Why Has Consumption Remained Moderate
after the Great Recession?[*]

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Abstract

Aggregate data show that after the end of the Great Recession consumption growth has been slower than what income growth and net worth appreciation would have suggested. Why? I discuss the role of various explanations that have surfaced in the literature, such as wealth effects, financial frictions, debt overhang, etc. I conclude that while financial frictions, directly or indirectly, were the trigger for the sharp decline and subsequent weakness of consumption in the aftermath of the crisis, in recent times the slow recovery is better explained by low consumer confidence and heightened uncertainty.

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1 Introduction

The performance of the US economy in the post-Great Recession period has been, in the words of Bob Hall (2016), "abysmal". After almost seven years from the official end of the downturn, real GDP is still below its normal growth path. Personal consumer expenditure, the largest component of GDP (67% when the recession started), has followed a similar weak growth path. After declining precipitously at the onset of the Great Recession, it has grown only moderately during the subsequent recovery, despite rebounds in disposable income and net worth, improved employment prospects, and a decline in overall debt levels (deleveraging). With these trends in the background, I try to address one key question: What explains the slow consumption recovery?

I discuss several explanations that have surfaced in the literature, some of which are clearly interconnected and overlap: (a) the wealth effect explanation; (b) the debt overhang explanation; (c) the credit constraints explanation; (d) the uncertainty explanation; (e) the distributive explanation; (f) the secular stagnation explanation; and (g) a variety of behavioral ("scarring", "inattention", etc.) explanations. It is probably still too early for a definite answer to the question above, although some explanations seem more relevant than others at this stage.

A plausible broad narrative is as follows. Financial frictions play a key role.[1] In the pre-recession period, the easing of financial frictions and a loosening of credit standards allowed credit constrained as well as "wealthy hand-to-mouth" consumers to borrow against increasingly valued collaterals (housing) to finance their consumption. Even unconstrained consumers benefited from the decline in liquidity constraints, as this reduced the conditional variance of consumption growth and the need for precautionary saving. Prospective homeowners experienced a loosening of downpayment constraints and could finance home purchase with greater loan-to-value ratios. The saving rate plummeted and leverage ratios increased.

The housing and stock market wealth shocks induced a sharp drop in spending during the recession.[2] On the housing side, this was due primarily to a deleveraging mechanism. People found themselves with much reduced equity but the same level of debt. The amount of debt that seemed optimal given expectations of rising house prices became suddenly unsustainable. Buffer stock theories of behavior suggest that consumers will want to return to the optimal net worth to permanent income level. This was achieved by reducing consumption and debt - the saving rate increased.

The slow recovery is a combination of various factors. The first is the legacy of the deleveraging process, which keeps consumption and the demand for loans at low levels. The second is the reluctance of financial intermediaries to ease credit as much as they had done previously. Hence, when housing wealth rebounds, wealth effects do not raise consumption as much as they did in the past. While the debt hangover can be

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[1] There are a number of theoretical papers making similar arguments, such as Guerrieri and Lorenzoni (2015), Midrigan and Philippon (2015), Huo and Rios Rull (2016).

[2] What caused the housing price collapse is still not clear. Unanticipated tightening in the ability to borrow may have preceded the housing bust; alternatively, it may have been a direct consequence of the widespread default crisis that originated from the subprime market segment.

a good explanation for the slow recovery in the period immediately following the recession, it has trouble fitting data from more recent years, since the deleveraging process has slowed down significantly. More likely, the continuing weakness in consumer demand comes from reduced income and employment prospects, as well as redistributive issues being magnified by heterogeneity in propensities to consume (as well as the feedback effects from the production side of the economy). Finally, monetary and fiscal policies have been either constrained or excessively timid in stimulating spending. On the monetary policy side, the zero lower bound makes it hard to stimulate consumption through conventional intertemporal substitution mechanisms. On the fiscal policy side, government interventions were limited and have been scaled down in recent times.[3]

2 The Macro Picture

2.1 Consumption and Disposable Income

In this section I lay down the macroeconomic facts. Most of these facts are well known, so the aim here is primarily to provide an updated picture. Unless noted otherwise, I use national income and product accounts (NIPA) data provided by the Bureau of Economic Analysis. I start by comparing trends in consumer spending with trends in personal disposable income. Figure 1 plots per capita personal consumption expenditure and personal disposable income over the last 20 years. All figures are seasonally adjusted at annual rates, expressed in real terms (using the PCE deflator of the second quarter of 2016), and normalized to equal 100 at the peak of the Great Recession (which the NBER's Business Cycle Dating Committee sets to the last quarter of 2007). The shaded areas represent recession periods.

Remarkable about Figure 1 is that while per-capita consumption declines monotonically throughout the recession, disposable income is relatively stable over the same period. Even visually, it is apparent that consumption grew faster than disposable income in the period before the Great Recession, and much slower than it in the post-2009 period.

Why was disposable income relatively stable? Figure 2 provides a decomposition of its various elements. In the left panel I plot the three non-government components: wages, proprietors' income, and financial income (which also includes rental income). During the recession financial income collapses due to the stock market bust. Proprietors' income had actually started to decline much earlier (due perhaps to events in the housing market). Wages decline, in real term, by almost 10%. In the post-recession period wages and financial income grow at low rates - and by the end of our sample period they are only slightly above pre-recession levels (+3.7% and +1.6%). In contrast, proprietors' income increases substantially: by the end of the period it is 20% above pre-recession levels, and at its highest value since 1996.

In the right panel of Figure 2 I plot wages together with transfers, taxes, and social insurance expen-

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[3]Nevertheless, some papers (Kydland and Zarazaga, 2016) suggest that even the limited fiscal interventions implemented may have increased consumers' uncertainty about projections of future tax rises to finance the government's deficit (and hence perversely contributed to the slow recovery).

diture supporting working-age individuals (the sum of Unemployment Insurance, Medicaid, and Disability Insurance). What keeps disposable income from falling as much as wages (the dominant part of disposable income, at 75%) is the generous increase in government transfers, in particular UI. The bulge visible in the 2009-11 period is the 99-weeks extension of UI. When that comes to an end, social insurance spending keeps growing due to long-run growth trends in the DI and Medicaid programs (with the latter being further expanded through ACA). Note also the pro-cyclical fluctuations in personal tax payments. By the end of our sample period personal taxes have grown faster than wages. All in all, the transfers component has almost doubled over the last two decades, while taxes have increased much less.

There is a sizable literature on the effect of the UI extension on unemployment durations (Hagedorn, Manovskii and Mitman, 2016; Rothstein, 2011; Mulligan, 2008); similarly, there is much debate on the effects of the stimulus packages implemented by the Bush and Obama administrations (see the essays by Taylor, Parker, and Ramey in the 2011(3) issue of the *Journal of Economic Literature*). Most of the debate centers on the size of the fiscal multiplier, over which there is considerable uncertainty. Given the goal of the paper, I will not discuss this literature here. One argument for focusing on the trends in government spending to explain the weak consumption behavior is that the unprecedented expansion in government transfers may have generated expectations of future higher taxes. Kydland and Zarazaga (2016) argue that this "fiscal sentiment" may potentially explain the weak consumption recovery. Of course the opposite argument is that demand was sustained by generous government transfers, and that once transfers declined, demand suffered. The issue is vastly unsettled.

What explains the drop in consumption during the Great Recession? An almost universally accepted view (articulated in several papers by Mian, Sufi and other authors) is that of "balance sheet" effects. In the period before the burst of the housing bubble, a decline in lending standards and an accommodating monetary policy led households to accumulate large amounts of debt (partly extracting equity from their houses, and partly to purchase the houses themselves). When the housing bubble burst, people were hit by several types of shocks at once: a direct wealth effect (induced by the decline in the value of their houses), an increase in borrowing constraints (due to financial intermediaries less willing to lend against reduced, and more uncertain, collateral values), and a "leverage" effect (the decline in housing and stock market wealth increased the debt/asset ratio beyond acceptable levels, requiring sharp adjustments). In a much cited contribution, Mian, Rao and Sufi (2013) examine the importance of the interaction of large housing wealth shocks with high levels of debt at the start of the recession, and find that consumption declined more strongly in US counties with high leverage and large house price declines. They argue that this "household balance sheet" channel can explain potentially a large fraction of the consumption decline. For example, they calculate that "shutting down" the household balance sheet channel would have resulted in auto sales declines of only 13%, compared to the actual 36% decline visible in the data.

While we have, by now, a good understanding of the mechanism(s) behind the 5% decline by the time the recession runs its course, it is much less obvious why consumption fails to recover after the recession ends.

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Research by Reinhart and Rogoff (2009) has argued that recoveries after severe financial crises (especially those associated with housing bubble bursts) take much longer than typical recessions, because all agents (consumers, firms, financial intermediaries, government) try to repair their damaged balance sheets and their activities amplify the effect of initial shocks.[4] In this sense, the theoretical predictions have proved quite accurate. I will come back to the important point of what may be behind the slow consumption recovery later.

2.2   Consumption Components

In Figure 3 I decompose trends in consumption into its three main components: Durables, Nondurables, and Services. I deflate each component by their corresponding PCE deflator (I do the same for the sub-components; all price deflators come from BEA Table 2.3.4). Prices have evolved differently for the three groups, so it is important to use the appropriate deflator for relative comparisons (in particular, the price index for durables has been trending down, while the price indexes for services and nondurables have been trending up).

Several things are worth noting. First, during the late 1990s and early 2000s the growth in durables spending was sustained. This is what Hall (2011) calls the durables "buying frenzy" of the housing boom period. Durables are also more likely to be purchased with debt, and the easing of credit standards may have stimulated their purchase.[5] Nondurables and services grow less than durables, and at similar rates. However, since services are the dominant component of total spending (68% in 2016), these growth rates still preserve their prominence in the aggregate. Second, during the recession, it is primarily durables and (partly) nondurables that drive consumption down. Finally, at least initially the consumer spending recovery is led by spending on durables. Nondurables and services stop growing altogether, and it is only in the last two years that signs of recovery appear.

Table 1 summarizes these trends more compactly, by reporting average annualized growth rates of real consumption (and its components) before and after the Great Recession. Clearly, most of the post-recession weakness in aggregate consumption is explained by low growth rates of services and nondurables.

A detailed look at the composite categories of durables, nondurables and services spending reveals additional aspects of the Great Recession and the subsequent recovery (or lack thereof). In all cases I deflate spending by the corresponding price indexes. Breaking down durable spending into its main components, Motor vehicles and parts ("Vehicles"), Furniture and equipment ("Furniture"), and Recreational goods and vehicles ("Entertainment"), I find (Figure 4) that most of the "durables frenzy" was concentrated among the latter two categories. In contrast, the bulk of the decline in per-capita spending is attributable to purchases of vehicles (a 25 percent decline by the end of 2009) and partly of furniture (a 9 percent decline), while

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[4] As an example, Giraud and Muller (2015) show that consumer demand shocks had larger effects (in terms of employment decisions) on firms that were more leveraged at the start of the recession.

[5] A more benign view of the durable "buying frenzy" is one of intertemporal substitution: Consumers bought their durables when the implied cost of borrowing was lower, and are now consuming the flow services.

spending on recreational goods (such as LCD TV sets, iPhones, game consoles, and so on) is stable. Entertainment goods display a very fast recovery after the Great Recession (a 75% increase in real terms), while purchase of vehicles remain below the levels achieved at the peak point of the recession until very recently. Part of the decline in durables may be explained by increased uncertainty leading to the postponement of the purchase of goods with large adjustment costs and for which the cost of "consumer remorse" is higher. In the case of cars, the high volatility in the price of its main complementary good, gasoline, may underlie the decline in spending (see below). Moreover, the financial crisis may have restricted available credit lines for the purchase of durable and semi-durable products like cars and appliances.[6] Finally, there is evidence suggesting that consumer incentive programs were responsible for the temporary increase in durable spending on vehicles in the second half of 2009 (although it was a small, short blip - see Mian and Sufi, 2012).

We next break down nondurable spending into its main categories, Food at home, Apparel, and Gasoline (left panel of Figure 5). After growing substantially in the pre-recession period, spending on apparel declines sharply during the recession and recovers only slowly afterwards - mimicking closely the trends seen for aggregate spending. Gasoline consumption, on the other hand, follows closely the sharp oscillations of oil prices. In particular, the price of gasoline increased dramatically during the 1998-2008 decade (more than tripling); collapsed in 2009; increased again and remained high until 2013, before declining again after 2014. These price oscillations may have increased uncertainty regarding optimality of car purchases. Hamilton (2009) argues that rising oil prices contributed to the recession by way of lowering demand for the popular but extremely fuel-inefficient light trucks (SUVs).

Another noteworthy trend is the unusual decline in food spending – a fundamental subsistence consumer category and a solid indicator of living standards. One element to consider, though, is smoothing through in-kind support provided by the SNAP program (food stamps) in the right panel of Figure 5. Indeed, when we consider a measure of food consumption (the sum of private food spending and SNAP spending) there is greater evidence of smoothing.[7] Moreover, earlier research by Aguiar and Hurst (2005) shows that a decline in food spending is not necessarily associated with a decline in nutritional content if consumers switch to home production or devote more time shopping for better deals. Even though their research focused primarily on individuals who face a sudden decrease in earnings and greater leisure time as they enter retirement, the logic of the argument could be extended to individuals who expect involuntary job loss or reduced work hours during the recession.

Data from the American Time Use Survey (ATUS) for the 2003-11 period allow me to test whether in fact the decline in food spending corresponds to a parallel increase in time spent on food preparation at home, shopping, and researching purchases. I find only some weak evidence in support of the hypothesis. I

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[6]Benmelech, Meisenzhal and Ramcharan (2016) show that the decline in car purchases was partly explained by a credit supply shock affecting traditional providers of liquidity in the auto loan market.

[7]Participation in the SNAP program has increased substantially, from 11.8 million households in 2007 to 22.5 million households in 2015. This increase comes partly from increasing take-up rates among eligible households and partly from increased eligibility due to decline in wages and employment at the bottom of the distribution.

use a sample of working age respondents (aged 18 to 65) and regress time spent on preparing food at home against a dummy for the post-recession period (2008-11) and various demographics (age, gender, education, race, employment status, interview weekday). There is a significant increase in time spent preparing food (0.08 more hours per week, s.e. 0.04). However, the data show a statistically significant *fall* in the amount of time spent shopping (0.34 fewer hours per week), and no evidence of an increase in the amount of time spent on researching purchases. See Table 2.

Nevo and Wong (2015) use micro data from the US AC-Nielsen Homescan database to find important changes in household shopping behavior during the Great Recession. In particular, they document that consumers appear to use more frequently shopping activities that results in lower price paid per unit of good (such as buying on sale or using coupons, buying in bulk, buying generic rather than brand products, and buying in megastores). Since these activities require time, they argue that this implies a large elasticity of substitution between expenditure and time spent on non-market work. Griffith, O'Connell and Smith (2015) document very similar behavior for the UK. Argente and Lee (2015) have recently studied distributional effects on prices using the same data sources for the US. They find that during the Great Recession prices in the top quartile of the income distribution have grown at a lower rate than prices in the bottom quartile (a non-negligible 0.7 percentage point difference). The difference between rich and poor households can be explained by the fact that the adjustment mechanisms described above (such as substitution from high to low quality goods) is mostly available to richer households (as poor households are already consuming lower quality goods).

The last component of consumption that I study is services (in Figure 6). The behavior of its sub-aggregates (Transportation, Recreation, Housing and utilities, Finance and insurance, Food services, and Health care) is heterogeneous. All service components (with the notable exception of health care) fail to recover their pre-recession levels (or do so barely, as in the case of housing services, recreation, and food away from home). Transportation services appear to be mired in what appears a sustained decline. Financial services (which include mutual fund management fees, but also bank and credit card fees, including late fees, over-limit fees, cash advance fees, etc.) declined as a reflection of the deleveraging process which I discuss later.

Relative prices rarely play a central role in discussions about the Great Recession. But Figure 7, where I plot inflation rates for the three consumption sub-aggregates, shows dramatic changes in relative prices of durables relative to services and nondurables (inflation rates are shown as 5-quarter moving averages). Inflation rates for durables have been persistently negative between 1998 and 2016, while the prices of services have increased steadily (at an almost constant 2% annual rate). Nondurables prices have been more volatile, albeit still around a 2% value. However, recently we have observed some deflation among nondurables prices too (perhaps due to the sharp decline in the price of gasoline). Even though goods (durables and nondurables) represents less than 1/3 of total spending, if these deflationary trends were to continue it would be problematic to maintain the 2% target annual inflation rate set by the FED (although the FED considers

a target net of food and energy prices). A deflationary process for goods implies well known negative effects on consumption. A decline in expected inflation increases the real interest rate, inducing more saving and depressing demand (in a situation in which the nominal interest rate is constrained from the zero lower bound). Lower-than-expected inflation also increases the real burden of debt, frustrating any attempt at deleveraging nominal quantities.

2.3   Saving, leveraging and deleveraging

How to measure saving, and what are its main trends? Consider the budget constraint of a representative consumer and rearrange terms to obtain two different definitions of saving:

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\begin{aligned}
W_{t+1} &= (1+r)W_t + Y_{t+1} - C_{t+1} - \tau(rW_t + Y_{t+1}) \\
W_{t+1} - W_t &= rW_t + Y_{t+1} - \tau(rW_t + Y_{t+1}) - C_{t+1} \\
\underbrace{W_{t+1} - W_t}_{FF} &= \underbrace{Y_{t+1}^d - C_{t+1}}_{NIPA}
\end{aligned}
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The NIPA definition corresponds to the right-hand side term (disposable income minus consumption).[8] The evolution of the saving rate almost mechanically follows the trends in consumption (C) and disposable income (Y^d) described above. Hence, the saving rate decreases before the Great Recession when consumption is growing faster than disposable income, and it increases after the recession because of the weakness in consumer spending relative to the more stable path of disposable income, before hovering around a 5% level in the last 3 years or so.

The Flow of Funds (FF) saving definition is the change in household net worth, on the left-hand side: the sum of household net financial investments (net acquisition of financial assets less net increase in liabilities) and net investment in tangible assets (gross investment less depreciation).

There is a large literature on the advantages and disadvantages of the two measures (see Gale and Sabelhaus, 1999), as well as a literature that considers alternative definitions (in which more care is devoted to inflation adjustment, durable purchases, etc.). I will not take any specific position here, and only discuss the broad trends. Figure 8 plots the two alternative measures of the household saving rate.[9] The broad trends are similar. The FF measure is uniformly higher and more volatile. The saving rate is on a declining path until 2006. The decline is reverted around the time the housing bubble bursts. The increase has slowed down in the last 2-3 years.

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[8]In fact, in the NIPA tables the saving rate is defined as $s = \frac{Y^d - C - I}{Y^d}$, where I includes personal interest (non-mortgage) payments and personal current transfer payments (donations etc. paid to government or abroad)). Capital gains are excluded, and so are net capital transfers (such as estate and gift taxes). However, the I component is very small.

[9]Bothe measures are smoothed versions obtained by local linear regressions. The original series, especially the FF one, are quite volatile on a quarterly basis.

Flow of funds data allow us to study how the increase in the saving rate of the last decade has come about. Since in this case $s_t = \frac{\Delta A_t + \Delta H_t - \Delta D_t}{Y_t^d}$, I can decompose the saving rate into its three components, the net change in financial assets, the net change in non-financial assets, and the net change in liabilities (all scaled by disposable income). Figure 9 illustrates. The initial increase in the saving rate (until the middle of 2010) is entirely explained by a massive reduction in the debt/income ratio. In fact, both financial and (especially) non-financial assets decline in value (relative to disposable income). Absent any change in debt, this would have resulted in a *decline* in the saving rate. Between 2010 and 2012 the saving rate keeps increasing because assets increase in value (especially financial assets) despite the (slow) net increase in debt. After 2012 the saving rate is stable because the two broad components (assets and liabilities) grow at similar rates. The decline in the stock of outstanding debt ΔD_t is defined as new originations minus principal repayment minus chargeoffs. An important issue is how much of the debt reduction comes from active reduction of debt (debt repayment and reduced borrowing) vs. defaulting on existing debt. Vidangos (2015) presents a decomposition from flow of funds data and shows that, as far as mortgage debt is concerned, charge-offs have played as important a role as the slow down in new originations.[10]

Household debt has played an important role in shaping most of the trends discussed thus far. Indeed, the most popular narrative of the Great Recession is that households responded to the wealth shocks caused by the bursting of the housing bubble by cutting their spending sharply and persistently in the attempt to repair their damaged balance sheets. Moreover, in traditional "saving for a rainy day" models (Campbell, 1987), borrowing is a function of expected increases in resources, and such expectations may have been revised downward due to weak employment and income prospects. Finally, households save more for precautionary reasons if they perceive more uncertainty about the future. In general equilibrium, this overall decline in demand lowers interest rates enough that the savers stop saving and start consuming. But in a zero lower bound world as the one the US economy was operating by the end of the 2000s, nominal interest rates could not go below zero, so savers failed to pick up the tab and hence aggregate consumption failed to be stimulated by conventional intertemporal substitution mechanisms. Besides demand issues, the credit crunch may also have forced deleveraging onto some households (I provide some evidence on how much persistence in credit constraints may have slowed down the consumption recovery).

A substantial body of work has documented the leverage/deleverage cycle in the US. In Figure 10 I plot one popular measure of leverage (total household debt over personal disposable income) against time. Unlike the figures above, I show this over a much longer time perspective (since 1948). There are five periods one can identify in the data. First, a growth period in the post-war era, ending approximately in the mid-1960s. This is followed by a period over which the leverage ratio is volatile but essentially stable, at around 60% of personal disposable income. In the mid-1980s, various tax reforms and the process of credit market liberalization induce a sustained increase in the leverage ratio (with some retrenchment around the 1991

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[10] The default/foreclosure crisis had a variety of effects on aggregate consumption. For the households who defaulted on their mortgages there is a positive liquidity effects that may have increased consumption; on othe other hand, foreclosures have negative exernalities, which may have exacerbated the consumption decline induced by housing wealth effects.

recession). The sub-prime boom of the 2000s induces an extremely rapid acceleration in the leverage ratio, such that by the mid-2000s the average American has more debt than disposable income. Finally, this rapid acceleration is followed by a precipitous deleveraging process which seems to have slowed down recently.

In Figure 11 I separate household debt into two components, mortgage debt and consumer debt (whose primary components are credit card debt, auto loans, and student loans), and plot measures of mortgage leverage and consumer debt leverage. The figure reveals two interesting facts. First, the rapid leverage acceleration during the housing boom of the 2000s was mainly driven by mortgage debt (perhaps not surprisingly). The non-mortgage leverage ratio was stable. The deleveraging that followed the turmoil in financial and housing markets was initially involving both consumer and mortgage debt; but while consumer loans have been increasing at a sustained pace in the post-recession period, deleveraging seems far from over when it comes to mortgages (or at least, it has not decelerated in any appreciable way).

Some of the housing deleveraging is undoubtedly coming from the "great escape" from homeownership depicted, in various guises, in Figure 12. Having reached an all-time high of 69% in 2004, the homeownership rate has declined monotonically and it is now (2016) around 63%. One needs to go back to the 1960s to find such low levels of homeownership among US households. Some of the decline is partly explained by homeowners defaulting on their existing mortgages after the housing price collapse and having their property foreclosed (in 2010, almost 1% of households did so). Partly, it comes from renters postponing purchase (or some homeowners moving into rentals). However, it does not appear to come from homes becoming less "affordable" by traditional standards, as the housing affordability index (HAI) shows.[11] The graph also shows that while about 10% of US households were applying for a mortgage loan in 2006, this number had declined to 2% by 2009, and has barely bulged over the last 5 years. Not only Americans buy fewer houses (and hence, presumably, reduce spending on all goods that are complement with housing). As reported by Melzer (2016), those who remain homeowners also reduce housing maintenance and appliance spending because the increased risk of default makes such investments less likely to be profitable in expectation. Baily and Bosworth (2013) identify the decline in residential and nonresidental investments as playing a major role in the weakness of GDP in the post-recession period. Leamer (2007) has a similar, if not stronger position: The fact that the residential sector still seems far from recovering spells doubts on the ability for GDP as a whole to go back to potential any time soon.

3   Counterfactuals

Is consumption in the post-recession period slower than what trends in disposable income and net worth would have predicted? In Figure 1 I have shown trends for disposable income; in Figure 13 I plot per capita household net worth over the last 20 years (the thick line). While the pace of recovery has been rather

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[11]The HAI measures the percentage of households that can afford to purchase the median priced home in the US based on traditional assumptions (such as a 20% downpayment, a monthly mortgage payment, inclusive of taxes and insurance, of 30% of household income, etc.). The source is the California Association of Realtors.

slow for disposable income, net worth has recovered substantially, partly due to the deleveraging process and partly through the resilient performance of the stock market. The average American is now wealthier than she was when net worth started to decline, around 2006, due to the fall in house prices. However, two things are worth stressing. First, most of these gains come from financial assets, not home equity (which is still on average $10,000 below pre-recession levels, in real terms - see the dashed line in Figure 13). Second, financial assets are less equally distributed than housing wealth, implying that most of the net worth gains have accrued to people at the top of the wealth distribution (who have presumably lower MPCs than those at the bottom, with implications for aggregate consumption that I discuss later).

It is useful to construct some simple metrics for the concept of "distance" from the average post-recession experience.[12] One immediate metric is a straightforward comparison with previous US recessions. Figure 14 shows that the run-up to the Great Recession was on the upper end of the range, but not fundamentally atypical. However, the follow-up period grossly deviated from the typical post-recession experiences of the past. Moreover, the deviation lasts to this very day (although the distance from the lower bounds seems to be closing in). Figure 15 shows that while the weakness is generalized to all consumption components, it is particularly strong among services (interestingly, there was pre-recession excess services spending which may justify its post-recession retrenchment).

A second, more direct counterfactual metric can be obtained using simple regression analysis.[13] To justify the empirical specification, consider a simple version of the Permanent Income Hypothesis, in which:

$$C_t = \theta \left(W_t + H_t \right)$$

where H and W are human wealth and net worth, respectively. Human wealth is the present discounted value of future disposable incomes, or $H_t = \sum_{\tau=0}^{\infty} (1+r)^{-\tau} E_t Y_{t+\tau}^d$. Assume that disposable income follows a simple random walk process and the horizon is infinite, so that $H_t = \frac{1+r}{r} Y_t^d$. Take first differences, divide both sides by consumption and assume θ is small.[14] It follows that a simple relationship for predicting consumption growth is:

$$\Delta \log C_t \cong \alpha + \beta \Delta \log Y_t^d + \gamma \frac{\Delta W_t}{Y_t^d} + \varepsilon_t \tag{1}$$

where W_t is measured at the beginning of the period and the error term ε_t captures other elements that may influence consumption but are neglected here (such as preference shifts, etc.). I use data before 2007:4 and run this specifications on per-capita, real variables. I then use the regression coefficients to predict consumption in the post-recession period and compare it with actual consumption.

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[12] The CBO (2012) calculates the contribution of the various components of GDP for explaining the GDP gap 12 quarters after the recession. It calcuates that of the 2.75 percentage points "missing", consumer spending can explain 0.75 percentage points (in contrast, the government side explains 2.5 percentage points; investment and export contribute a negative 0.75 points).

[13] The caveat is that this is a simple predictive exercise rather than a full-fledged empirical analysis of the "consumption function".

[14] In the infinite horizon version of the model wth quadratic preferences, $\theta = \frac{r}{1+r}$, so it is indeed very small.

I also run two additional specifications. One includes the lagged leverage ratio (total debt over disposable income) among the regressors:

$$\Delta \log C_t = \alpha + \beta \Delta \log Y_t^d + \gamma \frac{\Delta W_t}{Y_t^d} + \delta L_{t-1} + \varepsilon_t$$

This specification is advocated by Mian, Rao and Sufi (2013) and Dynan (2012) among others. It assumes that "debt hangover" reduces future consumption growth due to balance sheet effects.

The final specification adds a lagged measure of consumer confidence, obtained from the Michigan Survey of Consumers:

$$\Delta \log C_t = \alpha + \beta \Delta \log Y_t^d + \gamma \frac{\Delta W_t}{Y_t^d} + \delta L_{t-1} + \theta I_{t-1} + \varepsilon_t$$

The consumer confidence index is a "catch-all" for revised expectations about future income prospects, precautionary savings, etc. Its forecasting role for consumption behavior has been discussed by Carroll, Fuhrer and Wilcox (1994) and Ludvigson (2004).

The results of these simple regressions are reported in Table 3, while the counterfactual consumption measures are graphed in Figure 16 (the dashed lines) against actual per capita consumer expenditure (the solid line).

The four panels show the contribution of the various predictors. The figure shows that, judging from the first specification, the post-Great Recession weakness in consumption is indeed puzzling (given the consumption responses to income and net worth growth observed in the past). If consumers had responded to changes in disposable income and net worth as they had done in the past, the average American would spend today about \$3,700 more than she actually did (i.e., about 10% more) - there is a large gap between actual and "potential" consumption.[15] Adding a measure of leverage makes the gap between predicted and actual consumption slightly smaller, but not much so (and the leverage variable itself is statistically insignificant). Adding a measure of consumer confidence gives similar results - some of the gap is filled, but not all.[16] Finally, a specification that adds both a measure of leverage and a measure of consumer confidence explains approximately all of the gap.

How to interpret this evidence? A simple prediction model (one that controls only for changes in wealth and disposable income) reveals a large (and growing) gap between "predicted" and actual consumption in the post-Great Recession period. In that sense, the weakness of consumption is puzzling. However, an equally parsimonious model (which adds just lagged leverage and a lagged measure of consumer confidence) explains

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[15] Interestingly, the performance of the simple prediction model of column (1) tends to be much worse for recessions (like the 2007-09 and 1991-2 ones) where household leverage was high and rising, as shown in Figure 33 in the Appendix. When leverage is low or there is no build-up in the debt before the downturn, the simple prediction model of column (1) performs rather well. Ng and Wright (2013) discuss why recessions with financial market origins differ fundamentally from those due to more traditional economic shocks.

[16] In the Appendix, Figure 32 plots consumption growth against the lagged consumer confidence index. Clearly, there is a strong association between the two in the pre-recession period. In the post-recession period, consumer confidence drops and remains very low for a long time, hence helping explain the slow recovery in consumption.

almost the entire gap.[17] In the past, periods of high leverage and/or low consumer confidence produced lower consumption growth. Coupled with less than brilliant changes in wealth and disposable income (or less equally distributed ones), they produce the slow consumption recovery we see in the data.

This is suggesting that leverage and consumer confidence are both important elements of the story behind the weakness of consumption of the post-recession era. The role of leverage has been emphasized by a vast literature. The role of consumer confidence captures a combination of many elements: lower expectations of future income (the decline in the wage share, distributional issues, the slowdown in productivity growth, etc.), greater uncertainty, and other behavioral components that are harder to pinpoint precisely. I am going to use data at various levels of aggregation to parse through these various stories.

4   Narratives about the slow consumption recovery

In this section I evaluate the various explanations that have been proposed for the slow consumption recovery. They underlie partial equilibrium mechanisms that contribute to depress consumer demand. In general equilibrium, interest rates and prices would move to attenuate the fall in demand and bring the economy back to its full-employment equilibrium. In the period we are studying, however, constrained monetary policy made these conventional general equilibrium effects much more muted. Fiscal policy was less effective than it could have been because it was expansionary at a time when consumers were deleveraging (and hence using tax stimulus money to pay back debt rather than consume, see Sahm, Shapiro and Slemrod, 2010), and scaled down at a time where it may have been more effective (after the household deleveraging process was completed).

4.1   The wealth effect explanation

In the last two decades house prices in the US have gone through a spectacular boom-bust-recovery cycle, shown in Figure 17 for the US as a whole and for three representative states (California, Michigan, Texas), which epitomize the degree of heterogeneity experienced by households living in different parts of the country.

Changes in housing (and non-housing) wealth can potentially have non-negligible effects on consumption and there is now a vast literature documenting the presence of a "wealth effect" on consumption. In principle, with perfect credit markets and rational consumers who do not plan to size down their housing stock, the housing wealth effect should be close to zero. This is because housing provides consumption services, and so any increase in the value of one's house also increases the price of its services (Campbell and Cocco, 2007). However, consumers may change their consumption in response to changes in housing wealth if the latter relaxes borrowing constraints (which may be especially relevant for younger households with

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[17]Carroll, Slacalek and Sommer (2011) also found that a parsimonious regression model which controls only for unemployment risk, credit availability, and wealth shocks explains surprisingly well the behavior of the saving rate over the 1960-2011 period.

permanent income above current income), if they plan to downsize at some point in the future, or for other myopic/behavioral reasons. Kaplan and Violante (2014) point out the existence of wealthy "hand-to-mouth" consumers, whose wealth is mostly concentrated in illiquid assets with high transaction costs (such as housing and retirement wealth). These are the individuals who may mostly benefit from the ability to borrow against increasingly valued collaterals. Berger, Guerrieri, Lorenzoni and Vavra (2015) use a life-cycle model to derive a theoretical benchmark for the housing wealth effect. Mian and Sufi (2014) document that in the run-up to the crisis (2002-06), the housing wealth effect was an important contributor for explaining changes in consumption. See also Greenspan and Kennedy (2008) and Cooper (2009).

Estimates of the housing wealth effect are typically small. For example, a survey by the Congressional Budget Office (2007) states that "a $1,000 increase in the price of a home this year will generate $20 to $70 of extra spending this year and in each subsequent year", while Poterba (2000) writes that "the long-run impact of a $1 increase in [housing] wealth raises consumer spending by 6.1 cents". Mian and Sufi (2014) fin that the "marginal propensity to spend on new autos is $0.02 per dollar of home value increase", with considerable heterogeneity between low- and high-income zip codes. Perhaps more interestingly, they show that "the housing wealth effect is primarily driven by those who are constrained by low levels of cash on hand". While the effect is small, the large increase in housing wealth played a non-negligible role in explaining aggregate consumption changes.

4.1.1 Evidence from the PSID and state-level data

I have replicated the typical wealth effect regressions ran in the literature using more recent PSID data. In particular, I use data for the 1998-2012 period and regress the change in consumption (in real terms) against the change in housing wealth (which is self-reported), a quadratic in age, the change in family size and married status, the change in the state-level unemployment rate, years of schooling, and year dummies. The measure of consumption I use is the most comprehensive one can construct from the PSID.[18] I also experiment with a measure that excludes housing consumption (rent, property tax, home insurance, and home repairs) and a simple measure that excludes durables. To reduce the impact of measurement error, I drop the top and bottom 1% of the before-tax income distribution in each year and those who report exactly zero consumption. Finally, I cluster the standard errors by state of residence.

The results of the regressions are reported in Table 4. The first column is a simple OLS regression. The wealth effect is estimated at 1.4 cents higher consumption in response to a $1 increase in housing wealth. This is at the low end of typical housing wealth effect estimates. However, one worry is endogeneity. In general, changes in wealth arise from two different types of variation: (a) changes in the price of assets, for given portfolio composition, and (b) changes in portfolio composition, for given asset prices. The former are

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[18]It is the sum of nondurables (food at home, gasoline and clothing, the latter available since 2004), services (the sum of food away from home, rent, home insurance, property tax, utilities, education, child care, auto insurance, car maintenance, transportation, health and, after 2004, entertainment and home repairs), and durables (the sum of vehicle purchase and, after 2004, furniture).

exogenous (outside the household's control), but the latter are endogenous (for example, because consumers who expect higher returns in the future increase their asset holdings - a pure intertemporal substitution effect). In the case of housing, people who received positive permanent wage shocks (which are part of the error term) may renovate the house, which increases its value. House prices may also covary with local shocks. To partially address this problem, albeit not perfectly, I instrument the change in the self-reported value of housing with the Wharton Residential Land Use Regulation Index created by Gyourko, Saiz and Summers (2008). This is related to the elasticity of housing supply. States with high regulation have housing prices that respond less to the same sized shock. The instrument is powerful (a first-stage F-stat of 44).[19] Note that since the model is estimated in first differences, any fixed unobserved heterogeneity is implicitly accounted for.

Column (2) shows that the wealth effect estimated by IV is now much closer to the typical 5 cents per dollar estimate in the literature (in my case, it is 5.4 cents per dollar). The estimate is statistically significant. Column (3)-(6) assess robustness. In 2004 the definition of consumption becomes slightly broader, so the changes in consumption before and after 2004 are not strictly comparable. In column (3) I consider a narrower, but more consistent definition of consumption that excludes the components added in 2004. The results are virtually identical (4.6 cents per dollar). In column (4) I consider a definition of consumption that excludes housing, while in column (5) I focus just on nondurables and services. In both cases, I obtain similar estimates (3.7 and 5.9 cents. respectively). Finally, in column (6) I focus on a sample of those who are homeowners across the two periods in which changes in consumption and wealth are related. The estimate is again in the same ballpark (0.053).

May the wealth effect be a good explanation also for the slow post-recession recovery? As said earlier, since housing provides services, the presence of a housing wealth effect is predicted on some form of heterogeneity across consumers in the form of life horizon (some households may plan to downsize their housing needs in the future) or imperfect access to credit markets. The change in housing wealth in the post-recession period may have been producing wealth effects close to zero (as theory suggests) because people were not able (or perhaps not willing) to extract as much cash from their houses as they did in the run-up to the Great Recession.

One strategy is to test directly for a decline in the housing wealth effect. Unfortunately the last available wave of the PSID is for 2012, when the recovery in house prices was still in its initial stage. Instead, I use state-level consumption data (provided by the Bureau of Economic Analysis) and estimate the wealth effect separately for four sub-periods (1998-2003, 2004-2006, 2007-2009, 2010-2015). I construct state-level housing wealth following Case, Quigley and Shiller (2013) and others, i.e., I multiply state level homeownership rate (from the Census) by the number of households in the state (CPS data, extrapolated to the years where the information is missing), the state-level house price index for new purchases in base 1990 (from the Federal

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[19]The instrument is originally defined at the county level, but I do not have geocoded information from the PSID, so I calculate a weighted state-level measure. It is worth stressing that the validity of this instrument (and that proposed by Saiz, 2011, based on geographical contraints) is not uncontroversial. See Davidoff (2013) for a critique.

Housing Finance Agency) and the average house price in 1990 dollars (again from the Census). I also control for state-level changes in disposable income (again from BEA) and a measure of leverage (mortgage debt over disposable income, only observed since 2003). All variables are in per capita terms. The estimated coefficients on the wealth change variable are plotted in Figure 19, together with the robust confidence interval. There is very distinctive evidence of a decline in the housing wealth effect.[20] One implication is that the rebound in house prices of the 2010-2015 period did not translate into significant consumption growth - had the wealth effect being as strong as in the pre-recession period, consumption would have looked more sustained.[21]

An alternative strategy is to look at the evolution of cash-out refinancing mortgages, which are the primary vehicles through which consumers convert housing equity into spending. The caveat of course is that it is hard to distinguish between demand and supply factors (I try to provide some evidence on the demand/supply issue below). I do so in Figure 18, where I plot the share of newly refinanced mortgage debt balances that are due to equity-extraction through a cash-out refinance. For a long time the effect was stable around 10%; it then skyrocketed to more than 30% during the 2003-06 period, before crashing to less than 5% after the recession. In recent years it has gone back to the seemingly stationary 10% value.[22]

The decline in the estimated wealth effect and in the volume of cash-out refis mask three separate effects. On the demand side, some homeowners are still trying to put their financial accounts in order. On the supply side, homeowners may not be able to access home equity as easily as in the past, while renters planning to move into homeownership have to save even more for a downpayment if house prices increase and lenders keep lending standards tight. I discuss these issues in the next two sub-sections.

4.2   The credit constraints explanation

One way to shed some light on whether the trends shown in Figure 18 reflect lack of willingness on the part of banks to extend credit as generously as they did in the past is to use data that measure the extent of liquidity constraints faced by consumers. Strong financial frictions emerging after the financial crisis may be an important piece of the slow consumption recovery puzzle. For some consumers (i.e., those with permanent income exceeding current income), demand may be depressed by the inability to borrow; for others, higher savings reflect a downpayment constraint, as in Jappelli and Pagano (1994) - the days of NINJA mortgages are indeed long gone; for "wealthy hand-to-mouth" consumers (Kaplan and Violante, 2014) the reduced ability to access home equity may prevent them to smooth shocks as efficiently as predicted by theory. Tighter

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[20] I cannot reject the hypothesis that the housing wealth effect is the same for the whole period 1998-2009. However, I can reject the hypothesis that the effect is the same in the post-recession period.

[21] Another interpretation is that wealth changes in the pre-recession period were perceived as permanent, while those after the recession were perceived mostly as transitory. Christelis, Georgarakos and Jappelli (2015) compute MPCs from wealth shock, but distinguish between transitory and permanent shocks, finding that the response is much larger for permanent shocks (in contrast, most of the literature assumes that wealth changes revert to the mean).

[22] These numbers come from properties on which Freddie Mac has funded two successive conventional, first-mortgage loans, and the latest loan is for refinance rather than for purchase.

credit supply may also prevent purchases of durable goods that are typically financed through borrowing (such as cars, indeed the weakest durable component of all). Even unconstrained consumers may save more and depress consumption if they anticipate that it will be hard in the future to borrow in order to smooth transitory shocks. A higher likelihood of being constrained increases the conditional variance of consumption growth and prompts a precautionary saving response.

I use four different data sources to examine the importance of financial frictions, with a special eye towards the post-recession period. The first source is the Senior Loan Officer Opinion Survey on Bank Lending Practices, a survey on bank credit standards conducted by the Federal Reserve every three months. All major domestic banks participate. I use responses to two type of questions. The first captures a general attitude towards extending credit to consumers: "Please indicate your bank's willingness to make consumer installment loans now as opposed to three months ago".[23] The second type of questions attempts to capture supply tendencies for different loan segments.[24] I follow Muellbauer (2007) to construct indexes of credit availability net of a linear trend.[25]

Figure 20 shows results for four indexes of credit availability: general willingness to lend, and weak/loose standards for mortgage, credit card, and home equity loans. The series are not equally spaced: some started after the recession and others were discontinued. Nevertheless, the trends are similar. Credit availability increased during the 2000s, started to slow down around 2006, collapsed during the recession, and had recovered to the pre-recession levels by the end of the sample period. The notable exception is home equity loans, which are still substantially constrained: It is much harder to extract equity from housing now than it was in 2007.[26]

The same survey also provides a way of measuring movements in the demand for credit. Senior loan officers

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[23] Possible answers are: (a) Much more willing, (b) Somewhat more willing, (c) About unchanged, (d) Somewhat less willing, (e) Much less willing.

[24] The question is: "Over the past three months, how have your bank's credit standards for approving applications for [loan type j] changed?" Possible answers are: (a) Tightened considerably, (b) Tightened somewhat, (c) Remained basically unchanged, (d) Eased somewhat, (e) Eased considerably). I use information on credit card loans, mortgage loans, and home equity loans.

[25] The Federal Reserve provides data on the net percentage of those who report to be more willing to lend vs. those who report to be less willing to lend ($m_t - l_t$). I use the dynamic relationship: $wl_t = wl_{t-1} + (m_t - l_t)$, where wl is the fraction of banks willing to lend, m and l the fraction of banks that are more or less willing to lend. I normalize $wl_0 = 1$ and then I subtract a linear trend estimated on the data for wl.

[26] CoreLogic, a financial data collection and processing company, has developed its own credit availability index (the CoreLogic Housing Credit Index (HCI)). It is designed to vary with various borrowers characteristics (such as credit score, debt-to-income ratio, loan-to-value ratio, level of documentation provided, occupancy status and loan origination channel). The index rises during the housing boom (from 100 in January 2001 to 125 in 2006), it declines to a value of 30 by the end of 2010, and it has remained fairly low and flat (at around 40) over the last three years. See http://www.corelogic.com/blog/authors/archana-pradhan/2016/03/credit-availability-trends.aspx#.V9GrmpgrJaS. Similarly to CoreLogic, the Mortgage Bankers Association constructs a Mortgage Credit Availability Index (MCI) using a number of borrower characteristics (such as credit score, loan type, loan-to-value ratio, etc.). The trends in the MCI are similar to those for the HCI: the index collapses to 100 in 2012 from 850 in 2006, and it has crawled up very slowly over the last three years (165 in August 2016 - an 80% decline since the heydays of 2006). See https://www.mba.org/2016-press-releases/june/mortgage-credit-availability-decreases-in-may. The pictures for these two indexes are in the Appendix.

are asked about perceptions of increase in the demand for credit ("Apart from normal seasonal variation, how has demand for [loan type j] changed over the past three months? (Please consider only funds actually disbursed as opposed to requests for new or increased lines of credit." Possible answers are: (a) Substantially stronger, (b) Moderately stronger, (c) About the same, (d) Moderately weaker, (e) Substantially weaker). I construct an index of strong demand by cumulating the net changes (net of a linear trend) as I did for the supply indicators above. I present the index for mortgage loans and for home equity loans. The data reveal that while the demand for new mortgages has collapsed (as also evident from the discussion above, see Figure 12), the demand for home equity loans has recovered substantially, but it has not been met by a corresponding increase in supply.

Another source of data to look at the importance of supply constraints is the Home Mortgage Disclosure Act (HMDA), which requires lending institutions to report information on loan disposition (number of applications, etc.). Figure 22 shows the fraction of applications for conventional home-purchase loans that were denied, by level of income (below median income in the 5-digit Metropolitan Statistical Area/Metropolitan Division; 50-79% of median MSA/MD income; 81-99%; 100-119%; and 120% or more). There are undoubtedly selection effects to be worried about, but the raw data remain informative. Denial rates declined for all types of consumers in the 1999-2002 period, including those earning below the MSA/MD median income. In the intermediate period around the recession, denial rate increased for the richest consumers and remained stable (around 30%) for the lowest income group. After the recession they have stabilized at a higher level for most consumers and slowly eased primarily for the more reliable consumers.

The third source of information is a series of questions available from the Survey of Consumer Finances. The first is: "In the past five years, has a particular lender or creditor turned down any request you [...] made for credit, or not given you as much credit as you applied for?". The second is: "Was there any time in the past five years that you thought of applying for credit at a particular place, but changed your mind because you thought you might be turned down?". We classify as liquidity constrained those who answer yes to either question. There is a long history of using these questions to construct indicators of being liquidity constrained (see Jappelli, 1990). We then run a probit regression for the probability of being liquidity constrained against year dummies (the SCF is conducted every three years and the last available wave is 2013) and socio-economic indicators. We are asking whether the probability of being liquidity constrained increases significantly after the Great Recession controlling for household characteristics (including income and leverage ratio). The regression shows that the probability of being liquidity constrained increases by about 4 percentage points in both 2010 and 2013, controlling for a rich set of characteristics - full results reported in Table 5.

The last source of data is the Survey of Consumer Expectations (SCE), a monthly survey managed by the NY FED. Every four months the SCE has a special Credit Access Survey module that is designed to provide information on consumers' experiences and expectations regarding credit demand and credit access. The first wave available is October 2013, the last is October 2015. The type of questions used to elicit access

to credit are similat to the one in the SCF, athough they tend to be more detailed regarding the loan source. People are asked if they had applied for a certain loan type (credit card, auto loan, mortgage, etc.). If yes, they are asked whether the application was turned down, partially or completed accepted; if no, they are asked if they did not apply because they thought they were going to be turned down. I construct a global indicator of being liquidity constrained (whether being turned down for any loan or being discouraged from applying) and run a probit regression against credit score indicators and survey wave dummies. I find that high credit score individuals are significantly less likely to be liquidity constrained, but that the extent of liquidity constraints faced has not declined significanty over the 2013-2015 period.

What do we conclude from the analysis of these various data sources? Credit market frictions, which had eased considerably in the pre-recession period, came back to be potential constraints on household consumption choices when the financial crisis erupted. Since then, there has been a gradual reduction in the extent of financial frictions imposed onto consumers and firms, but it seems still far from complete. In particular, some market segments (marginal sub-prime borrowers who entered and exited homeownership in the boom-bust period) and certain types of product (home equity lines) are still far from recovering pre-recession levels.

4.3 The debt overhang explanation

In the debt overhang narrative, debt exerts a role on consumption growth over and above wealth effects. The theoretical argument goes back to Irving Fisher; King (1994) provides an excellent summary; Dynan (2012) studies the importance of this mechanism in the aftermath of the financial crisis using micro data from the PSID. The hypothesis requires abandoning the representative consumer framework and adopting one in which consumers differ, for example by their initial debt position. Consumers who are more leveraged when wealth starts to decline will reduce their consumption more than those who have lower levels of debt. The continuing weakness in consumption can thus be explained by the fact that highly-leveraged households need a long time to go back to the optimal debt/asset ratio following large shocks to their asset values. In general equilibrium, the reduction in the demand for borrowing reduces the interest rate, but the zero lower bound induces a trap where aggregate demand remains depressed.[27]

4.3.1 Evidence on the debt overhang hypothesis

What do micro data tell us about the dynamics of the deleveraging process? To answer this question I look at various data sources.

The first is the Survey of Consumer Finances. In Figure 23 I plot the ratio of median total debt to median income for different education groups (as a proxy for permanent income). I use medians to eliminate the influence of extreme outliers and, as traditionally done, I take ratio of moments rather than moments of ratios. I also focus on a sample younger than 65, but the results are similar if I don't. All groups deleverage

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[27]Of course, the reduction in debt is also partly forced onto the households by the credit crunch.

after the recession. For example, the high school graduate sample deleverages from a 75% level in 2007 to a 43% level in 2013; similarly, the high school dropout sample deleverages from 16% to 3%. Unfortunately the SCF does not have a panel component (with the exception of part of the 2007 sample that was reinterviewed in 2009). This means I can only observe deleveraging at the group level. Hence I turn to the PSID, where I observe deleveraging (i.e., the change in the level of debt at two points in time) at the household level. I define an indicator for deleveraging (i.e., $DLV_{it} = \mathbf{1}\left\{\Delta\frac{D_{it}}{Y_{it}} < 0\right\}$) and regress it, by probit, against demographics (family size, a quadratic in age, education, dummies for being married, white, employed, state of residence), being in negative equity territory at time $t-1$, total wealth quartile dummies, and a post-Great Recession dummy. The estimates, reported in Table 6, show that deleveraging accelerated in the post-recession period. There is in generally more deleveraging among households headed by older individuals with more schooling or in employment; also, households who found themselves with negative home equity by the end of year $t-1$, are more likely to deleverage between $t-1$ and t. I cannot reject the null that state dummies are jointly insignificant. Finally, wealthier households deleverage more on average, but the effect is non-monotonic.

I also look directly at the debt overhang hypothesis put forward by Dynan (2012) and others by augmenting the regressions of Table 4 above by a measure of the leverage ratio that household find themselves sitting on as the recession start. To this purpose, I consider the average level of leverage (total debt/income) that households had in 2006 and 2008. I then regress consumption changes in the post-recession period (i.e., I consider only the 2012-10 and 2010-08 changes) against the same variables of Table 4 plus the leverage ratio as of 2006-08. The regression estimates are in column 7 of Table 4. If excessive debt is dragging consumption down, I should find that households with a higher leverage have lower consumption growth rates than households with low values. The estimate of the wealth effect is now insignificant. The leverage variable has the right negative sign and is statistically significant. The issue is whether it matters quantitatively. I calculate that a one standard deviation increase in leverage at the beginning of the recession implies a lower average consumption change in the post-recession period of about $160. In the 2008-2012 period consumption changed on average by $640, so this is a sizable effect.[28]

I do an exercise that is similar in spirit in Figure 24, but this time I use state-level consumption data from the BEA. I classify states according to the average level of leverage (debt/income ratio) in 2007. I then plot average consumption growth rates for states in the bottom 25% and top 25% leverage ratios in 2007. Before the recession, the level of leverage does not explain significant differences in consumption growth across states (using a formal test, p-value 71.8%). In the recession period and beyond, however, high levels of leverage as of 2007 constitute a (statistically and economically) significant drag on consumption (p-value for the test of equal growth rates is 4.8%). The least leveraged states (such as Texas or Pennsylvania) grow at a 2.6% average rate - 18.2% cumulative growth over the 7 years period. The most leveraged states (California or Florida among others) grow at a much reduced rate, 1.7% on average a year, or 11.9% cumulatively.

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[28]A number of papers show that high-leveraged households respond more to similar sized income and wealth shocks than low-leverage households (Baker, 2014; Kaplan and Violante, 2014). I obtain very similar evidence if I ran the wealth effect regressions separately for high- and low-leveraged households.

Interestingly, however, most of the growth differences are in the early part of the post-recession period. As I will argue below this may reflect the fact that by 2013 the deleveraging process is mostly completed. I calculate that if all states had grown at rates similar to the most "virtuous" ones after 2007, aggregate PCE would have been 3.9% higher by the end of 2014 (weighting by state population). See Figure 36 in the Appendix.

4.4   Is deleveraging over?

Debt hangover plays an important role in explaining the slow consumption recovery in the post-recession period. An important question is whether the deleveraging process is over. Recent events suggest that the deleveraging process has slowed down considerably. First, as shown in Figure 11, non-mortgage debt has increased relative to income (credit card debt, auto and student loans). Second, Figure 25 plots the debt service ratio (total debt payments over disposable income) over time and shows a dramatic decline. At the onset of the Great Recession, the debt service ratio had reached an all-time high (at least since the FRB started to collect these data). But since then, the debt service ratio has declined substantially. In fact, it has declined to an all-time low. Moreover, it seems to have stabilized. It is hard to believe that consumption is still held back by the debt overhang, when debt payments represent the lowest fraction of disposable income in 35 years.[29]

In principle, theory would tell us that the deleveraging process ends when people reach a new equilibrium level of buffer stock over permanent income. It is hard to obtain a measure of this theoretical construct (which may have changed due to shifts in fundamentals, etc.), and I am not aware of theoretical analyses along these lines. Albuquerque, Baumann and Krustev (2014) present an econometric model for the optimal amount of leverage, but make little contact with theory. To get at least some sense about distance from optimality, Figure 26 plots a simple measure of the buffer stock level of asset at the aggregate level (net worth over disposable income, rather than permanent income which is not observed). It shows that after reaching a peak at the height of the housing bubble, the buffer stock level of assets declined by 25% by the end of the recession. Since disposable income was stable, the bulk of the decline is coming from net worth. But after the recession and a period of substantial stability, the buffer stock level has increased almost to the same level achieved before the recession, although at a lower leverage level, which is a desirable development as it reduces the financial vulnerability of households. Whether this means that we are back to "normal" it is not clear, because increased income and policy uncertainty may have increased the optimal buffer stock level. Moreover, a decline in permanent income may have acted in the same direction (I discuss the reasons for potential revisions of permanent income below).

Micro data tell a similar story. The Michigan Survey of Consumers asks people a series of questions

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[29]Economists at the NY FED have been using the FRBNY Consumer Credit Panel to trace the evolution of the deleveraging process over the last several years. They have also concluded that the deleveraging process is mostly over. See for example: http://libertystreeteconomics.newyorkfed.org/2014/11/just-released-household-debt-balances-increase-as-deleveraging-period-concludes.html#.V-MxV_ArLb0.

designed to elicit attitutes towards spending on big ticket items: "Generally speaking, do you think now is a good or a bad time for people to buy [major household items, a vehicle]?". For respondent who say it is a bad time, they are offered possible reasons why. I classify as "worried about borrowing constraints" those who say that times are bad primarily because: "Credit/financing hard to get; tight money" or "Larger/higher down payment required"; and classify as "worried about excessive debt" those who say that times are bad primarily because: "People should save money" or "Debt or credit is bad". Figure 27 illustrates. The trends are clear. First, liquidity constraints spiked up during the recession, and they were mostly relevant for vehicle purchase, as expected. But many more respondents report that "deleveraging" activities affect durable/car purchase. However, the fraction resumes to a relatively low value by the time the survey ends, in the second quarter of 2016. Even from a micro point of view, the deleveraging process hanging over consumer spending seem much less relevant in recent years than it was in the aftermath of the recession as an explanation for the continuing weakness in consumption.

4.5 The income shocks/income uncertainty explanation

Income (and wealth) shocks represent revisions in consumers' expectations about their future resources. According to the standard permanent income hypothesis, revisions in expectations about current and future income are the main determinants of changes in consumption. In particular, if consumers' expectations about the future become more pessimistic (i.e., income is expected to go down in the future or to grow less rapidly than initially thought), they will need to save more (the traditional "saving for a rainy day" mechanism), which will depress current consumption. The effect is stronger if expectations of permanent income are revised. If the diminished expectation effect is synchronized across the entire consumption distribution (as it typically happens during recessions or at the start of one), a negative effect on aggregate consumption easily follows. Similarly, increasing uncertainty may induce precautionary saving and depress consumption.

To obtain a descriptive picture of revised expectations and uncertainty induced by the Great Recession, I use income expectations data from the Michigan Survey of Consumers (MSC). The MSC elicits expected household income growth rates for the following 12 months. It also elicits expected price growth, allowing the construction of a measure of real income growth. I also use measures of unemployment risk ("During the next 5 years, what do you think the chances are that you will lose a job you wanted to keep?") and income risk (the cross-sectional standard deviation of the individual income growth expectations), and the fraction of individuals who report that they expect to be financially worse off in 12 months. These various elements are plotted in Figure 28.

In the top right panel I plot trends in average expected income growth. In the period before the Great Recession, real income growth expectations were stable around 2%, but started to decline around the time of the housing price collapse and were, on the eve of the official start of the recession, close to zero. They became negative during the recession and beyond, and it is only during the last two years that they have turned back into positive territory. At some point during the post-recession period, almost 60% of respondents expected

negative income growth in real terms. Negative expectations were fairly synchronized due to a common aggregate component. The top left panel shows the typical conter-cyclicality of unemployment risk. What is surprising is the persistence of high job loss probabilities after the recession ends. The bottom left panel shows that income risk has also increased lately. Finally, the recession led many households to dramatic revisions in their expectations of being financially worse off in the near future - and it's only in recent times that these have returned to somewhat steady state levels. All in all, these pictures suggest that the Great Recession has led many households to perceive an increase in risk and downward revisions in their future incomes. This climate of uncertainty remains elevated many years after the recession has ended. Theory tells us that there are obvious responses to downward revision in expectations and heightened uncertainty: An increase in savings.

4.5.1 Revisions in permanent income?

Recessions induce many types of "wealth effects", not just those related to declines in housing or stock market prices. During recessions human wealth (as well as health and social capital) may also be destroyed due to events such as layoffs, displacement, long-lived absences from active employment, etc. Such shocks create "scarring", or persistent effects.[30]

Did consumers perceived the shocks that hit them during the Great Recession as permanent, or at least as very persistent? In the US unemployment is typically a transitory shock. However, for some people, job losses or other labor market events experienced during the Great Recession may have been interpreted as strctural, rather than cyclical. This is for at least two reasons.

First, as discussed in the job polarization literature, recent recessions have been characterized by jobless recoveries, and this has been particularly the case for "routine" occupations (those more likely to be replaced by technology or outsourced). Jaimovich and Siu (2012) show that while all types of jobs are destroyed during recessions, the rate at which they get re-created differ dramatically for "routine" vs. "non-routine" jobs: routine jobs become increasingly less likely to return. To the extent that the decline in wages and employment opportunities is related to technological changes or other structural reasons, we would expect workers in routine occupations (still a large chunk of all occupations in the US) to experience a permanent decrease in the price of their skill, and hence a permanent decrease in their lifetime resources. Second, being displaced, entering the labor market, or starting new jobs during recessions typically has worse long-term consequences on outcomes as diverse as future wages, employment, health, and so on, than experiencing these events during economic booms, see Oreopoulos, von Wachter, and Heisz (2008) and von Wachter and Davis (2011). If the reason for scarring is skill depreciation, these persistent negative effects may have been heightened by the lenght and depth of the Great Recession.[31]

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[30]Other forms of "human capital" may be affected by recessions, such as health capital (see Ruhm, 2000; Browning, Dano and Heinesen, 2006, for two opposite views about whether recessions are bad for health) or social capital (loss of work-related connections, networks, etc., may reduce the ability to insure against shocks, increasing vulnerability to risk).

[31]De Nardi, French, and Benson (2012) test whether the drop in consumption observed during the Great Recession can be

The MSC contains a series of questions that try to elicit respondent's perceptions of long-lived changes in their well-being: "Compared with five years ago, do you think the chances that you will have a comfortable retirement have gone up, gone down, or remained the same?", "Five years from now, do you expect that you (and your family living there) will be better off financially, worse off financially, or just about the same as now?" (which is only asked after 2011), "What do you think the chances are that your income will increase by more than the rate of inflation in the next five years or so?", and the measure of job loss risk used above: "During the next 5 years, what do you think the chances are that you will lose a job you wanted to keep?". I plot the fraction of those who report lower expectations of comfortable retirement and expectation of being worse off financially in the future in the top left panel of Figure 29, the fraction of those who report a probability of expected decline in real income of more than 50% in the middle panel, and the average probability of job loss in the top right panel. The recession induces dramatic revisions in expectations of long-term welfare. However, by the time the survey ends the statistics appear realigned to pre-recession levels. Perception of long-term job loss probabilities appear elevated despite aggregate improvements in employment opportunities. Nonetheless, as the bottom panels show, most of the reversion to pre-recession means masks considerable heterogeneity. In the left-panel the decline in the expectation of a comfortable retirement appears permanent for those in the bottom quartile of the income distribution, and the reversion is visible only for the top quartile. In the bottom middle panel there are level differences (poor individuals have higher expectations of real income declines in the next five years), but similar mean reversion. In the bottom right panel, increased unemployment risk is only recorded for the low-income group, while for the high-income group there is actually a decline.

4.5.2 Increased income uncertainty?

During the Great Recession income volatility (and probably uncertainty) also increased. This may have contributed to the consumption weakness of the post-recession period. In general, uncertainty is counter-cyclical, i.e., it rises during recessions. Economic theory predicts that prudent households will respond to increased uncertainty by delaying purchases of durable goods and by saving for precautionary reasons (Bertola, Guiso and Pistaferri, 2005; Carroll and Samwick, 1998).[32] Recent research has also pointed to the effect that "uncertainty shocks" may have on economic recessions (Bloom, Floetotto, Jaimovich, Saporta-Eksten and Terry, 2011). Fernández-Villaverde, Guerron-Quintana, Kuester and Rubio-Ramirez (2015) point to the importance of policy uncertainty (although measures of policy uncertainty constructed by Baker,

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explained by downward revisions in wealth and income expectations (which they take from Reuters/University of Michigan Surveys of Consumers data set). They find that, depending on what assumptions are made concerning future income growth beyond the time horizon covered by their data, they can explain the entire drop in consumption with just the observed drop in wealth and income expectations.

[32]Bertola, Guiso and Pistaferri (2005) estimate that a 10% increase in consumption uncertainty decreases household car expenditure by about 1% on average in a sample of Italian households. While uncertainty is consistent with the drop in durable purchases, as said earlier other factors were likely to play an important role including tightening credit (making it harder to buy "big ticket" items), as well as the excess accumulation of durables in the pre-recession years, see for example Hall (2011).

Bloom and Davis, 2015, actually show a decline in policy uncertainty after the recession).

In Figure 30 I plot a measure of income uncertainty using the Michigan Survey of Consumers. The measure I use is the cross-sectional standard deviation of the permanent innovation in the income process, which I construct using the panel componenit of the survey. In general, it is difficult to separately identify transitory and permanent income shocks. However, the MSC has a short panel component (two observations per household). I use the following idea, developed in Pistaferri (2001). Suppose the income process can be written as:

$$\log y_t = x_t'\beta + P_t + \varepsilon_t$$
$$P_t = P_{t-1} + u_t$$

where P_t is the permanent component of income, which I assume follows a random walk process, and ε_t is an i.i.d. transitory shock. Permanent and transitory shocks are unpredictable, and hence $E_{t-1}u_t = E_{t-1}\varepsilon_t = 0$. Growth rates are:

$$\Delta \log y_t = \Delta x_t'\beta + u_t + \Delta\varepsilon_t$$

It follows that what people report in the survey is:

$$E_{t-1}\Delta \log y_t = \Delta x_t'\beta - \varepsilon_{t-1}$$

One can obtain a point estimate of the permanent shock using:

$$\left(\Delta \log y_t - E_{t-1}\Delta \log y_t\right) + \left(E_t\Delta \log y_{t+1} - \Delta x_{t+1}'\beta\right) = u_t$$

where the term $\left(E_t\Delta \log y_{t+1} - \Delta x_{t+1}'\beta\right)$ is the residual of a regression of the subjective expectation of income growth reported in the second wave against demographics (I use age dummies, year dummies, region dummies, and education dummies; the sample is people aged 18-65).

Figure 30 reveals that after remaning flat for a long period, including the recession itself, uncertainty started to rise around 2013 and has kept doing so until recently. This increase in uncertainty for the whole sample masks again considerable heterogeneity. The other two lines estimate uncertainty separately for people at the top and the bottom quartiles of the income distribution (using lagged income). Besides level effects (larger uncertainty among the poor), the rise in uncertainty we see for the whole sample is mostly driven by a rise in uncertainty at the bottom of the income distribution. This confirms evidence from Guvenen, Ozkan and Song (2014) that larger increases in volatility occurs at the bottom of the income distribution (where people are not well equipped to self-insure, and hence need to save or cut their consumption) than at the top. Alan, Crossley and Low (2012) estimate that increased uncertainty can explain half of the decline in aggregate consumption in the UK's Great Recession, with permanent recession-related shocks explaining

another quarter, while little role is played by the tightening of credit supply. There are three distinct features of the Great Recession that might have played a role in amplifying the precautionary savings effect. First, as Guvenen, Ozkan and Song (2014) show using social security data, in recessions, and particularly in the Great Recession, the likelihood of drawing a very negative shock to earnings is much higher. Interpreting these as higher probabilities for a "disaster" at the household level potentially amplifies the precautionary savings motive. Second, in normal times, the increase in demand for precautionary savings would drive down the real interest rate. However, as the economy is currently at the zero-lower bound for nominal interest rates, the real interest rate is bounded. In the presence of a zero lower bound, the precautionary savings motive is therefore amplified (see Basu and Bundick, 2015). Third, precautionary saving effects may have been exacerbated by the tightening of credit supply which increased the probability of being subject to liquidity constraints in the future.

What do we conclude? Downward revisions in permanent income and increased uncertainty can be potentially relevant explanations for the weakness in consumption, but in the data they appear important only for households in the bottom part of the income distribution. For this to have any significant effect on aggregate consumption, heterogeneity in MPC and more generally distributional issues have to play a significant role. I turn to these issues next.

4.6 The distributional explanation

A well known development in the US economy is the rapid and prolonged increase in income and wealth inequality. Another is the decline in the labor share. The two are connected, albeit not perfectly (most of the increase in income inequality is coming from the earned component of income). These trends have continued during the Great Recession and beyond. The aggregate increase in disposable income that I have documented in Figure 2 masks important distributional differences. Indeed, I calculate that about 60% of all the aggregate income gains of the post-recession period have, in fact, accrued to the top 10% of the income distribution.[33] This is in keeping with what discussed in the previous section, where I have documented that individuals at the bottom of the income distribution have perceived downward changes in their permanent income, as well as greater uncertainty after the recession. Several papers have documented that the increase in income inequality of the last two decades has come primarily from structural/permanent reasons, rather than transitory factors (instability). See Kopczuk, Saez and Song (2010); Guvenen, Ozkan and Song (2014).

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[33]In 2009, non-government aggregate income (the sum of wages, proprietors' income, rental income, and financial income) was $10.9 trillions; in 2015, this had increased to $12.8 trillions (in real terms). Hence, aggregate income increased by $1.9 trillions over the 2009-2015 period. In 2009, the top 10% earned (using Piketty and Saez data, downloaded here: https://docs.google.com/viewer?url=http%3A%2F%2Feml.berkeley.edu%2F~saez%2FTabFig2015prel.xls) 45.47% of total non-government income (using the Piketty and Saez' measure of income that excludes capital gains, to match the one in NIPA), or $5 trillions. By 2015, the top 10% share had risen to 47.81% (or $6.1 trillions). It follows that over the 2009-2015 period, the top 10%'s income increased by $1.1 trillion dollars, equivalent to about 62% of all aggregate income change in the entire US economy. If the calculation included the Great Recession (i.e., the 2007-2015) period, the ratio would be even larger (68% instead of 62%).

Does the rise in inequality matter for aggregate consumption? This question has fascinated economists for a long time. The question has also important policy implications: Do redistributive policies stimulate the economy? The obvious case in which distributional issues don't matter for aggregate consumption is when consumption responses are homogenous across consumers.[34] For inequality to have non-trivial effects on aggregate consumption, we need propensities to consume to be heterogeneous across consumers (or, equivalently, non-linear response of consumption to income and/or wealth).[35] There are of course many theoretical reasons to expect heterogeneous propensities to consume or a concave consumption function, already discussed in this paper (such as borrowing constraints, precautionary savings, or bequest motives for saving, with bequest typically modeled as "luxury" goods). These theories all predict that low-income and low-wealth households are, in general, more responsive to changes in their resources than high-income and high-wealth households. Hence, these theories predict that redistributive policies could be in principle expansionary (unless incentive distortions are severe). See Auclert (2016) for a discussion of the redistributive role of monetary policy founded precisely on response heterogeneity.

4.6.1 Micro evidence on MPC heterogeneity

Some studies use non-experimental data and assess whether propensities to consume are indeed heterogeneous, and in what direction the heterogeneity goes. Dynan, Skinner and Zeldes (2004) show that the rich have higher propensities to save (hence, lower propensities to consume) relative to current income. If income is temporarily high, it means that consumers expect it to revert to the mean (i.e., to go down in the future) and hence save in anticipation of that event. The intriguing finding of their study is that the MPS of the rich is higher than the poor's also with respect to lifetime income measures (for which they use various proxies). In particular, they regress the (S/Y) ratio against quintiles of the income distribution (instrumented with permanent income indicators such as education), and find that the saving ratio increases with the position in the income distribution. Using a different empirical approach, Banks, Blundell and Lewbel (1997) find important non-linearities in Engel curves for various consumption goods. Finally, Blundell, Pistaferri and Preston (2008) find that consumers with low education and low initial wealth (two standard markers for low socio-economic status) have larger responses to both transitory and permanent disposable income shocks.

Other papers use quasi-experimental changes in income induced by tax rebates and related policies

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[34] The focus on heterogeneity was present in the early studies looking at this question. Kaldor (1957) assumed that workers consume everything they have while profit makers save some of their profits for future capital accumulation. Pasinetti (1962) translated this idea into marginal propensities to consume declining with the level of income. In Friedman (1957) and Modigliani-Ando (1963), saving is instead a constant fraction of permanent (or lifetime) income, hence effectively eliminating any importance of distributional effects. Auclert and Rognlie (2016) study the effect of transitory and permanent changes in income inequality on aggregate output using a Bewley-Huggett-Aiyagari model in a context in which consumers have heterogenous MPCs and real interest rates are fixed (so that it can approximate a ZLB setting).

[35] This is a result that goes back to Gorman (1953) who gave the conditions under which a representative agent could exist –i.e., linear Engel curves. Complete markets, i.e., full insurance of resource shocks, deliver identical implications, regardless of functional forms.

to study how household consumption responds to exogenous (mostly temporary) income changes. These policies sometimes reduce inequality (in the absence of severe moral hazard responses) by targeting low-income consumers. They may affect aggregate consumption if there are large consumption responses among transfer recipients. These are more likely to occur if the transfers are perceived as permanent (independently of credit market imperfections), or if consumers face liquidity constraints (independently of the persistence of the income change). In the latter case, even a temporary tax rebate policy may be highly effective if appropriately targeted.[36] One issue to consider, however, is that heterogeneity in consumption responses to a certain tax policy needs not be a "fixed effect". That is, it is not obvious that a certain type of heterogeneity found in response to a given stimulus will be replicated by a different type of stimulus (if conditions, such as the nature of the recession, change). Hence, it is not clear that one should "target" stimulus to the groups where large responses were found in certain occasions, because they may be little responsive in different occasions (or vice versa). To give an example, consider that during recessions induced by financial crises the mass of liquidity constrained individuals increases to include households who (in "normal" recessions) would have relatively easy access to credit. Hence, the same type of individuals may be highly responsive to a tax rebate offered during a liquidity-driven recession but little responsive during, say, a technology-driven recession. Similarly, in the recent Great Recession a debt overhang may have led many consumers to use tax rebates to pay off debts rather than spend (see Sahm, Shapiro and Slemrod, 2010). The same consumers could have been more responsive to tax rebates in previous recessions, or in this recovery after the deleveraging process had come to a halt.

Jappelli and Pistaferri (2014) use survey questions containing responses to hypothetical income changes. They rely on a useful question contained in the 2010 Italian SHIW. The survey is designed to elicit information on how much people would consume or save were they unexpectedly to receive a reimbursement (or transfer) equal to their average monthly income. The responses to this question provide the sample distribution of the MPC of Figure 31.

In their sample, the average MPC is 48 percent, at the high-end of current estimates based on survey data on observed consumption and (transitory) income changes. Most importantly, they find substantial heterogeneity in people's responses. In particular, households with low cash-on-hand exhibit a much higher MPC than affluent households, which is in agreement with models where income risk or liquidity constraints play an important role.

4.6.2 What about the slow recovery?

Why may inequality considerations help explaining the slow consumption recovery? A simple example may be useful. Suppose that $\Delta c_{it} = \alpha_i \Delta y_{it}$, and that $cov(\alpha_i, y_{it}) < 0$, i.e., higher MPCs are found at

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[36]Traditional consumption theory states that consumers do not respond to transitory shocks such as one-shot stimulus package interventions, but only to changes in their permanent income. See Taylor (2011) for a recent discussion. Oh and Reis (2011) argue that targeted transfers may affect aggregate consumption both because of a neoclassical wealth effect and because of heterogeneity in MPCs.

the bottom of the income distribution. This is a simple form of concavity of the consumption function. To illustrate, consider an economy with just two consumers, R and P (for rich and poor). Hence $\Delta c_{Rt} = \alpha_R \Delta y_{Rt}$ and $\Delta c_{Pt} = \alpha_P \Delta y_{Pt}$. Aggregate consumption change is: $\Delta c_t = \Delta c_{Rt} + \Delta c_{Pt} = \alpha_R \Delta y_{Rt} + \alpha_P \Delta y_{Pt}$. Concavity requires that $\alpha_R < \alpha_P$. The change in aggregate income is: $\Delta y_t = \Delta y_{Rt} + \Delta y_{Pt}$. Take an extreme case in which the entire aggregate gains accrue just to rich household, so that $\Delta y_t = \Delta y_{Rt}$. It follows that the change in consumption in this case is $\Delta c_t^{\text{high ineq.}} = \alpha_R \Delta y_t$. If income gains had been shared equally, we would have observed: $\Delta y_{Rt} = \Delta y_{Pt} = \frac{\Delta y_t}{2}$. Hence the change in consumption would have been in this case $\Delta c_t^{\text{low ineq.}} = \alpha_R \Delta y_t + (\alpha_P - \alpha_R) \frac{\Delta y_t}{2} > \alpha_R \Delta y_t = \Delta c_t^{\text{high ineq.}}$. As more and more of the aggregate gains in the economy accrue to those with lower MPCs, any aggregate income increase produces lower and lower consumption responses. Hence, while in the past a Δy_t (with a more equal distribution of gains) would have produced a $\Delta c_t^{\text{low ineq.}}$ response, in the current scenario the same aggregate income change produces only a $\Delta c_t^{\text{high ineq.}} < \Delta c_t^{\text{low ineq.}}$ response.

A similar calculation can be done with wealth inequality.[37] One could argue that most of the wealth gains realized in the recovery have accrued to the wealthier households with low MPCs out of wealth (indeed, most of the net worth increase comes from stock market boom, with much less modest recovery in housing prices - and stock ownership is much more concentrated than housing wealth ownership).

A rough calculation of the impact of rising inequality on the weakness of aggregate demand in the post-recession period is similar to that proposed by Krueger (2012) and contained in the Economic Report of the President (2012, p. 48). Suppose that households in the bottom 90% of the income distribution have marginal propensities to save of zero (or unitary marginal propensities to consume). In the recovery period (2009-2015), aggregate income (before government transfers/taxes) went up by \$3,072 billions. Using Piketty and Saez (2003) statistics on income concentration, we calculate that the top 10% experienced a \$1,724 billion increase, while the bottom 90% took the rest, \$1,348 billions. Since aggregate consumption over the same period increased by \$2,437 billions, we can infer that the marginal propensity to save for people at the top of the income distribution is around 0.37. Consider now a counterfactual scenario in which the aggregate income gains had been shared equally (i.e., 10% of the gains would have accrued to the top 10% and the remainder to the bottom 90%). Keeping MPCs constant, we calculate that aggregate consumption would have increased by \$2,958 billions over the 2009-15 period (instead of \$2,437 billions), a 3.5% annual boost in aggregate demand. While this calculation has a number of caveats and ignores all sort of behavioral responses, it provides some useful (albeit large) benchmark. Behavioral responses may be important. For example, an implicit wealth transfer of the type considered here may induce wealth effects, reduce labor supply, and potentially eliminate the positive effect on aggregate consumption induced

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[37]I do not do this calculation here because it requires measures of wealth concentration, which are harder to obtain than measures of income concentration. The ones that can be computed from survey data suffer from under-representation at the top (and declining survey response). The ones that can be computed from tax records data (such as Saez and Zucman, 2016) are based on capitalization methods that assume heterogeneity of returns within asset classes, which some recent papers find too strong (Fagereng, Guiso, Malacrino and Pistaferri, 2016).

by response heterogeneity.

4.7 Other explanations

4.7.1 The behavioral explanations

Did the Great Recession alter fundamentally the approach of US consumers to their consumption/saving decisions? Malmendier and Shen (2016) argue that individuals who go through periods of high unemployment spend significantly less, after controlling for income, demographics, and current macro-economic factors such as the current unemployment rate, than those who do not. In that sense, the deep and prolonged Great Recession may have scarred their consumption behavior permanently.[38] The negative effects they find are stronger for cohorts with shorter lifetime histories: The young lower their spending significantly more than older cohorts after being exposed to severe recessions.[39]

The dramatic collapse of the housing market and the mortgage default/foreclosure cycle may also have persistently shifted preferences away from homeownership. Perhaps the notion that housing is a low-risk investment has been shattered forever. This may explain, more on the demand side, the great escape from homeownership detailed above (see Figure 12).

Recent research (Reis, 2006, Carroll, 2003) has emphasized that consumers may not update their expectations as fast or accurately as predicted by standard model, due to transaction costs or other types of frictions ("inattention"). Exceptions are easily predictable events or extraordinary events which capture people's attention at little cost. In these cases, it is more likely that expectations are formed rationally. The recent Great Recession, with all the media attention it received, may have indeed been perceived as an extraordinary event and hence made consumers update their expectations more carefully and/or attentively.

Fuster and Laibson (2010) consider the possibility of unjustified pessimism as an engine of persistent deviations of actual GDP from potential output. In particular, they notice the existence of large evidence from disparate fields that economic agents tend to suffer from extrapolative bias, consisting of putting excessive weight on more recent events when producing forecasts. In the same way that house price increases in the boom era may have led many agents to forecast further increases, which fueled the bubble, the collapse in prices may have led many agents to believe further declines were expected, hence restraining residential investment or home purchase (and contributing to the slow consumption recovery).

4.7.2 The secular stagnation hypothesis

A final hypothesis, sometimes associated with Summers (2014) (on the demand side), or Gordon (2016) (on the supply side), is that the US is in the grip of a secular stagnation era, and the slow consumption (and

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[38] Popular press has made similar points, see http://www.wsj.com/articles/the-recessions-economic-trauma-has-left-enduring-scars-1462809318 and http://www.latimes.com/business/la-fi-recession-psyche-20140627-story.html.

[39] There are other demographic (i.e., "cohort" like) explanations for the slow consumption recovery, highlighting the role of slow formation of new households, generational preference shifts (i.e., of "millenium" children), etc. I do not survey these narratives here.

GDP) recovery is purely a manifestation of it.

There are actually several versions of the secular stagnation idea (Eichengreen, 2014). The first is that the economy is stack in a zero lower bound trap, so that monetary policy has exhausted the tools for stimulating aggregate demand in conventional ways and it is not clear whether less conventional tools (such as QE) may help extricating the economy from the trap. See Eggertson and Mehrotra (2014) for a formal model. Various economists (including Summers, 2014; Woodford, 2012; Correia, Farhi, Nicolini and Teles, 2013) have invoked discretionary/unconventional fiscal interventions in a situation in which monetary policy is ineffective due to the zero lower bound trap. D'Acunto, Hoang and Weber (2016) discuss the experience of one such unconventional intervention (in Germany in the mid-2000s) in which the government announced future increases in consumption taxes, hence generating higher inflation expectations and inducing intertemporal substitution in spending. They show that the intervention was surprisingly successful.

A second version of the secular stagnation hypothesis is that the Great Recession, by creating a large stock of long-term unemployed and discouraged workers (also through the moral hazard effects of the UI extension policy, as suggested by Hagedorn, Manovskii and Mitman, 2016, and Mulligan, 2008), had a permanent negative effect on potential output. In this sense, the recession has done permanent damage to the economy. This could be seen as the macro version of the scarring effects at the micro level discussed above.

A third version of the secular stagnation hypothesis, which has been revived by Gordon (2016) is simply that the US economy has transitioned to a low productivity growth phase. The high levels of productivity growth experienced in the past were induced by inventions (such as electricity, etc.) that have no counterparts in our era (the productivity growth contribution of IT appears rather small, see Syverson 2016, and relegated to entertainment-type activities). In this version, stagnation started long before the Great Recession, but it was "masked" by the housing market bubble: Individuals with stagnant wages and reduced employment opportunities believed they could finance a level of consumption comparable with past growth rates by borrowing against ever-increasing values of their assets (a similar argument, in the context of employment across sectors is made by Charles, Hurst and Notowidigdo, 2016). Several authors have presented versions of this narrative and provided empirical evidence supporting it (Rajan, 2010, Kumhof, Ranciere and Winant, 2015, Bertrand and Morse, 2015), although the issues are largely unsettled (see, e.g., Coibion, Gorodnichenko, Kudlyak and Mondragon, 2014).

5   Conclusions

In this paper, I have reviewed various explanations proposed for the slow recovery of consumption following the end of the Great Recession. The prediction that "balance sheet" recessions tend to be deep and prolonged, as remarked by Reinhardt and Rogoff (2008), has proved quite accurate. The theoretical explanation that is often provided is that the deleveraging process of several agents at once (consumers, firms, financial intermediaries), tends to magnify the effect of any initial shock - which is *a fortiori* even more

evident given the size of the shock characterizing the Great Recession. Conventional general equilibrium forces, typically unleashed by expansionary monetary policy under nominal rigidities, have been largely ineffective due to the constraints imposed by the combination of low inflation and low nominal interest rates. However, various indicators and disparate evidence suggest that the process of deleveraging has slowed down considerably, at least among households.[40] These developments have led some commentators to forecast a "return to normal" in which consumers carry the US economy out of the doldrums. However, even after the apparent plateau reached by the debt/income ratio, consumption has continued to grow at stubbornly low rates. This is mostly due to feedback effects coming from the output side of the economy, with its mixed messages of slow wage growth and increased uncertainty. I have provided some evidence and discussed literature findings arguing that for a good fraction of the population (individuals at the bottom of the distribution of skills, with typically high marginal propensities to consume) the slowdown in wages has structural, not cyclical causes, and an enlarged measure of permanent income (which includes the value of assets, i.e., housing wealth as well) has been severely hit by the crisis and there is severe uncertainty about it getting back to pre-recession levels and providing relief from binding borrowing constraints. In this sense, the slow growth of consumption may just be the "new normal", not an episodic deviation from long-term trends.

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[40]Whether this is socially optimal is still an open question. Borrowing against expectations of rising house prices may restart the bad cycle of high leverage, housing bust, etc.. There is only scant evidence that the increased borrowing of more recent years is motivated by expected increases in human capital.

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TABLES

Table 1: Consumption growth rates before and after the Great Recession

	Period	
Consumption definition	2002:1-2007:3	2009:3-2016:2
Total consumption	3.00%	2.29%
Durables	5.62%	6.68%
Nondurables	2.78%	2.12%
Services	2.60%	1.68%

Table 2: Time use evidence

	Food prep.	Shopping	Purch. research
Post-recess.	0.0842 (0.0397)	−0.3373 (0.0398)	0.0006 (0.0533)
Age	0.0228 (0.0016)	−0.0009 (0.0016)	0.0001 (0.0001)
Male	−3.0604 (0.0375)	−1.3289 (0.0394)	0.0018 (0.0022)
White	0.1209 (0.0529)	0.3563 (0.0505)	0.0020 (0.0028)
Employed	−1.8969 (0.0533)	−0.2171 (0.0497)	−0.0042 (0.0031)
Education dummies	Y	Y	Y
Weekday dummies	Y	Y	Y
Constant	7.5675 (0.1807)	2.6258 (0.1526)	−0.0085 (0.0053)
N	98,253	98,253	98,253
R^2	0.0940	0.0419	0.0002

Table 3: Counterfactual metrics

	(1)	(2)	(3)	(4)
$\Delta \log Y_t^d$	0.3330 (0.0533)	0.3262 (0.0533)	0.3041 (0.0529)	0.2890 (0.0531)
$\Delta W_t / Y_t^d$	0.0146 (0.0047)	0.0155 (0.0047)	0.0122 (0.0046)	0.0134 (0.0046)
L_{t-1}		−0.0029 (0.0025)		−0.0048 (0.0024)
I_{t-1}			0.0119 (0.0038)	0.0135 (0.0039)
Constant	0.0037 (0.0005)	0.0057 (0.0018)	−0.0066 (0.0000)	−0.0047 (0.0034)
$\overline{R}^2$	0.2359	0.2375	0.2702	0.2810

Table 4: Wealth effect estimates

	OLS	IV					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ΔW	0.014 (0.003)	0.054 (0.020)	0.046 (0.019)	0.037 (0.018)	0.059 (0.021)	0.053 (0.023)	−0.015 (0.108)
High leverage							−0.349 (0.170)
Age	−16 (30)	−15 (29)	−27 (29)	−13 (24)	−35 (28)	−70 (47)	−55 (121)
Age^2/100	−25 (31)	−13 (30)	7 (29)	−17 (23)	15 (29)	3 (40)	−13 (79)
ΔFamily size	2546 (221)	2130 (311)	2232 (251)	2113 (253)	1895 (309)	1933 (348)	2558 (849)
ΔMarried	1486 (692)	168 (1110)	−134 (1053)	1040 (876)	−315 (1127)	1279 (1226)	2997 (2942)
Years of schooling	143 (34)	78 (37)	3 (29)	65 (28)	53 (32)	111 (39)	47 (53)
$\Delta Un.rate$	−443 (265)	−142 (280)	157 (168)	13 (167)	32 (240)	24 (577)	−598 (703)
Year dummies	Y	Y	Y	Y	Y	Y	Y
N	33,488	33,435	33,430	33,419	33,555	20,733	9,671

Table 5: Credit denials from the SCF

	(1)	(2)
2001	−0.016 (0.004)	−0.010 (0.004)
2004	−0.004 (0.004)	0.006 (0.004)
2007	−0.027 (0.004)	−0.007 (0.004)
2010	0.048 (0.004)	0.041 (0.004)
2013	0.032 (0.004)	0.037 (0.004)
Male		−0.034 (0.004)
Age		0.007 (0.000)
Age^2/100		−0.014 (0.000)
Education		−0.008 (0.000)
Married		0.003 (0.003)
White		−0.075 (0.003)
Employed		0.028 (0.003)
log(income)		−0.052 (0.001)
Leverage ratio/100		0.002 (0.001)

Table 6: Who deleverages?

Post-recession	0.026 (0.006)	Family size	0.003 (0.002)
Years of schooling	0.012 (0.001)	2nd wealth quartile	0.029 (0.008)
Age	0.017 (0.001)	3rd wealth quartile	0.019 (0.009)
Age^2/100	−0.018 (0.001)	4th wealth quartile	−0.014 (0.010)
White	0.010 (0.008)	Lagged neg. equity	0.213 (0.018)
Married	0.036 (0.007)	State dummies	Y
Employed	0.077 (0.008)		
N	33,938		

Note: Marginal effects. Robust s.e.'s in parenthesis.

FIGURES
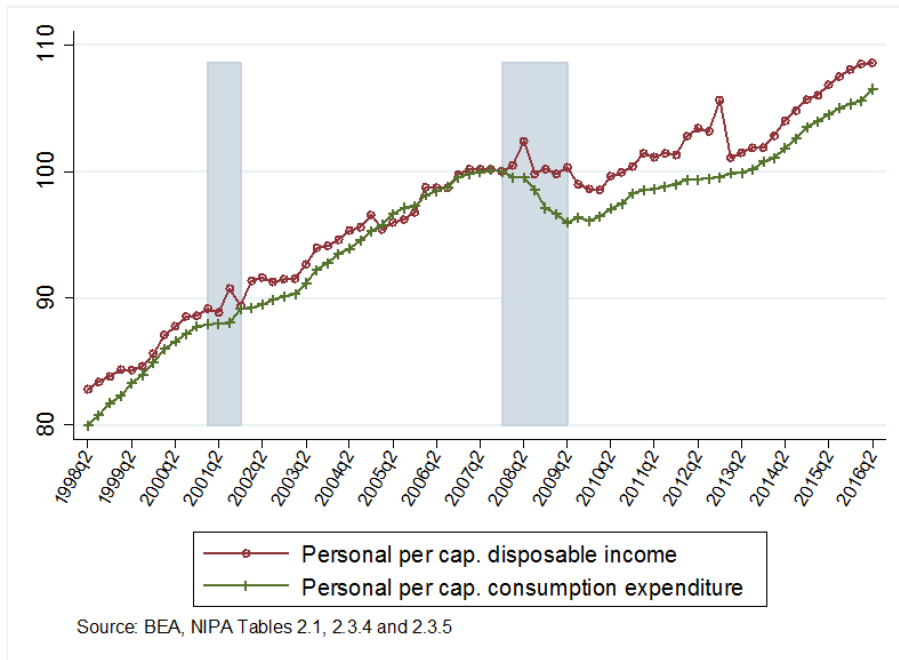
Figure 1: Consumption and Disposable Income.
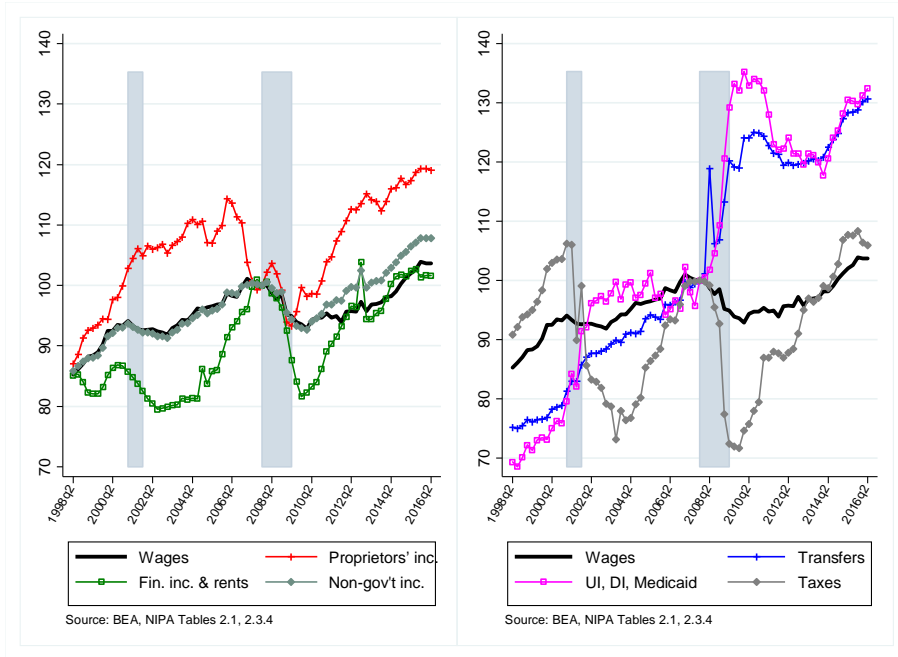
Figure 2: Components of income.
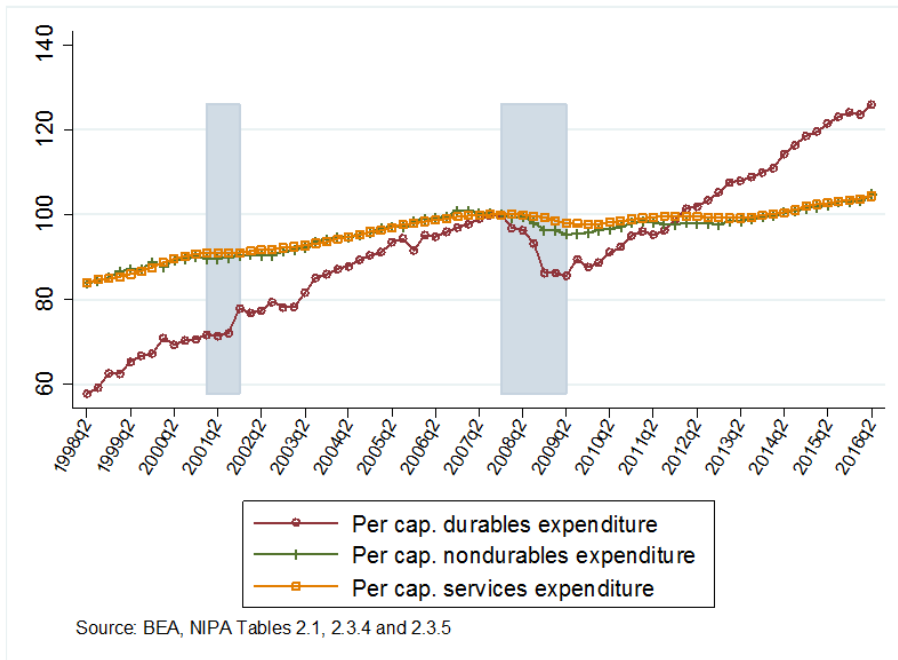
Figure 3: Consumption Components.
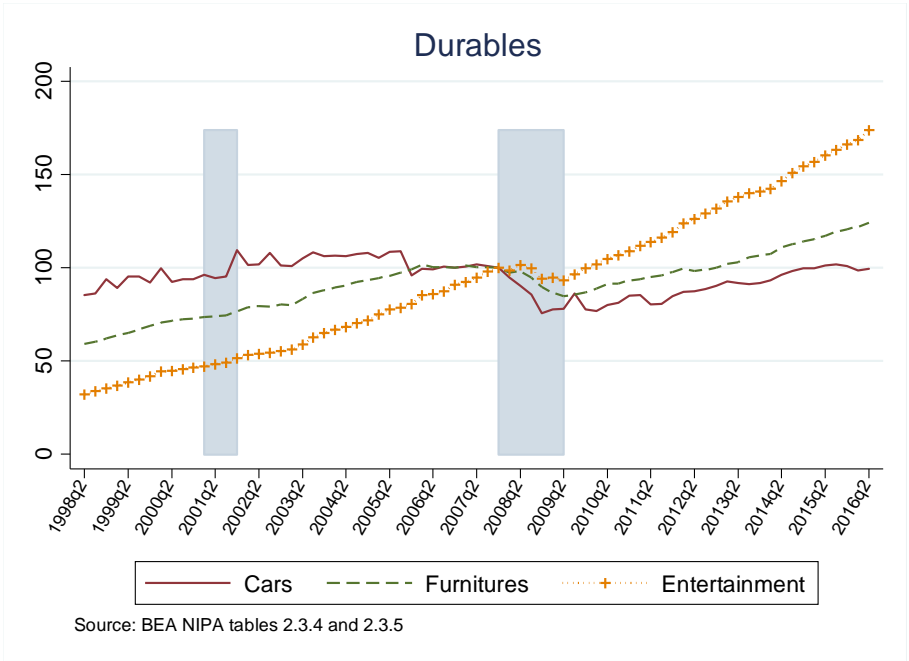
Figure 4: Components of Durable Spending.
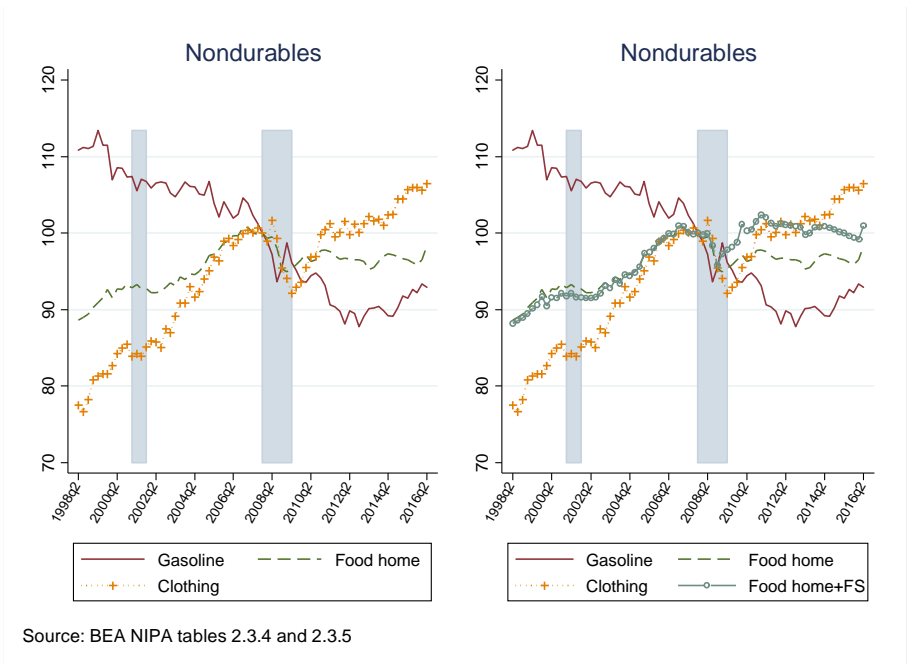
Figure 5: Components of nondurable spending.
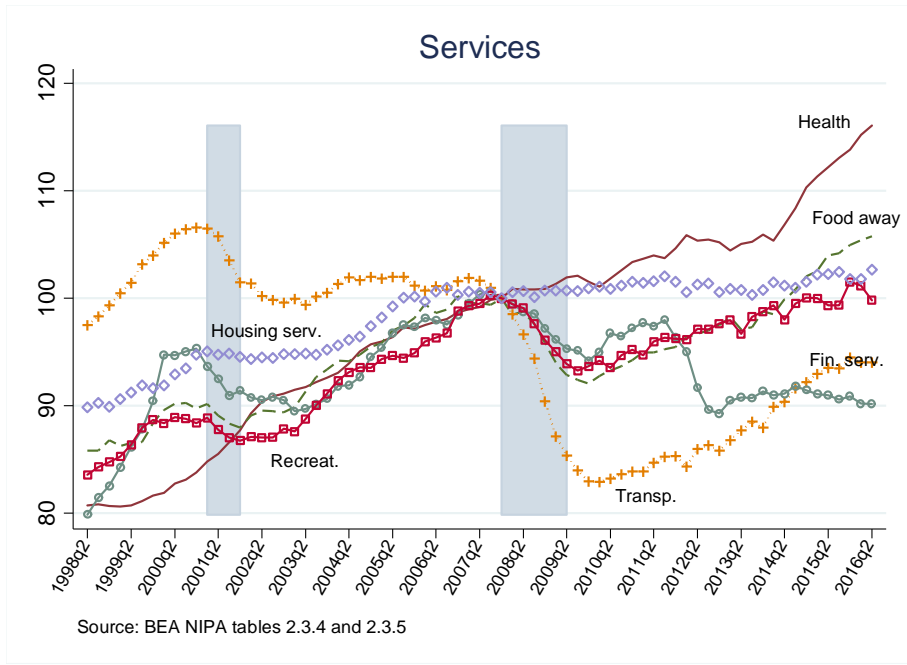
Figure 6: Components of services spending.
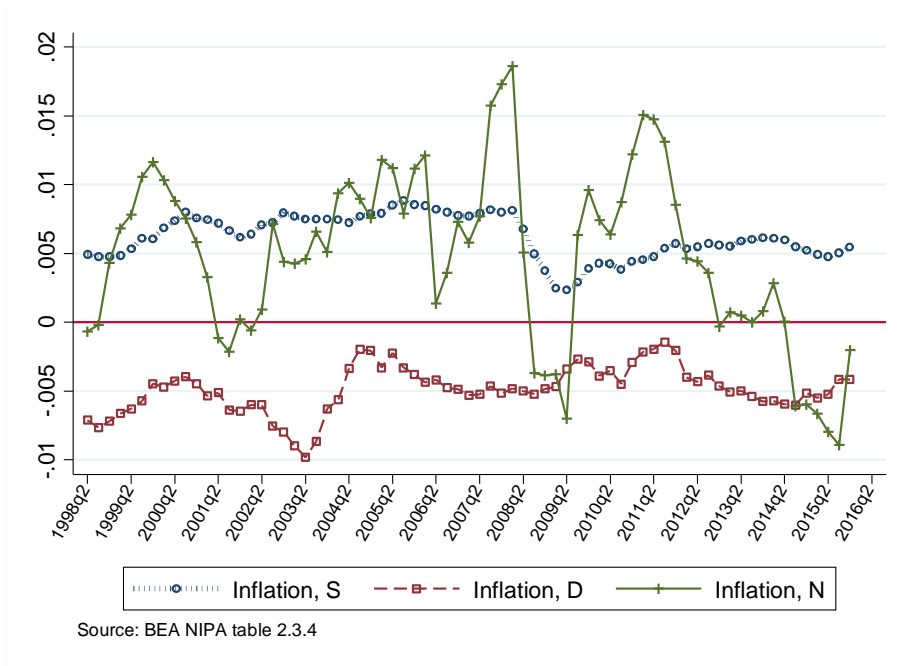
Figure 7: Inflation rates for the three consumption components.
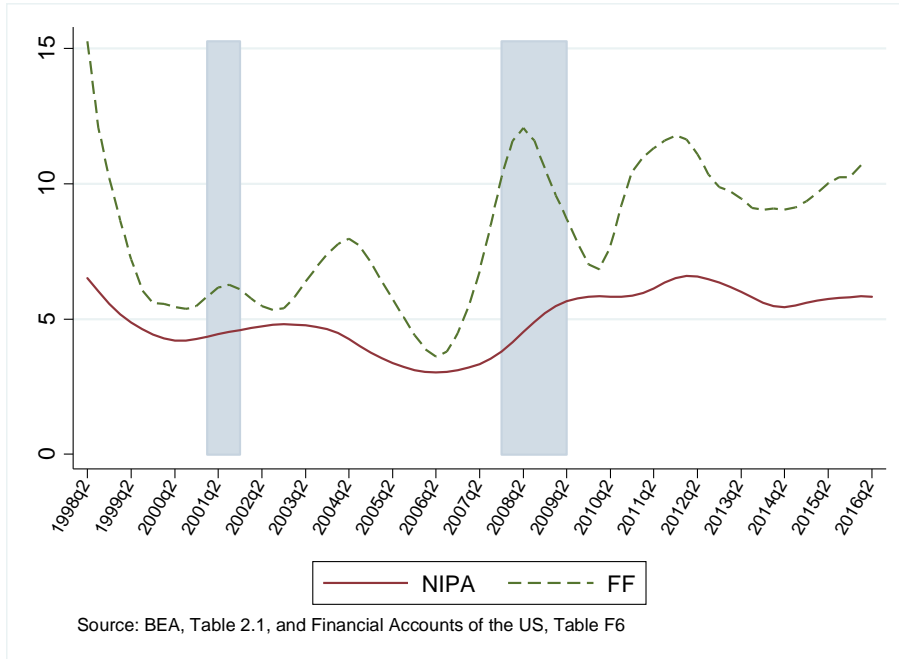
Figure 8: Different measures of the saving rate.
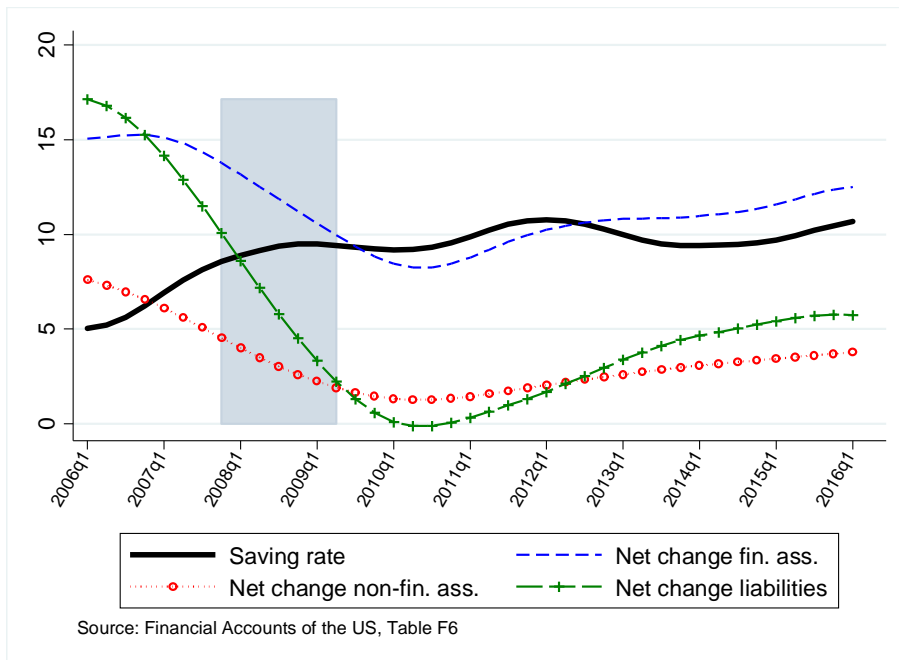
Figure 9: Decomposing the increase in the saving rate.
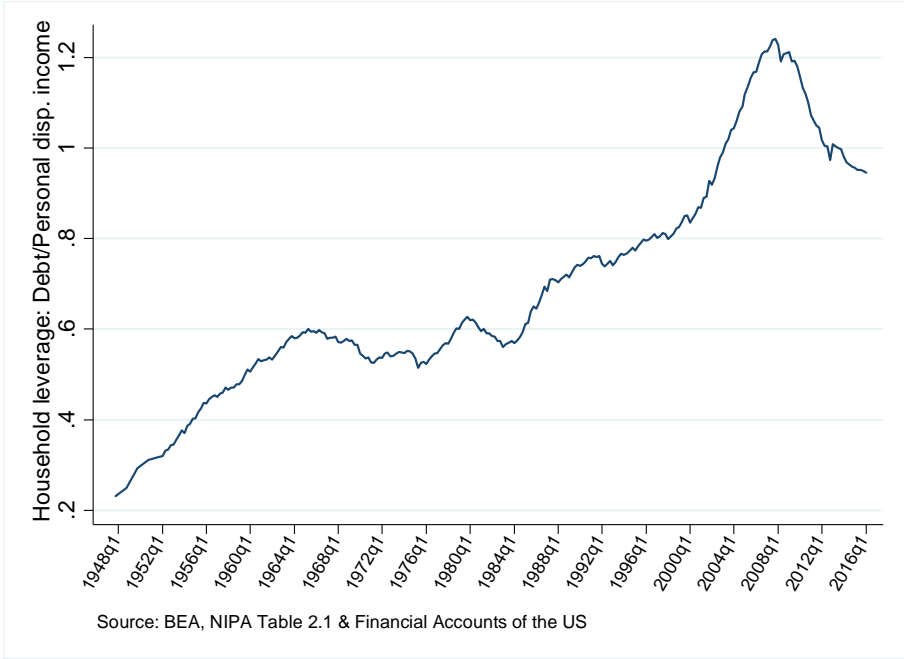
Figure 10: The Debt/Income Leverage Ratio.
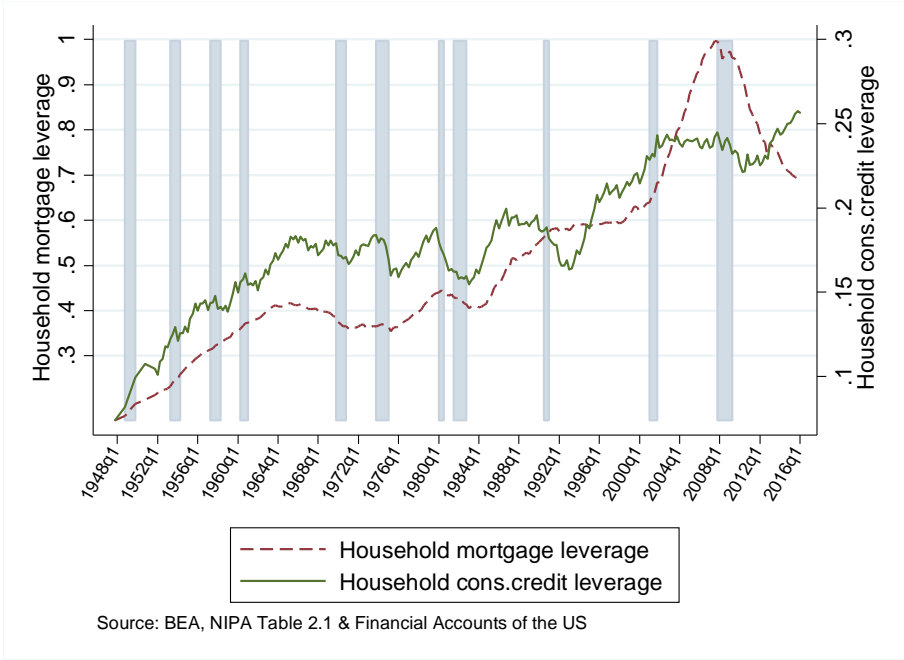
Figure 11: Mortgage and Consumer Debt Leverage Ratios.
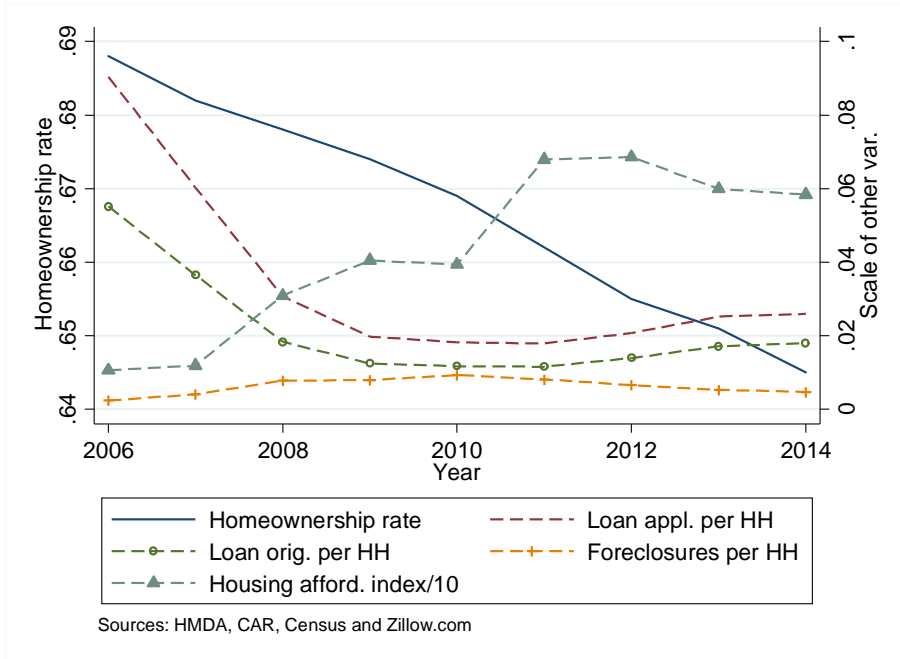
Figure 12: The great escape from homeownership.
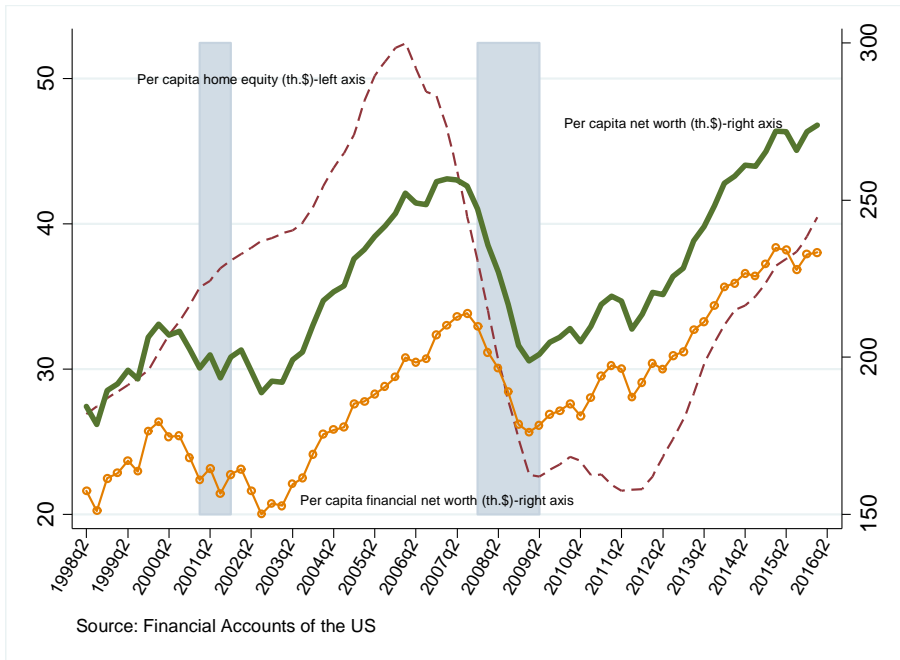
Figure 13: Net worth and its components.
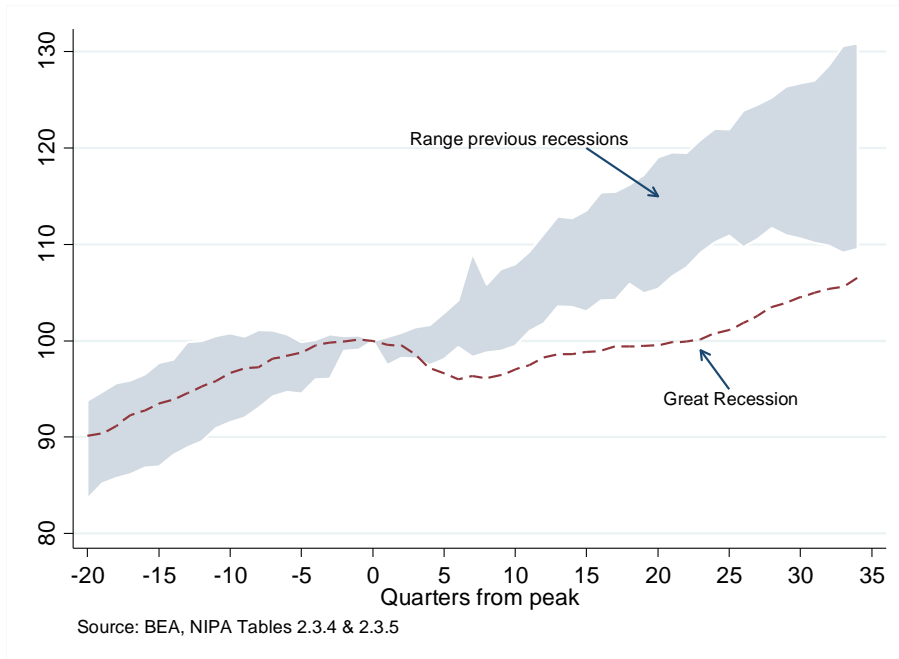
Figure 14: Comparison of the Great Recession with Previous Recessions: Total Consumption.
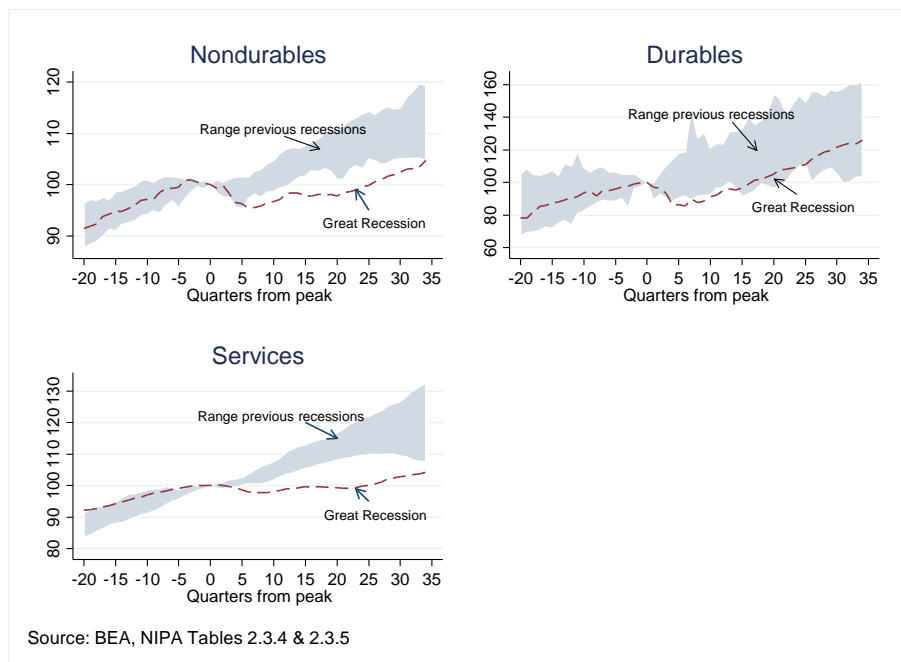
Figure 15: Comparison of the Great Recession with Previous Recessions: Components of Consumption.
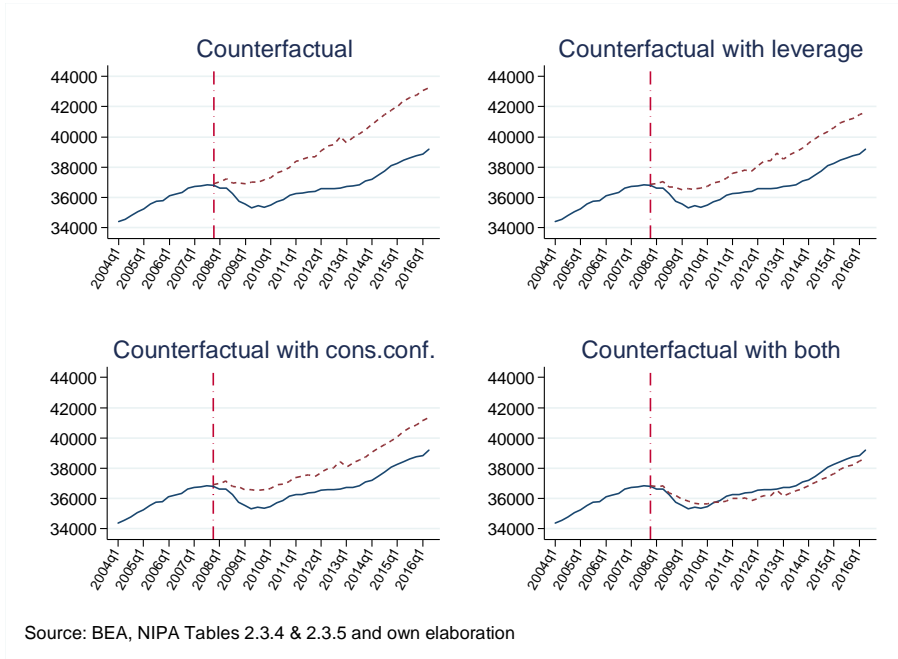
Figure 16: Counterfactuals.
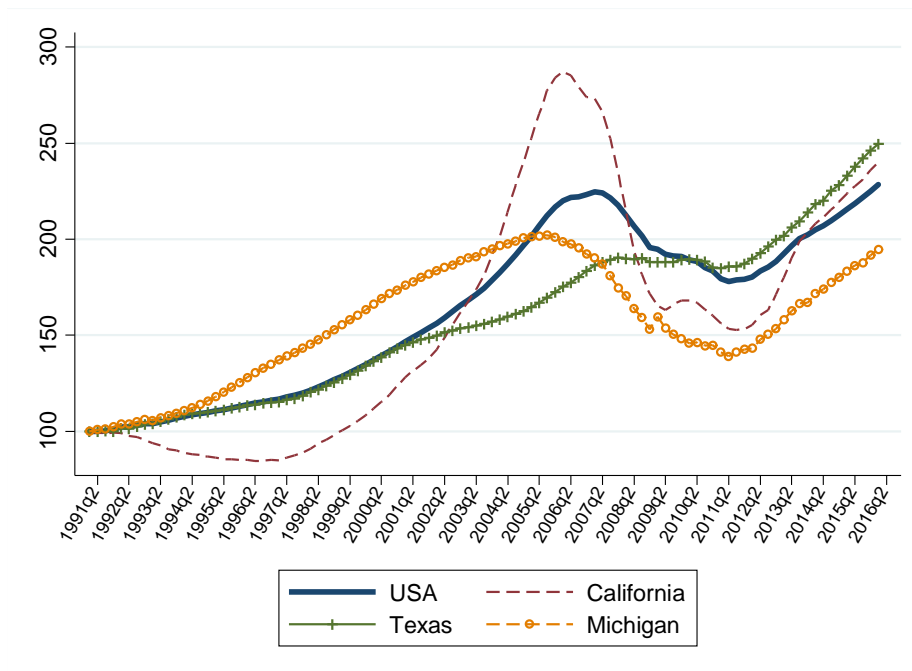
Figure 17: Heterogeneity in the housing boom-bust-recovery cycle.

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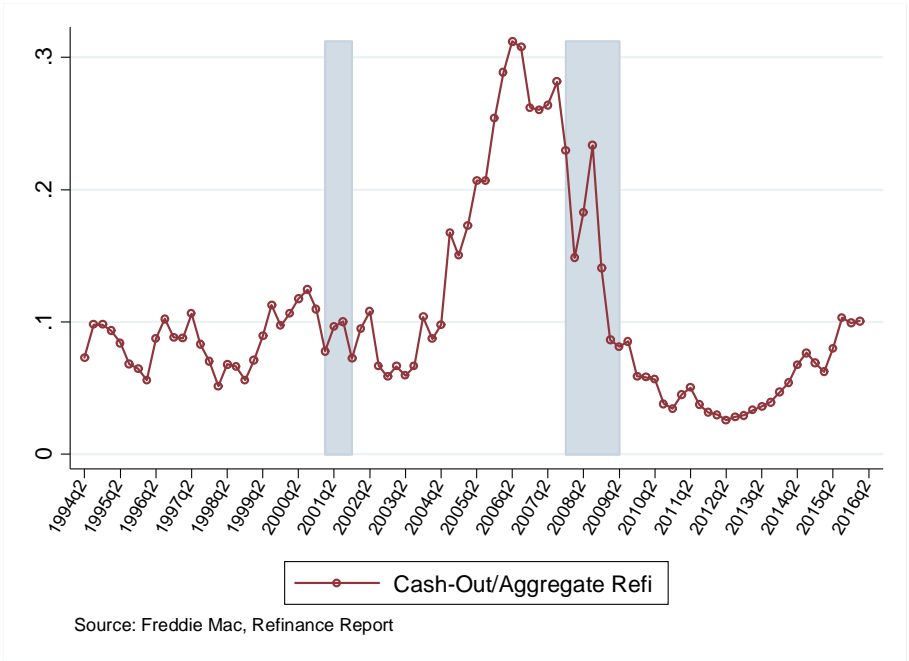
Figure 18: Total Cash-Out Dollars as a Percentage of Aggregate Refi Loans.
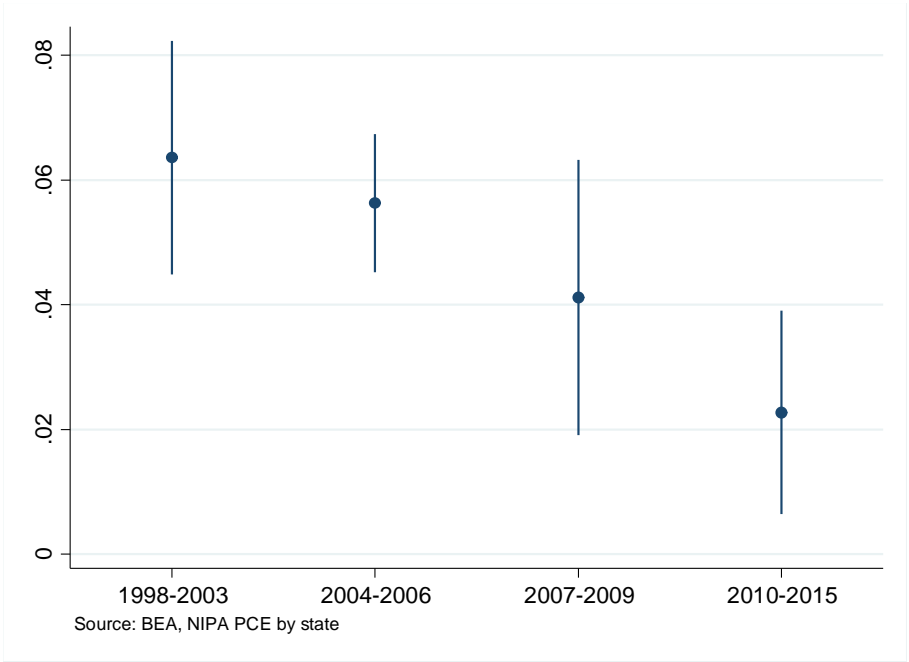
Figure 19: The change in the wealth effect.
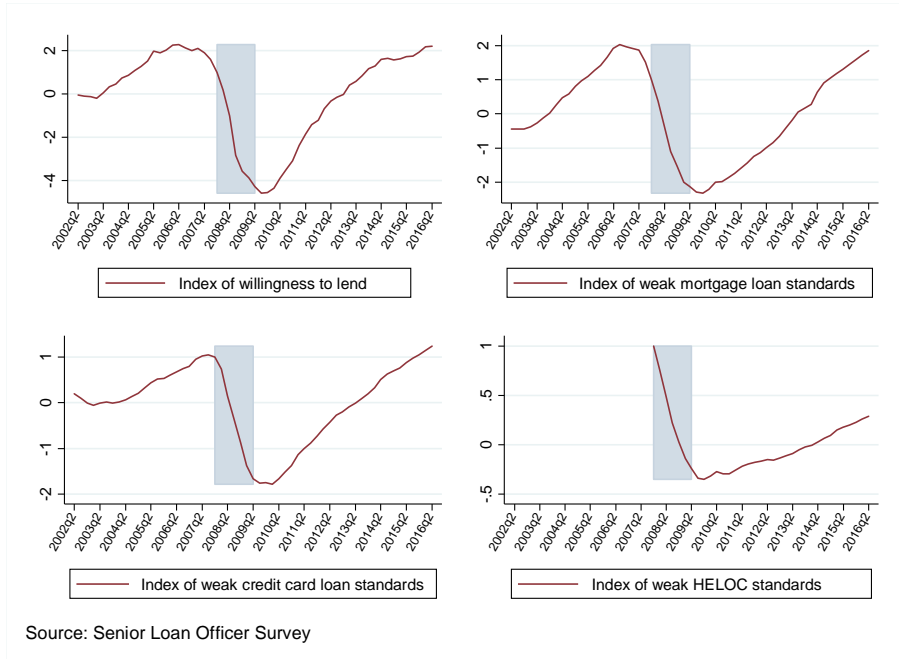
Figure 20: Indexes of credit availability from the Senior Loan Officer Survey
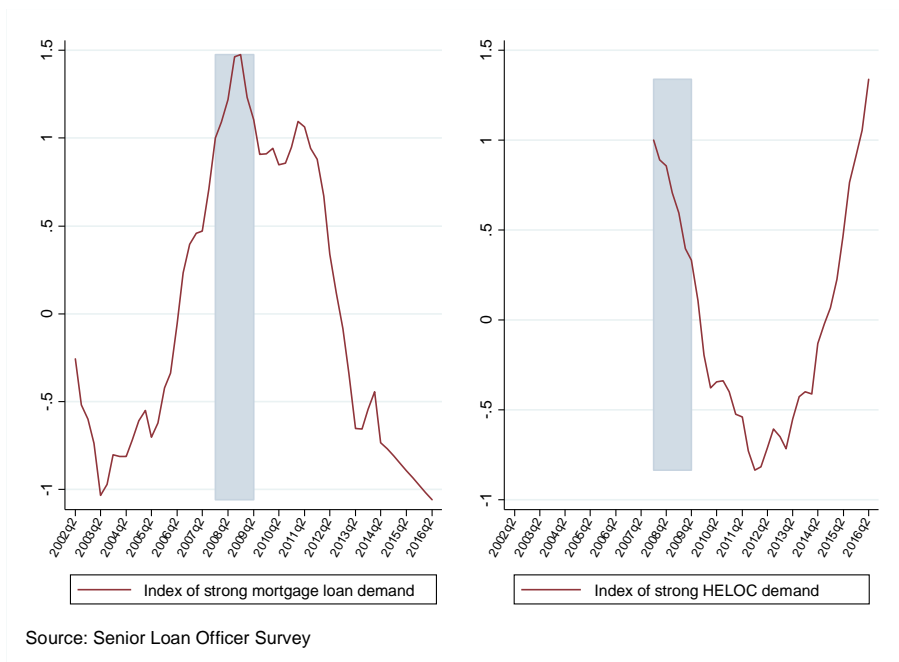
Figure 21: Indexes of credit demand from the Senior Loan Officer Survey
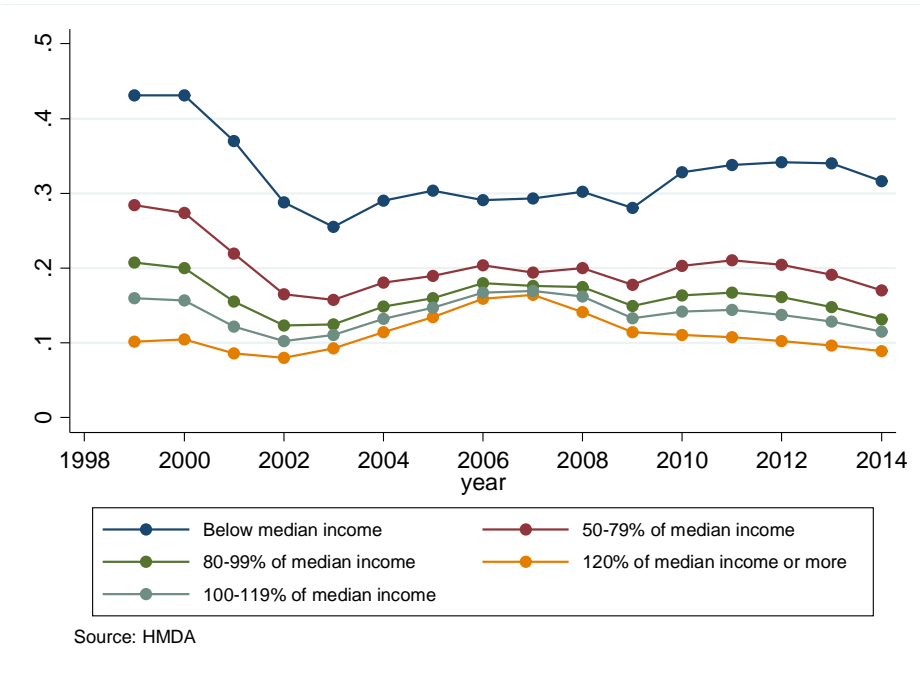
Figure 22: Mortgage application denial rates, by income.
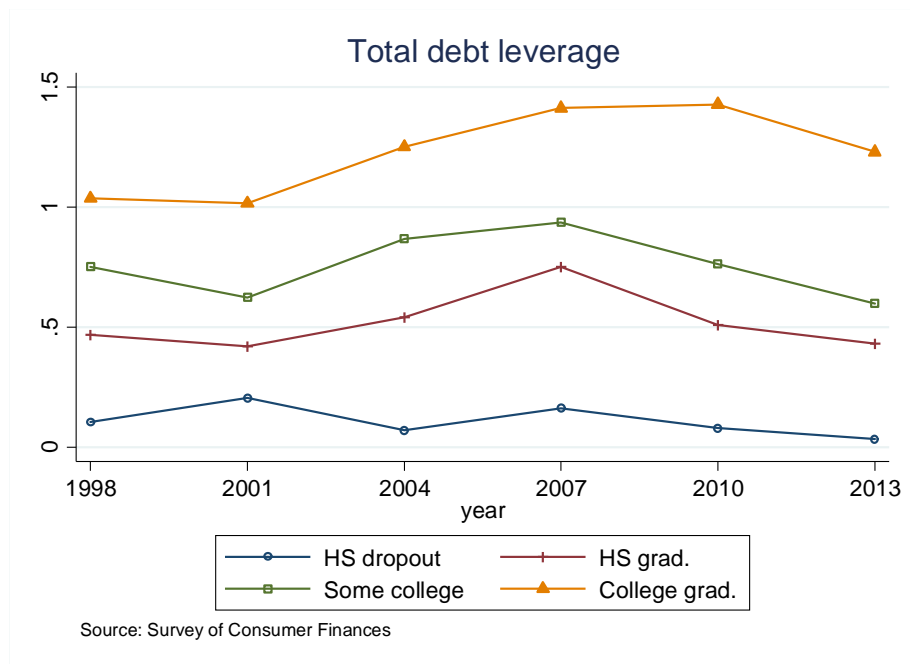
Figure 23: Deleveraging at the micro level.
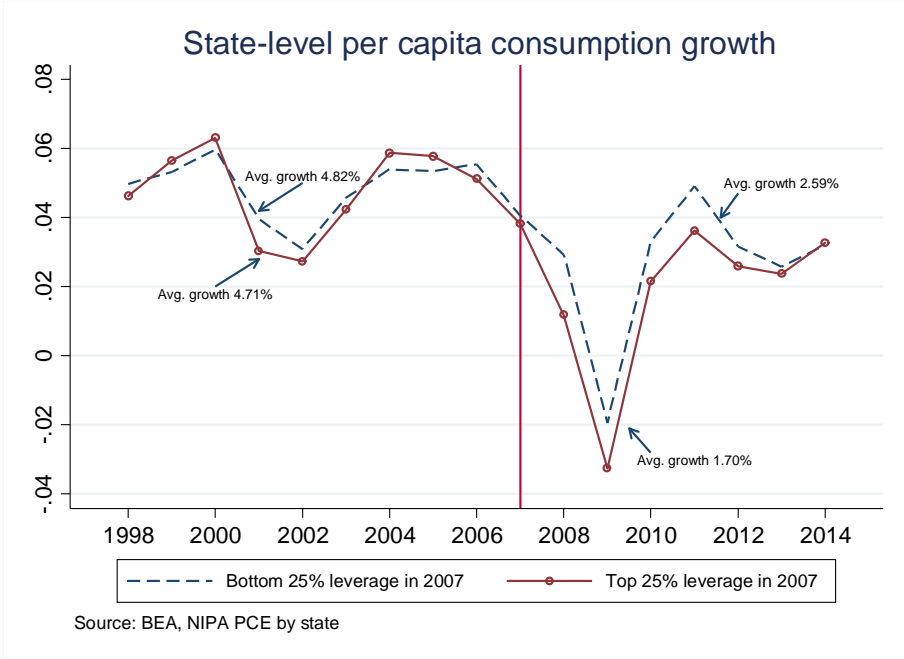
Figure 24: The debt overhang in state-level data
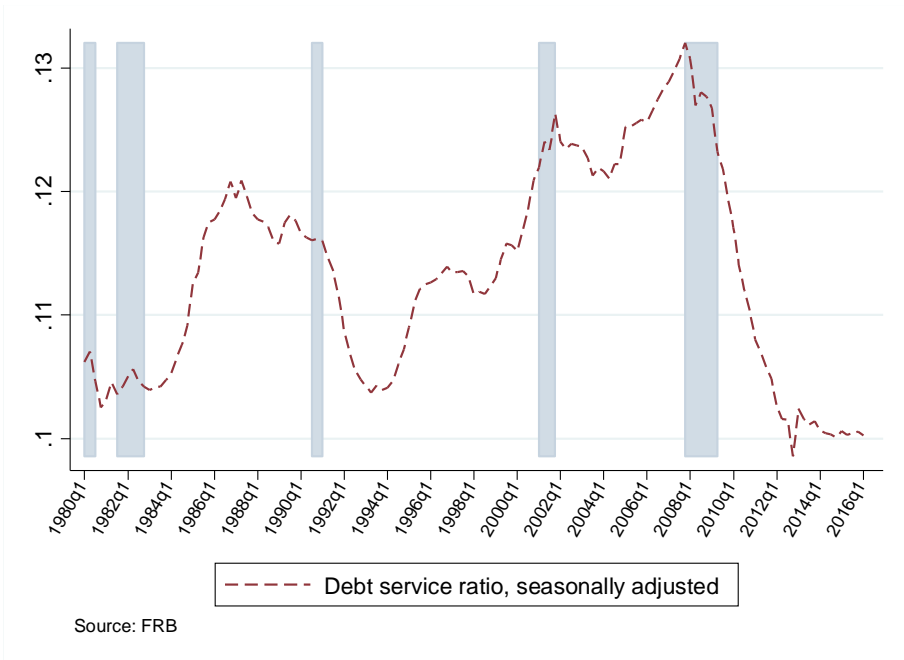
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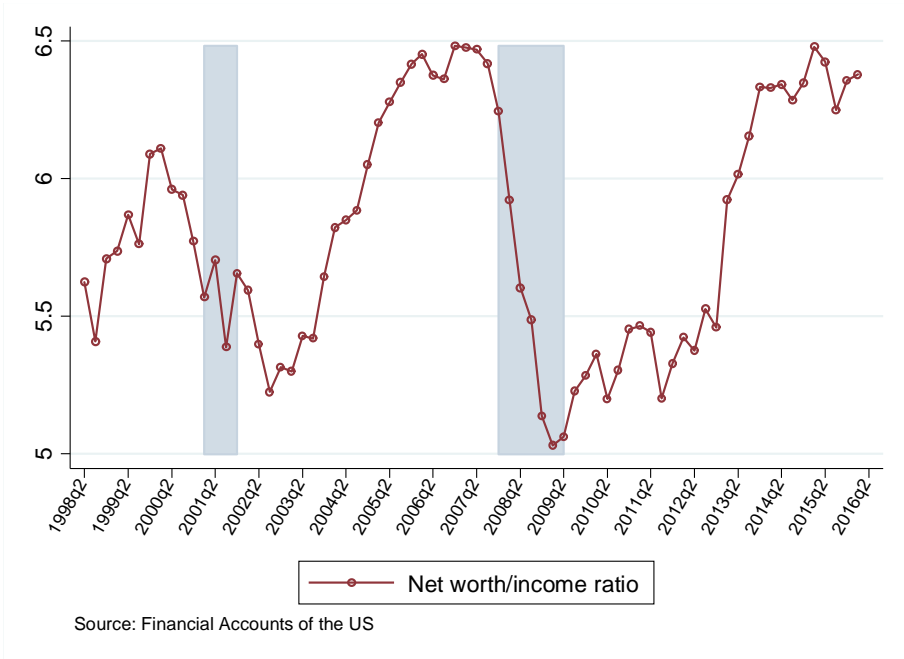
Figure 26: The net worth/income ratio.
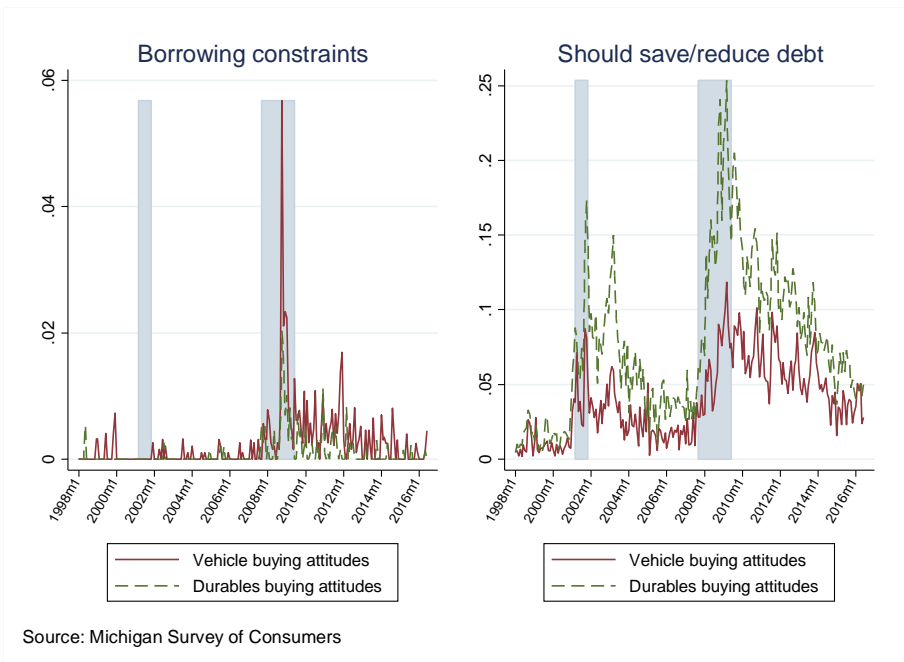
Figure 27: Reasons why it is a bad time for purchasing big ticket items.
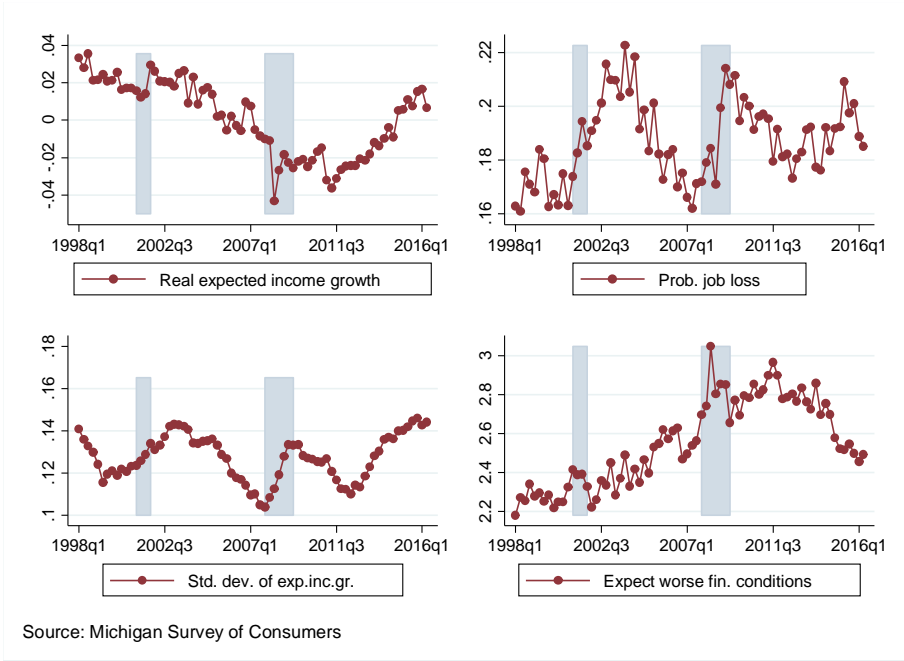
Figure 28: Individual perceptions of uncertainty.
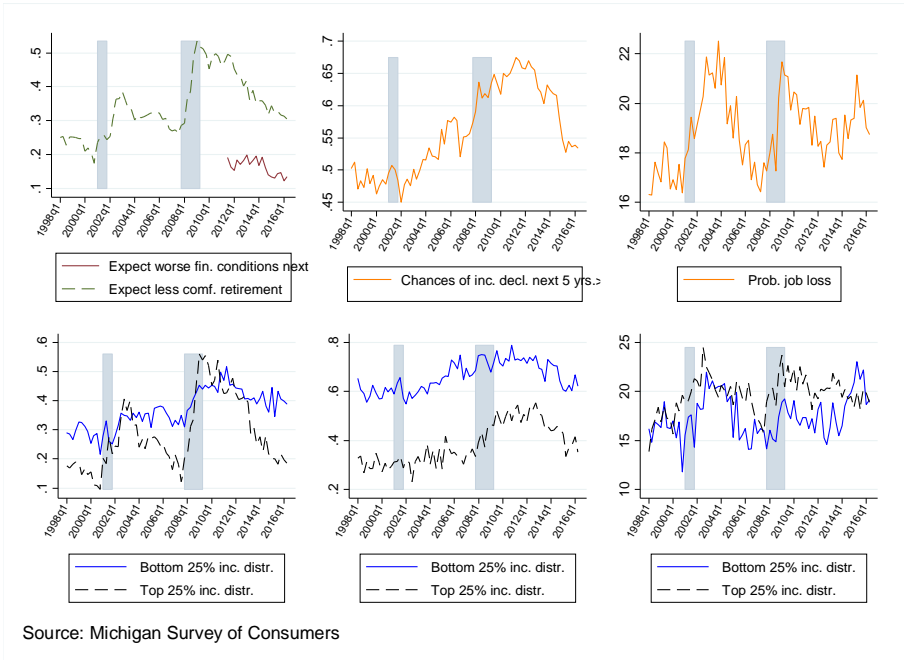
Figure 29: Expectations of long-term decline in well-being.
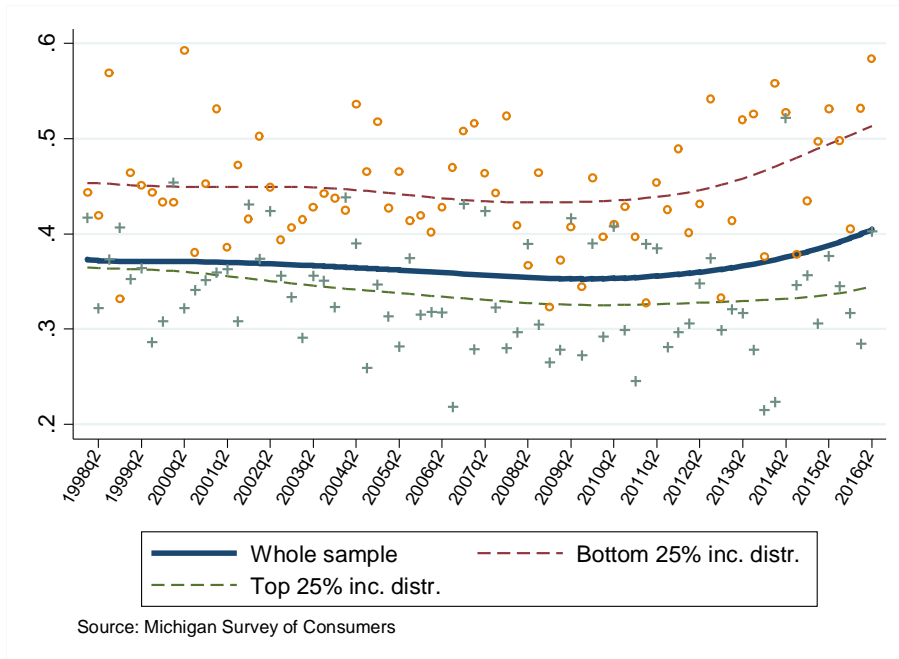
Figure 30: The standard deviation of the permanent innovation in the income process.
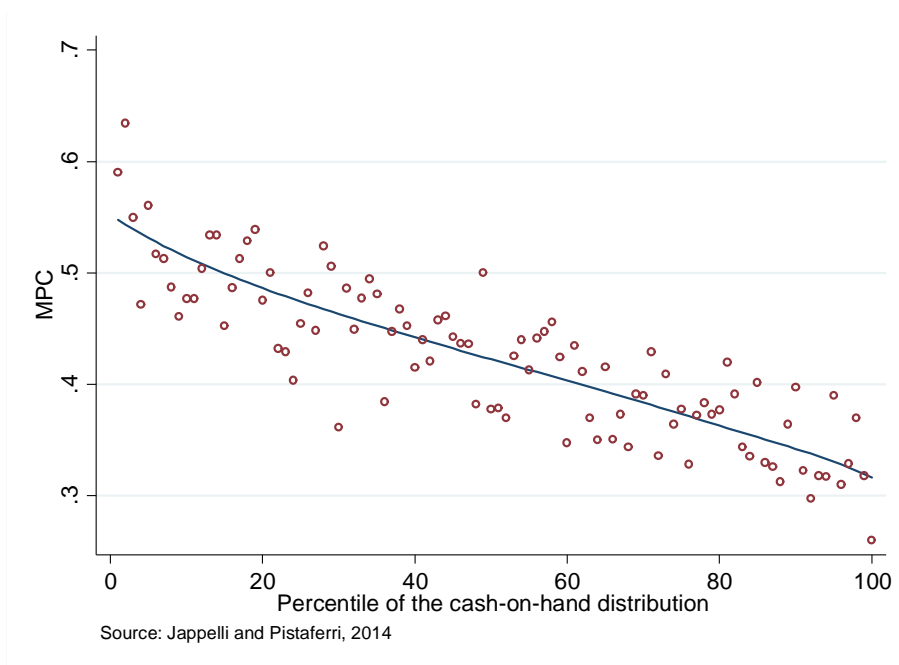
Figure 31: MPC heterogeneity.

A   Appendix

In Figure 32 I plot consumption growth against the consumer confidence index. Clearly, there is a strong association between the two in the pre-recession period. In the post-recession period, consumer confidence drops and remains very low for a long time, hence helping explain the slow recovery in consumption.

Figure 33 shows that the predictions of the simple model of equation (1) tends to be much more accurate for recessions where household leverage is low or there is no build-up in the debt before the downturn.

Figures 34 and 35 report the evolution of the credit availability indexes described in footnote 22.

Finally, Figure 36 shows how aggregate consumption woould have evolved if all US states had consumption growth rates similar to those of low-leverage states in 2007.
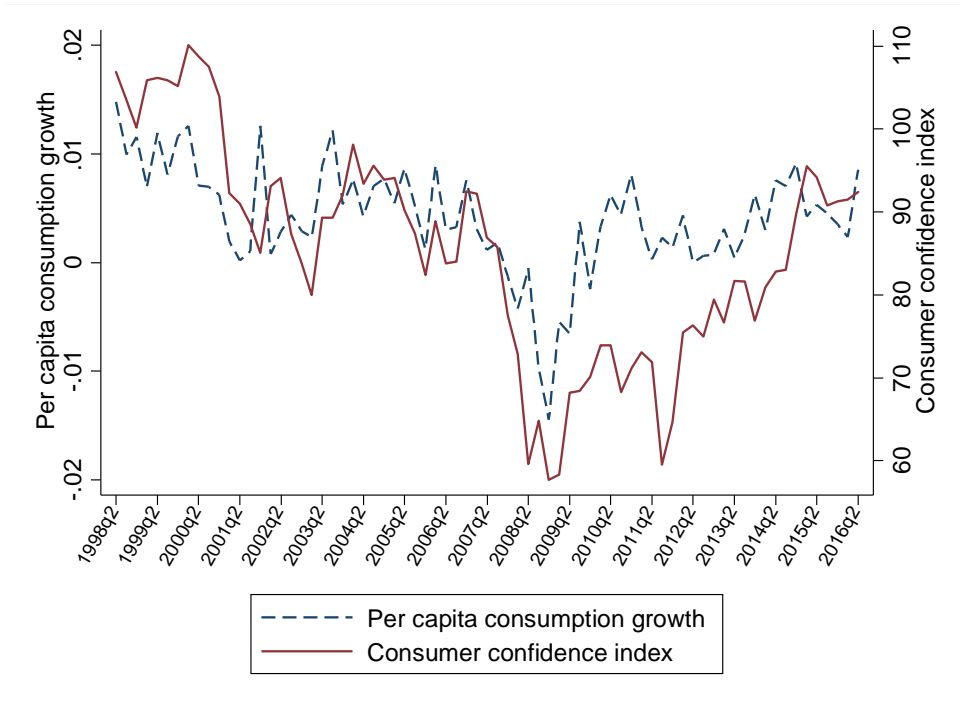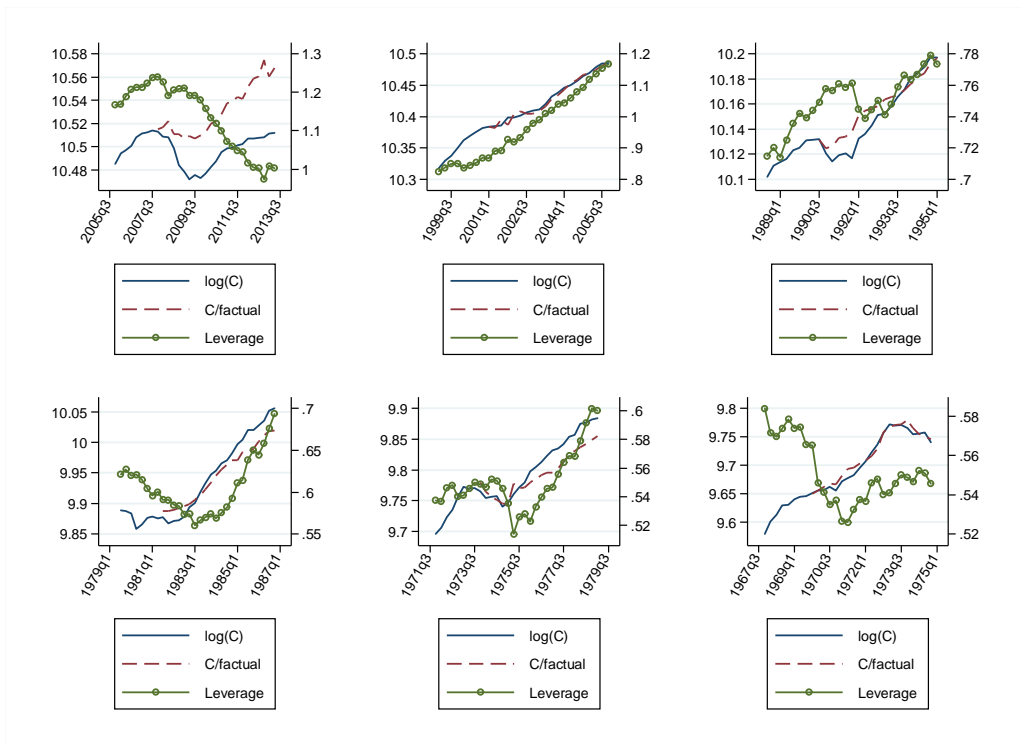
Figure 32: Consumer Confidence and Consumption Growth.

Figure 33: The performance of the prediction model over the last recessions and the leverage ratio.
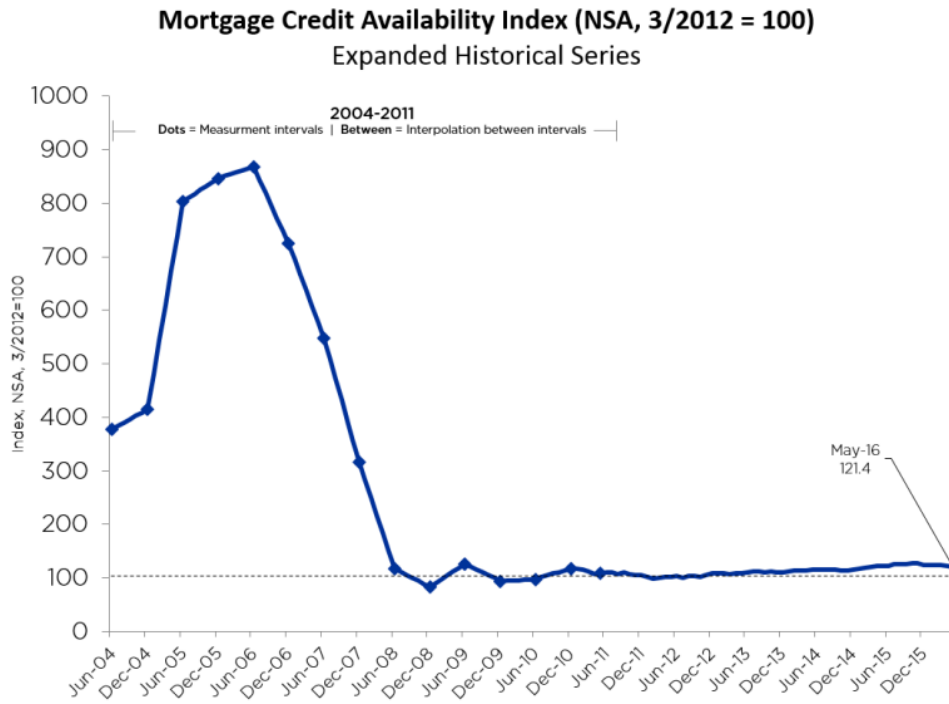
Mortgage Credit Availability Index (NSA, 3/2012 = 100)
Expanded Historical Series

Figure 34: The MCA index constructed by the MBA.

Figure 3: Housing Credit Index

HCI factors
Credit Score
Loan-to-Value Ratio (LTV)
Debt -to-Income Ratio (DTI)
Broker Share
Occupancy Status
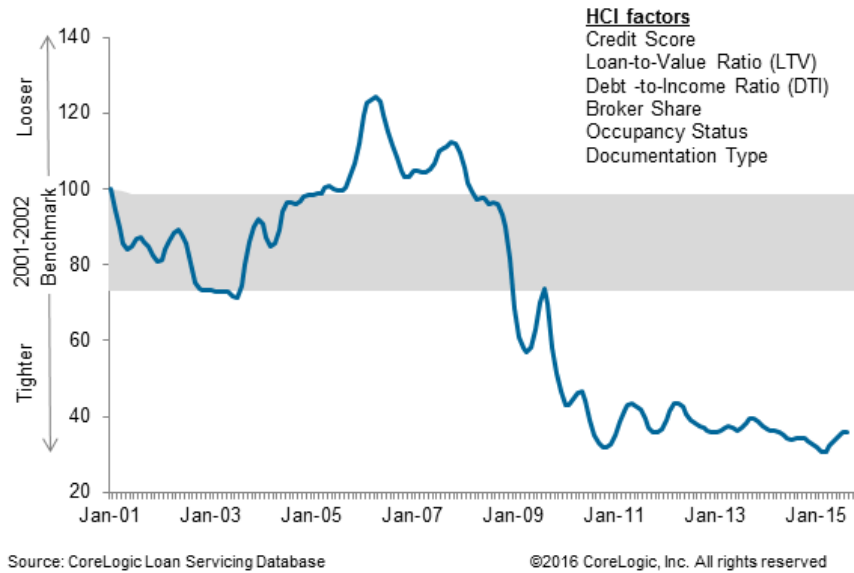Documentation Type

Source: CoreLogic Loan Servicing Database

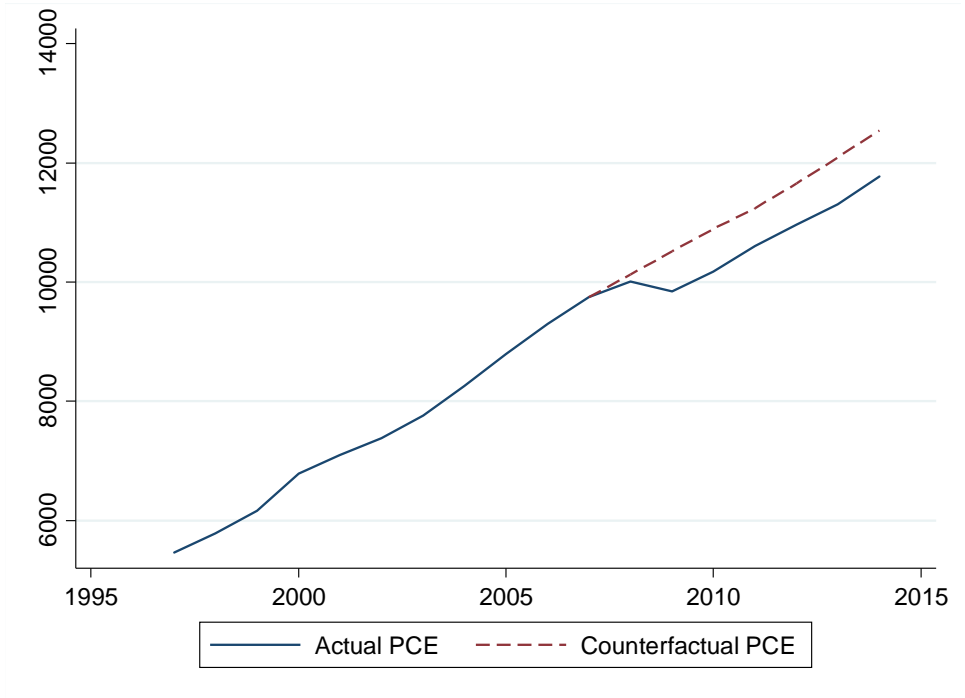Figure 35: The HCI index constructed by CoreLogic.

Figure 36: Assuming states grow at the same rate as the low-leverage ones.