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Changes in U.S. Household Balance Sheet Behavior after the Housing Bust and Great Recession: Evidence from Panel Data

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Abstract:
This paper uses panel data through 2011 to examine evidence of shifts in household balance sheet behavior following the financial crisis and Great Recession. The paper considers evidence of balance sheet repair through debt repayment as well as changes in the composition of households' balance sheets and/or saving decisions to determine whether households' desire for holding or investing in riskier versus safer assets has changed. The data show relatively small and limited balance sheet adjustment—especially for those households considered the most likely to have been impacted by the economic collapse. The adjustment that did occur typically raised households' liquid asset holdings and/or saving and reduced their risky asset positions (stocks). There is also some evidence of increased nonhousing debt repayment and slower take-up of new nonhousing debt. Overall, the findings are inconsistent with major adjustments occurring in households' balance sheet behavior—especially to the extent where these shifts would have contributed substantially to the sluggish economic recovery.

JEL Classifications: E21, D14, G11

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This paper presents preliminary analysis and results intended to stimulate discussion and critical comment. The views expressed herein are those of the author and do not indicate concurrence by the Federal Reserve Bank of Boston, or by the principals of the Board of Governors, or the Federal Reserve System.

This paper, which may be revised, is available on the web site of the Federal Reserve Bank of Boston at http://www.bostonfed.org/economic/ppdp/index.htm.

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1 Introduction

From late 2007 through late 2009 the United States experienced the deepest financial crisis and recession since the Great Depression. According to the Survey of Consumer Finances (SCF), median household wealth fell over 38 percent between 2007 and 2010 and median household income (adjusted for inflation) fell nearly 8 percent (see Bricker et al., 2012). This drop in household income and asset prices, combined with extremely high levels of household debt prior to the recession, left many households with substantially deteriorated balance sheets in need of repair.

Households can alter their balance sheets primarily by repaying outstanding debt, changing the composition of their existing portfolios—either by shifting around existing assets or changing the rate at which they add to different asset categories—and/or adjusting their rate of saving. Household debt repayment (so-called household deleveraging) and balance sheet rebuilding have often been cited as an explanation for the historically slow economic recovery since the Great Recession.[1]

This paper uses longitudinal household-level data from the Panel Study of Income Dynamics (PSID) to examine U.S. households' balance sheet behavior prior to, during, and following the financial crisis and Great Recession. One goal of the paper is to determine whether households' balance sheet adjustments have been substantial enough to be consistent with such behavior serving to help explain the slow economic recovery. Specifically, a large amount of active (nonforeclosure-related) debt repayment and/or substantial increases in households' (precautionary) saving would be evidence supporting the claim that changes in households' balance sheets have contributed to the slow recovery, since these adjustments would reduce household consumption and overall economic output. There should also be evidence that those households thought to be particularly vulnerable to the economic downturn on the eve of the crisis, such as homeowners with substantial leverage, were the ones adjusting their portfolios the most.

This paper's goal is to carefully document households' balance sheet adjustments to inform and help enhance micro-founded models of household risk-taking and portfolio choice during and following the financial crisis. Even if households do not dramatically reduce their leverage or increase their saving rate, they still may alter their balance sheets in ways that provide insight for parameterizing models of and/or thinking about household consumption going forward. For example, the collapses in the housing market and financial market may have altered households' willingness to hold risky assets due to increased concerns about

[1] Relevant papers on deleveraging include Dynan (2012a), Cooper (2012b), and Mian, Rao, and Sufi (2013).

future housing or financial wealth losses and/or economic crises. Balance sheet adjustments consistent with a change in households' risk tolerance would be, say, households directing new saving into relatively safe positions (cash and bonds) rather than into stocks and/or households selling their existing risky assets and shifting the proceeds into safer assets. Evidence that U.S. households have a reduced appetite for risk or an increased desire to hedge against potential future economic crises would suggest that their future outlook and/or risk aversion has changed, which likely has implications for their desired level of precautionary saving and/or risk hedging going forward. Unless household incomes change, greater (lower) precautionary saving or assets held as a risk hedge will reduce (increase) consumption and impact current and future aggregate demand.

A better understanding of household balance sheet behavior is also important because of the ongoing discussion about household financial stability in the United States. Indeed, the housing bust and financial crisis left many households with negative housing equity—homes worth less than the outstanding mortgage debt—and/or substantially less valuable retirement accounts and financial wealth holdings. Evidence of balance sheet repair by households particularly impacted by the crisis, either through debt repayment and/or increased saving in other assets would be consistent with households trying to improve their financial situation. It is important that households maintain diversified portfolios even if they have relatively lower levels of wealth.

To date, Bricker et al. (2012) have documented the evolution of household balance sheets through 2010 using triennial data from the *Survey of Consumer Finances* (SCF), and Bhutta (2013), Brown et al. (2013), and Knotek II and Braxton (2012) have explored debt repayment behavior using household-level credit data from Equifax. The SCF contains comprehensive data on household wealth and balance sheet composition but the cross-sectional nature of the data limits the potential analysis. In addition, the credit bureau data from Equifax do a good job of tracking a household's debt levels over time, but lack much other information about a given household—especially the asset side of its balance sheet and the household's income. The PSID extends through 2011, contains detailed information about household balance sheets, and is longitudinal, so one can track changes in an individual household's balance sheet behavior over time as well as look at how the household's economic status as of 2007 affected its subsequent balance sheet adjustment. The PSID also contains detailed information on a household's active saving (saving excluding capital gains) over time, and the geocoded household location data allow one to examine the arguably exogenous impact of local house price variation on an individual household's balance sheet behavior.

The results in this paper show some evidence of altered balance sheet behavior by house-

holds, but the adjustments tend to be relatively small and in some cases transitory. In particular, the percent of households decreasing their nonhousing debt during and after the Great Recession rises and the percent of households increasing their nonhousing debt falls. Consistent with the existing literature, much of the debt reduction is due to substantially less new borrowing rather than substantially more debt repayment. The nonhousing debt repayment that did occur was relatively small. For example, debt repayment by highly levered households in 2007 rose roughly 2 percentage points relative to income between 2007 and 2011, or about $350 annually.

On the asset side of household balance sheets, there is some evidence that households shifted the composition of their wealth toward safer, more liquid assets such as cash and bonds during the recession, which ended in June 2009, but shifted back to near their pre-recession allocations by 2011. There is also limited evidence of portfolio adjustments differing based on household leverage, wealth, or other factors. In addition, counterfactual analysis suggests that apart from homeowners with high stock market exposure in 2007, most households made very limited adjustments to their liquid risky asset holdings (stocks) beyond the changes in their portfolio shares caused by fluctuating stock market prices.

There are also no large shifts in U.S. households' overall saving. Shifts in the composition of household saving are somewhat less transitory than the shifts in household wealth, and are consistent with households wanting to increase liquidity and reduce their accumulation of risky assets after 2007. Still, the adjustments are limited and do not much differ for highly levered households and other households generally thought to be particularly at risk from the crisis, versus those thought to be less vulnerable. Household saving also responds similarly to idiosyncratic economic shocks before and after the recession.

Overall, there is little evidence of changes in households' balance sheet behavior on a scale that would be consistent with an explanation that balance sheet adjustments contributed to the slow economic recovery—especially by households generally thought to be the most impacted by the collapses in the housing and financial markets. Instead, the vast majority of U.S. households made small balance sheet adjustments, while only a few groups of households made larger changes.

It is possible that even with 2011 data it is too soon to observe substantial household balance sheet restructuring in response to the financial crisis and Great Recession. Indeed, households that, for example, experienced a large drop in house prices may have also suffered a long unemployment spell, and thus lacked the resources to improve their balance sheets. Still, these households could have adjusted the risk and/or liquidity of their existing portfolios even if they could not repay debt or increase their saving, and there is limited evidence of

such behavior in the data. Therefore, it seems that the Great Recession did not substantially alter households' desired level of portfolio risk or balance sheet liquidity.

The remainder of this paper proceeds as follows: section 2 presents a basic framework for thinking about a household's balance sheet adjustment and discusses the paper's analytical approach; section 3 discusses the data and sample used in the analysis; section 4 presents results for each potential avenue of household balance sheet adjustment; section 5 discusses the household-level results with regard to the aggregate data; and section 6 concludes.

2 Basic Framework and Approach

2.1 Background

Economists care about household balance sheet behavior because fluctuations in household wealth impact aggregate demand through financial and housing wealth effects (see Cooper, 2012a; Case, Quigley, and Shiller, 2005; Bostic, Gabriel, and Painter, 2009, among others). Identifying shifts in households' saving behavior is also relevant for predicting household consumption going forward. More recently, researchers have focused on household balance sheets—especially the liability side—because of the concern that so-called household deleveraging has reduced consumption and contributed to the slow economic recovery (see Cooper, 2012b; Dynan, 2012a; Mian, Rao, and Sufi, 2013).

Household balance sheets suffered greatly during the financial crisis. House prices and stock prices fell sharply, leading to a substantial decline in aggregate household net worth relative to income (see figure 1), and a deterioration in many household balance sheets (see Bricker et al., 2012). Financial asset prices have recovered, but house prices remain well below their previous peak. Since prior to the recession many households had the majority of their wealth in housing, there is likely heterogeneity in the extent to which U.S. household balance sheets have recovered due to recent asset price changes. The impact of the financial crisis on households' balance sheets, and thus their need to rebuild, likely also varied based on whether households owned or rented their homes prior to the downturn, and particularly their leverage conditional on being homeowners, as discussed in Mian, Rao, and Sufi (2013).

The key questions are to what extent did households adjust their balance sheets during and following the Great Recession and what are the implications of these adjustments (if any) for the macroeconomy. In particular, were these adjustments substantial enough to be consistent with the claim that household balance sheet rebuilding (deleveraging) was a major contributor to the sluggish economic recovery. Shifts in households' saving behavior and/or

other balance sheet adjustments could also impact economic activity going forward.

2.2 Basic Framework

The existing literature contains numerous models and studies—too many to cite—regarding household consumption behavior, wealth effects, portfolio choice, and the related topics of household risk aversion, the equity premium puzzle, and habit formation—just to name a few. The purpose of this paper is not to dissect the existing literature or propose a new theory of household portfolio allocation to test empirically. Instead, the goal is to document actual changes in households' balance sheet behavior during and following the Great Recession. Such analysis serves two purposes, as it provides insight into household balance sheet behavior—especially whether it is consistent with the claims of substantial deleveraing and balance sheet rebuilding leading to a sluggish recovery—and it provides relevant empirical moments for use in future theoretical work examining the impact of financial crises and negative wealth shocks on households' portfolio allocations.

This section presents some stylized examples to help illustrate some of the ways households could potentially adjust their balance sheets in response to large, adverse wealth shocks. The examples focus on household holdings of liquid versus illiquid assets as well as risky versus riskfree assets.

2.2.1 Variable Definitions

The definition of risky assets and liquid assets follows the approach in Brunnermeier and Nagel (2008). These authors use the PSID to test how the share of risky assets in a household's portfolio responds to fluctuations in its financial wealth, and claim their definitions follow "common practice." In particular, *safe assets* are the sum of cash-like assets (checking and savings accounts) and bonds; *liquid risky assets* (LRA) are the sum of stock and mutual fund holdings; *nonhousing debt* is all nonmortgage debt such as school loans, credit card debt, and other consumer loans; *liquid assets* are the sum of safe assets plus liquid risky assets; *liquid wealth* (LW) is liquid assets less nonhousing debt; and *financial wealth* (FW) is liquid wealth plus housing and business (or farm) equity.

Based on these definitions there are three relevant ratios that capture the allocation of risk and liquidity in a household's portfolio. The *liquid risky asset share* (LRA share) is the ratio of liquid risky assets to total liquid assets, and the *financial risky asset share* (FRA share) is the sum of LRA, housing equity, and business equity divided by financial wealth.[2]

[2]Housing equity includes a household's equity in both their primary residence and any secondary property

The *liquid wealth share* (LW share) is defined as LW divided by FW.[3]

2.2.2 Examples

Table 1 outlines two hypothetical households that have different beginning asset positions, different homeownership status, and are subject to different wealth shocks. Each household's portfolio is displayed before and after the price shock as well as after a hypothetical portfolio rebalancing.

Household A is a homeowner that experiences a 50 percent loss in housing equity, but no change in its cash or stock holdings. The lost housing equity causes household A's financial wealth to fall and its LW share to increase. With less housing equity the household's FRA share falls, and thus the household appears to have a somewhat less risky, more liquid portfolio merely as result of the decline in house prices. In other words, the house price shock by itself cause the same qualitative change in the household's portfolio that one would expect if, because of increased concerns about future financial crises, the household desired to increase its liquidity and reduce its risk exposure. In addition, suppose that household A becomes more concerned about its risky asset holdings as a result of the house price shock and transfers $25 from its stock position to cash. This reduces the household's LRA and FRA shares and reinforces the initial (passive) shift to having a more liquid and less risky portfolio. This example shows how it is difficult to distinguish between passive and active portfolio rebalancing, especially if one only observes a household's balance sheet before the asset price shock and then again after all the reshuffling had taken place.

In comparison, household B, rents its home, has no housing equity but some nonhousing debt, and experiences a 40 percent ($15) drop in the value of its stock position. This drop causes household B's LRA and FRA shares to decline since the risky assets in its portfolio are now less valuable. If household B subsequently repays some of its nonhousing debt because it feels that its debt-to-asset ratio is too high then its FRA share would decline further. Alternatively, the financial loss and crisis could cause the household to reassess its economic outlook and risk tolerance and prompt it to lower its target share of risky asset holdings. However, if this new target is above the household's post-shock risky asset level, then a seemingly perverse situation could occur where the household adds to its risky asset position despite having a crisis-induced desire for less risk on its balance sheet. Under each alternative, household B saves more and consumes less in order to repair its balance sheet.

(other real estate) they may own.

[3]The first two ratios are based on Brunnermeier and Nagel (2008), while the last ratio is specific to this paper.

The examples in this section are highly stylized and there are many additional permutations that could be considered, including situations where households adjust the share of their saving destined for risky or risk-free assets rather than adjusting their existing positions. A key takeaway from these examples is that there are many different ways in which households can potentially respond to negative balance sheet shocks. A given household's response will likely depend on its specific circumstances—factors such as whether they care more about their debt-to-asset ratio or the amount of risk in their portfolio—as well as any changes in the household's future outlook. How households actually react to negative balance sheet shocks is therefore an empirical question.

2.3 Approach

The means by which households conduct balance sheet adjustments are categorized within a few broad approaches. In particular, they can repay debt or take up additional debt at a slower rate. For example, if a household had planned to borrow $100 a month for the next year to finance expenditures, it could alternatively reduce its borrowing (and spending) by $50 a month and thus have less debt on its balance sheet after a year then previously planned. A household can also shift money between existing positions on its balance sheet to increase liquidity and/or reduce its exposure to risk. In addition, a household's saving rate can be increased (and current consumption cut back) in order to add funds and rebuild its balance sheet. Even if a household does not save more, it can alter the composition of its saving—the rate at which it adds to its existing asset positions—in order to shift its portfolio allocation over time.

The remainder of this paper will examine these possible household balance sheet adjustments in turn, paying particular attention to potential differences in balance sheet behavior across household groups. Indeed, there are a number of different groups of households that were likely particularly impacted by the financial crisis and housing bust and had a greater need than others to rebuild their balance sheets. These groups include: highly leveraged homeowners, and homeowners living in the so-called sand states—Arizona, California, Florida, and Nevada—where house prices fell dramatically starting in late 2006, and those households heavily invested in the financial markets on the eve of the crisis.

3 Data and Analysis Sample

This paper uses data from the PSID, which is a household-level survey that began in 1968 and follows households and their offspring over time. Sixty percent of the initial 4,800 surveyed households belonged to a cross-national sample from the 48 contiguous states, while the other portion was a national sample of low-income families from the Survey of Economic Opportunity. The survey was conducted annually through 1997 and biennially thereafter. The 2009 wave of the PSID includes more than 8,000 households. This paper focuses primarily on the biennial data starting in 1999 because household financial wealth and saving data prior to 1999 were collected only every five years. The analysis uses data from the 1999 to 2011 waves of the PSID.

In addition to detailed household (and individual) demographic and income data, the PSID contains self-reported house values and outstanding mortgage debt data. The mortgage data include both first and second liens, so one can calculate a household's housing equity (house value less all outstanding debt).[4] In the so-called wealth supplements, the PSID also has detailed household financial wealth information, including data on households' cash holdings (checking and savings accounts), bond holdings, stock holdings, retirement accounts (IRAs), business or farm equity, vehicle values, and nonprimary residence real estate holdings (other real estate). The wealth supplements also include data on households' so-called active saving and noncollateralized (nonhousing) debt holdings.[5]

Active saving is what households save out of their current income *excluding* capital gains. For example, households that pay off some of their outstanding mortgage principal in a given period have *positive* active saving. In contrast, increases in brokerage account balances due to stock price appreciation are *not* counted as saving. Data on households' active saving are constructed following the approach used in Juster et al. (2006), and are measured between PSID wealth supplements. That is, the 2001 saving data capture households' active additions to and subtractions from their asset positions between 1999 and 2001. The PSID tracks households' active saving in housing and all the financial wealth categories. The availability of household saving data is one advantage of using the PSID versus the Survey of Consumer Finances (SCF) for the paper's analysis. Additional details regarding the construction of the active saving data are available in the appendix.

The PSID also maintains Geocode Match Files that contain the identifiers necessary

[4]The terms housing equity and housing wealth will be used interchangeably in this paper.

[5]Non-collateralized debt includes households' school debt, credit card debt, and other unsecured borrowing. This borrowing is only broken out by category in 2011.

to link the main PSID data to other datasets with information on the characteristics of respondents' neighborhoods, zip codes, or metropolitan statistical areas (MSA).[6] For this paper, the MSA in which a household lives in a given year is used to match MSA-level real house price growth data from CoreLogic to the PSID.[7] The MSA-level house price data are used to rank a household's exposure to house price swings during the housing boom and bust, and are less subject to measurement error than a household's self-reported house values.[8]

The sample used for the paper's analysis includes all PSID households except in the cases where the results are restricted to homeowners and/or renters or other household groups. For instance, the analysis based on a household's 2007 homeownership status is limited to households for which there is complete 2007 homeownership data. Outliers are removed where noted to minimize their impact on the results.

4 Results

4.1 Debt Repayment

The paper considers households' debt repayment behavior both to check the external validity of the data and to analyze how households in the PSID adjusted both the asset and liability side of their balance sheets in the wake of the financial crisis and Great Recession. The analysis will focus primarily on households' nonhousing debt repayment, which is an interesting and less studied margin of household deleveraging.

It is worthwhile to analyze households' nonhousing debt repayment because much of the sizable decline in the overall debt-to-income ratio (see appendix figure A.1) was not due to households actively paying down mortgages. Instead, Bhutta (2013) shows that much of the drop in overall household debt was due to less new borrowing (debt inflow) rather than to abnormally high debt repayment (debt outflow). In addition, households that are current on their mortgages should reduce noncollateralized debt, such as credit card and student loan

[6]The Geocode Match data are highly sensitive (usually pinpointing the census tract in which families live), and are available from the University of Michigan under special contractual conditions designed to protect the anonymity of respondents.

[7]The quarterly CoreLogic data are converted to annual data (quarterly average) and deflated using the annual PCE deflator (2000 base year) before calculating the growth rates.

[8]There is substantial variation in MSA-level house prices both within a given year and over time for the PSID sample. Between 2001 and 2009 two-year house price growth averaged 3.3 percent, with a minimum of –52.9 percent and a maximum of 68.1 percent and a standard deviation of 17.3 percent. Between 2007 and 2009, house price growth ranged from –52.9 percent to 3.1 percent with a mean of –19.6 percent and a standard deviation of 11.4 percent.

debt, first—to the extent that they wish to reduce their leverage—since it tends to be much more costly than collateralized debt.

4.1.1 Total Debt

Table 2 ranks households' relative positions by quartiles in the (total) debt-to-income (DY) distribution in the years leading up to (2003 to 2007) and following (2007 to 2011) the December 2007 start of Great Recession by using a so-called transition matrix. Lower numbered quartiles represent lower DY ratios relative to the rest of the population and high quartiles represent high DY.[9] The diagonal elements in the matrices capture the percent of households who remain in the same quartile of the DY distribution over time.[10]

There are a couple of important take-aways from the results in table 2. First, U.S. households' relative DY ratio changed less during the 2007-2011 period than prior to the housing market collapse. That is, more households remained in the same DY quartile post-2007 than during the 2003-2007 period. This is particularly the case for households that began 2007 in the *lowest* quartile of the distribution, and debt take-up overall (the sum of the cells *above* the diagonal) since 2007 is less than that from 2003 to 2007—a finding that is consistent with previous research suggesting that U.S. households took on less new debt during and following the Great Recession. In contrast, a slightly greater share of households reduced their DY from 2007 to 2011 than in the earlier period—consistent with somewhat increased debt repayment—and more households moved from being in the top quartile of the DY distribution in 2007 to being in the bottom in 2011. This latter finding could be due in part to some households failing to accurately report foreclosure information.

Table 3 splits the DY transition matrices based on whether households owned or rented their homes in 2007.[11] Homeowners likely had a greater desire to repay debt than renters—to the extent they had target debt-to-asset ratios—given the losses they incurred from falling house prices. Less homeowners increased their debt between 2007 and 2011 than during the 2003-2007 period—a finding that is consistent with a reduced inflow of debt for these

[9] Households that have experienced a foreclosure since 2001 (based on retropsective data added in 2009) or have had a foreclosure proceeding started but not completed since 2009, are excluded from the analysis.

[10] It is possible that all households DY could shift up or down over time in a manner that preserves everyone's relative position in the DY distribution. To avoid this situation, the 2003 DY quartile cut-offs are used for the 2007 DY rankings in the 2003-to-2007 comparison and the 2007 DY quartile cut-offs are used for the 2011 rankings in the 2007-to-2011 comparison. The results are very similar, however, using the actual quartile rankings in each year. In addition, in order to be included in the analysis households must have non-missing DY data in 2003, 2007, and 2011.

[11] The DY distributions are calculated separately for homeowners versus renters since they tend to have very different debt burdens and borrowing needs.

households. In contrast, renters seemed somewhat more likely to have increased their debt following the start of the Great Recession than in the prior period—perhaps because those renters that were qualified took advantage of the lower prices to purchase homes.

In addition, more homeowners—roughly 10 percentage points—remained in the top quartile of DY distribution during the 2007-2011 period than during the 2003-2007 period. The comparison is even more stark for renters—more than double the percentage of households that rented their home remained in the top quartile of the DY distribution after the start of recession than before it began. These results are inconsistent with substantially higher debt repayment by homeowners or renters, and with homeowners engaging in more deleveraging because of their balance sheet losses incurred from falling house prices. The findings are very similar if the transition matrices are computed using a household's *total* debt rather than its DY ratio (not shown), so it does not appear that the results in table 3 are driven by changes in household income.

4.1.2 Nonhousing Debt

The results are qualitatively similar if one considers transition matrices for households' nonhousing debt (see appendix table A.1). There are other ways, however, to analyze changes in households' nonhousing debt. Following an approach in Knotek II and Braxton (2012), Figure 2 shows the percent of households that increased their nonhousing debt between PSID waves as well as the percent that decreased their nonhousing debt and the percent whose debt was unchanged. Overall, the percent of households that increased their debt has been relatively stable since 2005, while the percent of households reporting no change in debt has trended down over time (top panel).[12] In comparison, the percent of households reporting a reduction in nonhousing debt increased notably between 2009 and 2011, and has trended up since 2005.

The nonhousing debt patterns for homeowners versus renters are similar, suggesting that even though as of 2007 homeowners were more likely to be negatively impacted by the housing bust than renters, homeowners do not appear dramatically more likely to lower their existing nonhousing debt or limit their new borrowing. If anything, the change in the percent of households repaying debt or taking on new debt is somewhat larger for *renters* than for homeowners. Still, the results in figure 2 suggest both increased nonhousing debt repayment

[12]The overall trend in the debt increase series is somewhat different than in Knotek II and Braxton (2012), for example, most likely because those authors exclude student debt holdings from their calculations, which has increased substantially in recent years. It is not possible to separate student loan debt from other household nonhousing debt in the PSID prior to 2011.

and lower take-up amounts for new nonhousing debt following the Great Recession—patterns that are broadly consistent with households trying to improve their balance sheets. In addition, the average amount of new nonhousing borrowing declined noticeably between 2009 and 2011, and the average amount of debt repayment is higher (see figure A.2 in the appendix).

The upper panel of figure 3 shows the percent of homeowners that reported lowering their nonhousing debt based on the relative change in house prices they experienced between the 2007 and 2009 PSID waves.[13] Homeowners in first quartile (Q1) experienced the most negative (least positive) house price growth, and should have been the ones most likely to increase their nonhousing debt repayments if such deleveraging was linked to offsetting their housing losses. The percent of households repaying their debt increases somewhat for homeowners in the first quintile, but the biggest increase in the percent of households reporting debt repayment are those homeowners with less negative housing growth (Q4 of the distribution). Changes in reported repayment for households in Q2 or Q3 of the house price distribution are limited. Overall, the results are inconsistent with the idea that house price changes had a considerable impact on the number of households deciding to pay down their debt.[14]

The bottom two panels of figure 3 show the percent of households that decreased their debt based on their 2007 homeownership status and relative leverage judged by the DY ratio. Higher quartiles represent households with greater debt relative to their income as of 2007.[15] The results show an increase in the percent of households decreasing their debt since 2007, but there is little difference in the percent of households reporting lower debt—especially homeowners—for those households in the top three quartiles of the DY distribution. That is, the percent of high leverage homeowners who were repaying their nonhousing debt did not jump relative to other household types—a finding that is inconsistent with the claim that debt repayment by highly levered households has contributed to the sluggish economic recovery.

Despite the limited differences in the percent of households reporting increased or decreased debt holdings, it is possible that there are large differences across household groups

[13]House price data are assigned based on the MSA in which a household lives as of 2009. Housing appreciation (depreciation) is measured based on the average annual house price index in the MSA in 2007 relative to 2009.

[14]Results based on the house price growth homeowners experienced from 2003 to 2007 are very similar (not shown). House prices tended to fall the most in areas that they grew the most prior to the collapse so households with greater house price growth likely experienced a bigger negative housing shock. This did not, however, have a large differential impact on whether they chose to repay debt or not.

[15]The DY distributions are calculated separately for renters and homeowners, and are conditional on households reporting positive debt as of 2007.

in the dollar amount of households' debt changes. Figure 4 reports the median change in households' nonhousing debt relative to income (NDY) based on the house price changes that homeowners experienced between 2007 and 2009.[16] The left panel shows the results for homeowners who increased their debt and the right panel shows the results for homeowners who decreased their debt. The results are qualitatively similar regardless of the homeowners' house price exposure. Indeed, there are relatively large drops in the amount of *new* nonhousing borrowing between 2009 and 2011, but the size of the drop is similar for homeowners that experienced the largest house price drop (Q1) and those that experienced the least negative house price change (Q5). Households with the most unfavorable house price changes also do not decrease their NDY substantially more than other homeowners. In addition, while the amount of repaid debt increased slightly between 2009 and 2011 for debt decreasers, the pace was in line with the average debt repayment trends in prior years. Taken together, these results suggest that, consistent with the existing literature, the biggest change in U.S. households' debt behavior since the onset of the Great Recession is less new borrowing rather than substantially more debt repayment.[17]

The estimates in figure 5 divide households based on whether they were homeowners or renters as of 2007 (the start of the Great Recession) and whether their 2007 DY ratio was in the top quartile of the distribution (high 2007 debt) or not (lower 2007 debt). The median rate of new borrowing relative to income fell between 2009 and 2011 for debt-increasing homeowners regardless of their 2007 leverage, while the amount of debt repayment decreased slightly for high-debt homeowners and rose somewhat for low-debt homeowners. Relative to 2007, however, the rise in debt repayment and the reduction in the amount of new debt borrowed was much more substantial for high-debt households than low-debt households—a result that suggests household leverage prior to the financial crisis may have led to some differences in homeowners' nonhousing debt changes during the recovery. The median change in NDY is consistently higher for renters with high amounts of debt than for renters with lower amounts of debt. However, there is less evidence of a substantial reduction in the inflow of new debt among renters when compared to homeowners. The increase in debt repayment by high-debt renters between 2007 and 2009 also appears more transitory than that of homeowners.

Taken together, the results in figure 5 show that some households that potentially were

[16]Households in the top and bottom 1 percent of the debt change distributions are dropped to remove outliers.

[17]The results are similar based on the absolute dollar change in households' NDY (see figure A.3 in the appendix).

particularly impacted by the financial crisis—homeowners with high debt—were somewhat more likely to respond to the financial crisis by adjusting their nonhousing debt than were other households. Still, the magnitude of these effects was relatively small. In particular, debt repayment by high-debt households rose roughly 2 percentage points relative to income between 2007 and 2011 or about $350 annually, and the rate of debt increase fell by about $860 annually.[18] These debt changes are not trivial but since high-debt homeowners experienced average wealth losses over $55,000 these changes are unlikely to quickly restore household balance sheets. The results are also inconsistent with the theory that a large debt overhang in the U.S. economy has prompted households to dramatically alter their balance sheet behavior. It is possible, however, that households concentrated more on adjusting the asset side of their balance sheets.

4.2 Balance Sheet Composition Changes

Households may have responded to the housing price collapse and financial crisis by altering the composition of their portfolios especially if their experiences during the crisis made them desire having greater liquidity and/or holding less risky assets. For example, a household with $10,000 in stocks after the recession started could choose to sell half its holdings and shift the proceeds into a saving account (cash) to reduce its exposure to future stock market fluctuations. Table 4 shows the composition of U.S. household wealth over time (for select years). The results show that household balance sheet reshuffling was limited, at best, when averaged across all households. In addition, many of the small shifts that did occur, such as the increase in the share of households' cash holdings in 2009, appear transitory.[19]

Table 5 shows households' average shares of liquid wealth and risky asset holdings over time based on the definitions discussed in section 2.2.2. The shares are reported with and without households' retirement account assets.[20] The results are broadly consistent with those in table 4. The LRA share fell in 2009 (conversely the amount of nonrisky liquid wealth rose), but recovered by 2011, as households temporarily reduced their portfolio risk. In addition, the LW share rose somewhat in 2009 and remained at that level in 2011. Since stock holdings declined somewhat over this period, the rise in households' LW share is likely

[18] Estimates are based on homeowners' median income in 2007 of about $69,000.

[19] The top and bottom 1 percent of all the share data in this section are trimmed to remove outliers. A household with an outlying share observation in a given year is dropped from all that year's mean calculations so that the average shares in a given year add to 1.

[20] The analysis excludes vehicle related assets like in Brunnermeier and Nagel (2008). It is unclear whether those authors include IRA-type assets in their analysis or not.

due to households having somewhat less nonhousing debt. Still, there is little evidence of major shifts in households' portfolio allocations following the start of the Great Recession.

The results across all households, however, could mask important heterogeneity in households' balance sheet behavior. Table 6 reports average balance sheet shares (including retirement assets) in 2007 for homeowners and renters with high debt and lower debt. The results show that the qualitative pattern of households' portfolio shares are similar for a given housing tenure, regardless of whether the households are highly levered or not. Homeowners' LRA share declined in 2009 before recovering in 2011, while their FRA share decreased starting in 2007—likely reflecting reduced housing equity and less desire for financial-related risk. In contrast, homeowners' LW share rose starting in 2007 consistent with homeowners seeking to increase their liquidity. The main difference between high and low debt homeowners' balance sheet reshuffling is that the LW share rose somewhat more for high debt homeowners—suggesting perhaps that such households had a greater desire for liquidity. Still, the results are inconsistent with highly levered homeowners altering their balance sheets substantially more than their low-debt counterparts in the wake of the financial crisis.

In comparison, renters reduced their liquidity and took on more risk since 2007. This could be due partly to renters taking advantage of low house prices during 2007 to 2011 to purchase real estate. Leverage does not greatly impact renters' behavior, as the results are very similar if homeowners and renters are split based on their 2007 after-tax family income (see appendix table A.2). Homeowners increased their liquidity and reduced their financial risk after 2007, while renters increased their share of risky holdings and reduced their liquid wealth holdings. These patterns were little changed whether or not the households had low income or high income, even though low-income households likely fared worse during the Great Recession.[21]

The next set of results uses constructed counterfactual portfolio shares to determine the extent to which household portfolio adjustments occurring from 2007 onward were the result of passive asset price fluctuations versus active reshuffling by households. A large difference between the actual and counterfactual portfolio shares would imply that households actively adjusted their balance sheets. The counterfactual shares assume alternative stock market wealth data for households based on a household's previous period stock market wealth and the subsequent total market return.[22] In particular, households' stock market wealth in

[21]Low income households are those whose after-tax income was in the bottom 25 percent of the respective renter or owner income distribution.

[22]There is not enough information to perform similar calculations for other household assets. Stock holdings are relatively liquid, however, and altering them is an easy and low cost way for households to change the riskiness of their portfolios.

period $(t-1)$ is extrapolated to period t using the return on the Wilshire 5000 between $t-1$ and t.[23] This approach determines what a household's stock market holdings would have been in period t based solely on market fluctuations and not on any active adjustment by the household.[24] A household's portfolio shares are recalculated using this counterfactual wealth data and then the result is compared to the household's actual shares. Retirement account data are dropped from this analysis because the allocation of households' retirement account assets between stocks, bonds, cash, and other investments is unknown.

The results reported in table 7 suggest that overall households did very little active portfolio rebalancing. Households reduced their stock holdings somewhat relative to the market-induced changes—especially in 2011—but these changes were not large enough to have a noticeable impact on households' risky asset or liquidity positions relative to their total financial wealth.[25] Table 8 divides the results between households that owned their home in 2007 and those that were renters.[26] Homeowners seemed to be actively adjusting their stock positions and LRA shares somewhat more than renters in 2011, but otherwise the portfolio changes were similar and very limited for the two groups. In sum, even though some homeowners likely suffered large housing losses, these losses do not appear to have changed their views about holding risky assets enough to prompt them to substantially alter their risky asset positions relative to renters.

Still, there could be important additional heterogeneity underlying these results. Table 9 reports results conditional on households' 2007 homeownership status *and* financial wealth. Households with financial wealth holdings in the top quartile of the 2007 financial wealth distribution (high FW) are compared to households in the lower quartiles (lower FW).[27] The results suggest that high FW homeowners were the most active in adjusting their stock holdings to reduce risk, although these changes are not that much greater than for homeowners with low financial wealth. Therefore, it appears that households' exposure to the financial

[23]Households report their wealth as of the PSID interview date, which differs by household and is publicly available. Household specific stock market growth is therefore calculated based on the reported interview dates.

[24]This procedure is somewhat imperfect because it ignores the fact that households can add to or remove money from the stock market for reason other than portfolio rebalancing—such as receiving an inheritance of IBM stock—but it yields a reasonable approximation.

[25]The PSID unfortunately lacks the data to determine whether households maintain the overall share of their wealth in stocks or instead alter their individual stock positions towards ones that tend to be less volatile. For instance, households might shift money from technology startups to historically more stable, established companies like IBM.

[26]The wealth shares can be greater than one because debt can lower overall financial wealth below the value of a given household's asset positions.

[27]The financial wealth distributions are calculated separately for homeowners versus renters.

markets matters only to the extent that they were also homeowners, and even then this exposure did not substantially alter households' balance sheet behavior.

Overall, the results in tables 7 to 9 suggest that households engaged in active portfolio adjustment to limit risk exposure following the financial crisis and Great Recession. This behavior, however, was far from widespread, as it was limited to a small group of homeowners that made, at best, moderate adjustments to their portfolios. It would be incorrect to ignore the role of heterogeneity in household balance sheet behavior following the financial crisis. The altered behavior of a small group of households, however, does not appear to have had a substantial impact on overall household balance sheet adjustment—especially not to the extent that could help explain the United States' sluggish economic recovery.

4.3 Household Saving Behavior

Even though households engaged in limited reshuffling of their existing balance sheets, they may have taken a longer-horizon view regarding their portfolio composition in response to the financial crisis, and thus may have chosen to alter their balance sheets through the inflows of new saving rather than altering their existing balance sheet positions.

4.3.1 Overall Saving Changes

There is limited evidence of large changes in U.S. households' overall saving behavior since the Great Recession. In particular, table A.3 in the appendix shows few discernable patterns in household saving behavior between 2007 and 2011, and indicates that saving over this period does not vary much based on households' 2007 housing status. Analyzing household saving behavior is inherently difficult because some households may be savers by nature regardless of the situation, while other households may be spendthrifts. The next set of results addresses this concern by comparing the saving patterns of a given household over time. In particular, households are grouped into one of four outcomes based on how their saving evolved between 2003 and 2007 and 2007 and 2011: increase/increase (their saving rate increased in both periods), decrease/decrease (their saving rate decreased in both periods), increase/decrease (their saving rate increased between 2003 and 2007 but decreased between 2007 and 2011), or decrease/increase (their saving rate decreased between 2003 and 2007 but increased between 2007 and 2011). Households who reported zero saving in both periods were dropped from the analysis.

Table 10 compares households' saving behavior over time based on their 2007 homeownership status and their relative leverage. As an example, the table shows that 32.4 percent

of households with high leverage (Q4 of the 2007 DY distribution) decreased their saving rate between 2003 and 2007, but increased their saving between 2007 and 2011. The results suggest that a somewhat greater percentage of high-debt homeowning households increased their saving rate after lowering it over the previous period—a finding that is broadly consistent with high-debt households having a greater need to rebuild their balance sheets following the housing crash. Within the group of highly leveraged homeowners, however, a somewhat greater percentage of households shifted from increasing their saving to decreasing their saving over this period. In addition, the majority of high debt *renters* shifted from decreasing to increasing their saving—a result that suggests it was leverage in general and not necessarily high leverage combined with housing losses that lead some households to adjust their saving behavior.

Examining homeowners' saving behavior over time based on their exposure to house price growth between 2003 and 2007 tells a similar story (see table 11).[28] There are no major differences in homeowners' saving behavior based on how much price appreciation they experienced during the housing boom, even though households that experienced the greatest run-up in house prices tended to suffer the greatest housing losses. Looking directly at homeowners' house price declined between 2007 and 2009 yields very similar results. Taken together, the homeowner leverage and house price results are inconsistent with the idea that high leverage and the housing collapse led to large adjustments in households' balance sheet behavior.

Household unemployment during the recession, however, seems to have a bigger impact on households' saving behavior. In particular, table 12 reports changes in households' saving behavior based on the head of the household's duration of unemployment (if any) during the recession. Income losses due to extended unemployment may require households to decrease their saving going forward to make up for lost earnings. Alternatively, households with previously unemployed heads may increase their saving to rebuild their buffer stock of liquid wealth—especially if the unemployment spell raised their concern about future income losses. The results show increased saving for households with heads that experienced extended periods of unemployment. That is, continuous employment for the household head and/or a relatively short unemployment spell has little, if any, impact on a household's saving patterns. The majority of households with heads unemployed for longer than six months, however, increased their saving rates between 2007 and 2011. These households were also much more likely to switch from decreasing to increasing saving over time than they are to

[28] Homeowners that lack MSA and/or house price data are excluded from this analysis.

switch from increasing to decreasing saving.

Overall, there is some evidence that certain household groups altered their saving behavior during and following the Great Recession. These groups—the long-term unemployed and the high-debt renters—are not the ones typically thought of when considering the U.S. households most likely in need of balance sheet rebuilding. The groups also represent a relatively small share of the overall population, so their behavior is likely not a good representation of how the Great Recession affected households' saving behavior.

4.3.2 Shifts in the Composition of Household Saving

Even if U.S. households in the aggregate did not change their overall saving rate to rebuild their balance sheets or adjust the existing composition of their portfolios, they may have altered the destination of their saving in order to shift the composition of their balance sheets over the longer term.

Table 13 shows the disaggregated shares of total household saving, excluding housing, devoted to various assets over time. Households' shares of saving *including* housing exhibit a very similar pattern (not shown).

The data suggest that the composition of household saving changed somewhat during and following the Great Recession, but that these effects were transitory and/or small.[29] In particular, the share of saving in cash and IRA/401k accounts increased somewhat in 2009, and remained at its slightly higher level in 2011. The share of saving in stocks declines between 2009 and 2011, albeit from a relatively small initial level. Indeed, this decline amounted to only about $8 less annual saving in stocks, on average, for those households holding stock positions. This pattern of behavior is consistent with the stock market losses households experienced between 2007 and 2009—households likely increased their cash saving and cut back on stock contributions out of fear of further asset price declines. In addition, saving in IRA and other retirement accounts temporarily jumped up in 2009, likely due to the fact that many 401k and similar retirement contributions are deducted automatically from workers' paychecks, so as total household saving fell the relative share going to retirement accounts increased. Nonhousing debt "saving" also rose in both 2009 and 2011—continuing an earlier trend—consistent with the earlier results on households somewhat higher nonhousing debt repayment following the crisis.

The disaggregated saving data are interesting, but the main question of interest is whether,

[29] Recall that saving reported for 2009 covers the 2007 to 2009 period based on the way the PSID data are recorded.

in the wake of the financial crisis, households substantially altered the amount of their saving devoted to liquid assets and/or risky assets. Table 14 examines the composition of household saving over time using liquid and risky asset ratios similar to those in the balance sheet composition analysis. The main difference in the ratios is that saving (dissaving) in nonhousing debt is included as a potential liquid saving vehicle, and saving in retirement accounts (IRAs/401ks) is excluded since much of such saving occurs automatically through payroll deductions that are infrequently altered.[30] The four reported saving ratios are *liquid risk share* (LR Share): saving in stocks relative to total liquid saving (stocks + bonds+ nonhousing debt repayment + cash), *liquid saving share* (LS Share): total liquid saving relative to total saving (liquid saving plus mortgage debt repayment, business investment, and other real estate investment), *total liquid risk share* (TLR Share): risky saving in stocks relative to total saving, and *total risk share* (TR Share): total risky saving (stock + business + housing) relative to overall saving.

The results in table 14 show limited evidence of shifts in the composition of households' saving. The LS share edged up in 2009 but ticked back down in 2011, while the LR share inched down and then back up—suggesting households temporarily favored liquidity and slightly less risky assets. The patterns for the TLR share and the TR share reinforce a transitory shift by households to slightly less risky saving choices.[31] To investigate the role of heterogeneity in household saving behavior, table 15 reports saving behavior for high- and lower-debt renters versus high- and lower-debt homeowners. Both high-debt and low-debt renters decreased their relative amount of liquid saving (LS share) and increased the overall riskiness of their portfolio inflows (TR share). This suggests that renters took advantage of low prices and shifted their saving into purchasing homes or other nonfinancial risky assets following the financial crisis. These changes are somewhat more modest for renters with high debt, perhaps because they had greater difficulty borrowing.

In comparison, in 2009 both high- and low-debt homeowners temporarily reduced their saving in stocks (as indicated by their LR share). The subsequent recovery in homeowners' saving in stocks relative to total liquid saving is relatively stronger for *high*-debt households—a finding that is inconsistent with high-debt homeowners being more wary of their financial positions and cutting back more on risky holdings than did other households following the Great Recession. Homeowners also increased their overall liquid saving and lowered their overall risky saving levels (TR share) in 2011 relative to 2007. These results are consistent

[30]Vehicle saving is also excluded since these data are quite noisy and have little impact on households' overall saving.

[31]Results that include saving in retirement accounts are very similar to those in table 14 (not shown).

with homeowners in general being more cautious with their saving following the financial collapse, but there is little evidence that highly levered homeowners behaved substantially differently than their less levered counterparts.

Table 16 compares saving behavior for renters and homeowners with high versus low FW in 2007. The purpose of this analysis is to see whether households with greater exposure to the financial market drop—those with high financial wealth—adjusted their saving more following the crisis. Saving in liquid risky assets (stocks) relative to total liquid assets (LR Share) dipped in 2009 for all households. The LR share rebounded in 2011 for homeowners regardless of their FW, but remained lower for renters. These changes in saving behavior are not huge, but they are broadly consistent with renters' concerns about saving in liquid risky assets lingering beyond 2009.

In addition, the saving behavior of households with high FW differs somewhat based on their homeownership status. In particular, renters with high FW noticeably decreased their liquid saving relative to total saving, while increasing their total risky saving. In contrast, high FW homeowners increased their liquid saving share—with some of the increase appearing transitory—and temporarily *decreased* their overall saving in risky assets (TR Share). High FW homeowners' reduction in risky saving and increase in liquid saving was strongest in 2009—a finding that suggests that any effect of their relatively high exposure to the financial markets before the crisis did not have a lasting impact on their saving behavior. This pattern of saving contrasts with that of low FW homeowners whose reduction in risky saving and increase in liquid saving is more permanent. A possible reason for this difference in behavior is that high FW homeowners potentially had more of a cushion to absorb the financial losses associated with the crisis without needing to make long-term changes in their saving behavior. It is also worth noting that the TLR ratio increased in 2009 and 2011 for both high and lower financial wealth homeowners, which suggests neither group shied away from saving in stocks relative to their overall saving decisions despite the huge drop in asset prices.

The extent to which these differences in saving behavior are based on households' financial wealth holdings is less clear, however, since lower financial wealth renters behave in a very similar manner to high financial wealth renters—suggesting again that all renters took advantage of low prices to acquire nonliquid risky assets. In contrast, lower financial wealth homeowners exhibited more of an upward trend in their share of liquid asset saving (LS share) and more of a downward trend in total risky holdings (TR share), compared to the more transitory shifts in these shares for high financial wealth homeowners. That is, these homeowners' reduction in risky saving and increase in liquid saving were strongest in 2009—a finding that suggests that any differential effect they felt due to their high financial market

exposure prior to the crisis did not have a lasting impact on their saving behavior. It is also possible that high financial wealth homeowners had more of a buffer with which to absorb the financial losses, and thus they felt a limited need to alter the composition of their saving to rebuild their balance sheets.

The results in this subsection suggest that there was some limited heterogeneity in saving behavior across household groups following the financial crisis and Great Recession. The differences in behavior, however, are not large, and thus it is difficult to conclude that households particularly exposed to the financial and housing collapse were the ones that consistently adjusted their saving behavior following the start of the recession.

4.4 Response of Household Saving to Household Level Shocks

The final set of analysis considers the impact of household-level economic shocks—such as health shocks, employment shocks, and wealth shocks—on changes in a household's saving behavior conditional on homeownership, income growth, wealth, and other factors that likely impact a household from year to year. This approach attempts to quantify the impact of unexpected, plausibly exogenous events on households' saving decisions.

The basic empirical setup is as follows:

$$P(y = 1|S, X, Z, d) = \Phi(\alpha + c_i + X_{i,t}\beta + S_{i,t-1}\eta + Z_{i,t-1}\gamma + d_t\delta + e_j\nu) \ , \tag{1}$$

where y is an indicator variable for whether a household increases its saving rate between two periods; $X_{i,t}$ is a vector of contemporaneous household-level controls; $Z_{i,t-1}$ is a vector of lagged household-level controls; $S_{i,t-1}$ is a vector of lagged household-level economic shocks; d_t is a series of time dummies; and e_j is a set of location (state) fixed effects. The household control variables include a cubic in the age of the household head, dummies for the level of education completed by the household head, lagged real household income growth, the lagged level of real household income, the lagged level of the household's financial wealth relative to income, and the household's lagged debt-to-income (DY) ratio. As an example of the timing of the estimates, a household's DY ratio as of 2007 is used to predict the likelihood of the household increasing its saving rate between the 2005–2007 period and the 2007–2009 period.

Equation 1 is estimated over the 2003–2007 (pre-recession) and 2007–2011 (during and post-recession) periods.[32] The shocks included in the analysis are positive and negative wealth, health, and house price shocks as well as an indicator for job displacement. The ap-

[32]Separate estimates for each year yield similar results (not shown).

pendix contains a detailed description of how the shock variables are defined and constructed.

The sign of the expected impact of a given shock on whether households increase their saving is, in some instances, ambiguous. For example, a household with a negative health shock may increase saving because of higher expected future medical expenses or the household's saving may decline to the extent they need to spend more currently on healthcare-related costs. Similarly, a household with a displaced worker may save less because it has less income with which to cover its expenses or saving may increase if the job displacement period is over and the household wants to make up for forgone saving during the unemployment period. In other cases the expected sign of the effect is more clear. Households with a target level of wealth (savings) will likely lower their saving rate in response to a positive wealth shock and increase it in response to a negative wealth shock. Households' saving response to house price shocks will likely depend on how long the household plans to stay in its home and whether the household views an unexpected house price decline as a reason to increase saving in other assets to offset its decreased housing equity.

The household-level economic shock indicators are included with a lag so, for instance, a positive wealth shock taking place between 2007 and 2009 is used to predict the likelihood of the household increasing its saving rate during the 2007–2009 period and the 2009–2011 period. The goal of this timing is to identify how a household's saving behavior responds in the aftermath of the wealth shock. In addition, a standard concern with consumption and saving analysis is the influence of unobserved household-specific effects. Since the dependant variable in this analysis compares a household's saving in one period with saving in another period, however, any household-specific effects are effectively differenced out of the analysis.

Table 17 reports estimates of equation 1 with and without house price shocks since including these shocks limits the sample—not all households live in an MSA and not all MSAs in which households live have available house price data. The point estimates reported are marginal effects, and the standard errors are adjusted accordingly. House price shocks have a very small and not precisely estimated impact on households' predicted probability of increased saving. In contrast, there is a strong relationship between a household's stock market windfalls (and losses) and its predicted probability of saving. Households with a positive wealth shock, all else equal, have a 15 to 17 percentage point *lower* predicted probability of saving, while households with a negative wealth shock have a *higher* predicted probability of saving of a similar size. As predicted, households feel less of a need to save when they experience a financial windfall and more of a need to save after experiencing a large financial loss. These estimated effects are similar before and after the start of the Great Recession. The response to negative wealth shocks is slightly stronger in the recent period, but the

difference is not statistically significant.

In addition, positive health shocks tend to increase household saving—perhaps because households have more income to save given a likely reduction in their medical costs. The magnitude of this effect became a bit smaller in the 2007–2011 period, but again the difference is not statistically significant. Negative health shocks tend to reduce households' predicted probability of increasing their saving in the recent period but the effect is small and not precisely estimated. Job displacement seems to raise households' predicted probability of increasing their saving. The effect is strongest in the pre-recession sample that is restricted to homeowners living in MSAs for which there is house price data. Otherwise the effect is somewhat small and not precisely estimated.

Overall, there is not overwhelming evidence that households dramatically changed how they adjusted their saving in response to idiosyncratic economic shocks during and following the Great Recession. In particular, wealth shocks, which have the largest and most precisely estimated impact on households' saving behavior, appear to have had a similar effect on saving before and after 2007. The other shocks may have time-varying impacts on households' probability of increasing their saving, but they are small and imprecisely estimated.

5 Discussion

A relevant question is how can and should one reconcile the relatively small changes in household debt and other balance sheet behavior observed in this paper with the substantial decline in the aggregate debt-to-income ratio since late 2006 (see figure A.1). Despite the conventional wisdom that balance sheet repair—especially through so-called household deleveraging—was an important contributor to the sluggish economic recovery, this paper does not find that the majority of U.S. households engaged in substantial balance sheet adjustments.

The first step in reconciling the aggregate and household-level data is to note, as discussed earlier, that much of the aggregate DY decline is due to reduced debt inflows rather than "exceptional unwinding of debt by households," as shown in Bhutta (2013). Bhutta further notes that "the relatively modest expansion in outflows appears closely related to increased financial distress and mortgage defaults." Dynan (2012b) finds that the vast majority of debt repayment by households was due to foreclosures, but debt charge-offs through foreclosure are not a form of *active* household debt repayment. This paper focuses on active leverage reduction by households, which should be relatively small based on the existing evidence in

the literature.

One could argue, however, that reduced debt inflows could have an impact on demand in a manner similar to active household debt repayment. That is, if a household had planned to borrow $100 a month to finance spending but cut this amount to $50 dollars a month, then its spending for the year will be lower than it otherwise would have been. Households might make this type of change to limit their debt burden at the end of the year. The reduced borrowing could also be driven by something unrelated to their balance sheets, such as lower expected future income.

In addition, Bhutta (2013) and Brown et al. (2013) find that the reduction in debt inflows is mainly due to reduced first-time home purchases as well as less second-home buying and purchases by investors. The lower debt inflows due to households borrowing less from home equity or credit cards are therefore small. Fewer new home purchases have an indirect impact on economic activity through general equilibrium channels, but not the direct effect economists have in mind when they argue that household balance sheet rebuilding may have contributed to the sluggish economic recovery. Reduced home purchases did not result from the household debt overhang, but rather stemmed from less household income available to finance buying a home as well as more cautious loan underwriting by banks.

Finally, as discussed in Cooper (2012b) it is not clear that a factor like deleveraging is even needed to explain the sluggish recovery in household demand following the Great Recession. Indeed, household consumption tracked aggregate income closely during the recovery especially when the huge losses in household wealth are taken into account, as shown in figure 6.[33] Not finding substantial changes in household balance sheets during and following the Great Recession, thus may not be as problematic as it first seems with regard to explaining household consumption behavior over this period.

6 Conclusion

This paper used household-level panel data to examine whether households' balance sheet and saving behavior changed because of the housing crisis and Great Recession. A fair amount of attention has been paid to household debt repayment in the wake of the financial crisis but there had been much less research examining whether households responded to the crisis by adjusting their balance sheets in other ways. Understanding the extent of household balance adjustment is important because such adjustments are often viewed as contributing

[33]This figure is reproduced from Cooper (2012b). Incorporating data from the 2013 comprehensive revision of the National Income and Product Accounts does not noticeably change the depicted relationships.

to the sluggish economic recovery. Signs of a shift toward increased (precautionary) saving by households would also have important implications for predicting consumption and aggregate demand.

Overall, the results show that while some household balance sheet adjustment did occur after 2007, it was fairly limited in scope and the overall effects were small. There is no evidence of enough substantial balance sheet adjustment to be consistent with household balance sheet repair contributing to the slow economic recovery, nor is there evidence of big enough changes in households saving behavior or risk tolerance to raise concerns about the strength of aggregate demand going forward in the wake of the crisis. It also does not appear that the households believed to be in need of adjusting their balance sheets—such as high-debt homeowners on the eve of the housing crisis—made substantially larger adjustments than did other households.

The lack of substantial balance sheet adjustments—especially in terms of household debt repayment—is easier to reconcile when one takes into account that even if households have substantial debt relative to their assets, banks do *not* force them to repay it as long as they remain current on their contracted debt payments. Mortgage contracts should not be confused with firm- or investor-based debt (margin) contracts where the borrower has to either pay back debt or pledge more collateral when asset values decline. Households do not face similar margin calls when house prices fall.

It is difficult to say whether the limited changes observed in household balance sheets and saving behavior during and following the Great Recession represent the true behavioral response by households or if not enough time has elapsed to observe the lasting impact of the financial crisis and Great Recession on households' balance sheet behavior. Indeed, through 2011 some of the households potentially affected the most by the crisis may have lacked the resources to make meaningful adjustments to their balance sheets and saving behavior. Yet even if they lacked the resources to rebuild their balance sheets, households could have adjusted the riskiness of their existing portfolios to the extent they were concerned about future economic shocks—and there is little evidence of this type of behavior occurring. Therefore, this paper's results could certainly capture households' true desired adjustments to their balance sheets. The next waves of the PSID (2013) and SCF (2013) should provide important additional information for further addressing these issues.

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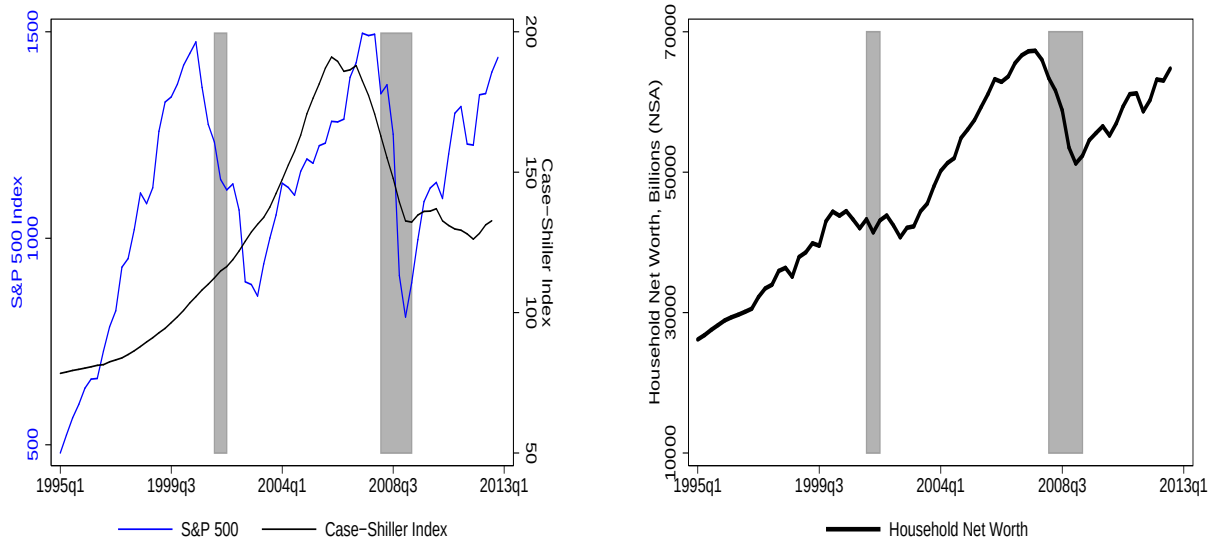
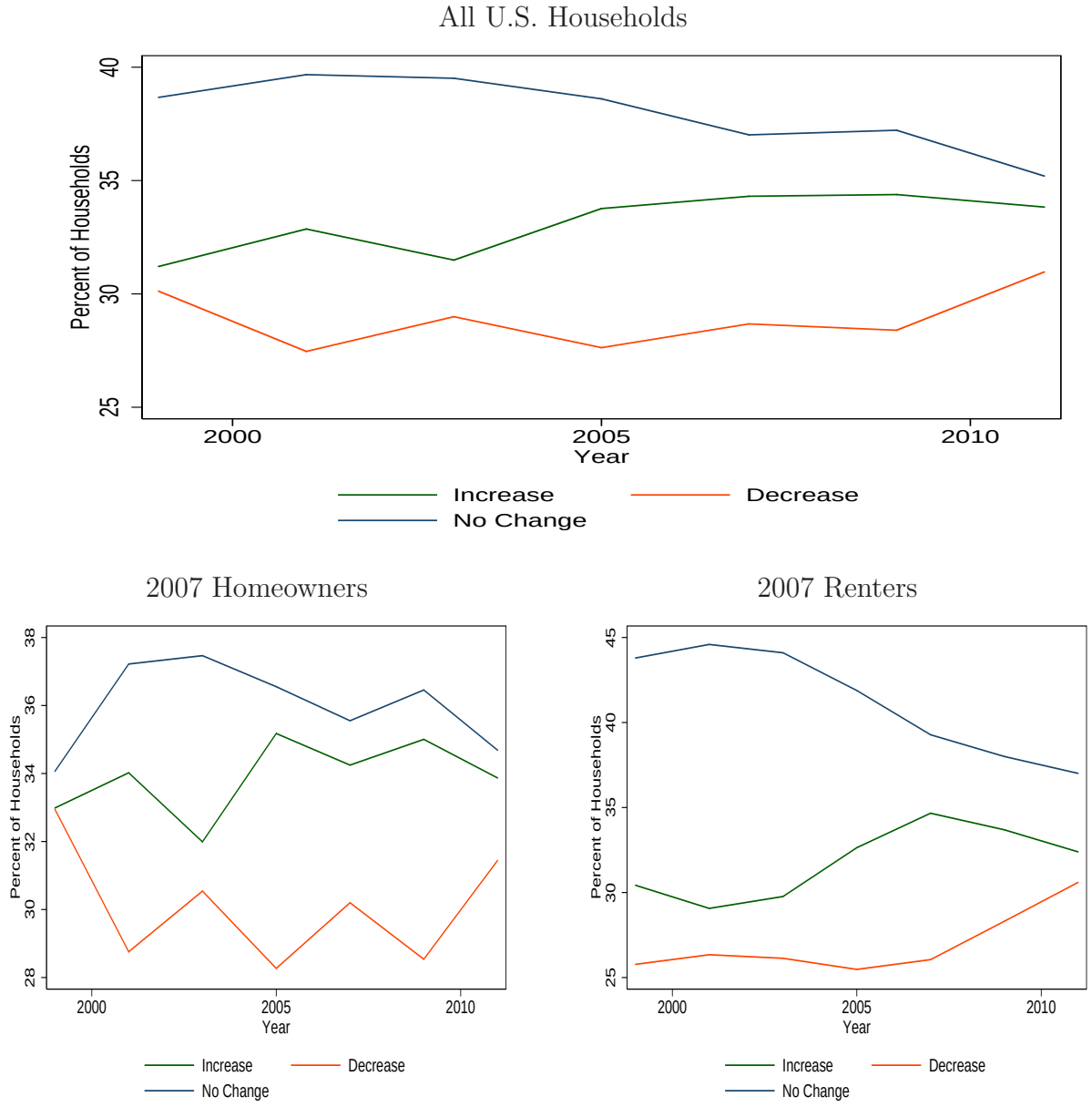
FIGURE 1: Recent Financial and Saving Data



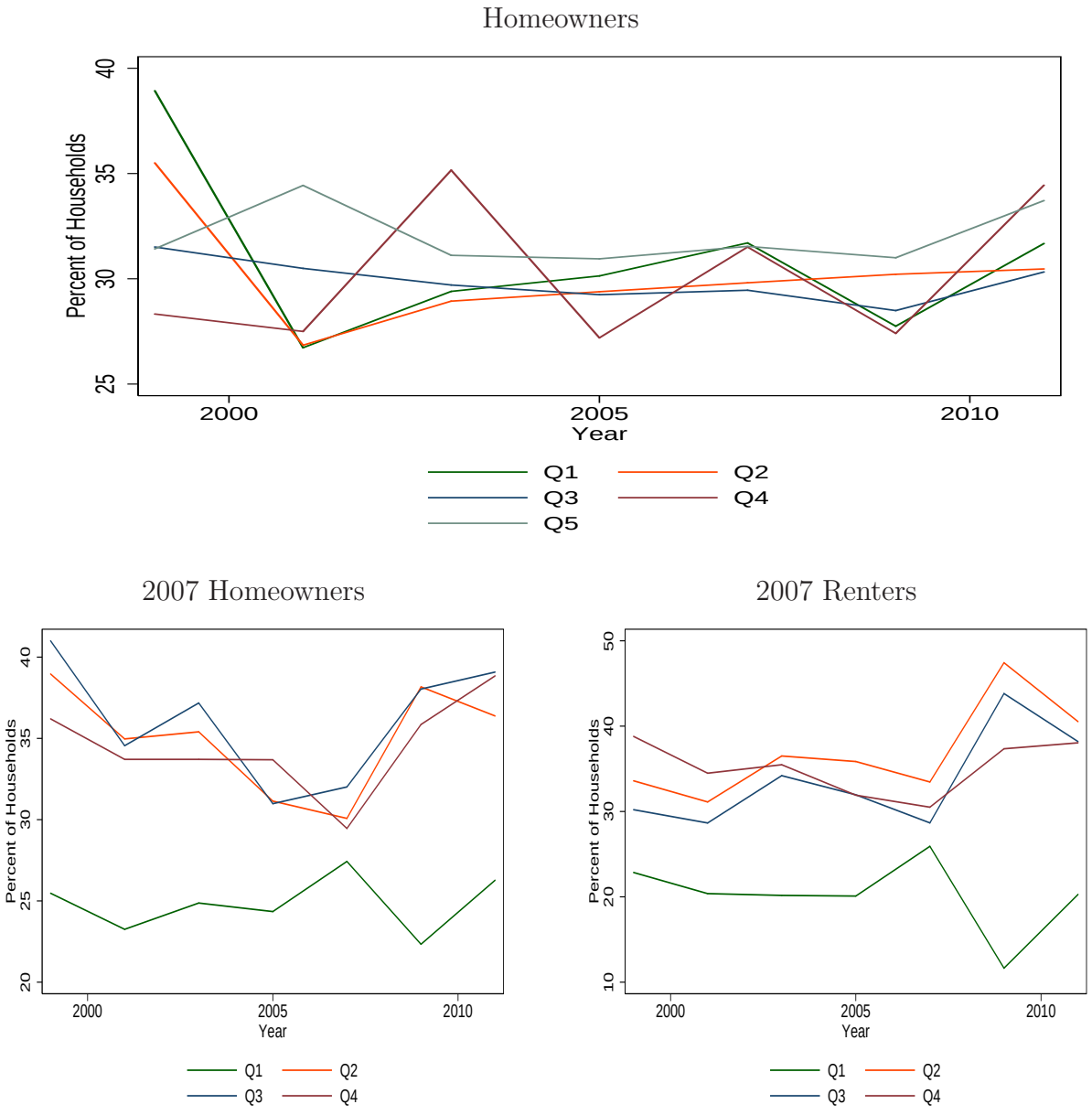
Source: Haver Analytics.

FIGURE 2: Nonhousing Debt Changes



Source: PSID and author's Calculations.
Notes: The top panel plots the percentage of all PSID households that reported an increase, decrease, or no change in their nonhousing debt. The bottom left panel reports the percent of *homeowners* that reported an increase, decrease, or no change in their nonhousing debt, and the bottom right panel reports the percent of *renters* that reported an increase, decrease, or no change in their nonhousing debt.

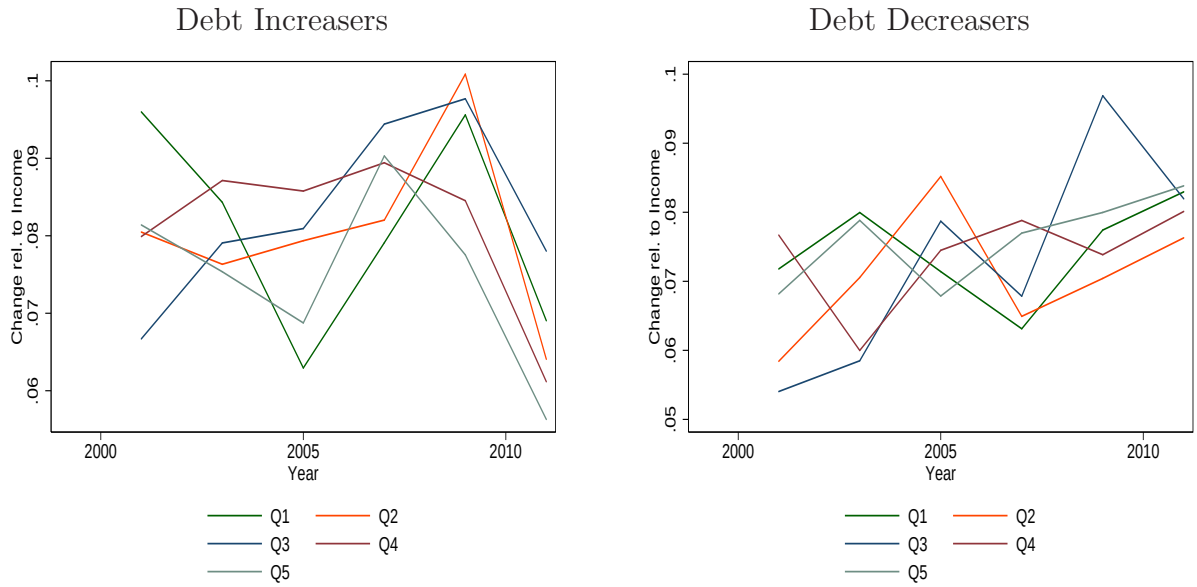
FIGURE 3: Percent of Households that Decreased Their Nonhousing Debt



Source: PSID and author's Calculations.

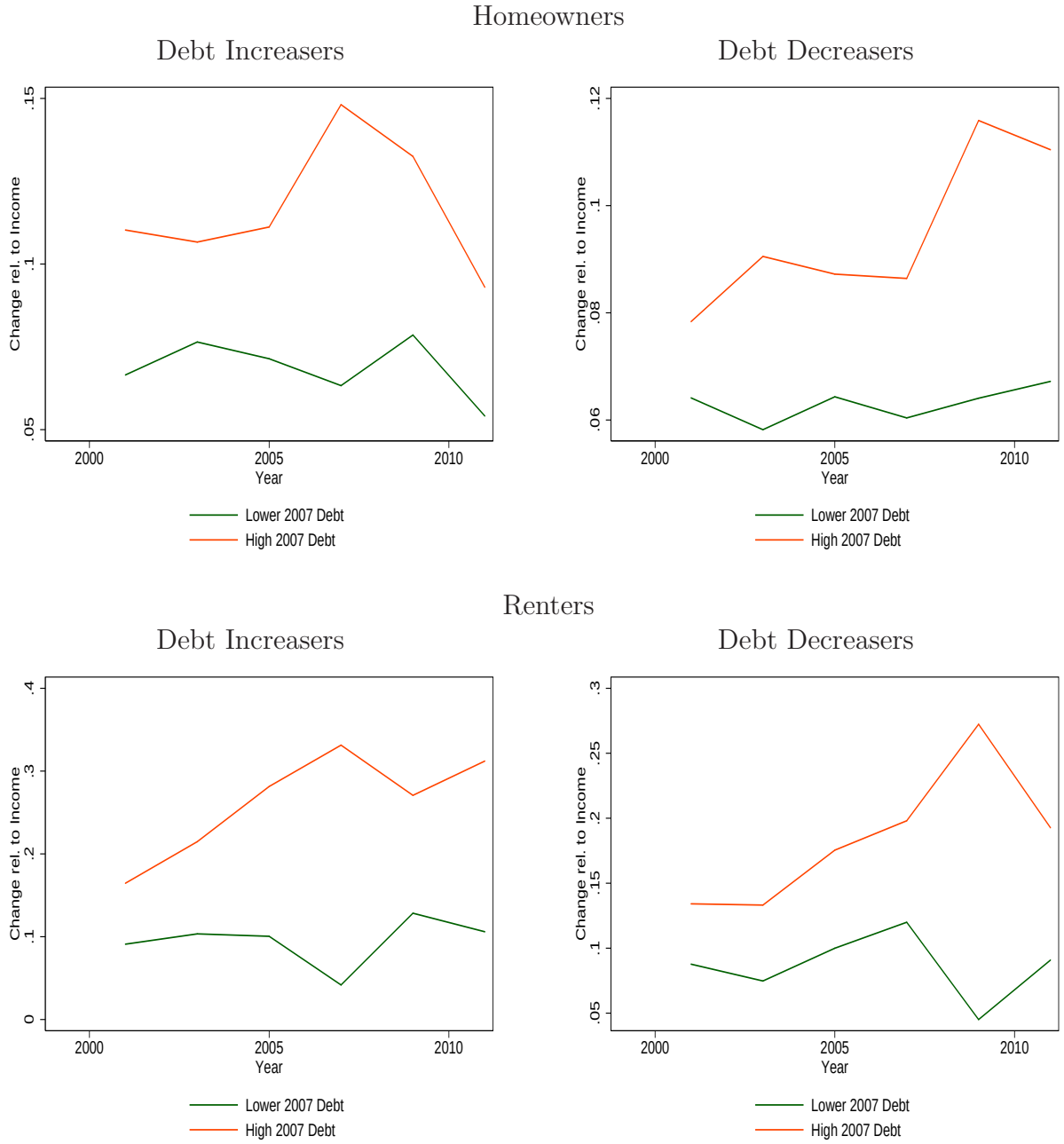
Notes: The top panel plots the percentage of homeowners that reported *decreasing* their housing debt conditional on the relative house price growth in the MSA in which they lived between 2007 and 2009. The bottom left panel reports the percent of *homeowners* that decreased their nonhousing debt based on their debt-to-income ratio as of 2007, and the bottom right panel reports the same results for renters. The distribution of debt-to-income is determined independently for homeowners versus renters and is conditional on the household having positive debt.

FIGURE 4: Nonhousing Debt-to-Income Changes based on 2007–2009 House Price Fluctuations



Source: PSID and author's calculations.
Notes: Figures report the median change in households' nonhousing debt relative to (family) income; the sample is restricted to households that were homeowners in 2007. Homeowners are sorted based on the house price change in the MSA in which they lived between 2007 and 2009—Q5 represents the largest (least negative) house price change between 2007 and 2009, while Q1 captures the most negative house price growth; households in the top and bottom 1 percent of the debt change distributions are dropped to remove outliers.

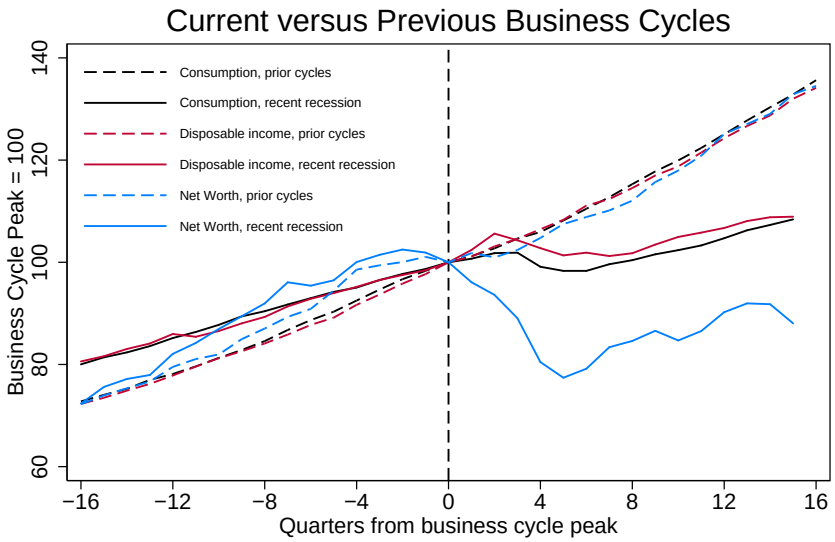
FIGURE 5: Nonhousing Debt-to-Income Changes based on 2007 Leverage



Source: PSID and author's calculations.

Notes: These figures report the median change in households' nonhousing debt relative to (family) income; the sample is restricted to households that were homeowners or renters in 2007; high debt households are those in the top quartile of the relevant 2007 debt-to-income ratio (owners or renters); lower debt households are all households not in the top quartile of the relevant debt-to-income ratio; households in the top and bottom 1 percent of the debt change distributions are dropped to remove outliers.

FIGURE 6



Source: BEA, Flow of Funds.

Note: Prior cycles include the 1970, 1974, 1981−82, 1990, and 2001 recessions.

TABLE 1: Stylized Balance Sheet Examples

	Household A	Household B
Initial balance sheet		
Cash	50	50
Stocks	50	25
Housing equity	50	0
Nonhousing debt	0	25
Initial totals		
Liq. Assets	100	75
Liq. Wealth	100	50
Fin. Wealth	150	50
Initial ratios		
Liq. Wealth Share	2/3	1
Liq. Risky Asset Share	1/2	1/3
Fin. Risky Asset Share	2/3	1/2
After balance sheet shock		
Liq. Assets	100	65
Liq. Wealth	100	40
Fin. Wealth	125	40
Updated ratios		
Liq. Wealth Share	4/5	1
Liq. Risky Asset Share	1/2	3/13
Fin. Risky Asset Share	3/5	3/8
After rebalancing (Scenario 1)		
Liq. Wealth Share	4/5	1
Liq. Risky Asset Share	1/4	3/13
Fin. Risky Asset Share	2/5	3/10
After rebalancing (Scenario 2)		
Liq. Wealth Share	n.a.	1
Liq. Risky Asset Share	n.a.	2/7
Fin. Risky Asset Share	n.a.	4/9

Notes: Household A owns its home and experiences a 50 percent housing loss; Household B rents its home and experiences a 40 percent ($15) stock market loss). Under portfolio rebalancing scenario 1, household A transfers $25 from stocks to cash, and household B repays $10 of debt; under scenario 2, household B instead adds $5 to its stock holdings. Definitions: liquid assets equals stocks plus cash and bond holdings; liquid risky assets equal stock holdings; financial risky assets equal stocks plus housing equity plus any farm or business equity; liquid wealth equals liquid assets less any nonhousing debt; financial wealth equals all assets less any nonhousing debt; liquid wealth share equals liquid wealth relative to financial wealth; liquid risky asset share equals liquid risky assets divided by liquid wealth; financial risky asset share equals financial risky assets divided by financial wealth.

TABLE 2: Household Leverage Changes: Transition Matrices

2003 Debt-to-income Quartile	2007 Debt-to-Income Quartile 1 %	2 %	3 %	4 %
1	47.7	19.7	12.1	20.5
2	24.1	38.7	20.2	17.0
3	7.6	25.6	39.4	27.5
4	7.0	9.1	24.2	59.7

Notes: 2007 quartiles based on quartile cut-off values from the 2003 debt-to-income distribution. To be included in the analysis households must have debt-to-income data in 2003, 2007, and 2011. Households that report on a foreclosure between 2001 and 2011 are excluded.

2007 Debt-to-Income Quartile	2011 Debt-to-Income Quartile 1 %	2 %	3 %	4 %
1	68.6	12.8	8.1	10.5
2	34.9	42.0	13.8	9.2
3	18.2	17.3	48.3	16.2
4	17.1	4.0	12.9	65.9

Notes: 2011 quartiles based on quartile cut-off values from the 2007 debt-to-income distribution. To be included in the analysis households must have debt-to-income data in 2003, 2007, and 2011. Households that report on a foreclosure between 2001 and 2011 are excluded.

TABLE 3: Household Leverage Changes: Transition Matrices by Homeownership

2007 HOMEOWNERS

2003 Debt-to-Income Quartile	2007 Debt-to-Income Quartile[a] 1 %	2 %	3 %	4 %
1	39.0	19.3	16.3	25.4
2	20.4	43.0	19.3	17.4
3	6.9	29.8	35.4	27.9
4	5.1	9.2	23.1	62.6

2007 Debt-to-Income Quartile	2011 Debt-to-Income Quartile[b] 1 %	2 %	3 %	4 %
1	68.2	14.9	8.0	9.0
2	25.5	51.6	17.2	5.7
3	10.1	17.8	54.7	17.3
4	9.6	3.3	14.5	72.7

2007 RENTERS

2003 Debt-to-Income Quartile	2007 Debt-to-Income Quartile[a] 1 %	2 %	3 %	4 %
1	48.4	29.5	13.1	9.0
2	25.4	39.1	24.6	10.9
3	21.4	27.9	22.9	27.9
4	16.3	25.2	24.4	34.2

2007 Debt-to-Income Quartile	2011 Debt-to-Income Quartile[b] 1 %	2 %	3 %	4 %
1	30.7	20.4	16.7	32.3
2	18.1	20.9	23.7	37.2
3	10.0	14.7	33.8	41.6
4	2.7	4.7	14.4	78.2

Notes: [a] 2007 quartiles based on quartile cut-off values from the 2003 debt-to-income distribution; [b] 2011 quartiles based on quartile cut-off values from the 2007 debt-to-income distribution; homeowner and renter distributions are calculated separately; to be included in the analysis households must have debt-to-income data in 2003, 2007, and 2011; households that reported a foreclosure between 2001 and 2011 are also excluded.

TABLE 4: Portfolio Composition: Disaggregated Wealth Shares over Time

Shares of Nonfinancial Assets

	2001	2005	2007	2009	2011
Other Real Estate	0.04	0.05	0.05	0.04	0.04
Business/Farm	0.03	0.03	0.03	0.03	0.03
Vehicles	0.36	0.35	0.35	0.38	0.39
House Value	0.57	0.58	0.57	0.54	0.54

Shares of Financial Assets

	2001	2005	2007	2009	2011
Stocks	0.11	0.09	0.09	0.08	0.07
Cash (Saving Accts.)	0.65	0.67	0.68	0.71	0.69
Bonds	0.08	0.07	0.06	0.06	0.06
IRA & 401k Accts.	0.16	0.17	0.16	0.15	0.18

Notes: Nonfinancial assets include housing equity, vehicles, the value of personal businesses or farms, and other real estate holdings (nonprimary residence(s)). Financial assets include stocks, bonds, checking, saving and other cash accounts, and defined contribution retirement accounts.

TABLE 5: Portfolio Composition: Risky Asset Holdings

	2001	2005	2007	2009	2011
LRA Share	0.16	0.12	0.12	0.10	0.10
LRA Share (incl. retirement accts.)	0.28	0.26	0.26	0.23	0.26
FRA Share	0.72	0.75	0.72	0.64	0.63
FRA Share (incl. retirement accts.)	0.73	0.75	0.73	0.65	0.67
LW Share	0.44	0.42	0.44	0.48	0.48
LW Share (incl. retirement accts.)	0.47	0.46	0.48	0.52	0.52

Notes: Table reports mean shares by year. LRA Share: *liquid risky asset share* [stocks holdings/(stock + cash + bond holdings)], FRA Share: *Financial Risky Asset Share*[(stock holdings + business equity + housing equity)/(financial wealth)], LW Share: *Liquid Wealth Share* [(cash + bond holdings+ stocks – nonhousing debt)/(financial wealth)]. The top and bottom 1 percent of share distributions are dropped in each year to remove outliers.

TABLE 6: Portfolio Composition: Homeownership, Leverage, and Risky Asset Holdings

Renters					
	2001	2005	2007	2009	2011
			Lower Debt		
LRA Share	0.12	0.08	0.08	0.08	0.11
FRA Share	0.23	0.16	0.07	0.13	0.23
LW Share	0.75	0.86	0.97	0.87	0.78
			High Debt		
LRA Share	0.20	0.18	0.18	0.18	0.22
FRA Share	0.48	0.35	0.24	0.38	0.44
LW Share	0.82	0.89	0.99	0.93	0.88

Homeowners					
	2001	2005	2007	2009	2011
			Lower Debt		
LRA Share	0.28	0.28	0.28	0.26	0.28
FRA Share	0.87	0.97	1.01	0.92	0.88
LW Share	0.33	0.27	0.21	0.29	0.32
			High Debt		
LRA Share	0.48	0.46	0.48	0.43	0.47
FRA Share	0.98	1.11	1.14	1.05	0.99
LW Share	0.44	0.26	0.21	0.27	0.39

Notes: The table reports mean shares by year; high income households are those in the top quartile of the relevant 2007 debt-to-income ratio (owners or renters); lower debt households are all households not in the top quartile of the relevant debt-to-income ratio; LRA Share: *liquid risky asset share* [stocks holdings/(stock + cash + bond holdings)], FRA Share: *Financial Risky Asset Share*[(stock holdings + business equity + housing equity)/(financial wealth)], LW Share: *Liquid Wealth Share* [(cash + bond holdings+ stocks – nonhousing debt)/(financial wealth)]; ratios *include* retirement account holdings. The top and bottom 1 percent of shares are dropped in each year to remove outliers.

TABLE 7: Portfolio Composition: Counterfactuals

	2001	2005	2007	2009	2011
LRA Share	0.16	0.12	0.12	0.10	0.10
Counterfactual				0.11	0.13
FRA Share	0.72	0.75	0.72	0.64	0.63
Counterfactual				0.65	0.63
LW Share	0.44	0.42	0.44	0.48	0.48
Counterfactual				0.48	0.49

Notes: The table reports mean shares by year; LRA Share: *liquid risky asset share* [stocks holdings/(stock + cash + bond holdings)], FRA Share: *Financial Risky Asset Share*[(stock holdings + business equity + housing equity)/(stock holdings + business equity + housing equity + cash holdings + bond holdings)], LW Share: *Liquid Wealth Share* [(cash + bond + stock holdings + debt repayment)/(total wealth)]; ratios *exclude* retirement account holdings. The top and bottom 1 percent of share distributions are dropped in each year to remove outliers.

TABLE 8: Portfolio Composition: Counterfactuals (Homeowners versus Renters)

Renters

	2001	2005	2007	2009	2011
LRA Share	0.11	0.07	0.04	0.04	0.05
Counterfactual				0.07	0.06
FRA Share	0.49	0.34	0.09	0.23	0.29
Counterfactual				0.24	0.29
LW Share	0.60	0.75	0.97	0.83	0.76
Counterfactual				0.83	0.76

Homeowners

	2001	2005	2007	2009	2011
LRA Share	0.19	0.16	0.16	0.13	0.13
Counterfactual				0.14	0.18
FRA Share	0.90	1.00	1.04	0.95	0.88
Counterfactual				0.96	0.88
LW Share	0.31	0.22	0.15	0.22	0.28
Counterfactual				0.22	0.29

Notes: The table reports mean shares by year; LRA Share: *liquid risky asset share* [stocks holdings/(stock + cash + bond holdings)], FRA Share: *Financial Risky Asset Share*[(stock holdings + business equity + housing equity)/(stock holdings + business equity + housing equity + cash holdings + bond holdings)], LW Share: *Liquid Wealth Share* [(cash + bond + stock holdings + debt repayment)/(total wealth)]; ratios *exclude* retirement account holdings. The top and bottom 1 percent of share distributions are dropped in each year to remove outliers.

TABLE 9: Portfolio Composition: Counterfactuals (Homeowners versus Renters and Financial Wealth)

Renters

	2001	2005	2007	2009	2011
	Lower Financial Wealth				
LRA Share	0.05	0.03	0.02	0.02	0.03
Counterfactual				0.02	0.03
FRA Share	0.21	0.13	0.00	0.09	0.18
Counterfactual				0.10	0.18
LW Share	0.81	0.89	0.99	0.92	0.85
Counterfactual				0.92	0.84
	High Financial Wealth				
LRA Share	0.14	0.09	0.10	0.09	0.08
Counterfactual				0.10	0.12
FRA Share	0.48	0.39	0.29	0.39	0.43
Counterfactual				0.38	0.43
LW Share	0.65	0.78	0.93	0.78	0.72
Counterfactual				0.78	0.72

Homeowners

	2001	2005	2007	2009	2011
	Lower Financial Wealth				
LRA Share	0.13	0.09	0.09	0.08	0.07
Counterfactual				0.08	0.11
FRA Share	0.85	0.96	1.00	0.91	0.84
Counterfactual				0.92	0.84
LW Share	0.29	0.19	0.10	0.20	0.26
Counterfactual				0.19	0.27
	High Financial Wealth				
LRA Share	0.39	0.38	0.40	0.32	0.33
Counterfactual				0.36	0.40
FRA Share	1.05	1.16	1.22	1.11	1.07
Counterfactual				1.12	1.05
LW Share	0.36	0.32	0.36	0.33	0.35
Counterfactual				0.34	0.38

Notes: The table reports mean shares by year; high wealth households are those in the top quartile of the relevant 2007 financial wealth distribution (owners or renters); lower financial wealth households are all the households not in the top quartile of the relevant financial wealth distribution; LRA Share: *liquid risky asset share* [stocks holdings/(stock + cash + bond holdings)], FRA Share- *Financial Risky Asset Share*[(stock holdings + business equity + housing equity)/(stock holdings + business equity + housing equity + cash holdings + bond holdings)], LW Share: *Liquid Wealth Share* [(cash + bond + stock holdings + debt repayment)/(total wealth)]; ratios *exclude* retirement account holdings. The top and bottom 1 percent of share distributions are dropped in each year to remove outliers.

TABLE 10: 2007 Leverage and 03-07/07-11 Saving Rate Changes

2007 HOMEOWNERS

2007 Debt-to-Income Quartile	Increase/Increase %	Increase/Decrease %	Decrease/Increase %	Decrease/Decrease %
Q1	15.6	40.0	25.0	19.4
Q2	17.9	34.4	27.0	20.7
Q3	16.3	35.9	31.0	16.8
Q4	15.4	36.1	32.4	16.1
Total	16.0	36.6	30.0	17.4

2007 RENTERS

2007 Debt-to-Income Quartile	Increase/Increase %	Increase/Decrease %	Decrease/Increase %	Decrease/Decrease %
Q1	13.9	36.2	27.4	22.5
Q2	17.9	38.4	30.2	13.5
Q3	13.9	19.9	52.7	13.4
Q4	23.0	13.1	59.0	4.9
Total	15.5	32.6	34.5	17.3

Notes: The table reports the percentage of a given household group in each category. Increase/Increase: households increased their saving rate between both 2003 and 2007 and between 2007 and 2011; Increase/Decrease: households increased their saving rate between 2003 and 2007 and decreased their saving rate between 2007 and 2011; Decrease/Increase: households decreased their saving rate between 2003 and 2007 and increased their saving rate between 2007 and 2011; Decrease/Decrease: households decreased their saving rate between 2003 and 2007 and between 2007 and 2011. Leverage is defined based on a household's position in the 2007 debt-to-income distribution.

TABLE 11: House Price Growth Growth and 03-07/07-11 Saving Rate Changes

2007 HOMEOWNERS

HP Growth Prior to 2007	Increase/Increase %	Increase/Decrease %	Decrease/Increase %	Decrease/Decrease %
Q1	15.7	35.9	30.2	18.2
Q2	16.9	35.4	29.2	18.5
Q3	17.4	37.9	30.3	14.4
Q4	14.1	37.3	30.4	18.2
Total	16.0	36.6	30.0	17.4

Notes: The table reports the percentage of a given household group in each category. Increase/Increase: households increased their saving rate between both 2003 and 2007 and between 2007 and 2011; Increase/Decrease: households increased their saving rate between 2003 and 2007 and decreased their saving rate between 2007 and 2011; Decrease/Increase: households decreased their saving rate between 2003 and 2007 and increased their saving rate between 2007 and 2011; Decrease/Decrease: households decreased their saving rate between 2003 and 2007 and between 2007 and 2011. House price growth is calculated based on the change in the CoreLogic house price index between 2003 and 2007 in the MSA in which the household lives.

TABLE 12: 2008 Unemployment and 03-07/07-11 Saving Rate Changes

2008 Unemployment	Increase/Increase %	Increase/Decrease %	Decrease/Increase %	Decrease/Decrease %
0 Weeks	15.5	35.2	32.0	17.3
<26 Weeks	10.6	36.6	35.2	17.6
≥26 Weeks	25.0	18.8	31.2	25.0
Total	15.3	35.2	32.2	17.3

Notes: The table reports the percentage of a given household group in each category. Increase/Increase: households increased their saving rate between both 2003 and 2007 and between 2007 and 2011; Increase/Decrease: households increased their saving rate between 2003 and 2007 and decreased their saving rate between 2007 and 2011; Decrease/Increase: households decreased their saving rate between 2003 and 2007 and increased their saving rate between 2007 and 2011; Decrease/Decrease: households decreased their saving rate between 2003 and 2007 and between 2007 and 2011. The length of unemployment is calculated based on the head of the household's reported weeks of unemployment (if any) in 2008.

TABLE 13: Shares of Total Household Saving Excluding Housing

Saving Component	2001	2005	2007	2009	2011
Other Real Estate	0.009	0.012	0.010	0.007	0.002
Cash (Saving Accts.)	0.167	0.183	0.185	0.197	0.197
Stocks	0.025	0.019	0.020	0.016	0.000
Bonds	0.065	0.055	0.047	0.042	0.046
Vehicles	0.408	0.383	0.363	0.344	0.361
IRA & 401k	0.025	0.021	0.022	0.027	0.018
Business/Farm	0.009	0.006	0.007	0.006	0.003
Nonhousing Debt Repayment	0.293	0.321	0.346	0.361	0.373

Notes: The table reports the mean shares of total saving excluding housing in the PSID. To remove outliers, observations in the top and bottom 1 percent of the saving share distribution in a given year are dropped, and households with missing share data in a given year are excluded from that year's mean share calculations.

TABLE 14: Saving Composition

	2001	2005	2007	2009	2011
LR Share	0.14	0.13	0.11	0.09	0.10
LS Share	0.70	0.64	0.71	0.73	0.72
TLR Share	0.11	0.10	0.08	0.07	0.08
TR Share	0.41	0.46	0.38	0.34	0.36

Notes: The table reports mean shares by year. LR Share: *liquid risk share* [saving in stocks/(stock + cash + bond saving)], LS Share: *liquid saving share*[(stock + bond + cash saving)/total saving including housing], TLR Share- *total liquid risk share* [stock saving/total saving including housing]; TR Share: *total risk share* [(stock + housing + business saving)/total saving including housing]; Ratios *exclude* retirement account saving; The top and bottom 1 percent of the share distributions are dropped in each year to remove outliers.

TABLE 15: Saving Composition: Homeownership and Leverage

Homeowners

	2001	2005	2007	2009	2011
			Lower Debt		
LR Share	0.21	0.20	0.18	0.15	0.17
LS Share	0.63	0.53	0.61	0.65	0.66
TLR Share	0.16	0.15	0.12	0.13	0.14
TR Share	0.53	0.62	0.52	0.49	0.49
			High Debt		
LR Share	0.17	0.13	0.11	0.10	0.13
LS Share	0.57	0.40	0.41	0.53	0.53
TLR Share	0.11	0.08	0.06	0.06	0.08
TR Share	0.53	0.67	0.66	0.53	0.55

Renters

	2001	2005	2007	2009	2011
			Lower Debt		
LR Share	0.07	0.06	0.06	0.03	0.03
LS Share	0.86	0.90	0.98	0.89	0.87
TLR Share	0.06	0.05	0.05	0.02	0.02
TR Share	0.19	0.15	0.07	0.12	0.16
			High Debt		
LR Share	0.03	0.04	0.03	0.02	0.02
LS Share	0.87	0.92	0.99	0.93	0.93
TLR Share	0.04	0.04	0.03	0.01	0.02
TR Share	0.18	0.12	0.04	0.10	0.09

Notes: The table reports mean shares by year; homeownership is measured as of 2007; high debt households are those in the top quartile of the relevant 2007 debt-to-income distribution (owners or renters); lower debt households are all households not in the top quartile of the relevant debt-to-income distribution. LR Share: *liquid risk share* [saving in stocks/(stock + cash + bond saving)], LS Share- *liquid saving share*[(stock + bond + cash saving)/total saving including housing], TLR Share: *total liquid risk share* [stock saving/total saving including housing]; TR Share: *total risk share* [(stock + housing + business saving)/total saving including housing]; ratios *exclude* retirement account saving. The top and bottom 1 percent of share distributions are dropped in each year to remove outliers.

TABLE 16: Saving Composition: Homeownership and 2007 Financial Wealth

Homeowners

	2001	2005	2007	2009	2011
	Lower Financial Wealth				
LR Share	0.13	0.11	0.09	0.08	0.09
LS Share	0.58	0.46	0.51	0.57	0.58
TLR Share	0.08	0.07	0.05	0.06	0.07
TR Share	0.51	0.61	0.55	0.49	0.48
	High Financial Wealth				
LR Share	0.44	0.49	0.40	0.35	0.42
LS Share	0.73	0.60	0.69	0.76	0.73
TLR Share	0.37	0.37	0.30	0.31	0.35
TR Share	0.60	0.75	0.65	0.55	0.63

Renters

	2001	2005	2007	2009	2011
	Lower Financial Wealth				
LR Share	0.03	0.04	0.02	0.01	0.01
LS Share	0.87	0.94	0.99	0.93	0.92
TLR Share	0.04	0.03	0.02	0.00	0.01
TR Share	0.16	0.09	0.03	0.08	0.10
	High Financial Wealth				
LR Share	0.12	0.11	0.13	0.07	0.06
LS Share	0.83	0.83	0.95	0.84	0.81
TLR Share	0.11	0.10	0.10	0.06	0.05
TR Share	0.26	0.27	0.15	0.21	0.25

Notes: The table reports mean shares by year; homeownership is measured as of 2007; high financial wealth households are those in the top quartile of the relevant 2007 financial wealth distribution (owners or renters); lower financial wealth households are all households not in the top quartile of the relevant financial wealth distribution. LR Share: *liquid risk share* [saving in stocks/(stock + cash + bond saving)], LS Share: *liquid saving share*[(stock + bond + cash saving)/total saving including housing], TLR Share- *total liquid risk share* [stock saving/total saving including housing]; TR Share: *total risk share* [(stock + housing + business saving)/total saving including housing]; ratios *exclude* retirement account saving. The top and bottom 1 percent of share distributions are dropped in each year to remove outliers.

TABLE 17: Impact of Idiosyncratic Shocks on Households' Predicted Probability of Increased Saving

	2003 to 2007		2007 to 2011	
Pos. Wealth Shock$_{t-1}$	–0.164***	–0.150***	–0.171***	–0.165***
	(0.020)	(0.025)	(0.021)	(0.025)
Neg. Wealth Shock$_{t-1}$	0.165***	0.167***	0.184***	0.191***
	(0.019)	(0.023)	(0.020)	(0.024)
Pos. Health Shock$_{t-1}$	0.057**	0.064	0.032	0.027
	(0.026)	(0.042)	(0.028)	(0.042)
Neg. Health Shock$_{t-1}$	–0.001	0.038	–0.038	–0.050
	(0.031)	(0.053)	(0.030)	(0.047)
Job Displacement$_{t-1}$	–0.005	0.172***	0.049	0.043
	(0.038)	(0.067)	(0.032)	(0.054)
Pos. House Price Shock$_{t-1}$		–0.007		0.010
		(0.020)		(0.031)
Neg. House Price Shock$_{t-1}$		0.017		–0.004
		(0.025)		(0.018)
Income Growth$_{t-1}$	–0.051***	–0.054***	–0.026**	–0.025
	(0.013)	(0.021)	(0.013)	(0.023)
Debt-to-Inc.$_{t-1}$	0.021***	0.000	0.021***	0.003
	(0.005)	(0.007)	(0.004)	(0.006)
Fin. Wealth-to-Inc.$_{t-1}$	–0.040***	–0.038***	–0.034***	–0.032***
	(0.006)	(0.007)	(0.006)	(0.007)
Log Income$_{t-1}$	0.031***	0.014	0.032***	–0.007
	(0.010)	(0.016)	(0.010)	(0.015)
Homeowner$_{t-1}$	0.046***	0.048	–0.031**	–0.003
	(0.016)	(0.049)	(0.016)	(0.049)
N	8450	3949	8488	4188
Psuedo-R^2	0.031	0.033	0.027	0.035

Notes: The dependent variable equals 1 if a household increases its saving rate between periods and is 0 otherwise. The table reports marginal effects; estimates also include state fixed effects, year fixed effects, a cubic term in the age of the household head as well as dummy variables indicating the education level of the head of the household as of time t. A positive health shock is an improvement of two or more slots in the health ranking for the household head between survey years, while a negative health shock is a decline in the head of the household's health status by two or more slots. A positive wealth shock is defined as a household's reported stock market return that is 25 percentage points or more greater than the market predicted return for the household, and a negative wealth shock is a reported return 25 percentage points or more *less* than the market predicted return. A positive house price shock is defined as an actual change in house prices in the MSA in which the household lives that is 10 percentage points or more greater than the household's expected house price change. Similarly, a negative house price shock is defined as an actual house price change that is 10 percentage points or more less than the household's expected house price change as they did in the previous period. Job displacement is defined as leaving a job for nonvoluntary reasons.

A Appendix

A.1 Household Financial and Nonfinancial Shock Definitions and How These Measures are Constructed

Health Shocks

The PSID asks household heads to rank their health status on a scale of 1 to 5 with one being the best (excellent health) and 5 being the worst (poor health). A positive health shock is defined as an improvement of two or more slots in the ranking for the household head between survey years, while a negative health shock is a decline in the head of the household's health status by two or more slots.

Wealth Shocks

Wealth shocks are defined based on the difference between a household's reported change in stock market wealth between PSID waves and the gain or loss one would have expected for the household based on its previous stock portfolio value and the return on the overall stock market between the household's PSID interviews. A household that reports a stock value change at least 25 percentage points greater than the expected return for the household is considered to have experienced a positive wealth shock and a household that reports a return at least 25 percentage points *less* than its expected return is a negative shock.

House Price Shocks

To construct house price shocks it is assumed that a household expects its house value to change the same amount in the current period as did in the previous period. A positive house price shock is therefore defined as an actual change in house prices in the MSA in which the household lives that is at least 10 percentage points greater than the household's expected house price change. Similarly, a negative house price shock is defined as an actual house price change that is at least 10 percentage points less than the household's expected house price change in the previous period.

Job Displacement

Households are classified as being displaced if they report leaving their job for involuntary reasons, such as a firing, plant closing or the company being sold, as opposed to leaving voluntarily to go back to school or to try a new job and so on. The length of the head of the household's unemployment spell (if any) is used an alternative measure of job loss since only

currently unemployed households are asked why the left their last job starting in 2003.

In addition, while the house price shocks, health shocks, and job displacement are arguably exogenous, the wealth shocks by definition could be due to potentially endogenous factors such as a household's portfolio allocation. Still, the coefficient estimates for the wealth shock variables at least capture the response of household saving to a large portfolio windfall or loss relative to the overall stock market.

A.2 Measuring Active Saving in the PSID

The exact definition of active saving in the PSID between wealth supplements (periods $t-1$ and t) depends on the type of asset. For assets with potentially large capital gain components, such as stocks, IRA accounts, other real estate, and investment in businesses or farms, active saving for household i in asset j, $AS^{i,j}_{t-1,t}$, is defined as follows:

$$AS^{i,j}_{t-1,t} = I^{i,j}_{t-1,t} - R^{i,j}_{t-1,t} \ , \tag{A.1}$$

where $I^{i,j}_{t-1,t}$ is the amount invested by the household in asset j between $t-1$ and t and $R^{i,j}_{t-1,t}$ is the amount removed from asset j by household i over that same period.

Households' active saving in stocks is initially calculated using equation (A.1). The accuracy of the stock saving data is of particular concern, however, according to the PSID administrators. Households cannot easily distinguish between capital gains in stocks and excess income they invested in equities over a two-to-five year period. As a result, a counterfactual measure of households' active saving in stocks is constructed using households' reported value of stock market wealth and the *actual* change in the stock market between the wealth supplements. This approach yields an arguably more reliable measure of households' active saving in stocks and is discussed in more detail below.

For asset categories where capital gains are not a major factor, active saving is the difference between a household's reported asset value in period t and its value in period $t-1$. These assets include: households' checking and savings account holdings, bond holdings, vehicle values, and noncollateralized debt. In particular,

$$AS^{i,j}_{t-1,t} = V^{i,j}_{t} - V^{i,j}_{t-1} \ , \tag{A.2}$$

where V^{j}_{t} is the value of asset j in time t.

The remaining active saving category is housing ($j = h$). A household's amount of saving

in housing depends on whether or not it moves. Households who do not move save by paying down their mortgage principal, while households who move potentially save or dissave by altering the amount of equity in their homes.

$$AS^{i,h}_{k-1,k} = \begin{cases} D^{i,h}_{k-1} - D^{i,h}_{k} & \text{if move } =0 \\ E^{i,h}_{k} - E^{i,h}_{k-1} & \text{if move } =1 \ , \end{cases} \tag{A.3}$$

where $D^{i,h}_k$ is a household's amount of outstanding mortgage debt in period k, $E^{i,h}_k$ is the amount of equity a household has in its home at time k, and *move* is an indicator variable that equals 1 if a household moved between $k-1$ and k and is 0 otherwise. I use k as the time subscript to distiguish that the time horizon for active saving in housing is different from the other assets. Prior to 1999, housing data are available yearly and the difference between k and $k-1$ represents one year while $t-1$ to t covers five years. After 1999, the housing and active saving data cover two-year horizons and $t = k$. More formally:

$$AS^{i,h}_{t-1,t} = \begin{cases} \sum_{k=t-1}^{t} AS^{i,h}_{k,k+1} & t \leq 1999 \\ AS^{i,h}_{k,k+1} & t > 1999 \ . \end{cases} \tag{A.4}$$

Active saving in housing prior to 1999 is summed so it covers the same time horizon as the other active saving measures.

Total (active) saving for a given household is simply the sum of its saving in each particular asset:

$$S^{i}_{t-1,t} = \sum_{j} AS^{i,j}_{t-1,t} \ . \tag{A.5}$$

A.2.1 Alternative Approach for Measuring Active Saving in Stocks

Generally, households have a good sense of the value of their stock portfolio at a given point in time. They are likely less able to distinguish, as they are asked to do in the PSID, between capital gains on equity holdings and any additional investments or withdrawals from their brokerage accounts. As a result, this paper constructs an alternative measure of households' active saving in stocks based on their reported portfolio values and the market rate of return between period $t-1$ and period t.

A household's implied stock portfolio value in period t is its reported stock portfolio value in period $t-1$ adjusted by the growth rate in the actual stock market between $t-1$ and t.[34]

[34]Stock market growth is calculated between the month of a household's interview in period $t-1$ and the

More formally,

$$V_t^{i,m} = (1 + g_{t-1,t})V_{t-1}^i \ , \tag{A.6}$$

where $V_t^{i,m}$ is the implied value of a household's portfolio based on the market return, V_{t-1}^i is the value of the household's reported equity holdings at time $t-1$, and $g_{t-1,t}$ is the stock market growth rate.[35] A household's implied active saving in equities is the difference between its reported stock portfolio value in period t and its implied portfolio value $V_t^{i,m}$ from equation (A.6). More specifically,

$$\bar{AS}_{t-1,t}^{i,s} = V_t^i - V_t^{i,m} \ , \tag{A.7}$$

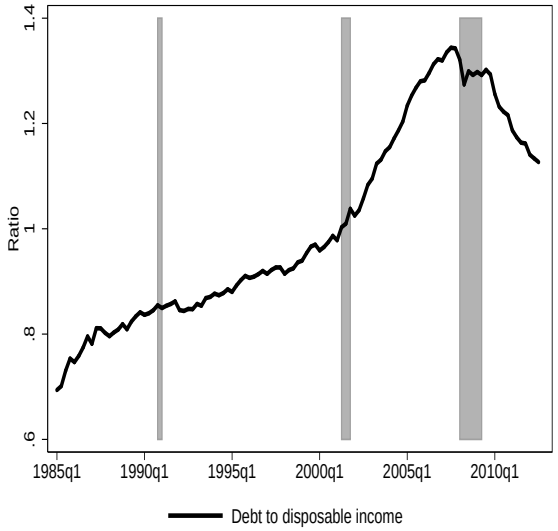
where $\bar{AS}_{t-1,t}^{i,s}$ is the household's imputed measure of active saving in stocks. This imputed measure is used in place of households' reported data no active saving in stocks.

month in period t.

[35]Stock market growth is calculated based on the S&P 500 Index.

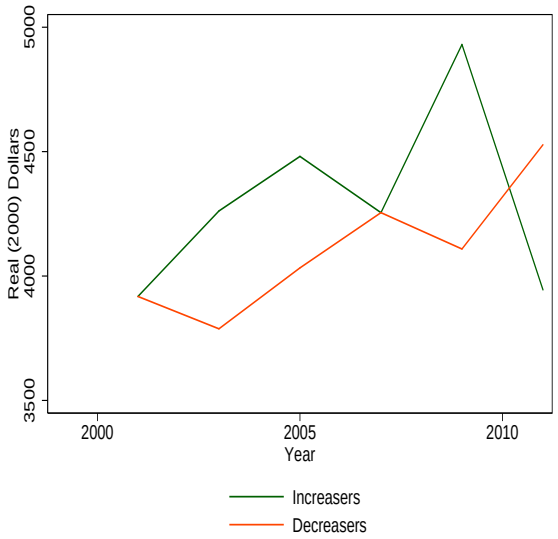
A.3 Additional Figures and Tables

FIGURE A.1: U.S. Household Debt-to-Income Ratio



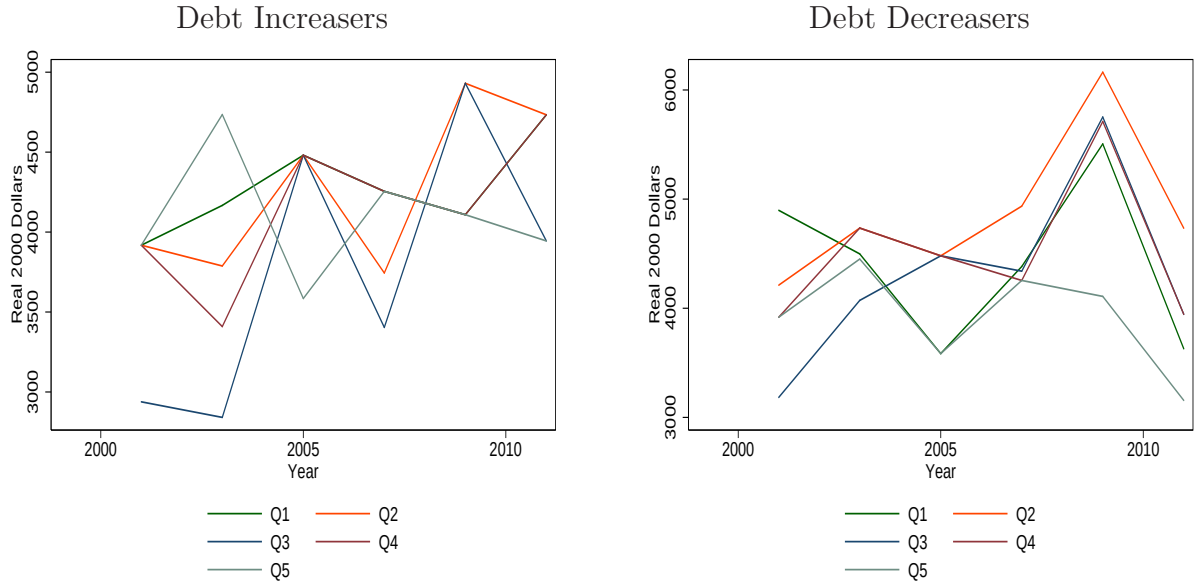
Source: Haver Analytics.
Notes: Figure reports total household debt from the Flow of Funds accounts relative to aggregate disposable income from the Bureau of Economic Analysis.

FIGURE A.2: Real Nonhousing Debt Changes



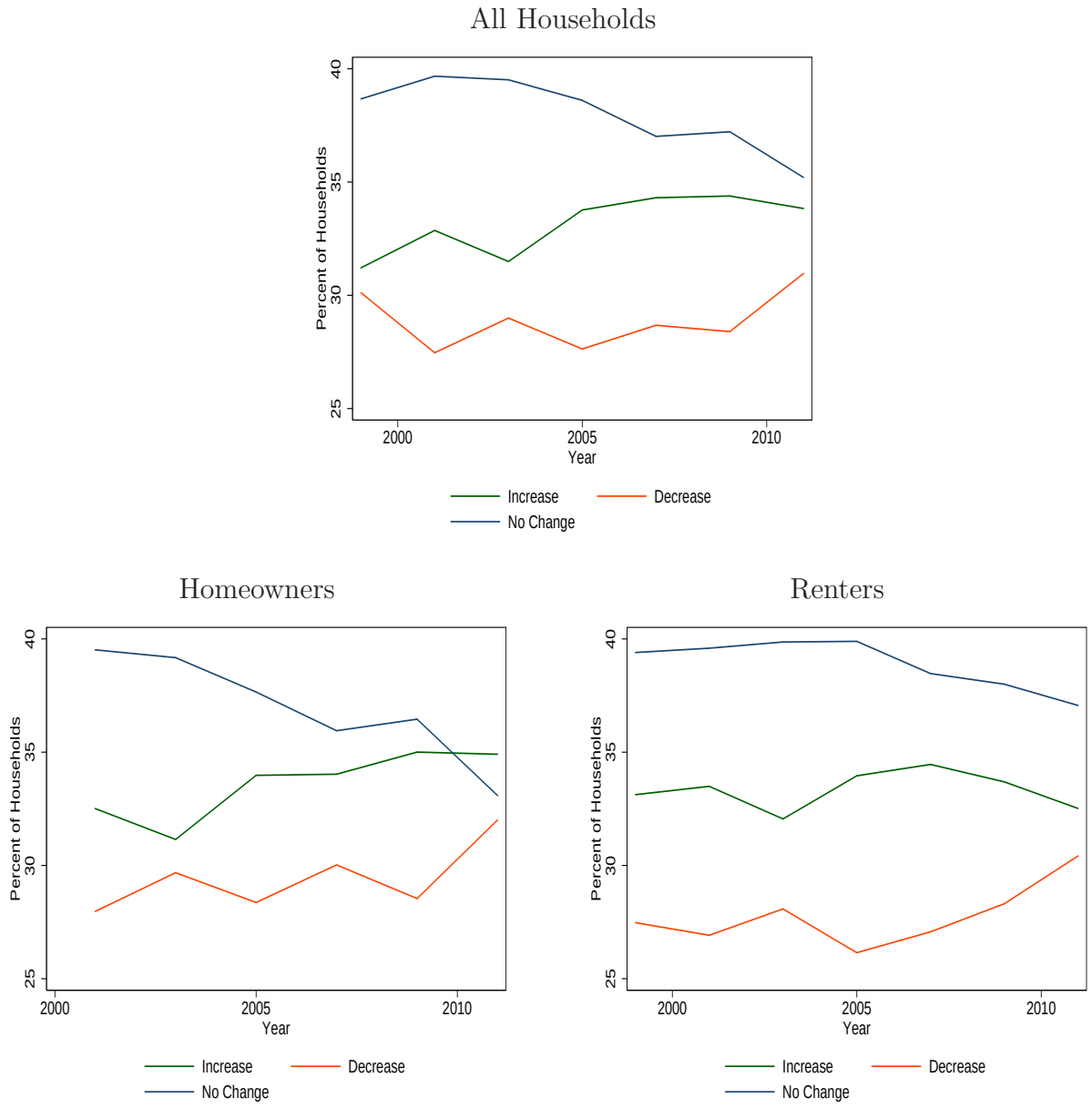
Source: PSID and author's calculations.
Notes: Figure shows the median change in nonhousing debt for households that increased their borrowing or decreased their outstanding leverage. Amounts are in real 2000 dollars.

FIGURE A.3: Nonhousing Debt Changes based on 2007–2009 House Price Fluctuations



Source: PSID and author's calculations.
Notes: Figures report the median change in households' real nonhousing debt; the sample is restricted to households that were homeowners in 2007. Homeowners are sorted based on the house price change in the MSA in which they lived between 2007 and 2009—Q5 represents the largest (least negative) house price change between 2007 and 2009, while Q1 captures the most negative house price growth; households in the top and bottom 1 percent of the debt change distributions are dropped to remove outliers.

FIGURE A.4: Nonhousing Debt Changes



Source: PSID and author's calculations.

Notes: The top two panels plot the percentage of households who report an increase, decrease, or no change in their nonhousing debt. The bottom left panel reports the percent of *homeowners* that decreased their nonhousing debt conditional on the quintile of the housing wealth to total wealth distribution that they are in. Higher quintiles mean that households have a greater share of their total wealth in housing. The bottom right panel reports the mean dollar change in debt for households who reported that their debt increased or decreased.

TABLE A.1: Household Leverage Changes: Transition Matrices by Homeownership

2007 HOMEOWNERS

2003 Nonhousing Debt Quartile	2007 Nonhousing Debt Quartile[a] 1 %	2 %	3 %	4 %
1	38.9	25.3	21.5	14.2
2	19.7	29.3	29.0	22.1
3	12.0	21.0	33.5	33.5
4	7.0	10.5	21.2	61.3

2007 Nonhousing Debt Quartile	2011 Nonhousing Debt Quartile[b] 1 %	2 %	3 %	4 %
1	46.6	25.6	16.5	11.3
2	28.5	24.1	32.9	14.5
3	15.9	24.6	33.8	25.7
4	8.5	8.8	20.8	61.9

2007 RENTERS

2003 Nonhousing Debt Quartile	2007 Nonhousing Debt Quartile[a] 1 %	2 %	3 %	4 %
1	41.7	27.0	20.9	10.4
2	22.1	29.4	25.0	23.5
3	13.7	18.8	35.9	31.6
4	8.3	11.3	16.5	63.9

2007 Nonhousing Debt Quartile	2011 Nonhousing Debt Quartile[b] 1 %	2 %	3 %	4 %
1	36.0	28.6	23.6	11.8
2	20.8	34.9	29.2	15.1
3	12.1	20.1	38.6	29.3
4	4.0	3.6	20.7	71.7

Notes: [a] 2007 quartiles based on quartile cut-off values from 2003 nonhousing debt distribution; [b] 2011 quartiles based on quartile cut-off values from 2007 nonhousing debt distribution. All quartiles are based on real nonhousing debt calculated using the PCE deflator (2000 base year). Homowner and renter distributions are calculated separately; To be included in the analysis households must have nonhousing debt data in 2003, 2007, and 2011; households that report a foreclosure between 2001 and 2011 are excluded.

TABLE A.2: Portfolio Composition: Homeownership, Income, and Risky Asset Holdings

Renters	2001	2005	2007	2009	2011
			Low Income		
LRA Share	0.12	0.08	0.08	0.08	0.11
FRA Share	0.23	0.16	0.07	0.13	0.23
LA Share	0.79	0.90	0.99	0.92	0.85
			Higher Income		
LRA Share	0.20	0.18	0.18	0.18	0.22
FRA Share	0.48	0.35	0.24	0.38	0.44
LA Share	0.74	0.81	0.95	0.82	0.74

Homeowners	2001	2005	2007	2009	2011
			Low Income		
LRA Share	0.25	0.25	0.21	0.21	0.21
FRA Share	0.88	0.90	0.99	0.89	0.86
LA Share	0.29	0.25	0.16	0.23	0.28
			Higher Income		
LRA Share	0.36	0.35	0.36	0.32	0.36
FRA Share	0.91	1.03	1.06	0.97	0.93
LA Share	0.38	0.27	0.23	0.30	0.36

Notes: The table reports mean shares by year; low income households are those in the bottom quartile of the relevant 2006 after-tax family income distribution (homeowners or renters); higher income households are all households not in the bottom quartile of the relevant income distribution; LRA Share: *liquid risky asset share* [stocks holdings/(stock + cash + bond holdings)], FRA Share: *Financial Risky Asset Share*[(stock holdings + business equity + housing equity)/(financial wealth)], LW Share: *Liquid Wealth Share* [(cash + bond holdings+ stocks–nonhousing debt)/(financial wealth)]; ratios *include* retirement account holdings. The top and bottom 1 percent of share distributions are dropped in each year to remove outliers.

TABLE A.3: Household Saving Rates: Transition Matrices

2007 HOMEOWNERS

	2011 Saving Rate Quartile			
2007 Saving Rate Quartile	1 %	2 %	3 %	4 %
1	28.1	20.8	21.4	29.7
2	17.5	35.5	24.0	22.9
3	19.6	32.2	28.5	19.7
4	29.7	23.7	18.7	27.9

2007 RENTERS

	2011 Saving Rate Quartile			
2007 Saving Rate Quartile	1 %	2 %	3 %	4 %
1	24.0	27.3	19.7	29.1
2	14.2	44.8	22.9	18.2
3	16.8	37.6	27.9	17.8
4	24.1	27.4	23.4	25.1

Notes: 2011 quartiles based on quartile cut-off values from the 2007 debt-to-income distribution. Saving rate data exclude saving in housing. Calculations exclude households that reported a foreclosure between 2001 and 2011.