6th decile for the 5th but since the 6th and the 5th decile are in different interaction groups (d=3 and d=2 respectively) the effect sizes and/or magnitudes might be different for these two deciles. The same logic extends to the other definitions of reference groups and to other parts of the income distribution. The decision of which variables to interact and how to define the interaction groups was based on a set of auxiliary regressions where all monetary variables (thus also Y_{it}, $\tilde{C}_{it}$, HW_{it} and REP_{it}) where interacted with all 9 deciles and the groups comprising the 10th decile. Based on whether the interaction effects were statistically significant and had similar coefficients, the interaction groups (d=1, … , d=6) were formed.

Table 4: Interaction effects

definition A	Interactions	definition B	interactions	definition C	interactions
				100	d=6
		100-96	d=5	99-96	d=5
100-91	d=5	95-91	d=4	95-91	d=4
dec9	d=4	dec9	d=4	dec9	d=4
dec8	d=4	dec8	d=4	dec8	d=4
dec7	d=3	dec7	d=3	dec7	d=3
dec6	d=3	dec6	d=3	dec6	d=3
dec5	d=2	dec5	d=2	dec5	d=2
dec4	d=2	dec4	d=2	dec4	d=2
dec3	d=2	dec3	d=2	dec3	d=2
dec2	d=2	dec2	d=2	dec2	d=2
dec1	d=1	dec1	d=1	dec1	d=1

Table 5 reports the results from a baseline specification. In column (1) the proxy for the reference group's expenditures is not included and the regression is run on the entire sample. Column (2) still does not make use of the reference consumption measure but restricts the sample to those

Table 5: Baseline specification

	dependent variable: $\Delta ln(D)$				
		(1)	(2)	(3)	(4)
	peer income	no	no	definition C	definition C
	high quality only	no	yes	no	yes
1	ln(Y)	0.082	0.097	0.118*	0.145*
2	(d=2)*ln(Y)	0.16	0.205		
3	(d=3)*ln(Y)	0.397	0.441		
4	(d=4)*ln(Y)	0.12	0.183		
5	(d=5)*ln(Y)	-0.467	-0.388		
6	(d=6)*ln(Y)	-0.615***	-0.699***		
7	ln(Y~C)			0.09	0.133
8	ln(HW)	0.031***	0.030***	0.031***	0.030***
9	ln(REP)	0.254***	0.277***	0.258***	0.283***
10	$ln(D_{t-1})$	-0.200***	-0.198***	-0.200***	-0.198***
11	$(d=2)*ln(D_{t-1})$	0.025	0.02	0.026	0.021
12	$(d=3)*ln(D_{t-1})$	0.116***	0.125***	0.118***	0.127***
13	$(d=4)*ln(D_{t-1})$	0.278***	0.306***	0.278***	0.306***
14	$(d=5)*ln(D_{t-1})$	0.518***	0.525***	0.514***	0.523***
15	$(d=6)*ln(D_{t-1})$	0.880***	0.865***		
16	ln(FW)	-0.003	-0.006	-0.003	-0.006
17	(d=2)*ln(FW)	-0.095***	-0.099***	-0.093***	-0.097***
18	(d=3)*ln(FW)	-0.184***	-0.218***	-0.181***	-0.215***
19	(d=4)*ln(FW)	-0.177***	-0.218***	-0.178***	-0.220***
20	(d=5)*ln(FW)	-0.357***	-0.471***	-0.401***	-0.512***
21	(d=6)*ln(FW)	-0.321***	-0.379***		
22	BUSd	0.457***	0.352**	0.461***	0.348**
23	CCd	0.241***	0.236***	0.243***	0.240***
24	normY	-0.001	0.009	0.01	0.026
25	dum1998	0.037	0.03	0.047	0.038
26	dum2001	-0.045	-0.046	-0.039	-0.044
27	dum2004	0.05	0.051	0.047	0.041
28	dum2007	0.065	0.069	0.066	0.068
29	constant	0.448	0.111	-0.805	-1.674
30	d=2	-1.219	-1.59	0.284	0.32
31	d=3	-3.781	-3.919	0.364	0.617*
32	d=4	-2.441	-2.89	-1.327**	-1.170**
33	d=5	4.338	4.843	-1.479	-0.256
34	d=6	1.504	3.648	0	0
	N	21,335	16,871	18,185	14,506
	F-stat.	88	89	86	88
	F p-val.	0	0	0	0
	RVI	0.45	0.38	0.50	0.42
	FMI	0.83	0.81	0.83	0.81
	av. DF	953	2,416	1,170	3,274

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

observations which did not report any conflicting information and the corresponding sample is labelled the high quality sample. Columns (3) and (4) also report results based on the full and the high quality sample but this time including the reference group consumption measure.

Table 5 demonstrates that the results are very robust across the full sample and the high quality subsample. This indicates that the procedure of constructing the change in debt measure is robust to potentially misreported information and measurement error. The first result from Table 5 with respect to household behaviour, is that the measure of reference consumption does not seem to cause multicollinearity problems as one might expect since income plays such an important role in its construction. Results are quasi identical across specifications which include and do not include $\tilde{C}_{it}$. Second one can observe a positive effect of income on the growth rate of household debt. Only for households in the 100th percentile (d=6, using definition C) and households between the 99th and 96th percentile (d=5, using definition C) there seems to be a negative relationship. Since the interaction effects where not statistically significant in specifications (3) and (4), they were dropped but Table A4 in the Appendix provides the full set of results. Third, there are no statistically significant effects of the reference group consumption measure. The estimated effects are positive but not significantly different from 0. When considering the (also statistically insignificant) interaction terms for $\tilde{C}_{it}$ (Table A4) it seems that there is a positive effect of the top percentile on the next 4% (d=5). In contrast for households between the 70th and 51st percentile (d=3) there even seems to be a negative effect but it is also not statistically significant. Third, there is a positive and statistically significant effect of housing wealth on the growth rate of household liabilities. To the extent that HW_{it} captures capital gains on real estate this result is in line with the housing-driven-debt hypothesis. Also real estate purchases in the current period have a statistically highly significant positive impact on household debt. Fourth, the stock of past liabilities has a negative impact until the 70th percentile. Only for the upper 30 percentiles there is an increasingly positive effect of past debt on the growth rate in household debt and thus an explosive dynamic. Since the top 30% took on the biggest share in debt this result fits the outcomes of the descriptive analysis. Fifth, financial wealth holdings are consistently related with lower growth rates of household debt. This finding makes intuitive sense since, accumulating (liquid) financial assets and liabilities at the same time is either a highly risky investment strategy or simply a costly way of running one's private finances. So far there is no evidence in favour of the expenditure cascade hypothesis but strong evidence in favour of the housing-driven-debt hypothesis. The results from the remaining two definitions of reference consumption will serve as a robustness check for this conclusion.

Table 6: Additional measures of reference consumption

	dependent variable: Δln(D)				
		(1)	(2)	(3)	(4)
	peer group definition	none	def. A	def. B	def. C
1	ln(Y)	0.139**	0.142*	0.158**	0.118*
2	ln(C~)		0.06	0.021	0.09
3	ln(HW)	0.031***	0.031***	0.031***	0.031***
4	ln(REP)	0.253***	0.271***	0.267***	0.258***
5	$\ln(D_{t-1})$	-0.201***	-0.200***	-0.201***	-0.200***
6	$(d=2)*\ln(D_{t-1})$	0.027	0.026	0.026	0.026
7	$(d=3)*\ln(D_{t-1})$	0.118***	0.119***	0.118***	0.118***
8	$(d=4)*\ln(D_{t-1})$	0.279***	0.277***	0.279***	0.278***
9	$(d=5)*\ln(D_{t-1})$	0.514***			0.514***
10	$(d=6)*\ln(D_{t-1})$	0.879***			
11	ln(FW)	-0.003	-0.003	-0.002	-0.003
12	(d=2)*ln(FW)	-0.092***	-0.093***	-0.093***	-0.093***
13	(d=3)*ln(FW)	-0.181***	-0.180***	-0.181***	-0.181***
14	(d=4)*ln(FW)	-0.174***	-0.166***	-0.176***	-0.178***
15	(d=5)*ln(FW)	-0.400***			-0.401***
16	(d=6)*ln(FW)	-0.444***			
17	BUSd	0.459***	0.552***	0.484***	0.461***
18	CCd	0.242***	0.252***	0.241***	0.243***
19	normY	-0.013	0.003	0.009	0.01
20	dum1998	0.044	0.043	0.053	0.047
21	dum2001	-0.035	-0.03	-0.032	-0.039
22	dum2004	0.06	0.047	0.069	0.047
23	dum2007	0.07	0.059	0.077	0.066
24	constant	-0.068	-0.704	-0.472	-0.805
25	d=2	0.324	0.288	0.288	0.284
26	d=3	0.458	0.344	0.369	0.364
27	d=4	-1.227**	-1.454**	-1.332**	-1.327**
28	d=5	-1.155			-1.479
29	d=6	-5.538***			
	N	21,335	14,761	16,037	18,185
	F-stat.	105	96	99	97
	F p-val.	0	0	0	0
	RVI	0.35	0.46	0.43	0.45
	FMI	0.83	0.83	0.83	0.83
	av. DF	939	267	490	862

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

Table 6 reports specification (1) from Table 5 again in the first column. The next three columns present the results when using all three different definitions of the reference group. Since the top group is defined differently in all three cases and since the top group is excluded from the estimation because it has no reference group itself, sample sizes vary across definitions. Definition A yields the smallest sample because all observations belonging to the top decile of the income distribution are removed. Definition B only removes the top 5% and definition C only the top 1%. The practice of oversampling the top end of the distribution can be seen by the fact that the top 1% accounts for roughly 15% of the entire sample, as indicated by the differences in sample size between specifications (1) and (4). The first important result from Table 6 is that outcomes are very robust across the specifications and thus robust to the inclusion or exclusion of the top end of the income distribution. Second, Table 6 reproduces all the results from before. Also there are no statistically significant effects of the other two reference group definitions. Table A5 in the Appendix reports the interaction terms for Y_{it} and $\tilde{C}_{it}$ but since most of them are statistically insignificant they are not reported in the main tables. In contrast to the insignificant effects of $\tilde{C}_{it}$ there are positive and statistically highly significant effects of housing wealth and current real estate purchases in all specifications. Thus also when relying on the broader definitions of reference groups there is no evidence in favour of the expenditure cascades hypothesis to be found but robust evidence backing the housing-driven-debt hypothesis.

6 Conclusion

This paper investigates the rise in US household debt levels prior to the Financial Crisis. Two potential explanations are of particular interest: First, the expenditure cascades hypothesis focussing on the role of upward looking status comparison in triggering debt-financed consumption cascades in an environment of increasing income inequality. Second the housing-driven-debt hypothesis which emphasizes the role of rising real estate prices for household liabilities via equity extraction on the one hand and purchases of new homes on the other hand. These two hypothesis are tested using the Survey of Consumer Finances which provides high quality data on household balance sheets and is the only survey in the US which is able to claim to deal with the problem of non-observation and non-response of rich households in a convincing way by means of oversampling based on information from the federal tax authority. In order to be able to use the SCF for such an investigation a measure of the change in household debt from the previous year to the year of the interview is constructed. Even though the SCF hast no panel structure it is possible to derive such a measure by exploiting the detailed information on households' credit history. Constructing such a measure enables to test the two hypothesis of interest based on a dataset which adequately captures recent trends in income inequality. Since the expenditure cascades hypothesis relies fundamentally on shifts in the income distribution in order to explain rising debt levels, using a dataset which is able to picture these trends is key.

Based on regression analysis the paper does not find statistically significant evidence backing the expenditure cascades based explanation for rising US household debt between 1995 and 2007. It finds positive (but statistically insignificant) effects for households between the 99th and 96th percentile of the income distribution for which the top percentile serves as the reference group. In contrast for households between the 70th and 51st percentile there are negative effects, but these are once more not statistically different from 0. In contrast the paper finds evidence supporting the housing-driven-debt explanation. There is in particular a positive and statistically significant effect of housing wealth on household liability growth rates, which is interpreted as evidence of a wealth effect through re-mortgaging and equity extraction. In addition there is also significant evidence that real estate purchases in the current period play an important role in explaining the growth rate of household liabilities. The interpretation of these findings is that real estate dynamics are the binding constraint for household indebtedness. So even if status comparison might be important in household decision making it seems that the household's balance sheet is the ultimately binding constraint. Whether the valuation of assets and in particular real estate is done in a sustainable way by the lending institution is of course a different question.

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Appendix

Table A1: Debt relative to income I

	debt in % of disposable income											
	top 1%	perc 99-96	perc 95-91	dec 9	dec 8	dec 7	dec 6	dec 5	dec 4	dec 3	dec 2	dec 1
1989	23	60	87	79	85	79	69	64	58	46	43	42
1992	49	83	96	84	84	88	78	81	67	64	53	113
1995	40	72	89	98	99	100	89	77	72	83	73	127
1998	35	87	101	102	120	109	95	98	80	80	80	119
2001	27	76	91	100	106	95	91	105	76	84	79	88
2004	54	95	121	134	141	129	144	123	128	95	94	170
2007	31	101	133	159	174	154	150	142	100	118	94	182
2010	46	119	123	147	158	148	158	149	133	115	113	351
2013	34	88	129	143	136	135	129	115	120	99	99	222

Table A2: Debt relative to income II

	change to prevoius survey year											
	top 1%	top 2-5%	top 6-10%	dec 9	dec 8	dec 7	dec 6	dec 5	dec 4	dec 3	dec 2	dec 1
1989												
1992	25	23	10	5	-1	9	9	17	9	19	10	71
1995	-8	-11	-7	13	15	12	11	-4	5	19	20	13
1998	-5	15	11	4	20	9	6	21	9	-3	7	-8
2001	-8	-11	-10	-2	-14	-14	-4	7	-4	5	-0	-30
2004	26	19	30	34	35	34	53	18	52	11	15	81
2007	-22	6	12	25	34	25	6	19	-28	23	0	13
2010	14	18	-9	-12	-17	-6	8	7	33	-3	19	169
2013	-12	-31	5	-4	-22	-14	-29	-33	-13	-16	-14	-129

Table A3: Defining ΔD for the first mortgage on the primary residence

line	step 1	step 2	step 3	definition	case	result (ΔD)	N (2004, m=3)
1	tB=year ∧ use = ref	~~P > rD~~	~~B > D~~	ΔD=D-B	1	ΔD=D-B<0	93
2	tB=year ∧ use = ref	~~P > rD~~	~~B = D~~	ΔD=D-B	1	ΔD=0	63
3	tB=year ∧ use = ref	~~P > rD~~	~~B < D~~	ΔD=D-B	1	ΔD=D-B>0	3
4	tB=year ∧ use = ref	~~P ≤ rD~~	~~B > D~~	ΔD=D-B	1	ΔD=D-B<0	3
5	tB=year ∧ use = ref	~~P ≤ rD~~	~~B = D~~	ΔD=D-B	1	ΔD=0	6
6	tB=year ∧ use = ref	~~P ≤ rD~~	~~B < D~~	ΔD=D-B	1	ΔD=D-B>0	0
7	tB=year ∧ use = ex	~~P > rD~~	~~B > D~~	ΔD=ex+D-B	2	ΔD=ex+D-B<ex	24
8	tB=year ∧ use = ex	~~P > rD~~	~~B = D~~	ΔD=ex+D-B	2	ΔD=ex	32
9	tB=year ∧ use = ex	~~P > rD~~	~~B < D~~	ΔD=ex+D-B	2	ΔD=ex+D-B>ex	0
10	tB=year ∧ use = ex	~~P ≤ rD~~	~~B > D~~	ΔD=ex+D-B	2	ΔD=ex+D-B<ex	1
11	tB=year ∧ use = ex	~~P ≤ rD~~	~~B = D~~	ΔD=ex+D-B	2	ΔD=ex	1
12	tB=year ∧ use = ex	~~P ≤ rD~~	~~B < D~~	ΔD=ex+D-B	2	ΔD=ex+D-B>ex	0
13	tB=year ∧ use = 0	~~P > rD~~	~~B > D~~	ΔD=D	3	ΔD=D	46
14	tB=year ∧ use = 0	~~P > rD~~	~~B = D~~	ΔD=D	3	ΔD=D	53
15	tB=year ∧ use = 0	~~P > rD~~	~~B < D~~	ΔD=D	3	ΔD=D	2
16	tB=year ∧ use = 0	~~P ≤ rD~~	~~B > D~~	ΔD=D	3	ΔD=D	2
17	tB=year ∧ use = 0	~~P ≤ rD~~	~~B = D~~	ΔD=D	3	ΔD=D	5
18	tB=year ∧ use = 0	~~P ≤ rD~~	~~B < D~~	ΔD=D	3	ΔD=D	1
19	tB<year	P > rD	B > D	ΔD=rD-P	4.2.1	ΔD=rD-P	1,431
20	tB<year	P > rD	B = D	ΔD=0	4.2.2	ΔD=0	147
21	tB<year	P > rD	B < D	ΔD=rD-P	4.2.1	ΔD=rD-P	17
22	tB<year	P ≤ rD	~~B > D~~	ΔD=0	4.1	ΔD=0	35
23	tB<year	P ≤ rD	~~B = D~~	ΔD=0	4.1	ΔD=0	17
24	tB<year	P ≤ rD	~~B < D~~	ΔD=0	4.1	ΔD=0	2
Note: crossed out entries indicate that these steps were not undertaken.							1,984

Table A4: Baseline specification including interaction terms for Y and C~

	dependent variable: Δln(D)			
	(1)	(2)	(3)	(4)
peer group definition	no	no	def. C	def. C
high quality only	no	yes	no	yes
ln(Y)	0.082	0.097	0.075	0.09
(d=2)*ln(Y)	0.16	0.205	0.165	0.193
(d=3)*ln(Y)	0.397	0.441	0.776	0.886
(d=4)*ln(Y)	0.12	0.183	0.122	0.177
(d=5)*ln(Y)	-0.467	-0.388	-0.560*	-0.511
(d=6)*ln(Y)	-0.615***	-0.699***		
ln(C~)			0.3	0.244
(d=2)*ln(C~)			-0.302	-0.217
(d=3)*ln(C~)			-0.749	-0.769
(d=4)*ln(C~)			-0.299	-0.238
(d=5)*ln(C~)			-0.035	0.119
ln(HW)	0.031***	0.030***	0.031***	0.030***
ln(REP)	0.254***	0.277***	0.258***	0.283***
ln(D_{t-1})	-0.200***	-0.198***	-0.200***	-0.198***
(d=2)*ln(D_{t-1})	0.025	0.02	0.025	0.02
(d=3)*ln(D_{t-1})	0.116***	0.125***	0.117***	0.126***
(d=4)*ln(D_{t-1})	0.278***	0.306***	0.279***	0.307***
(d=5)*ln(D_{t-1})	0.518***	0.525***	0.516***	0.523***
(d=6)*ln(D_{t-1})	0.880***	0.865***		
ln(FW)	-0.003	-0.006	-0.003	-0.006
(d=2)*ln(FW)	-0.095***	-0.099***	-0.094***	-0.099***
(d=3)*ln(FW)	-0.184***	-0.218***	-0.184***	-0.217***
(d=4)*ln(FW)	-0.177***	-0.218***	-0.176***	-0.217***
(d=5)*ln(FW)	-0.357***	-0.471***	-0.359***	-0.473***
(d=6)*ln(FW)	-0.321***	-0.379***		
BUSd	0.457***	0.352**	0.464***	0.352**
CCd	0.241***	0.236***	0.243***	0.237***
normY	-0.001	0.009	0.012	0.027
constant	0.448	0.111	-2.495	-2.284
d=2	-1.219	-1.59	1.739	0.668
d=3	-3.781	-3.919	0.107	-0.468
d=4	-2.441	-2.89	0.508	-0.474
d=5	4.338	4.843	4.755	3.689
d=6	1.504	3.648		
N	21,335	16,871	18,185	14,506
F-stat.	88	89	78	79
F p-val.	0	0	0	0
RVI	0.45	0.38	0.54	0.45
FMI	0.83	0.81	0.83	0.80
av. DF	953	2,416	1,224	2,769

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

Table A5: Comparing various peer group definitions including interaction terms for Y and C~

	dependent variable: Δln(D)				
		(1)	(2)	(3)	(4)
	peer group definition	no	def. A	def. B	def. C
1	ln(Y)	0.082	0.076	0.078	0.075
2	(d=2)*ln(Y)	0.16	0.314	0.316	0.165
3	(d=3)*ln(Y)	0.397	0.768	0.796	0.776
4	(d=4)*ln(Y)	0.12	-0.038	0.187	0.122
5	(d=5)*ln(Y)	-0.467			-0.560*
6	(d=6)*ln(Y)	-0.615***			
7	ln(C~)		0.329	0.25	0.3
8	(d=2)*ln(C~)		-0.517	-0.451	-0.302
9	(d=3)*ln(C~)		-0.772	-0.739	-0.749
10	(d=4)*ln(C~)		-0.256	-0.288	-0.299
11	(d=5)*ln(C~)				-0.035
12	ln(HW)	0.031***	0.030***	0.031***	0.031***
13	ln(REP)	0.254***	0.271***	0.267***	0.258***
14	$\ln(D_{t-1})$	-0.200***	-0.200***	-0.200***	-0.200***
15	$(d=2)*\ln(D_{t-1})$	0.025	0.025	0.025	0.025
16	$(d=3)*\ln(D_{t-1})$	0.116***	0.118***	0.117***	0.117***
17	$(d=4)*\ln(D_{t-1})$	0.278***	0.278***	0.279***	0.279***
18	$(d=5)*\ln(D_{t-1})$	0.518***			0.516***
19	$(d=6)*\ln(D_{t-1})$	0.880***			
20	ln(FW)	-0.003	-0.003	-0.002	-0.003
21	(d=2)*ln(FW)	-0.095***	-0.094***	-0.094***	-0.094***
22	(d=3)*ln(FW)	-0.184***	-0.183***	-0.183***	-0.184***
23	(d=4)*ln(FW)	-0.177***	-0.165***	-0.175***	-0.176***
24	(d=5)*ln(FW)	-0.357***			-0.359***
25	(d=6)*ln(FW)	-0.321***			
26	BUSd	0.457***	0.554***	0.485***	0.464***
27	CCd	0.241***	0.252***	0.241***	0.243***
28	normY	-0.001	0.003	0.009	0.012
29	constant	0.448	-2.779	-2.018	-2.495
30	d=2	-1.219	2.471	1.792	1.739
31	d=3	-3.781	0.403	-0.173	0.107
32	d=4	-2.441	1.636	-0.313	0.508
33	d=5	4.338			4.755
34	d=6	1.504			
	N	21,335	14,761	16,037	18,185
	F-stat.	88	77	78	78
	F p-val.	0	0	0	0
	RVI	0.45	0.57	0.58	0.54
	FMI	0.83	0.83	0.83	0.83
	av. DF	953	210	350	1,224

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