

## **Is A Household Debt Overhang Holding Back Consumption?**

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The recent plunge in U.S. home prices left many households that had borrowed voraciously during the credit boom highly leveraged, meaning that they had very high levels of debt relative to the value of their assets. Analysts often assert that this “debt overhang” created a need for household deleveraging that, in turn, has been depressing consumer spending and impeding the economic recovery. This paper uses household-level data to examine this hypothesis. I find that highly leveraged homeowners had larger declines in spending between 2007 and 2009 than other homeowners, despite having smaller changes in net worth, suggesting that their leverage weighed on consumption above and beyond what would have been predicted by wealth effects alone. Results from regressions that control for wealth effects and other factors support the view that excessive leverage has contributed to the weakness in consumption. I also show that U.S. households, on the whole, have made very limited progress in reducing leverage over the past few years. It may take many years for some households to reduce their leverage to pre-crisis norms. Thus, the effects of deleveraging on the economy may persist for some time to come.

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## 1. Introduction

The bursting of the U.S. housing bubble inflicted enormous damage on household finances. Besides contributing to a significant decline in the net worth of homeowners, the plunge in home prices left many of those that had borrowed voraciously during the credit boom highly leveraged, meaning that they had very high levels of debt relative to the value of their assets. Analysts often assert that this “debt overhang” created a need for household deleveraging that, in turn, has been depressing consumer spending and impeding the economic recovery.

The past few years have indeed seen both a sizable decline in aggregate household debt and weak growth in aggregate consumer spending. However, the nature of the relationship between these two developments is not well understood. According to the simplest models used by economists, a household’s consumption is determined by its income (actual and expected), wealth, preferences, and the return it earns on saving. In slightly more refined models, the uncertainty faced by a household and its ability to borrow play a role. However, debt does not typically exert an independent influence on consumption in traditional models; rather, borrowing is presumed to vary with consumption, as the latter rises and falls in reaction to changes in its determinants.

The traditional framework points to many factors that may be contributing to the lackluster performance of consumer spending in recent years. Wealth losses, weak income growth, limited availability of credit, as well as a more uncertain and pessimistic outlook for future income would all be expected to have depressed spending. Within the traditional framework, the observed decline in debt over the past few years would be interpreted as the result of weak consumption growth rather than a driving force in and of itself.

This paper asks whether a need to reverse the run-up in leverage that arose from the credit boom and subsequent collapse in home prices is in fact contributing to the recent weakness in consumer spending. To test this deleveraging hypothesis, I look at whether the households with the greatest mortgage leverage several years ago have reduced their spending the most, all else equal. I use household-level data so that I can control for other factors that might have led highly leveraged households to have different patterns of consumption relative to their counterparts with less leverage.

High levels of debt and leverage might have had an independent influence on consumer spending for several reasons. First, some households may target a given level of leverage; the sharp rise in leverage that occurred with the slump in house prices may have induced these households to pare back their consumption in order to pay down debt. Second, financial institutions are typically less willing to lend to households with higher levels of leverage. As a result, the rise in leverage has impeded some households from borrowing more to finance consumption and has prevented other households from raising their discretionary cash flow by refinancing into lower-rate mortgages.

To set the stage for my analysis of deleveraging, I begin by examining how some households ended up with so much leverage in the first place. I find that, as of 2007, homeowners in states that had experienced the most pronounced housing booms tended to have considerably more mortgage debt than homeowners in other states. However, even the most indebted of these households did not appear excessively leveraged because they had seen so much home price appreciation. In other words, they appeared to have fairly solid balance sheets under the assumption that house prices would remain flat or increase going forward. In the end, of course, these homeowners were left in a precarious situation when the house price growth proved to be a bubble—with mortgages that often exceeded the value of their homes, they had limited (if any) ability to borrow more, refinance, or sell their homes in the face of a shock to income that made it difficult to make their (relatively high) mortgage payments.

Following the bursting of the housing bubble, highly leveraged households had larger declines in spending than their less-leveraged counterparts despite having smaller changes in net worth, suggesting that their leverage weighed on consumption above and beyond what would have been predicted by wealth effects alone. Results from regressions that control for wealth effects and other factors that might have influenced consumption are consistent with this view. Not surprisingly, highly leveraged mortgage borrowers also had more difficulty meeting their loan payment obligations in the wake of the house price bust, with nearly a fifth of them no longer homeowners by 2011.

The most similar study of deleveraging to date is a paper by Mian, Rao, and Sufi (2011), which compares spending patterns across counties with different average degrees of household leverage. That paper finds that retail sales dropped much more sharply in counties with higher leverage. One challenge in interpreting these results is that the counties with the most leverage also tended to be the counties with the largest house price declines, such that a powerful wealth effect, in addition to any deleveraging effect, should have been depressing consumption in these areas. My paper goes beyond the Mian, Rao, and Sufi analysis to show that high leverage appears to be associated with weak consumption growth even after accounting for wealth effects.

The limitations of my data source make it difficult to quantify the precise effects of deleveraging on the macroeconomy. However, using data that extend through 2011, I show that U.S. households, on the whole, have made very limited progress in reducing leverage over the past few years. Important financial strains persist, as evidenced by the fact that there was essentially no reduction between 2009 and 2011 in the share of homeowners reporting that they were somewhat or very likely to have problems making their mortgage payments over the coming year.

## 2. Background

### *The Household Debt Crisis and the Macroeconomy*

The lackluster economic recovery during the past two-and-a-half years has spurred discussion about whether the United States will experience a “lost decade” as Japan did following the bursting of its own property-price bubble in the early 1990s. Reinhart and Rogoff (2009) present evidence that the weakness in the U.S. economy is likely to persist for a very long time.

Examining a large number of severe financial crises in developed and emerging economies, Reinhart and Rogoff document that economic slumps tend to be deep and protracted following such crises. With the authors noting that it is “beyond contention that the [recent] U.S. financial crisis [was] severe by any metric” (page 467), the implication is that our economy will share a similar fate.

Household debt plays a key role in the narrative supporting this view. The amount of outstanding consumer loans and, especially, residential mortgage loans rose significantly in the United States during the credit boom in the early and middle part of the last decade (Figure 1). The subsequent sharp increase in problems making mortgage payments, which began before the economy fell into recession and joblessness rose, suggested that many households took on more debt during the boom than they could sustain over the long run. Although rapid rising home prices meant that mortgage leverage—as captured by the aggregate mortgage loan-to-value ratio—barely budged for much of the credit boom, it rose sharply after home prices turned down in mid-2006 (Figure 2). Many analysts think that this “debt overhang” and the ensuing process of deleveraging have held back consumption and the broader recovery over the past few years and will remain a headwind against economic growth for some time to come.

It is important to explore the veracity of this narrative. As policymakers gauge whether additional fiscal and monetary stimulus might be justified, they need to understand how the still-elevated level of aggregate household leverage bears on the underlying strength of the economy. Moreover, better understanding the implications of high leverage might shed light on the benefits of specific policy interventions. For example, Gagnon (2011) and others have argued that we need to improve programs that allow underwater borrowers to refinance so that more households can benefit from the low mortgage rates that have resulted from accommodative monetary policy. Other analysts have advocated reducing mortgage principal in order to revive the economy (see, for example, Goodman, 2011).

### *What is the Relationship between Household Debt and Spending?*

In the simplest models used by economists, households can borrow as much as they wish, and a household’s spending at any given time is based on its expected lifetime resources, interest rates, and tastes. This level of spending, together with a household’s current income, determines its current saving or dissaving (borrowing). If incomes are expected to rise over time until retirement, as they typically do, households in this constraint-free world will tend to take on debt,

on net, when young, move into positive net worth as they age, and then run down their net worth in retirement. Of course, evidence suggests that in the real world many households cannot borrow as much as they wish. These constrained households may have to accept levels of consumption that are low relative to their lifetime resources at some points in their lives.

Even households with positive net worth often choose to hold some debt. This behavior arises in part because of the convenience of using credit cards, but more significantly when a household wants to own a home and its desired housing services correspond to a property with value exceeding the household's wealth. In this case, the household not only has a motivation for borrowing but also can use the home as collateral in order to create an ability to borrow that would not otherwise exist.

Two factors appear to have been especially important to the rapid growth of U.S. household debt in the early and mid-2000s. First, financial innovation continued to broaden households' access to credit and lower the cost of credit for households that already had access, with the process (which had been underway for decades) in some ways accelerating over the period, amid lagging financial regulation.<sup>1</sup> For example, nontraditional mortgages became popular, which allowed households with lower or more variable incomes, less wealth, and weaker credit records to obtain mortgages. Second, and perhaps relatedly, rapid house price appreciation fueled growth in mortgage debt and other household debt. Most notably, higher home prices increased desired spending via a wealth effect, and some of that higher spending was financed by borrowing.<sup>2</sup> Moreover, higher house prices increased the collateral against which constrained households could borrow in order to finance their desired spending.

A household's leverage is often measured by the ratio of its debt to its assets, or, in work focusing on housing, the ratio of a homeowner's mortgage balance to the value of the underlying home. The use of such measures probably reflects in part lenders' emphasis on these ratios when setting the interest rate on loans or determining their willingness to lend altogether. In any case, such measures are closely related to the traditional leverage ratio of assets to net worth used in the corporate finance literature. If  $D$  represents debt,  $A$  represents assets, and  $NW$  represents net worth, then:

$$\frac{D}{A} = 1 - \frac{1}{\frac{A}{NW}} . \quad (1)$$

Economic theory suggests that household spending and balance sheets should have changed in several ways in response to the one-third drop in national-average home prices since their peak

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<sup>1</sup> See Dynan (2009).

<sup>2</sup> Although homeowners who experience house price appreciation also experience an increase in their future housing costs, they see an increase in their net lifetime resources if they plan to downsize in the future (and do not fully internalize any increase in housing costs for their children).

in mid-2006. The direct effect of the decline in home prices was a drop in household assets and net worth with no change in debt, leaving households more leveraged than before the price drop. The loss in wealth should have led households to spend less and therefore save more out of their current income; over time, that higher saving should push net worth back up again. Further, there are two reasons to expect that this rebuilding of wealth following the decline in home prices should have led to lower debt. First, lower household spending—on consumer goods and services as well as homes—would be generally associated with a reduced desire to borrow to finance such spending. Second, homeowners had a reduced capacity to borrow because the decline in home prices means that they have less collateral against which to do so.

The point is that traditional wealth effects alone should have led to an endogenous reduction in debt. Debt also probably fell endogenously for other reasons. In particular, weak income growth as well as uncertainty and pessimism about future income prospects likely damped consumer spending and, in turn, depressed the need to borrow to finance that spending.

However, some part of the decline in household debt may have been driven by the high levels of debt, leverage, and debt service themselves. Households that experienced a sharp increase in leverage when home prices declined might simply have been uncomfortable with being so leveraged. Other households may have felt the need to reduce debt because their debt-service obligations increased to unsustainable levels after low time-limited “teaser” interest rate obtained at origination expired. When house prices are stable or rising, borrowers with teaser rates can typically refinance into new low-rate their loans before seeing their interest rate increase, but borrowers that fell into negative equity with the home price decline would not have been able to do so. Further, households’ discomfort with their recent level of leverage and debt service obligations may have been exacerbated by the heightened probability of job loss; such a dynamic has been formalized recently in a model presented by Carroll, Slacalek, and Sommer (2012).

Lender behavior—in conjunction with high levels of leverage—may also have contributed to the decline in household debt. Households with high leverage (and high debt service obligations) generally have more difficulty obtaining loans from financial institutions and have had particular difficulty in recent years because of the sharp tightening of loan standards in the wake of the financial crisis. Although credit conditions have been gradually thawing over the past couple of years, the supply of credit remains considerably more restrictive than normal, particularly for mortgages.<sup>3</sup>

These considerations might help explain both the low levels of new borrowing and (in some cases) the high rate of loan default in recent years.<sup>4</sup> Further, some of these considerations—if they have weighed heavily enough on households—may have provided an additional motivation to reduce spending and raise saving beyond that related to changes in wealth and the other

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<sup>3</sup> See Bernanke (2012).

<sup>4</sup> See Bhutta (2012), Woodward and Hall (2012), and Dynan (2011) for a discussion of how the decline in aggregate debt owes to both depressed new borrowing and high rates of default.

traditional determinants of consumption. Yet, the empirical aggregate consumption functions used by policymakers traditionally do not include debt or leverage as an explanatory variable, capturing balance sheet considerations solely by including aggregate net worth (see Dynan, 2012). It is important to explore, then, whether high debt and leverage might be having an independent influence on consumption in order to assess whether the traditional approach might be leading analysts seriously astray.

### *Previous Literature*

Relatively little attention was given to household debt issues prior to the recent crisis. Much of the literature was focused on whether credit constraints explained the excess sensitivity of aggregate consumption to aggregate income (see, for example, Ludvigson, 1999). At the household level, Johnson and Li (2007) found that the consumption of households with low liquid assets and high debt service burdens was more sensitive to income than the consumption of households with just low liquid assets. There was also some interest in the role of appreciating homes as collateral for borrowing-constrained households, particularly as house prices began to rise rapidly early in the 2000s (see, for example, Iacoviello, 2005, and Disney, Bridges, and Gathergood, 2010). But, some research from previous decades did give heed to the possible role of household debt in economic downturns. For example, Mishkin (1977) argued that fears of excessive debt-service burdens induced a deleveraging that contributed to the severity of the 1973-75 recession.

Much more research has been focused on household debt, particularly mortgages, since the financial crisis. This newer literature includes papers that look at the early rise in defaults among subprime borrower (Mayer, Pence, and Sherlund, 2009), the interplay between the borrower's choice to default and the lender's choice to modify, (Foote, Gerardi, Goette, and Willen, 2009), strategic defaults among underwater borrowers, (Bhutta, Dokko, and Shan, 2010), and the relationship between defaults and securitization (Keys, Mukherjee, Seru, and Vig, 2010). The research has yielded a number of interesting and important findings.

Yet, nearly all of the more recent work has used mortgage records or credit bureau data. Those data sources have shed light on important issues regarding the crisis, but they have their shortcomings. Most notably, the background information about the debt holders is typically limited to what one would find on a loan application. Researchers have partly mitigated this problem by merging additional data such as average income by zip code, but the potential for such merges is limited and the information is still not household-specific. An important strength of the household survey data set used in my analysis is that it provides rich background information about the borrowers that I study.<sup>5</sup>

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<sup>5</sup> Stafford, Gouskova, and Chen (2012) use data from the same household survey to study the factors that have precipitated mortgage distress in recent years.

In addition, most of the past work has been backward-looking, aimed at exploring the causes of credit distress. There has been fairly little work that ties credit distress and, especially, deleveraging to economic activity.<sup>6</sup> Two notable exceptions are papers by Mian and Sufi (2011) and Mian, Rao, and Sufi (2011), which look at employment and spending patterns in counties with different degrees of leverage on household balance sheets. One limitation of these papers is that the counties with the most leverage also tend to be the counties with the largest house price declines, such that the degree to which their finding of soft recent economic activity reflects a special deleveraging effect as opposed to traditional wealth effects is unclear.

### **3. Data Source**

#### *The Need to Use Micro Data*

U.S. statistical agencies publish timely estimates of aggregate household debt and related variables at a quarterly frequency. However, these data have limited value for understanding the causes and consequences of the household debt crisis. In particular, the aggregate measures may not adequately capture important debt-related pressures in sub-groups of the population. For example, the 2002-2006 increase in aggregate household debt shown in Figure 1, though more concentrated over time, was no larger in magnitude than the rise over the preceding two decades, which did not have particularly pernicious consequences. Indeed, the earlier rise in debt likely benefited households by allowing them to better smooth their consumption over the business cycle and over the lifecycle. A key difference between the rise in debt in the early to mid-2000s and that in earlier decades was that the latter was fairly spread out across the population (Dyran, 2009), whereas the former saw concentrations of households taking on very large amounts of debt (see, for example, Mayer, Pence, and Sherlund, 2009). Because the aggregate data essentially masked this trend, policy analysts who took the traditional approach of focusing on aggregate measures greatly underestimated the amount of risk building up in the financial system prior to the crisis.

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<sup>6</sup> Another strand of more forward-looking work considers how households are adjusting their balance sheets as they deleverage. See Brown, Haughwout, Lee, and van der Klaauw (2011) and Bricker, Bucks, Kennickell, Mach, and Moore (2011).

Looking beyond the aggregate data is likely to be equally important in assessing the nature and implications of the deleveraging that has occurred since the bursting of the credit bubble. For example, the recent behavior of the aggregate saving rate might suggest that deleveraging is not an important force holding back consumer spending. The saving rate has, in fact, risen in recent years—from just below 1½ percent at its low point in 2005 to an average of 4½ percent over the past year (Figure 3). But, given the conventional wisdom that the marginal propensity to consume out of wealth is between 3 and 5 cents on the dollar (Carroll, Otsuka, and Slacalek, 2011), the decline in household net worth *alone* would predict an increase on the order of 4 to 6.5 percentage points—much higher than the realized increase.<sup>7</sup> Absent other factors, deleveraging, if important, should have raised the saving rate yet further. Accordingly, skeptics argue that the observed rise in the saving rate is too small for deleveraging to have been an important force.

The problem with such arguments is that many factors are currently affecting consumption and saving, some of which—including low interest rates and consumption-smoothing in the face of transitory disruptions to income—are probably boosting consumption and reducing saving.<sup>8</sup> Aggregate data likely offer too little variation to identify any independent effect that deleveraging might have had on consumer spending. In addition, because aggregate data do not provide a good picture of the financial situation of the most-indebted households, they also cannot tell us how much more deleveraging is to come. Given the importance of these issues for the prospects of the U.S. economy, it is essential to study deleveraging with household-level data.

### *The Panel Study of Income Dynamics*

This paper uses household survey data from the *Panel Study of Income Dynamics* (PSID) to examine the household-level underpinnings of the run-up in borrowing and subsequent deleveraging. This survey collects a rich set of background information from its participants that can shed light both on what led some households into such precarious financial positions and what, if anything, they have done subsequently to reduce debt and rebuild their net worth. The resulting findings are thus a complement to the existing body of micro-data research on the mortgage crisis, nearly all of which is based on administrative financial data records where the background information is largely restricted to what is on a loan application.

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<sup>7</sup> See also Davis and Palumbo (2001), who estimate time-series models of consumption and conclude that consumption rises by 3 to 6 cents for every dollar that wealth increases.

<sup>8</sup> Another factor that might be coming into play is the distribution of income. Using data from tax returns, Saez (2012) showed that the share of income going to the top decile fell, on net, between 2007 and 2010 (taking back a small portion of the substantial rise seen since the early 1980s). Because high-income households tend to have higher saving rates, this trend would tend to raise consumption and lower the aggregate saving rate.

The PSID is a panel survey of households. Households participating in the PSID were surveyed every year when the survey began in 1968, but beginning with the 1995 wave, the frequency was changed to every other year. The most recently released full wave contains information from about 8,000 interviews conducted in 2009. In February 2012, a very limited set of preliminary data from the 2011 wave of the PSID was released, including the information needed to construct net worth as well as the results from a special module on foreclosures and mortgage payment problems. The documentation cautions that these data are subject to revision, but, given the importance of using timely information for the questions at hand, I make use of them in the analysis below.

The PSID contains fairly extensive information about mortgages on primary residences as well as loans used to finance motor vehicle purchases. Balances on other common types of household debt—such as credit cards, student loans, medical and legal bills, and loans from relatives—were reported as a group until 2011, when the questionnaire was changed to collect more detail.<sup>9</sup> The PSID also has some information about assets and about net equity in businesses, vehicles, and second homes, so one can create a limited measure of households' net worth.<sup>10</sup> Expenditures on food and a few other items are available for most waves of the survey; questions about many more categories of spending were added between 1999 and 2005 such that a broad (though still not complete) measure of consumption can be constructed for the 2005, 2007, and 2009 waves. The special module on foreclosures and mortgage payment problems first appeared in the 2009 survey.

I calculate the mortgage debt of each household as the sum of the balances of any first and second mortgages on its primary residence. I calculate consumer debt as the sum of outstanding balances on up to three vehicle loans (backed out from information on the original balance of the loans and the payment history) plus the reported sum of balances on other types of consumer loans. Debt service obligations are derived from information on required loan payments, except for the “other loan” category where, because much of this debt is presumably credit card debt, I follow the Federal Reserve's convention of assuming the required monthly payment is 2.5 percent of the balance.<sup>11</sup> I calculate the net worth of each household as the sum of the values of its primary residence, its private annuities and individual retirement accounts, any other stocks or bonds it holds, its mutual fund and bank accounts, and its net equity in businesses, vehicles, and second homes—minus the household's mortgage debt and its non-vehicle-related consumer debt.

For income, I use total family income before taxes, as information about after-tax income is not available. I set non-housing consumption equal to the sum of spending on vehicles, vehicle-

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<sup>9</sup> I aggregate the more detailed 2011 information such that I have a total non-mortgage debt figure for each household that is conceptually equivalent to that provided in earlier waves. In principle, there is no reason to expect an important series break, but, of course, one always needs to use caution in interpreting patterns when survey questionnaires change.

<sup>10</sup> The survey asks for very little information about pensions and retirement saving. It also excludes some more unusual types of assets and liabilities.

<sup>11</sup> See <http://www.federalreserve.gov/releases/housedebt/about.htm>.

related items, gasoline, transportation, furniture, clothing, tuition, other-school related items, and food (both at home and away from home). One complication is that the time period over which the expenditures are supposed to be reported varies by category, from “an average week” to the previous month to the previous year. In constructing a non-housing consumption measure, I adjust spending for all of the components to be on an annual basis and add them together, essentially ignoring the time mismatch.<sup>12</sup>

I augment the PSID data with state-level information in order to better capture the macroeconomic conditions faced by each household. Specifically, I add state unemployment rates as well as indexes of state house prices produced by CoreLogic, a private firm that collects and distributes consumer, financial, and property information.

One longstanding issue confronting researchers using household-level wealth data is the treatment of outliers. The distribution of wealth in the United States is highly skewed, with a long right tail. As a result, extreme values will tend to have an undue influence on means and results from ordinary least squares regressions. Measurement error in wealth data and small sample sizes further reduce the usefulness of such analyses. For these reasons, I focus mainly on medians in the analysis of summary statistics below and apply a transformation that downweights the influence of outliers in the regression analysis.

The calculations presented throughout the paper are based on weighting the PSID observations. I use the longitudinal weights provided by the PSID for the core sample of households combined with the additional sample of immigrant families.

#### *Summary Statistics on Household Balance Sheets and Consumption*

Table 1 shows some summary statistics for the households in the sample. All responding households from each wave are included, although, for some variables, such as consumption and net worth, some observations are missing because the household did not report full data for the variable or its components. As discussed above, I show medians instead of means so as to avoid the influence of unduly large readings, particularly for balance sheet variables. Accordingly, the results describe the experience of the typical household rather than the average household. While the means, in principle, might be more telling about aggregate conditions, they are unlikely to actually be representative given the relatively small numbers of wealthy households in the PSID sample.<sup>13</sup>

The movements in the variables between waves of the PSID are broadly consistent with other information on economic developments in recent years. Median before-tax family income moves

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<sup>12</sup> The exception is vehicle expenses, for which I include unannualized spending for the year to date. An alternative is to use spending for the previous calendar year, but that choice would have made the data less timely and thus less useful in identifying any recent effects of deleveraging.

<sup>13</sup> For precisely these reasons, the *Survey of Consumer Finances*, which is viewed as the most representative of U.S. household wealth surveys, oversamples rich households.

up between the 2005 and 2007 waves, corresponding to an increase in income between calendar years 2004 and 2006, and moves up again (a bit) between the 2007 and 2009 waves, corresponding to calendar years 2006 and 2008; aggregate personal income, as published in the National Income and Product Accounts (NIPA) also rose over those spans.<sup>14</sup> Median non-housing consumption rose between 2005 and 2007 but reversed that gain between 2007 and 2009, falling 8 percent; aggregate NIPA consumption also rose between 2005 and 2007 and then edged down between 2007 and 2009. The larger decline seen in PSID consumption may reflect the fact that the median household did worse than the average household during the recession; it may also reflect the fact that my measure excludes less discretionary items like payments for utilities and health care. Median net worth rose considerably between 2005 and 2007, but plunged over the next two years; aggregate household net worth, as published in the Flow of Funds Accounts, showed the same general pattern, though less-pronounced changes.

The homeownership rate in the PSID sample fell between 2005 and 2007, and again between 2007 and 2009. The median reported home value rose 18 percent between 2005 and 2007 and then reversed two-thirds of that gain between 2007 and 2009. Although this pattern is consistent with households recognizing a boom and bust in home prices, the timing differs from that seen in direct data on home prices. The CoreLogic national index of home prices peaked in April 2006 and, by mid-2007, was just 2 percent above its reading two years earlier. Between mid-2007 and mid-2009, the CoreLogic index declined 24 percent. On face value, this comparison suggests that households adjust their views of the values of their homes with a lag, or perhaps are too optimistic in general. However, a more complete analysis is needed before drawing strong conclusions.<sup>15</sup>

The credit cycle seen in aggregate data appears to some extent in the PSID data as well. The fractions of households in this sample holding mortgage debt and vehicle debt fell between 2007 and 2009. Median vehicle debt for households holding such debt also declined between 2007 and 2009, but median mortgage debt for households with mortgage debt increased over that period. The latter pattern may reflect new homeowners, who tend to purchase smaller houses, being shut out of the market—indeed, Bhutta (2012) concludes that first-time homebuying has been very weak, especially for households with less-than-excellent credit scores. It may also reflect the possibility that the credit crunch was felt mostly in the tails of the distribution, at least at the beginning.

The table also shows some clear limitations of the data. In particular, the fraction of households holding mortgages, at just over 40 percent is considerably below the roughly 50 percent figure that shows up in the *Survey of Consumer Finances* (SCF), which is widely considered to be the

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<sup>14</sup> Even though the recession began in December 2007, the first annual decline in NIPA personal income was between calendar years 2008 and 2009.

<sup>15</sup> Since the findings in this paper are based on what households perceive their home values to be, they may be more telling about household behavior than results based on actual home value data. On the other hand, the findings here may be less useful for macroeconomic forecasters who base their outlook on actual home values.

best available data on U.S. household balance sheets. Moreover, median net worth is only about half as large as in the SCF. The latter discrepancy likely owes in large part to the fact that the PSID collects data on only a limited part of total household wealth. Indeed, Bosworth and Smart (2009) present a thorough comparison of the PSID and the SCF and conclude that, once put on a comparable basis, the wealth measures in the two surveys are very similar through the 95<sup>th</sup> percentile of the wealth distribution.

Another issue raised by Table 1 is that median nonhousing consumption seems low relative to median before-tax income. Again, the explanation may be the limited scope of the questions. Li, Schoeni, Danziger, and Charles (2010) find that the information from many of the consumption categories added since 1999 compares favorably with estimates from the *Consumer Expenditure Survey*. In any event, to the extent that the movements in these partial measures are correlated with movements in more comprehensive measures, the results presented below should generalize to consumption as a whole.

#### **4. Household Debt and Spending during the Credit Boom**

To lay the groundwork for the analysis of deleveraging, I examine households' experience in the period leading up to the crisis, so as to shed more light on why households accumulated so much debt during the boom. Table 2 compares households in the top quintile of leverage as of 2007 with those with lower leverage. Given that rapidly rising home prices in some parts of the country were thought to have been a key precipitating factor for the credit crisis, I divide households into three groups that might be expected to have very different responses to this trend: non-homeowners, homeowners residing in states in the top quartile of house price appreciation between 2000 and 2006 (henceforth known as "boom states"), and homeowners residing in other states (henceforth known as "non-boom states").<sup>16</sup> Households with retired heads are excluded from the comparison because I normalize some variables by current household income, which is often hard to interpret for retirees. The sample is also restricted to households that had a complete set of interviews for the 2005, 2007, and 2009 waves of the PSID.

##### *Pre-crisis Patterns of Leverage among Non-homeowners*

The first two columns of Table 2 present estimates for non-homeowners. For non-homeowners, I define leverage as total debt—which effectively means consumer debt such as auto loans, credit card balances, and student loans—divided by total assets. The median amount of consumer debt for highly leveraged non-homeowners in 2007 was \$20,000, whereas the median amount of consumer debt for other non-homeowners was zero. Along many other dimensions, the two groups summarized in the first two columns look fairly similar. For example, median levels of before-tax income and nonhousing consumption in 2007 were about the same, and both groups

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<sup>16</sup> By this measure, the states with house-price booms were Arizona, California, Connecticut, Florida, Hawaii, Maryland, Nevada, New Jersey, New York, Rhode Island, Virginia, and Washington, DC.

had a few hundred dollars of financial assets at the median. With the increase between 2005 and 2007 in the median ratio of consumer debt to income for the highly indebted group only about one-quarter as large as the median 2007 ratio, it appears that many of the highly indebted have been so for a while. This result could indicate a chronic shortfall of self-control by some households, but it could also reflect fully rational behavior for households that expect their income to be much higher in the future because, for example, they are in a profession where income rises sharply with tenure. Note that highly indebted non-homeowners are considerably more likely to have a college degree than other non-homeowners. More education might increase the credit use of this group in two ways: first, because it is associated with greater access to credit, and, second, because the people with more education tend to have steeper age-income profiles.

#### *Pre-crisis Patterns of Leverage among Homeowners Living in Non-Boom States*

The third and fourth columns of Table 2 correspond to homeowners living states outside the top quartile of house price appreciation during the boom. For homeowners, I defined leverage as mortgage debt for a household's primary residence divided by the value of that residence, all as of 2007. Using this more restricted measure of leverage allows me to retain more households for the analysis, as there are many cases where full data on other types of assets and liabilities are not available.<sup>17</sup> Highly leveraged homeowners in non-boom states tended to be younger and to have (slightly) lower income and smaller homes than other homeowners in those states. At the median, the consumption of the highly leveraged homeowners in those states was a little higher relative to income than the consumption of other homeowners. Both the mortgage debt and consumer debt of the highly leveraged group were considerably higher; at the median, mortgage debt amounted to nearly two years' worth of income for that group versus eight months for less-leveraged homeowners. For the highly leveraged, monthly debt obligations represented 28 percent of pre-tax income at the median, and roughly a fifth of them had become homeowners over the preceding two years.

Relative to two years earlier, the homeowners in these non-boom states who were not highly leveraged look to have been in a stronger financial position, with no increase in debt and an increase in the median ratio of net worth to income of 0.26. In contrast, the highly leveraged group experienced an increase in mortgage debt equal to about three months' worth of income at the median. Even for this group, though, the median ratio of net worth to income increased between 2005 and 2007, and the median ratio of consumer debt to income edged down.

#### *Pre-crisis Patterns of Leverage among Homeowners Living in Boom States*

The most striking comparison in Table 2 is between highly leveraged homeowners and other homeowners in the states with the largest housing booms, shown in the fifth and sixth columns.

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<sup>17</sup> The results are not sensitive to this choice, which is not surprising given that housing assets and liabilities dominate the balance sheets of most PSID homeowners.

The highly leveraged households again tended to be younger, but had considerably less pre-tax income at the median than households in those states that were not highly indebted (\$77,000 versus \$93,000). Yet, median nonhousing consumption for this group was somewhat higher (\$28,000 versus \$25,000). For both the highly leveraged households and other households, housing was a much more important part of the balance sheet than in states that saw lower rates of house price appreciation, with the median mortgage debt and home values in the fifth and sixth columns about double the corresponding figures in the third and fourth columns.

More than a quarter of the highly leveraged homeowners in boom states in 2007 had become homeowners since 2005. Mortgage debt for the group grew sharply between 2005 and 2007, rising by an amount equal to more than a year's worth of income at the median. In part, this pattern reflects new homeowners entering a housing market that was increasingly expensive. However, new homeowners represented only a little more than a quarter of the highly leveraged households in boom states. Other households likely increased their mortgage leverage by extracting equity through home equity lines of credit, by exchanging smaller mortgages for larger ones in "cash-out" refinancing transactions, and by taking on larger mortgages as they turned one home over for the next.<sup>18</sup>

Despite this increase in mortgage debt, the 2007 financial positions of highly indebted households in housing boom states likely seemed solid to those that did not anticipate the housing bust: Median net worth relative to income had risen by 0.13 over the preceding two years, and the median ratio of mortgage balance to home value was 0.84. Note, though, that the typical highly indebted household in a boom state in 2007 had low levels of financial assets relative to other households in those states, and they had debt service obligations that amounted to 34 percent of pre-tax income in 2007—much higher than for households with less debt and for highly indebted households in non-boom states. Such a household would likely have trouble making mortgage payments if faced with an unanticipated disruption to income, but appeared to have a sufficient equity cushion to sell its home and pay off the mortgage should such a shock occur.

In boom states, the highly leveraged homeowners were slightly less likely to have a college degree than those with less debt—in contrast with the pattern for homeowners in other states and for non-homeowners.<sup>19</sup> To the extent that less-educated households are more likely to be lured into taking on precariously high levels of debt because of a lack of financial sophistication, one would expect the difference between the median education levels of highly leveraged people and other people to be the same for homeowners in boom and non-boom states and for homeowners and non-homeowners (all else equal). However, credit access was probably higher for

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<sup>18</sup> Greenspan and Kennedy (2007) estimated that those forms of home equity extraction accounted for about four-fifths of the rise in home mortgage debt since 1990.

<sup>19</sup> The difference is even larger if one separates households according to who took on the most leverage over the past two years. In boom states, 37 percent of the top quintile of households by changes in leverage had a college degree, compared with 45 percent of other households.

homeowners in boom states than for other people, because lenders believed that continued rapid house price appreciation would make it easier for households to meet their debt obligations. Together with a lack of financial sophistication on the part of less-educated people, this effect would produce the pattern observed in these data.

### *The Relationship between Mortgage Leverage and Home Price Appreciation Across States*

The results in Table 2 suggest that homeowners who did not expect home prices to fall sharply may have viewed themselves as in a fairly solid financial position as of 2007. Even the highly leveraged homeowners in states that had seen the largest house price booms appeared to be in decent financial shape under this assumption. Expectations of stable home prices, or perhaps even further appreciation of home prices, may well explain why those homeowners ended up in the position of having relatively high consumption and debt service obligations, as well as low levels of financial assets. However, a cross-state analysis of leverage and home price appreciation illustrates that the financial situation of many homeowners would take a dramatic turn for the worse if home prices were to take back some of their earlier gains.

The three left panels of Figure 4 show actual 2007 mortgage leverage at various points in the distribution (median, 80<sup>th</sup> percentile, 90<sup>th</sup> percentile) in different states plotted against earlier home price appreciation in that state. The size of the circle corresponds to size of the population in the state. I dropped states for which I had 30 or fewer observations on the view that the results based on small sample sizes were less likely to be representative.

The left panels show a slightly negative relationship between actual mortgage leverage in 2007 and earlier home price appreciation. In other words, excessive mortgage debt looked to be less of a problem in states that had experienced more pronounced housing booms. Indeed, in all but three of the states that saw home prices increase by more than 50 percent between 2000 and 2006, homeowners at the 90th percentile of reported leverage would be able to withstand a 10 percent decline in the value of their home without going “underwater” (that is, without seeing their home value fall below the total mortgage balance on that home).

The three right panels of Figure 4 show what the patterns would likely be if home price were to decline to values that reflected only increases at the rate of consumer non-housing inflation since 2000. The numerator of this counterfactual loan-to-value remains the 2007 level of mortgage debt. To construct the denominator, I first estimated what the value of each household’s home would have been in 2000 if its appreciation between 2000 and 2007 matched state-average home price appreciation and then increased the estimated 2000 home value by the rate at which the “all items less shelter” component of the Consumer Price Index grew between 2000 and 2007. As can be seen, these counterfactual measures of leverage are not only much higher, but also increase strongly with the size of the house price boom in each state, particularly at the upper end of the distribution. Homeowners above the 90<sup>th</sup> percentile of leverage are underwater in most states and have leverage ratios that exceed 1.5 in 15 percent of the states.

All told, the results in this section show that the rise in household debt was both concentrated geographically and also concentrated within geographic areas. The rapid rate of home price appreciation in some parts of the country appears to have been centrally related to the increase. The results are also consistent also with the view that the most-indebted households may have ended up in vulnerable situations because they did not appreciate the risk that home prices might take back some of their earlier gains.

## 5. Deleveraging and its Consequences

### *The Post-Crisis Experience of Highly Leveraged Households*

I now turn to the question of what happened to highly leveraged households following the financial crisis and the onset of the recession. The different columns of Table 3 are based on the same households featured in the corresponding columns of Table 2. Households that were highly leveraged in 2007 are again compared to households that had less leverage in 2007, and I again show separate comparisons for non-homeowners, homeowners in states that were in the top quartile of house price appreciation during the housing boom, and homeowners in other states (all as of 2007).

The top panel of the table shows changes experienced by the different groups of households between the 2007 and 2009 waves of the PSID. One feature that stands out is the greater decline in consumption seen by the highly leveraged homeowners relative to their counterparts with less debt. This pattern is particularly evident in the housing boom states, where the consumption of the median household in the highly leveraged group fell by 15 percent—about twice as much as the median for other households. Notably, the larger declines occurred despite high-leverage homeowners seeing more income growth and smaller wealth losses than lower-leverage homeowners. A more refined take on the question comes from comparing the relative movements of the ratios of nonhousing consumption (C) and net worth (W) to income (Y)—the rows shown in bold. For lower-leverage homeowners in housing boom states, at the median, C/Y declined by 0.04 and W/Y declined by 0.83. These figures suggest a marginal propensity to consume out of housing wealth of  $0.04/0.83 = 0.05$ —in line with the estimates often cited by policymakers. For high-leverage homeowners in housing boom states, conventional wealth effects would imply a decline in C/Y equal to the loss in wealth (0.67) multiplied by a typical estimated of the marginal propensity to consume (0.05), or 0.03. However, the median C/Y of these households actually declined by 0.07. It would thus appear that high loan-to-value ratios might have an additional independent important damping effect on consumption. To draw strong conclusions on this point, however, one should control for the various ways in which households that have a lot of leverage might be different from other households; I do so in the next section with regression analysis.

The results in the second panel of the table speak to how mortgage payment problems varied with 2007 leverage. Not surprisingly, highly leveraged households were much more likely by

2009 to have had problems or to anticipate having problems making their mortgage payments. Specifically, in housing boom states, 19 percent of highly leveraged homeowners were behind on their mortgage payments versus 3 percent of other homeowners in those states. The comparable figures for states that saw lower amounts of house prices appreciation during the housing boom were 11 percent and 2 percent. Highly indebted households were also more likely to have experienced a foreclosure filing, to have had their mortgage modified, and to have reported being very or somewhat likely to fall behind on their mortgage payments over the coming year. In both boom and non-boom states, more than a fifth of highly leveraged homeowners as of 2007 moved between 2007 and 2009, more than double the rate for homeowners with less leverage, and 8 to 10 percent had exited homeownership altogether. Those figures suggest that an important way that some highly indebted households reduced their debt was by downsizing or defaulting.

I noted earlier that, for some households, the strains of having large amounts of debt may manifest themselves primarily through the large debt service payments required each month. In a similar analysis comparing homeowners with high debt service obligations relative to their incomes to other homeowners (not shown) I found that the former group also saw more pronounced declines in their consumption between 2007 and 2009. The prevalence of mortgage payment problems was the same or lower for high debt-service burden households as for high leverage households. However, households with high debt service in boom states seemed more likely to *anticipate* distress than households with high mortgage-to-house values ratios, with nearly a third of them reporting that they were somewhat or very likely to fall behind on their mortgage payments over the coming year.

### *Formalizing the Results*

The central question of interest is whether the debt overhang is holding back consumption growth. In particular, I seek to answer whether consumption has shown more weakness than would be expected given the movements in its other fundamental determinants, including the loss in wealth, weak income, and pessimism or uncertainty about future income. The bolded results in Table 3 are supportive of the notion that excessive leverage has had an important additional depressing effect on the consumption of some households. In this section, I test the hypothesis more formally using regression analysis.

The discussion in Section 2 reviewed the traditional determinants of consumer spending and highlighted why debt, leverage, and perhaps, debt service obligations might have an independent influence on spending. All told, those considerations suggest estimating the following equation:

$$\Delta C_{it} = \alpha + \beta_w \Delta W_{it} + \beta_Y \Delta Y_{it} + \beta_{lev} \frac{D}{A_{i,t-1}} + \beta_{dsr} \frac{DS}{Y_{i,t-1}} + \gamma X_{it} + \varepsilon_{it} \quad (2)$$

where  $\Delta C_{it}$  corresponds to the change in the consumption of household  $i$  in period  $t$ ,  $\Delta W_{it}$  to the change in its wealth,  $\Delta Y_{it}$  to the change in its current income (relevant for households that are liquidity constrained or myopic),  $D/A_{i,t-1}$  is its leverage in period  $t - 1$ , and  $DS/Y_{i,t-1}$  is the

fraction of its income going toward debt service payments.  $X_{it}$  is a vector of other variables that might influence household consumption growth such as the interest rate, economic conditions in its state, and demographic factors (which might be correlated with time preference, the risk of job loss, and revisions to expected future income). As in Table 3, the changes represent differences between the 2007 and 2009 waves of the PSID. Both leverage and debt service are measured as of the beginning of the period over which the change is calculated because, presumably, it is the household's *ex ante* level of balance sheet distress that is relevant for its consumption. If the debt overhang did hold back consumption growth between 2007 and 2009 above and beyond what would be typical given movements in the other determinants of consumption, one would expect to see negative coefficients on the debt-related variables.

Several complications present themselves. First, there are models that could produce a negative  $\beta_{lev}$  or  $\beta_{dsr}$  even in the absence of a separate channel related to the degree of leverage or debt burden. Most notably, if time preference rates vary across households, marginal propensities to consume might tend to be higher for low-wealth households because these households are likely to be more impatient. In this case, one would expect low-wealth homeowners to have a larger consumption response to the house price bust. Since debt and, especially, leverage are highly correlated with wealth, the coefficients on these variables would be biased downward. To shed light on whether my results are being biased by such effects, I estimate regressions for the period 2005-2007. Given that house prices rose, on net, over this period, one would expect to see positive coefficients on the debt variables in these specifications if households with low wealth simply have higher marginal propensities to consume; if the coefficients continue to be negative, the results are consistent with the view that high debt tends to damp consumption.

Second, the timing of the data is not ideal for estimating equation (2). Although house prices at the national level had been falling for about a year by the time the 2007 wave of the PSID was launched, they continued to decline rapidly for much of the period between the 2007 and 2009 waves. As a result, the degree of debt overhang that may have induced some households to pare back their consumption between 2007 and 2009 is likely understated by the *ex ante* measures. However, it is undesirable to simply use *ex post* (2009) levels of debt variables in the regression because they may be correlated with the consumption change simply because debt is often used to finance consumption and (relatedly) because the debt variables are endogenous with respect to any deleveraging the household has done. For this reason, I try splitting the sample based on whether the household resided in a housing boom state because those states also tended to see the largest housing busts such that leverage saw a sharper increase. I also try instrumenting 2009 levels of leverage with households' 2007 leverage and 2007-2009 house price growth in their state.

Third, given the noisiness of household data, the small size of the PSID sample is likely to make the estimates imprecise, particularly in cases where I focus on just a subset of the sample. Using broad measures of leverage and debt burden would reduce the sample size considerably because a number of households do not report all of the information needed to calculate total debt, total

assets, or total service obligations. Hence, I focus on mortgage-related measures of debt and assets, which are available for most households.

Finally, I follow a long tradition in the empirical literature examining household-level consumption and finances by using a transformation that downweights large values; Carroll, Dynan, and Krane (2003) provide a formal justification for doing so by showing that the residuals from a linear regression using household data are far from normal. Using log differences in equation (2) is not desirable because it would require dropping households with negative readings for wealth, a group highly relevant to the question at hand. Instead, I take the inverse hyperbolic sine of consumption, income, and wealth before differencing. For a variable  $x_{it}$ , the inverse hyperbolic sine is defined as:

$$\log\left(x_{it} + (x_{it}^2 + 1)^{\frac{1}{2}}\right). \quad (3)$$

Except in the case of very small values, the transformed variable can be interpreted like a logarithmic variable (see Woolley, 2011, and Pence, 2006, for more discussion). The drawback to moving away from a linear specification, however, is that one cannot interpret the coefficients on the income and wealth changes as marginal propensities to consume. For this reason, I estimate some specifications that are more in the spirit of the calculation done for Table 3—dividing the first difference of consumption, income, and wealth by average family income across the 2005, 2007, and 2009 waves of the PSID.

### *Regression Results*

Given that mortgage leverage and mortgage debt service obligations are likely to be correlated, I begin with regressions that include just one measure or the other. Table 4 shows estimates based on equation (2) featuring 2007 mortgage leverage as the debt variable. The dependent variable is the change in nonhousing consumption over the period 2007-2009. In the baseline specification, the inverse hyperbolic sine transformation is applied to consumption, income, and wealth before taking changes, and the changes are also multiplied by 100 so that they roughly corresponds to percent changes. The table shows the estimated coefficients for the leverage measure, the changes in income and wealth, and the change in the unemployment in the household's state of residence; a constant, head age, whether the head has a college degree, the level of income, and the level of the state unemployment rate are also included in the regression, but the coefficients are not shown.

In the baseline specification, the estimated coefficient on the change in income has the expected positive sign and is highly statistically significant. The estimated coefficient on the change in wealth also has the expected positive sign and is highly statistically significant. Conditional on the other variables, the change in the state unemployment rate is not significant, nor is the level of state unemployment rate (which is not shown). One might have expected these variables to have a significant negative relationship with consumption given that Carroll, Slacalek, and

Sommer (2012) concluded that heightened uncertainty about job loss has induced a sizable precautionary saving response that has been weighing on consumption. Most other specifications tried show similar results for the changes in income, wealth, and state unemployment (although I note a few exceptions below).

The estimated coefficient on mortgage leverage in the baseline specification is negative and statistically significant at about the 6 percent level, suggesting that, even after controlling for wealth and other traditional determinants of consumption, higher leverage did indeed weigh on consumption over the 2007-2009 period. At face value, the point estimate, -6.1, suggests the effect could be material: if one interprets the difference in the inverse hyperbolic sine (multiplied by 100) as the percent change, the estimate implies that an increase in a household's mortgage loan-to-value ratio from 1 to 1.10 would have reduced its consumption growth by 0.6 percentage point over this two-year period, or 0.3 percentage point per year.

In column (2), I replace the changes in consumption, income, and wealth with the first-difference divided by average income over the 2005-2009, multiplied by 100. Unfortunately, the coefficient on the change in wealth is not precisely estimated, so the data are not helpful in uncovering the average marginal propensity to consume out of wealth. At 0.005, the point estimate on the change in wealth looks small relative to the conventional belief that the marginal propensity to consume out of wealth is a few cents on the dollar (or even more), but the estimated coefficient is likely attenuated by measurement error in the PSID wealth data.<sup>20</sup> Mortgage leverage again has a negative sign, but it is not statistically significant.

Columns (3) through (5) present estimates of the baseline specification for different subgroups of the PSID sample. Starting with the homeowner sample, which is about 40 percent smaller than the full sample, the estimated coefficient on mortgage leverage is similar to that in the baseline specification. However, it is only statistically significant at the 18 percent level because the standard error is much larger, which would be expected given the smaller sample size. Likewise, the standard errors are yet larger when the homeowner sample is split by whether the household resided in a state in the top quartile of house price appreciation between 2000 and 2006. Although not statistically significant, the estimates in columns (4) and (5) suggest that leverage weighed much more on consumption in housing boom states than in other states.<sup>21</sup> This pattern may reflect the fact that *ex ante* leverage understates any leverage-induced distress by more in the boom state since the subsequent house price depreciation was larger in those states. I return to this issue with columns (7) and (8).

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<sup>20</sup> Using a median estimator instead of OLS reduced the standard error by about half, but had little effect on the magnitude of the coefficient on the wealth term. Restricting the coefficient on the wealth term to equal 0.05, a more conventional estimate of the marginal propensity to consume, has little effect on the other estimation results.

<sup>21</sup> This pattern for boom and non-boom states shows up consistently in many variants on the specification shown here.

I next vary the measure of leverage. In column (6), I replace mortgage leverage with a dummy variable indicating whether a household is in the top quintile of mortgage leverage; the estimate on this dummy is negative and statistically significant at the 9 percent level. In column (7), I replace 2007 mortgage leverage with 2009 mortgage leverage. As discussed above, given that much of the house price bust occurred after the 2007 wave of the PSID, the *ex post* measure should better capture the mortgage distress relevant to the 2007-2009 change in consumption. However, the problem with the *ex post* measure is that, to the extent that credit was still flowing over this period, some households likely borrowed more over the period in order to increase their consumption. For these households, one might expect a positive relationship between *ex post* leverage and consumption. It is perhaps not surprising, then, that the estimated coefficient on leverage in this specification falls (in an absolute sense) to around 0. In column (8), I attempt to circumvent the bias induced by the endogeneity of debt with respect to consumption by instrumenting 2009 leverage with 2007 leverage as well as state-level house price growth. In this specification, the estimated coefficient is a bit higher than in the baseline, at -7.8, and statistically significant at the 6 percent level.

Column (9) shows the results when the regression is estimated for the 2005-2007 change in nonhousing consumption. One interpretation of my results thus far is that leverage itself somehow damps consumption, but an alternative explanation for the negative coefficients on leverage for the 2007-09 period is that low-wealth households are more sensitive to wealth changes and that higher leverage is simply proxying for lower wealth. If this alternative explanation were correct, however, one would expect a positive coefficient on the leverage variable over the 2005-07 period when wealth was rising. The data speak against this alternative, as the coefficient and standard error on the leverage term are quite similar to that in the baseline case for the 2007-09 period. Most other coefficients in the two regressions are also similar, although the estimated coefficient on the change in the state unemployment rate is much larger and statistically significant at the 9 percent level for the 2005-07 regressions. Column (10) shows the results when the data are pooled (with a dummy variable for observations from the 2009 wave added); the estimated coefficient on leverage is -5.5 and statistically significant at the 2 percent level.

Table 5 presents regressions where the debt variable is the 2007 mortgage debt service burden, defined as the ratio of annual mortgage debt service obligations to pre-tax household income. All other features of the baseline specification are the same. The estimated coefficient on the debt service burden in the baseline specification is -6.8 and is statistically significant at the 6 percent level; at face value, this estimate would imply that, on average and all else equal, for every additional 10 percent of a household's income going toward debt service payments one would expect its 2007-2009 consumption growth to have been 0.7 percentage point lower. The negative coefficient shows up across the variants on the specification, with varying degrees of significance. Among the more notable results in the next few columns, one again sees a stronger effect in boom states than non-boom states.

In columns (7) and (8), I shows results for specifications where an additional terms corresponding to the interaction between the debt service burden and the level of the state unemployment rate is added in order to explore the hypothesis that a higher debt service burden is more likely to cause a retrenchment in consumption when the risk of job loss is high. (To make space for these variants, I drop the regressions that explore the results when *ex post* measures of debt are added; these specifications are less interesting in this case because one would not expect the same sort of dramatic change in debt service as for leverage over the 2007-2009 period.) Although, one might expect negative coefficients on the interaction terms under the hypothesis above, the coefficients are positive and insignificant. Columns (9) show the estimates for the 2005-07 period, as well as for the pooled sample. As in Table 4, the negative effect of high indebtedness appears to prevail for the earlier period, although it is somewhat weaker.

Finally, Table 6 shows the results when both 2007 mortgage leverage and 2007 mortgage debt service burden are included in the regression. Doing so might be informative as to which debt variable is actually driving the relationship, which, in turn, could shed light on the underpinning of the relationship and have also have possible policy implications. As one might expect given the correlation between the two variables, the coefficients are not very precisely estimated. Moreover, the coefficients on the variables are largely similar to those in Tables 4 and 5. However, the coefficient on the debt service burden is close to 0 when the equation is estimated for the 2005-2007 period, suggesting that, at least during the boom, debt service obligations did not crowd out consumption after controlling for leverage. Such a pattern could be explained by the ease with which most homeowners were able to refinance and extract equity during the boom should they have run into cash-flow problems.<sup>22</sup>

On the whole, the regression analysis is limited by somewhat large standard errors. Still, the fairly consistent pattern of marginally significant negative coefficients on the debt variables is supportive of the view that the debt overhang produced by the drop in house prices represents an additional headwind for consumption—above and beyond the direct wealth effects associated with lower house prices.

## **6. More Recent Evidence about the Highly Indebted**

### *The Evolution of Mortgage Payment Problems*

As discussed earlier, preliminary partial data on household balance sheets and mortgage payment problems from the 2011 wave of the PSID have recently been released. The data represent just a small subset of the variables that will ultimately be available, and they are subject to revision.

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<sup>22</sup> More work clearly needs to be done on this issue. If households had ready access to home equity during the boom, one might have expected the coefficient on current income to have been smaller in the 2005-07 regressions than in the 2007-09 regressions. I see no such pattern.

Still, the information is highly relevant and timely (particularly by the standards of household surveys) and thus worth exploring.

Figure 5 shows the evolution of various variables related to mortgage payment problems, again comparing homeowners who were in the top quintile of mortgage leverage as of 2007 with others and also dividing homeowners by whether they resided in a housing boom state or not.<sup>23</sup> Broadly speaking, it remained the case in 2011 that the homeowners who had the highest ratios of mortgage debt to home value in 2007 were more likely to have or expect problems making their mortgage payments than other homeowners. It also remained the case that the distress was more pronounced in the “boom” states (those that fell in the top quartile of states in terms of home price appreciation between 2000 and 2006).

The top left panel of the figure shows a small decline in the fraction of highly leveraged households that were behind on their mortgage payments between 2009 and 2011. This pattern is consistent with the decline in mortgage delinquency rates seen in aggregate data. The number of highly leveraged homeowners in housing boom states who were in foreclosure rose between 2009 and 2011, as shown in the top right panel. The nationwide foreclosure crisis does not show up very clearly in the chart, but note that the chart includes only households that were in the process of foreclosure, not those for whom a foreclosure had been completed.<sup>24</sup>

A smaller share of 2007 homeowners reported being *somewhat* likely to fall behind on their mortgage payments in 2011 as compared with 2009 (middle left panel) but a larger share reported being *very* likely to fall behind (middle right panel). Thus, the data do not show a clear pattern of improvement in terms of expected mortgage payment problems. Summing across the two panels, the share of highly leveraged homeowners in boom states that reported being either somewhat or very likely to experience mortgage payment problems remained quite elevated, declining by just 0.03 from 0.28 to 0.25. One might have expected a larger decline given that a considerable share of this group underwent major changes in their housing situations between 2009 and 2011 (presumably, in many cases, relieving mortgage-related pressures they faced): about a third of this group had moved since 2007 (up from 21 percent in 2009) and 17 percent were no longer homeowners at all (up from 8 percent in 2009).

In sum, the preliminary 2011 PSID data on mortgage distress do not paint a particularly encouraging picture. Although homeowners were better off by some measures, they continued to anticipate a fair degree of difficulty servicing their loans—and that result is especially strong among households that had high ratios of mortgage debt to house value in 2007. Perhaps, though, the finding is not surprising given that macroeconomic conditions remained very weak.

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<sup>23</sup> To be consistent, I impose the other restrictions from Table 2 and Table 3, including just homeowners who had a complete set of interviews from 2005 through 2009 and who were not retired over this period.

<sup>24</sup> Even, so, at less than 2 percent of the mortgage holders in the 2011 sample as a whole, the number of mortgages in foreclosure seems relatively small. Although the PSID has very high rates of sample retention from wave to wave, it may also be the case that households in foreclosure are more difficult to find and interview.

### *How Much More Deleveraging is to Come?*

One way to assess how much deleveraging is to come is to examine where a household's leverage ratio stands relative to where that household might like it to be. Households likely choose target levels of leverage based on a variety of factors—including what levels of leverage preclude access to low-cost credit, what levels of leverage imply they would not be able to pay off their mortgages if they were to sell their homes, and what levels of leverage simply seem excessive. Given this, it would be difficult to estimate a target level of leverage for any given household with confidence. However, one reasonable benchmark for a target might be the level of mortgage leverage the household had in the pre-crisis period.

Table 7 presents such an exercise for households in the 2009 and 2011 waves of the PSID. In the top panel, I assume that most households are trying to reduce their mortgage leverage ratio to the levels they had in 2003. The exception is for households that have become homeowners since 2003—I assume these households are trying to reduce their mortgage leverage ratio to 0.9. The rows of the panel show the share of households whose actual ratios exceed the target by different amounts. In the middle and lower panels of the table, I show the same results under the assumptions that households' targets equal their 2005 ratios and their 2007 ratios, respectively. However, the results in the different panels are fairly similar, suggesting that the analysis is not very sensitive to which year's ratios are assumed to be the target. This is perhaps not surprising given that aggregate mortgage leverage did not move much during the credit boom, implying that, on average, mortgage debt was about keeping pace with home price growth.

The results of the exercise suggest that, as of 2011, between a fifth and a quarter of households were above their assumed mortgage leverage targets. A small but material share—between 4 and 5 percent—were above their targets by 0.5 or more (note that the share of mortgage borrowers in this group would be much higher given that the sample here includes both non-homeowners and homeowners, with and without mortgages). Another striking feature of the table is that, on the whole, households appeared to be in somewhat worse shape in terms of their mortgage leverage ratios in 2011 than in 2009. We know that some households reduced leverage dramatically by defaulting on their mortgages, but others likely sank further underwater because their home values continued to fall.<sup>25</sup>

Meeting these targets would be no easy task for some homeowners. Table 8 offers evidence on what it would take for PSID households to bring their mortgage leverage ratios down to an assumed target if they were to do so solely by paying off their mortgage debt. The assumed target for each household is its 2005 mortgage leverage ratio unless that household had become a homeowner since 2005, in which case the target mortgage leverage ratio is assumed to be 0.9.

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<sup>25</sup> On an annual average basis, the CoreLogic index of national home prices fell by about 5 percent between 2009 and 2011. In addition, as discussed earlier, there is some evidence that the PSID homeowners' assessments of their home values lag the actual data, implying that their 2009 leverage ratios may have been understated because households had not yet fully incorporated the earlier plunge in house prices.

For each household, I calculate how much of its pre-tax income would need to be diverted toward repaying loans in order to accomplish the needed reduction in debt.<sup>26</sup> The table shows the number of households falling in specific ranges of the amount of pre-tax income that would need to be diverted. Note, though, that even households in the smaller categories might have to make a considerable change to their saving and consumption behavior if they wanted to accomplish the reduction over a limited time frame—diverting just an additional month’s worth of pre-tax income to paying down debt over the course of a year could be a big deal for a household whose income and finances have already been stretched thin by the weak macroeconomic conditions.

Table 8 shows that a little more than three-quarters of PSID households (including both homeowners and non-homeowners) were already lower than their assumed target mortgage leverage ratios in 2011. About 7 percent of the sample can get there with a fairly modest reduction in debt—equivalent to 3 months or less of pre-tax income. But 7 percent need to reduce debt by more than a year’s worth of pre-tax income and 1½ percent need to reduce debt by more than three years’ worth of pre-tax income. This exercise shows that if this deleveraging were accomplished by saving alone, it could mean a fairly drastic cut in consumption for many years for a small share of households.

Getting back to 2005 values of leverage might seem like a high bar for a lot of households. However, anecdotal evidence is consistent with the view that many households would like to reduce their debt and also with the view that households feel like they have not made much, if any, progress. For example, in one survey of roughly 1000 U.S. adults between the ages of 25 and 65, 45 percent of respondents said that they felt their debt was too high relative to their income in March 2012 (Absolute Strategy Research, 2012). The share was up a bit from the share a year earlier (45 percent). When asked whether the financial crisis had changed their attitudes toward debt, 35 percent of households responded “Yes: I now plan to reduce my total debt level over the next 12 months.”

Of course, households can reduce their leverage in other ways. They can sell their homes and using the proceeds to pay down mortgage debt, and they can default on their mortgage obligations. They can also achieve reduced leverage if their house price rises, although many households may be reluctant to count on such an outcome given the experience of the last decade.

## **7. Discussion**

The plunge in home prices between 2007 and 2009 left enormous scars on households’ balance sheets. Many people who had taken advantage of rising home prices and easy credit conditions during the early to mid-2000s to borrow large amounts were left with considerable debt

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<sup>26</sup> Quantifying the reduction in terms of after-tax income might be more meaningful, but the PSID does not provide information about households’ after-tax income. I use the households’ most recently reported income (the figure in the 2009 wave, which corresponds to the calendar year 2008). The results do not change much if I use average household income over several recent waves of the PSID instead of a single year’s reading.

overhangs in the form of elevated mortgage debt-to-asset ratios. The estimates in this paper provide evidence that the spending of such households has been especially weak—more so than would be expected based on other factors affecting them, including the decline in wealth they experienced. One implication is that the traditional approach to analyzing and forecasting aggregate consumer spending—which does not take levels of leverage into account—may be misleading policy analysts who rely on it.

That said, it is difficult to use the estimates in this paper to quantify the degree to which the household debt overhang is holding back consumption. The point estimates from my regressions suggest that an increase in a household's mortgage leverage ratio of 0.1 is associated with annual consumption growth that is a few tenths of a percentage point lower. With the roughly half of Americans who have mortgages experiencing considerable jumps in leverage as a result of the 1/3 nation-wide decline in home prices, one might conclude that excessive leverage is having a noticeable (albeit modest) damping effect on aggregate consumption growth. However, my estimates have relatively large standard errors, suggesting that the confidence interval around such an assessment is large. Moreover, before drawing firm conclusions, one would want to explore whether there are important non-linearities (such as whether the leverage ratio only matters when it is above a certain level) and whether the results hold up in more recent data (which, for the PSID, are not yet available).

My results also suggest that, on the whole, households made very limited progress in recent years reducing excess mortgage leverage. Although we know that some households dramatically reduced their leverage by defaulting, my data show that the share of households with ratios exceeding various possible targets actually increased between 2009 and 2011. Important financial strains persist, as evidenced by the fact that there was essentially no reduction between 2009 and 2011 in the share of homeowners reporting that they were somewhat or very likely to have problems making their mortgage payments over the coming year. Further, my results suggest that it may take many years for some households to reduce their leverage to pre-crisis norms. The effects of deleveraging on the economy could thus persist for some time to come.

More research is needed to discern the mechanism through which the debt overhang is restraining households' spending. Highly indebted households may be purposefully holding back their spending in order to return their leverage to what they perceive as more manageable levels. Alternatively, they may be unable to spend more because they are especially constrained from borrowing in the current environment of tight credit. Or, the leverage may be impeding their ability to lower their monthly mortgage obligations by refinancing into loans with lower interest rates. In the latter cases, one would expect more of a pick-up in consumption as credit conditions ease.

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Table 1  
**Summary Statistics for PSID Households**

	2005	2007	2009
<b>Medians values:</b>			
Family income (previous year)	45,180	49,000	50,504
Non-housing consumption	15,548	16,560	15,280
Net worth	57,000	66,000	41,000
<b>Fraction holding:*</b>			
Homes	65.1	64.1	61.9
Mortgage debt	43.9	43.1	42.3
Vehicle debt	37.2	40.0	38.0
Other debt	50.7	50.6	51.1
<b>Median values for those holding:</b>			
Homes	170,000	200,000	180,000
Mortgage debt	98,000	110,000	118,400
Vehicle debt	10,249	10,141	9,895
Other debt	6,000	8,000	8,200
Number of observations	8002	8289	8690

Note. Median values expressed in nominal dollars. Calculations are weighted using the longitudinal weights provided by the PSID. All responding households from each wave are used, although, for some variables, such as consumption, net worth, and vehicle debt, some observations are missing because the household did not report full data for the variable or its components.

Table 2  
**Pre-crisis Experience of Highly Leveraged Households and Other Households**

	Non-homeowners		Homeowners in non-boom States		Homeowners in boom states	
	High 2007 leverage	Other	High-2007 leverage	Other	High-2007 leverage	Other
<b>2007 characteristics:</b>						
Head age	37.55	42.35	40.21	49.60	41.41	50.32
Head has college degree *	.31	.21	.37	.37	.40	.44
Income/1000	31.20	30.32	72	75.60	77.00	92.80
Nonhousing consumption/1000	12.62	12.05	21.30	21.32	28.22	25.36
Number of vehicles *	1.09	1.12	2.04	2.21	2.09	2.11
Net worth/1000	-13.40	4.03	30.00	184.05	61.00	324.00
House value/1000	.00	.00	150.00	180.00	300.00	365.00
Financial assets/1000	.40	.60	5.00	23.00	10.00	45.00
Mortgage debt/1000	.00	.00	139.00	55.00	260.00	100.00
Consumer debt/1000	20.00	.00	16.71	6.00	15.00	5.48
Nonhousing consumption/Y	.35	.36	.30	.27	.37	.29
Net worth/Y	-.48	.16	.47	2.59	.85	3.97
Mortgage/Y	.00	.00	1.92	.74	2.63	1.01
Consumer debt/Y	.78	.00	.24	.07	.18	.06
Mortgage/house value	.00	.00	.88	.37	.84	.32
Debt service/Y	.25	.00	.28	.16	.34	.17
<b>Change 2005-2007:</b>						
Became homeowner	.00	.00	.19	.05	.27	.03
Number of vehicles	.04	.05	.06	.07	.21	.08
Nonhousing consumption / Y	.01	.00	-.03	-.01	-.01	.01
Net worth / Y	-.40	.00	.06	.26	.13	.72
Mortgage / Y	.00	.00	.27	.00	1.06	-.02
Mortgage / house value	.00	.00	.07	-.02	.26	-.03
Consumer debt / Y	.19	.00	-.04	.00	-.02	.00
Debt services / Y	.04	.00	.02	.00	.08	-.00
<b>State characteristics:</b>						
%Δ house prices 2000-2006*	63.96	56.09	32.71	36.89	131.76	124.60
2007 unemployment rate *	4.61	4.61	4.68	4.68	4.28	4.28
Number of observations	286	1336	544	1674	189	619

Notes. Means shown for variables marked with \*; all other statistics are medians. High-leverage households are those in the highest quintile (on a weighted basis) of total debt to total assets as of 2007 for non-homeowners and those in the highest quintile of mortgage debt relative to house value as of 2007 for homeowners. Housing boom states are those in the top quartile of 2000-2006 house price growth. Sample restricted to non-retired households with a complete set of interviews for 2005-2009 waves; statistics in some cells are based on fewer observations because of missing data.

Table 3  
**Comparison between Highly Indebted Households and Others  
 After Peak of Credit Boom**

	Non-homeowners		Homeowners in Non-boom states		Homeowners in boom states	
	High 2007 leverage	Other	High 2007 leverage	Other	High 2007 leverage	Other
<b>Change 2007-2009:</b>						
Income in previous year (%)	14.55	8.57	8.37	6.48	8.98	6.79
Nonhousing consumption (%)	1.28	-6.42	-3.30	-2.66	-14.68	-6.81
Number of vehicles*	.05	.01	-.02	-.03	-.10	.03
<b>Nonhousing consumption/Y</b>	<b>-.03</b>	<b>-.04</b>	<b>-.03</b>	<b>-.02</b>	<b>-.07</b>	<b>-.04</b>
<b>Net worth/Y</b>	<b>.18</b>	<b>.00</b>	<b>-.07</b>	<b>-.23</b>	<b>-.67</b>	<b>-.83</b>
Mortgage/Y	.00	.00	-.26	.00	-.44	.00
Mortgage/house value	.00	.00	-.03	.00	.06	.03
Consumer debt/Y	-.18	.00	-.01	.00	.00	.00
Debt service/Y	-.04	.00	-.02	.00	-.02	.00
Moved*	.62	.51	.22	.09	.21	.09
Exited homeownership*	.00	.00	.10	.05	.08	.03
<b>2009 mortgage distress:</b>						
Behind on mortgage*	n/a	n/a	.11	.02	.19	.03
Foreclosure started*	n/a	n/a	.03	.00	.04	.01
Mortgage modified*	n/a	n/a	.13	.05	.25	.08
Somewhat likely to fall behind*	n/a	n/a	.09	.06	.21	.12
Very likely to fall behind*	n/a	n/a	.04	.01	.06	.02
<b>State economic environment:</b>						
%Δ house prices 2007-2009*	-13.65	-13.53	-11.93	-11.93	-21.03	-33.96
2009 unemployment rate	9.68	10.02	9.29	9.26	9.05	9.68
<b>Number of observations</b>	<b>286</b>	<b>1336</b>	<b>544</b>	<b>1674</b>	<b>189</b>	<b>619</b>

Notes. Means shown for variables marked with \*; all other statistics are medians. High-debt households are those in the highest quintile (on a weighted basis) of total debt to total assets as of 2007 for non-homeowners and those in the highest quintile of mortgage debt relative to house value as of 2007 for homeowners. Housing boom states are those in the top quartile of 2000-2006 house price growth. Number of observations is based on number in group that had complete set of interviews for 2005, 2007, and 2009 waves; statistics in some cells are based on fewer observations because of missing values.

Table 4  
**Regression Results for 2007-2009 Change in Consumption on Mortgage Leverage**

	Different change measures		Different samples			Different leverage measures			Different estimation ranges	
	Baseline	$100 * \frac{\Delta C}{Y_{avg}}$	Home-owners	Owners non-boom states	Owners boom states	Dummy for top quintile	Ex post leverage	Ex post leverage (IV)	2005-07	Pooled 2005-07, 2007-09
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$\Delta$ State(UR)	-0.009 (1.773)	-1.187 (1.300)	-1.024 (2.169)	-1.109 (2.661)	3.517 (5.505)	-.032 (1.773)	-.014 (1.775)	.113 (1.777)	-3.552 (2.073)	-.421 (1.212)
$\Delta$ Income	.106* (.016)	.092* (.015)	.065* (.024)	.046 (.028)	.116* (.049)	.106* (.016)	.106* (.016)	.105* (.016)	.118* (.016)	.113* (.011)
$\Delta$ Wealth	.021* (.004)	.005 (.004)	.018* (.005)	.026* (.007)	.007 (.008)	.021* (.004)	.023* (.004)	.021* (.005)	.020* (.005)	.021* (.003)
Leverage	-6.065 (3.246)	-2.401 (2.349)	-6.115 (4.576)	-4.616 (5.299)	-11.597 (9.176)	-4.417 (2.596)	-.724 (2.941)	-7.796 (4.108)	-5.474 (3.313)	-5.396* (2.273)
Adjusted R <sup>2</sup>	.022	.010	.010	.012	.008	.022	.022	.020	.030	.033
Number of Obs.	3639	3566	2200	1613	587	3639	3631	3631	3519	7160

\*Significant at 5 percent level.

Notes. In baseline specification, consumption, income, and wealth changes are measured as 100\*the difference in the inverse hyperbolic sine of consumption, income, and wealth, and leverage is measured as the ratio of mortgage debt to home value. In column (2), changes are measured as 100 times the difference divided by average family income from the 2005, 2007, and 2009 waves. Regressions also include a constant and control for head age, head education, level of income, and level of state unemployment rate. Sample includes only households with a complete set of interviews from 2005 through 2009. Pooled regression in column (10) also includes year dummy for 2009. Regressions drop extreme outliers for leverage and, in column (2), for the change in wealth relative to income. Standard errors in parentheses.

Table 5  
**Regression Results for 2007-2009 Change in Consumption on Mortgage Debt Service Burden**

	Different change measures		Different samples			Variants on debt service			Different estimation ranges	
	Baseline	$100 * \frac{\Delta C}{Y_{avg}}$	Home-owners	Owners non-boom states	Owners boom states	Dummy for top quintile	Incl. interaction with UR	Incl. interaction with $\Delta UR$	2005-07	Pooled 2005-07, 2007-09
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$\Delta$ State(UR)	.207 (1.774)	-1.073 (1.301)	-.886 (2.176)	-1.117 (2.661)	3.584 (5.508)	.343 (1.779)	.250 (1.777)	.094 (1.790)	-3.453 (2.074)	-.241 (1.212)
$\Delta$ Income	.124* (.017)	.101* (.015)	.102* (.027)	.072* (.032)	.202* (.059)	.122* (.017)	.125* (.017)	.125 (.017)	.123 (.016)	.124* (.012)
$\Delta$ Wealth	.021* (.004)	.004 (.004)	.018* (.005)	.026* (.007)	.008 (.008)	.021* (.004)	.021* (.004)	.021 (.004)	.019 (.005)	.021* (.003)
DSB	-6.782 (3.899)	-6.914* (2.852)	-4.661 (4.017)	-3.556 (5.536)	-9.125* (5.973)	-4.094 (2.705)	-16.653 (22.931)	-17.234 (22.137)	-2.097 (4.459)	-4.852* (2.127)
DSB*UR							.861 (1.971)			
DSB* $\Delta UR$								1.827 (3.808)		
Adjusted R <sup>2</sup>	.025	.010	.012	.013	.013	.024	.024	.024	.030	.034
Number of Obs.	3629	3566	2190	1606	584	3629	3629	3629	3514	7145

\*Significant at 5 percent level.

Notes. In baseline specification, consumption, income, and wealth changes are measured as 100\*the difference in the inverse hyperbolic sine of consumption, income, and wealth, and debt service burden is measured as the ratio of mortgage debt service obligations to family income. In column (2), changes are measured as 100 times the difference divided by average family income from the 2005, 2007, and 2009 waves. Regressions also include a constant and control for head age, head education, level of income, and level of state unemployment rate. Sample includes only households with a complete set of interviews from 2005 through 2009. Regressions drop extreme outliers for debt service burden and, in column (2), for the change in wealth relative to income. Standard errors in parentheses.

Table 6  
**Regression Results for Change in 2007-2009 Consumption  
on Mortgage Leverage and Mortgage Debt Service Burden**

	Baseline	Variants on leverage	Different estimation ranges	
		Ex post leverage (IV)	2005-2007	Pooled 2005-2007 & 2007-2009
	(1)	(2)	(3)	(4)
$\Delta$ State(UR)	.191 (1.776)	.268 (1.778)	-3.561 (2.077)	-.250 (1.213)
Income change	.122* (.017)	.122* (.017)	.121* (.016)	.122* (.012)
Wealth change	.020* (.004)	.021* (.005)	.019* (.005)	.020* (.003)
Leverage	-4.108 (3.535)	-5.234 (4.433)	-5.108 (3.615)	-4.192 (2.430)
Debt Burden	-4.849 (4.240)	-5.039 (4.217)	.590 (4.853)	-3.658 (2.237)
Adjusted R <sup>2</sup>	.025	.025	.031	.034
Number of Obs.	3627	3619	3512	7141

\*Significant at 5 percent level.

Notes. In baseline specification, consumption, income, and wealth changes are measured as the difference in the inverse hyperbolic sine of consumption, income, and wealth; debt service burden is measured as the ratio of mortgage debt service obligations to family income; and leverage is measured as the ratio of mortgage debt to home value. In column (2), changes are measured as 100 times the difference divided by average family income from the 2005, 2007, and 2009 waves. Regressions also include a constant and control for head age, head education, level of income, and level of state unemployment rate. Sample includes only households with a complete set of interviews from 2005 through 2009. Regressions drop extreme outliers for leverage and debt service burden and, in column (2), for the change in wealth relative to income. Standard errors in parentheses.

Table 7  
**Households' Progress toward Different Possible Deleveraging Targets  
 2009 and 2011 Waves of the PSID**

		Households in 2009 PSID	Households in 2011 PSID
Target assumed to be household's mortgage LTV as of 2003*	<b>Share of households for whom:</b>		
	$LTV_{\text{actual}} - \text{target} > 0.0$	.194	.217
	$LTV_{\text{actual}} - \text{target} > 0.1$	.134	.159
	$LTV_{\text{actual}} - \text{target} > 0.2$	.095	.111
	$LTV_{\text{actual}} - \text{target} > 0.3$	.064	.086
	$LTV_{\text{actual}} - \text{target} > 0.4$	.048	.059
	$LTV_{\text{actual}} - \text{target} > 0.5$	.032	.044
Target assumed to be household's mortgage LTV as of 2005*	<b>Share of households for whom:</b>		
	$LTV_{\text{actual}} - \text{target} > 0.0$	.219	.237
	$LTV_{\text{actual}} - \text{target} > 0.1$	.138	.169
	$LTV_{\text{actual}} - \text{target} > 0.2$	.096	.116
	$LTV_{\text{actual}} - \text{target} > 0.3$	.069	.089
	$LTV_{\text{actual}} - \text{target} > 0.4$	.050	.065
	$LTV_{\text{actual}} - \text{target} > 0.5$	.038	.048
Target assumed to be household's mortgage LTV as of 2007*	<b>Share of households for whom:</b>		
	$LTV_{\text{actual}} - \text{target} > 0.0$	.244	.253
	$LTV_{\text{actual}} - \text{target} > 0.1$	.145	.175
	$LTV_{\text{actual}} - \text{target} > 0.2$	.088	.124
	$LTV_{\text{actual}} - \text{target} > 0.3$	.059	.087
	$LTV_{\text{actual}} - \text{target} > 0.4$	.043	.062
	$LTV_{\text{actual}} - \text{target} > 0.5$	.033	.048

\*Except for households that have purchased a home since that year; for those households, the target mortgage loan-to-value ratio was assumed to be 0.90.

Notes. Based on all households that had interviews in the year in which actual leverage was captured and the year on which the target was based. Shares were calculated on a weighted basis.

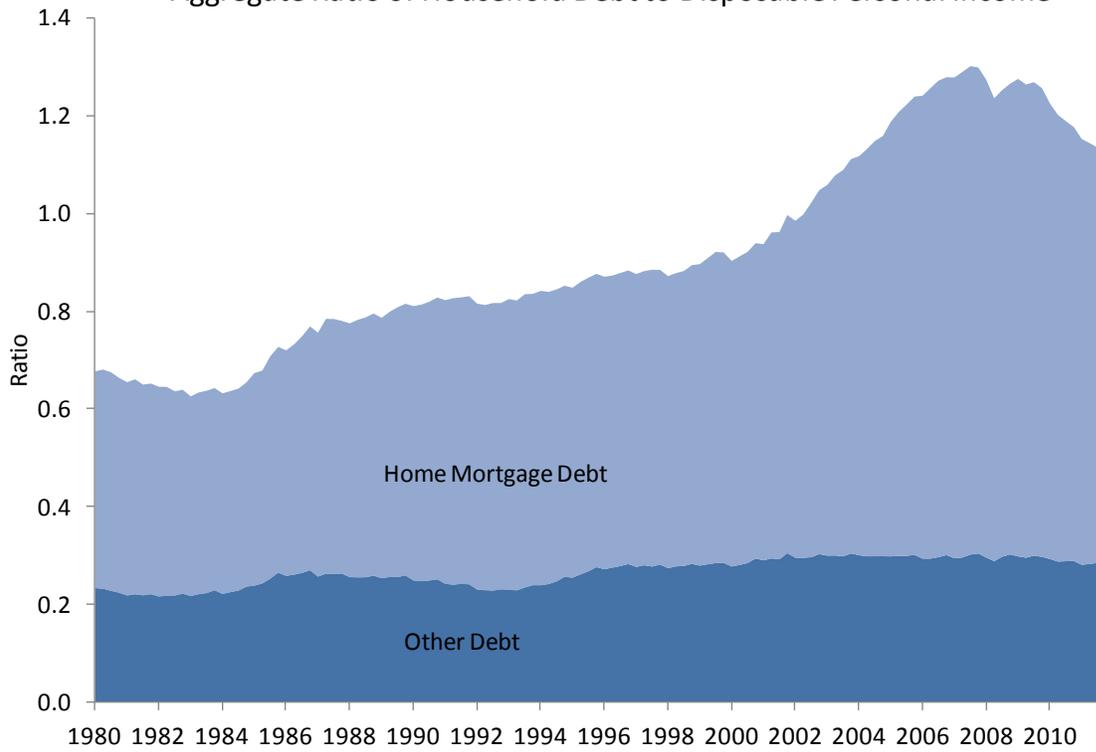
Table 8  
**Amount of Deleveraging Needed to Bring  
Mortgage Leverage Back to Pre-Crisis Norms**

Amount of debt reduction needed to bring mortgage leverage to assumed target* (expressed in terms of households' pre-tax incomes):	Share of PSID households
No reduction needed	.763
0-1 months of income	.027
2-3 months of income	.047
3-6 months of income	.046
6-12 months of income	.048
1-2 years of income	.040
2-3 years of income	.016
3+ years of income	.014

\* Assumed target equals 2005 mortgage leverage ratio, except for households who have become homeowners since then, for whom the assumed target ratio is 0.9.

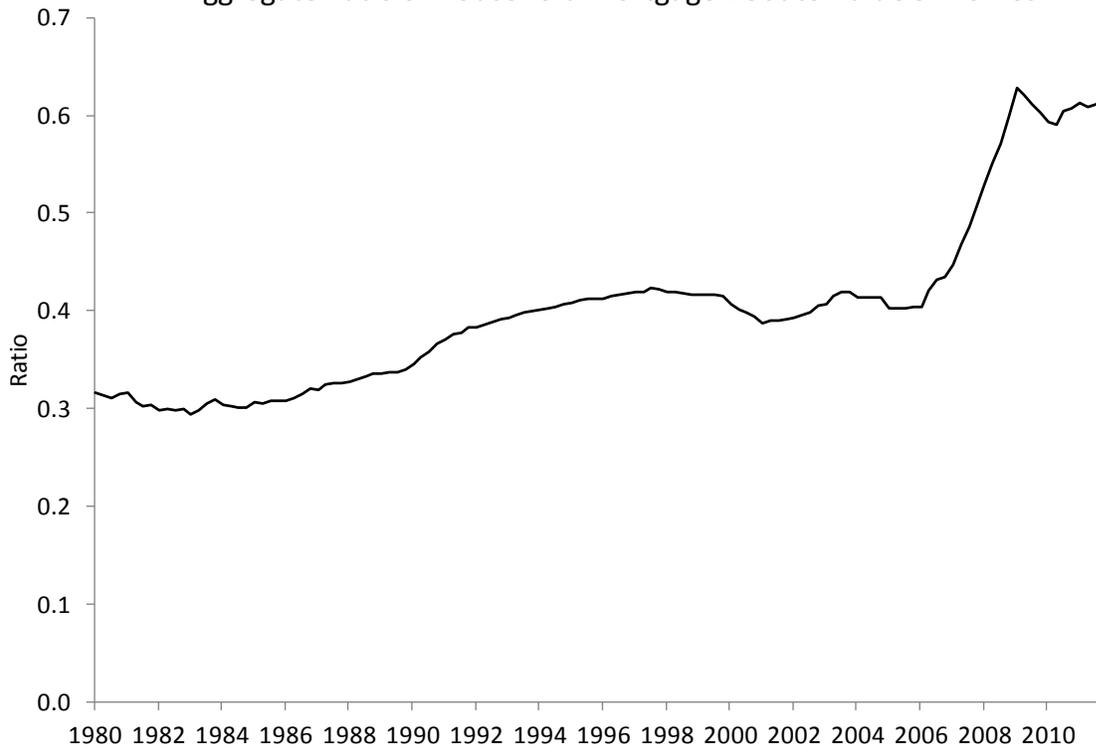
Notes. Includes all household in both the 2009 and 2011 waves of the PSID. Income is captured as of the 2009 wave and therefore corresponds to the calendar year 2008. Shares calculated on a weighted basis.

Figure 1  
Aggregate Ratio of Household Debt to Disposable Personal Income



Note: Based on data from the U.S. Flow of Funds and National Income and Product Accounts. Last value is 2011:Q4.

Figure 2  
Aggregate Ratio of Household Mortgage Debt to Value of Homes



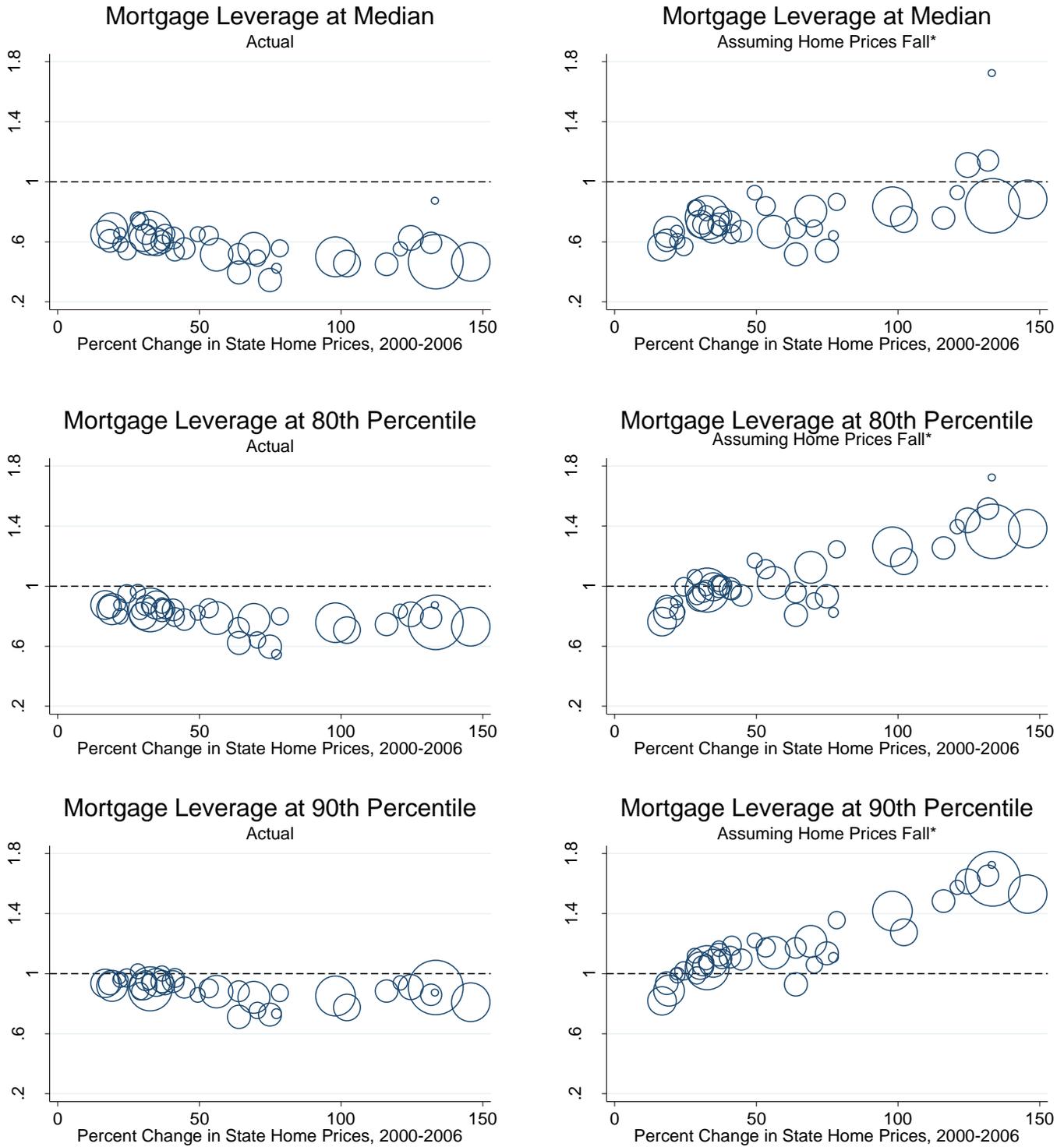
Note: Based on data from the U.S. Flow of Funds Accounts. Last value is 2011:Q4.

Figure 3  
Personal Saving Rate



Note: Data from U.S. National Income and Product Accounts. Last value is 2012:Q1.

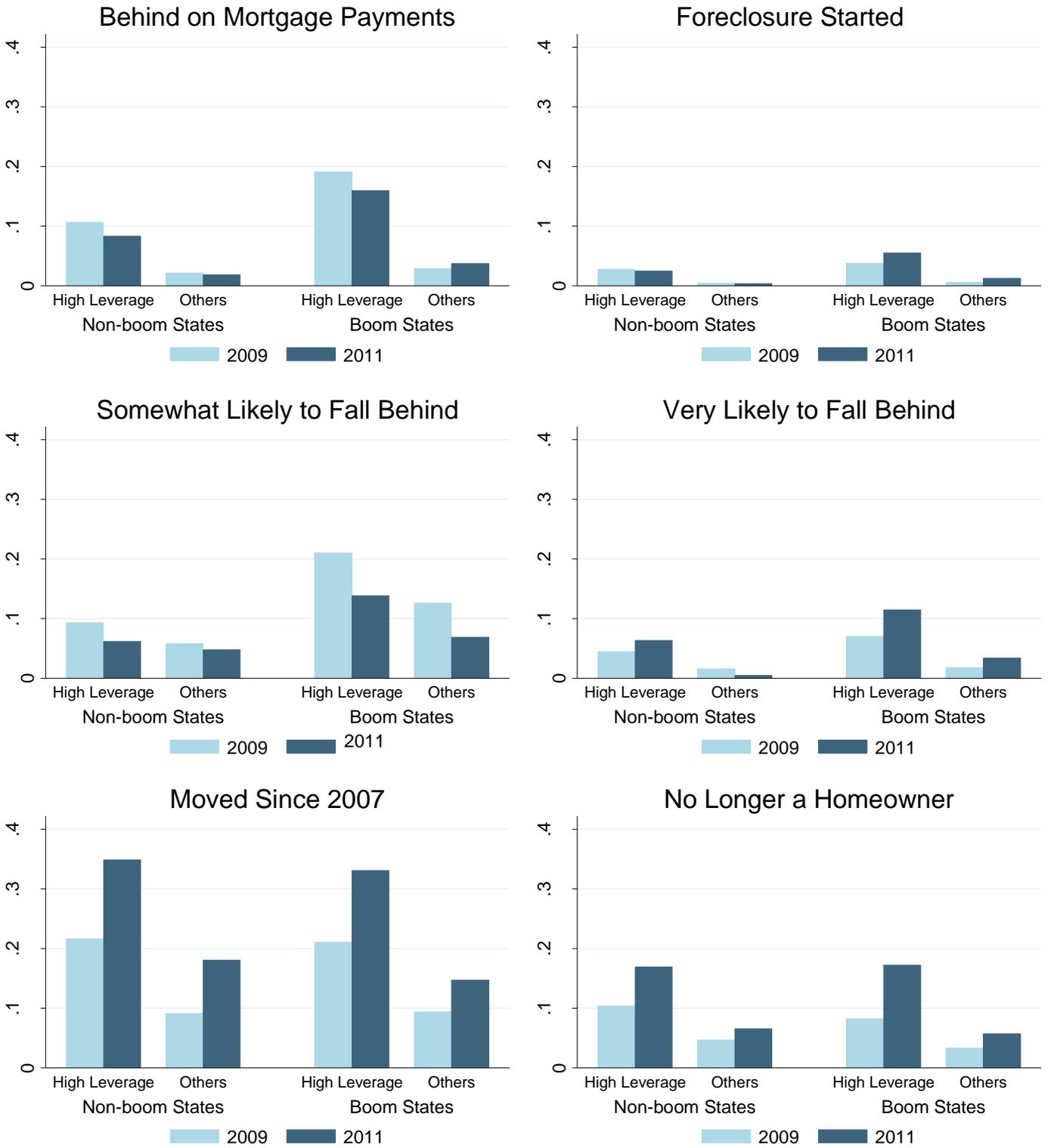
Figure 4  
**Mortgage Leverage in 2007 and House Price Appreciation, By State**



\*The numerator of counterfactual LTV equals 2007 mortgage balance; the denominator equals the estimated value of the 2007 home in 2000 times the increase in non-housing consumer prices from 2000 to 2007.  
 Notes. States with 30+ observations. Area of symbols proportional to state population.

Figure 5

**Mortgage Distress among PSID Households Who Owned Homes in 2007**



Note: Samples defined as in Tables 2 and 3.