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Abstract

Using a panel sample from the Panel Study Income Dynamics (1999–2015), I find that homeowners' contemporaneous spending and nonhome wealth increased with home equity withdrawals, but their longer-term spending and wealth declined if their home equity was extracted during the housing boom period. Following Hurst and Stafford's (2004) definition of liquidity constraint, I find that the constrained homeowners' contemporaneous spending increased less, while their financial wealth increased more than those of the unconstrained. Unconstrained homeowners invested more than constrained homeowners in nonhome real estate and businesses. In the long run, the consumption spending of both groups persistently declined, while their wealth recovered from initial declines.

JEL classification: D91, D14, E21, G21, G02
Key words: consumption, liquidity constraint, housing market, home equity, mortgage

1 INTRODUCTION

The effect of housing wealth on consumption has intrigued economists for a long time. Theoretically, rising house prices can expand homeowners' lifetime budget constraints so that their annual spending will increase by an annualized fraction (the pure wealth effect). Or, for cash-strapped homeowners, rising house prices can raise collateral values, enabling them to borrow against their home equity to fund their spending (the housing collateral effect). Declining house prices will operate in the opposite way.[1]

Recent empirical literature has highlighted the role of the housing collateral effect in favor of the pure wealth effect. The unprecedented housing boom and subsequent bust in the 2000s in the United States provide a useful opportunity for investigating this issue. Cooper (2013) has shown that housing wealth has influenced consumption more significantly for households that have lower liquid wealth or higher debt burdens, even more so for the period after 2001. In the period from 2002 to 2006, existing homeowners responded strongly to the increase in house prices by increase their borrowing (Mian and Sufi, 2011).[2] Mian and Sufi (2014) link this rise of home equity based debt to the increase in spending

[1]This simple characterization circumvents the complexities and subtleties of studying the housing wealth effect when housing is both an asset and a durable good, as economists recognized early on. Buiter (2010), among others, forcefully reiterates the notion that there is no aggregate wealth effect from a change in house prices in a representative agent model, because the representative agent in an economy both owns and consumes the existing housing; with heterogeneous agents, the wealth effect is heterogeneous and redistributive. Conceptually, the pure wealth effect (or permanent effect) can only be materialized for occupant-owners when greater housing wealth causes them to hold fewer nonhousing assets to fund their spending than they otherwise would hold (Congressional Budget Office, 2007). Plus, the collateral effect (or transitory effect) may be seen as the front-loaded pure wealth effect when households are liquidity-constrained. Belsky and Prakken (2004) and Congressional Budget Office provide excellent overviews of the conceptual framework and relevant empirical evidence up to the advent of the Great Recession. A recent insightful paper by Berger et al. (2018) features a useful rule-of-thumb formula that expresses the way consumption responds to permanent house price shocks as the product of marginal propensity to consume out of transitory income shocks and the housing value. They demonstrate that this simple formula is robust to a number of variants of an incomplete markets model with income and house price uncertainty, though their formula does not emphasize the distinction between constrained and unconstrained consumers.

[2]Mian and Sufi (2011, Figure 1) and Dynan (2012, Figure 1) illustrate the secular increase in the household leverage of mortgage loans (measured by debt-to-income ratio) over time, and in particular, its sharp rise after 2000. Beyond traditional mortgage loans, LaCour-Little, Yu, and Sun (2014, Figure 1) document the tripling of home equity loans, from $275 billion in 2000 to a peak of $950 billion in 2008.

by showing that ZIP codes with lower gross income experienced more new auto purchases in response to home value change during that period.

The empirical analysis in this article addresses three logically connected themes. If the housing collateral effect is dominant, one expects to observe a positive correlation between the extracted home equity (not just the house value) and the increase in consumption spending on the household level. The article begins by documenting this correlation using a 1999–2015 Panel Study of Income Dynamics (PSID) homeowner sample.[3] The estimates confirm that homeowners did increase their consumption spending in relation to extracted home equity, on par with the implied housing collateral effect estimates in the existing literature (Cooper, 2013).

The magnitude of the marginal propensity to spend out of home equity withdrawals (HEWs) implies that a substantial portion of the extracted home equity is not spent. I examine homeowners' active savings in financial wealth (including risky and nonrisky components) and real wealth (including nonhome real estate and private businesses) and find that homeowners saved the most in financial wealth (especially the less risky type), followed by savings in real wealth and home improvement. These findings suggest that homeowners are keen to improve their cash-on-hand position when it comes to the use of HEW funds, consistent with buffer-stock behavior (Carroll, 1997). To justify such behavior, the internal return from maintaining the cash-on-hand position must be high. Observed spending and active saving together account for 35 cents per additional dollar of HEW.

If the housing collateral effect is more important to households that are in greater need of financial liquidity, then the correlation between the extracted home equity and the increase of consumption spending for this subgroup should be more pronounced. The second part of this article splits PSID homeowners into two categories, constrained and unconstrained, in order to examine the differences in their spending and saving responses. The criterion for classifying the sample observations is based on whether a homeowner's Loan-to-Value (LTV) ratio crosses the critical value of 0.8 from below with the incurrence of HEW. An important paper by Hurst and Stafford (2004) convincingly justifies the use of such a criterion, on the ground that there is a jump in the marginal borrowing cost when the total LTV ratio moves from below 0.8 to above 0.8, as dictated by U.S. mortgage industry

[3]Throughout the paper, I use "homeowners" and "households" interchangeably, as all of the households in my sample are homeowners.

practices and government regulations. The fact that a homeowner engages in borrowing despite such a discrete jump in the borrowing cost reveals her desire for the needed liquidity. This criterion is more advantageous than a uniform cash-on-hand cutoff measure (e.g., in Cooper 2013, Mian and Sufi 2014) because homeowners with heterogeneous preferences or other unobserved characteristics could reveal themselves as the constrained type by their willingness to assume a higher borrowing cost, thus overcoming the difficulty that the optimal cash-on-hand position may be endogenously chosen by a household and could vary from household to household due to the heterogeneity of their preferences.

In terms of the differences between the constrained and unconstrained households, I find that constrained households saved slightly more in financial wealth, while the unconstrained saved more in real wealth. However, I also find that consumption spending increased less for the constrained households than for the unconstrained, which is not easily explained by the canonical rational expectations consumer framework.

Even though HEW is the means for households to tap into their housing wealth via its collateral value, which especially enables constrained households to relieve their liquidity constraints, in subsequent years, a higher debt burden may nonetheless depress consumption. Higher leverage may tighten future borrowing constraints, impede refinancing, and could lead to a higher likelihood of liquidity constraints down the road (Dynan and Edelberg, 2013). All of these considerations imply that the improvement in homeowners' wealth enabled by HEW may be short lived. The third part of this article examines these long-term implications for the same homeowners. I find that homeowners who leveraged up during the housing boom years (from 2001 to 2005) saw their consumption spending decline in the long term and remain low after ten years. Although their overall wealth level eventually recovered after initially declining, their financial wealth was still lower than the initial level. These long-term consumption and wealth change patterns are more pronounced for constrained households during the housing boom period (defined as having their LTV ratio rising higher than 0.8 during the years 2001 to 2005).

In terms of data and methodology, this article is closely related to Hurst and Stafford (2004) and Cooper (2010) and differs from more recent studies such as Mian and Sufi (2011), Mian and Sufi (2014), LaCour-Little, Yu, and Sun (2014),

Adelino, Schoar, and Severino (2015) and Stroebel and Vavra (2019). The latter collection of studies examines the effects of overall house value growth on household behavior through instrumental variable estimation methods. As I emphasized in the beginning of this paper, conceptually, the total wealth effect of house value is the sum of the effect of contemporaneously extracted home equity and the current effect from remaining home equity through the lifetime budget constraint. Lacking direct measures of HEWs, these studies are silent on the exact magnitude of the housing collateral effect that occurs through cash-out home equity. Further, because the definition of liquidity constraints hinges on the measure of HEWs, these studies cannot distinguish between constrained and unconstrained households if their preferences and discount rates are heterogeneous.[4]

Both Hurst and Stafford (2004) and Cooper (2010) extensively document the household characteristics of those who initiated HEWs and directly investigate the impact of HEWs on household consumption and wealth changes by using the rich information in PSID data.[5] Because comprehensive consumption data is not available for earlier years, Hurst and Stafford could only gauge households' consumption changes by their wealth changes—my results in this article show how and why their estimates, based on wealth changes, may overstate the effect on consumption changes.[6] Cooper examines the impact of home equity borrowing on household spending, as well as balance sheet reshuffling, in the early 2000s. Building on his work, this article makes the following distinctive contributions: (1) I use data that spans the years 1999 to 2015, covering the periods of housing boom as well as bust; (2) I exploit the panel structure of PSID data, not only by using household fixed-effect estimation (which is preferred because of the identification power of within-household variations) to obtain the contemporaneous effects, but also by examining the long-term effects of HEWs, years after the households leveraged up; (3) I examine the consumption and balance sheet effects of HEWs for liquid-

[4]Alternative proxies of liquidity constraints have been utilized to imperfectly divide a sample into constrained versus unconstrained observations, such as low wealth-income ratio (Zeldes, 1989), income shortfall relative to its long-term average (Cooper, 2013), high debt-payment-to-income ratio (Johnson and Li, 2010), or high LTV ratio (Disney and Gathergood, 2011).

[5]Other studies explore more detailed, proprietary data sources to examine specific aspects of the impacts of HEWs, including car purchases (McCully, Pence, and Vine, 2019) and consumer debt payoff (Bhutta and Keys, 2016).

[6]Since 1999, PSID has greatly enhanced its survey of the domains of household spending and wealth. More details are provided in Section 2.

ity constrained and unconstrained households separately, and decompose balance sheet effects into the effects on active savings versus capital gains separately. All of these improvements provide complementary and more updated evidence on the behavior of households associated with HEWs.

The estimated signs and magnitudes of possible destinations of households' HEW dollars speak to the broad literature concerning the housing market and its interactions with the economy, with the backdrop of the Great Recession still in rear view. As a case in point, Mian and Sufi (2015) argue that the elevated levels of household debt were responsible for the severity of the latest recession by amplifying the shocks from collapsing house prices. There is no denying that households that leveraged up were more exposed to the risks of the housing sector. But what they did with the home equity proceeds also matters. For the low cash-on-hand households, leveraging up and spending away the borrowed funds or ploughing them back into the already elevated housing market would have further amplified the resulting welfare loss from a collapsed housing market. Fortunately, as I find in this study, they chose to put these proceeds into less risky financial assets. As another example, I present evidence that homeowners were *not* observed to have put a great deal of money—relative to their HEW dollars—into nonhome real estate. This relates to the issue of whether and how the mortgage credit boom during the early 2000s affected the housing market,[7] that is, whether the mortgage expansion worked through the extensive margin (i.e., mortgage became more affordable for marginal first-time home buyers, who had lower credit scores and would not otherwise have been approved for home purchase loans) (Adelino, Schoar, and Severino, 2016; Foote, Loewenstein, and Willen, 2016; Mian and Sufi, 2009) or through the intensive margin (i.e., homeowners who already had access to mortgage credit took advantage of the cheap credit available to purchase more real estate) (Albanesi, De Giorgi, and Nosal, 2017; Bhutta, 2015; LaCour-Little, Yu, and Sun, 2014; Mian and Sufi, 2011, 2014; Haughwout et al., 2011). My research shows that the average effect of existing homeowners tapping into the available credit to purchase additional nonhome properties is fairly small. Therefore, as a group, they are unlikely to have played a significant role in bidding up housing prices

[7]In the literature, despite different identification strategies, both Favara and Imbs (2015) and Di Maggio and Kermani (2017) posit a causal interpretation of the relationship between mortgage credit expansion and house price growth on the regional level.

through nonhome property investments. Another strand of the literature has highlighted the collateral value of home equity for potential entrepreneurs to start new businesses (Corradin and Popov, 2015; Fairlie and Krashinsky, 2012) and hence stimulate increased employment in affiliated industries (Adelino, Schoar, and Severino, 2015). My results, though they do not directly examine the entrepreneurship propensity of households that extracted their home equity (as some of the existing literature does), corroborate their view by finding that borrowers increased their investments in private businesses at the time they extracted their home equity.

The rest of this article proceeds as follows. Section 2 introduces the PSID database and the construction of the sample. It also presents the socioeconomic characteristics of the households that extracted home equity. Section 3 outlines the empirical specifications used in the investigation and presents the baseline results. Section 4 applies Hurst and Stafford's (2004) definition of liquidity constraints to my sample to classify the households into constrained and unconstrained ones, and examines their heterogeneous responses to HEWs. Section 5 gives a synopsis of the findings after discussing the limitations of the data. The final section concludes.

2 DATA AND SUMMARY STATISTICS

2.1 PSID and Sample Construction

This paper analyzes data from the PSID database because it provides a broad set of demographic and socioeconomic variables that are often missing or incomplete in other databases. PSID is the longest-running longitudinal household survey in the world, surveying a representative sample of U.S. households and individuals, beginning in 1968 and continuing into the present. Households in PSID were interviewed annually through 1997 and biennially afterwards. PSID's wealth supplements contain a variety of wealth variables that are particularly suited to our purposes. Prior to 1999, the wealth supplement survey was administered once every five years; since 1999, this wealth supplement has been incorporated into the biennial core interviews.

My analysis sample covers the period from 2001 to 2015, although some of the variables from the 1999 survey are also used to calculate how they changed from 1999 to 2001. The following restrictions are imposed when obtaining the unbalanced panel sample of PSID: (1) the household head had to have been the

same person, was between 22 and 60 years of age, and had not retired from year $t-2$ to t; (2) these households were homeowners and their home value was greater than $\$5,000$; (3) households in the top or bottom 0.1 percentile of important wealth or income variables in any of the included years are dropped;[8] (4) from $t-2$ to t, households with food spending, nondurable spending (category I), labor income,[9] or home values that increased or decreased by 100-fold are dropped; (5) households with LTV ratios greater than 3.0 in either $t-2$ or t are dropped. With these restrictions, the resulting sample has 5,082 unique households and 18,532 total observations.[10] Nearly half of the households were observed in more than three interviews, and 18% were observed in all of the interviews conducted from 2001 to 2015. All of the financial and economic variables, whenever applicable, have been deflated, using the consumer price index for all urban consumers, to 2005 dollars.

The value of HEWs is calculated the same way as is done in Cooper (2010):

$$\text{HEW}^i_{t-2,t} = \begin{cases} M^i_t - M^i_{t-2}, & \text{if } M^i_t > M^i_{t-2} \text{ and did not move between } t-2 \text{ and } t, \\ HE^i_{t-2} - HE^i_t, & \text{if } HE^i_{t-2} > HE^i_t \text{ and moved between } t-2 \text{ and } t, \end{cases} \tag{1}$$

where M stands for the mortgage balance and HE stands for the home equity. (1) states that, for homeowners who did not move between $t-2$ and t, the HEW equals the increase of their mortgage balances; for homeowners who did move, however, the HEW equals the decrease in their home equity after moving. The incidence of moving could be endogenous, or subject to exogenous shocks such as job-related relocation, but this does not change the fact that the amount of home equity a

[8]These variables are: liquid wealth (cash plus stock holdings), financial wealth (net of non-collateralized debts), net worth (exclusive of home equity), home value, home equity withdrawals, changes in total net worth (inclusive of home equity), total spending, total family income and home value, buying or selling values of nonhome real estate assets, stocks or mutual funds, the value of individual retirement accounts, the value of business assets, as well as change in non-collateralized debt.

[9]Labor income includes wages and salaries, labor portion of income from business, and miscellaneous labor income.

[10]The sample sizes for various regression analysis may differ from the above, depending on the number of missing values for the variables in regressions. In particular, since the PSID inquired about households' income measures of year $t-1$ in the survey of year t, while the spending measures were more current, I take the average of the income of year $t-1$ (from survey of year t) and the income of year $t+1$ (from survey of year $t+2$) as the current income of year t (except for the last year of the data).

homeowner wants to cash out when moving is still subject to her choice.[11]

2.2 Consumption Spending and Active Saving

Households can either spend the HEW funds for consumption or invest/save them in stock market, home improvement, real estate, or private businesses. The scope of consumption expenditure items in the PSID surveys has been expanded over the years. Originally, spending on food was the only type of expenditure elicited in the surveys. Beginning in 1999, PSID added questions about spending on health care, education, childcare, homeowner insurance, utilities, and transportation.[12] Beginning in 2005, PSID further added questions about spending on home repairs and maintenance, household furnishings and equipment, clothing and apparel, travel and vacations, and recreation and entertainment.

I employ four different measures of nondurable spending in my analysis, each with progressively increasing scope, in addition to durable spending and total spending measures.[13] Durable spending is the sum of any schooling expenses, out-of-pocket medical expenses, vehicle purchase down payments and annualized vehicle loan payments.[14] Total spending is the sum of nondurable III and durable

[11]Two sources of measurement error in (1) work against each other. On one hand, (1) could potentially understate the true value of HEWs. A homeowner's refinancing or new borrowing must have occurred sometime between $t-2$ and t. By the end of t, this homeowner may likely have paid off some of the mortgage balance, unless she was only required to pay interest *and* she chose to do exactly that. The difference between M_t^i and M_{t-2}^i would thus be less than the true amount of HEWs. On the other hand, (1) does not disentangle any transaction costs involved for executing HEWs (such as processing, origination or underwriting fees, appraisal fees, and document preparation and recording fees) that may have been added to the loan amount, which would overstate the discretionary amount of HEWs. To address these concerns, I experiment with varying threshold values for the difference between M_t^i and M_{t-2}^i (e.g., $\$5,000$ instead of \$0) in the formula (1). I find essentially the same results for consumption spending.

[12]Li et al. (2010) find that with these newly added items, PSID now covers more than 70 percent of the total outlays more granularly measured in the Consumer Expenditure Survey, another another wellknown data source for U.S. household expenditure.

[13]The first measure of nondurable spending is food spending, including food consumed at home, food delivered, and food consumed away from home. The second measure, named as *nondurable category I*, includes food spending plus expenditures on utilities, transportation, car and homeowner insurance premiums car and homeowner insurance premiums (these items became available in 1999). The third measure (*nondurable category II*) is category I spending plus expenditures on furnishings, clothing, vacations, and recreation (these items became available in 2005). The fourth measure (*nondurable category III*) is category II spending plus expenditures on home repairs and maintenance. Naturally, as the analysis moves from food spending to nondurable category III spending, available observations for the regressions decline in number.

[14]I categorize schooling expenses and out-of-pocket medical expenses as "durable" spending

spending.

Following Juster et al. (2006) and as is provided by PSID, a household's total net worth includes the value of owned businesses, money in checking/savings accounts, money market funds, and government bonds, equity in nonhome real estate properties, value of stock shares in public companies, mutual funds, investment trusts or estates, the net value of owned vehicles and boats, the cash value of life insurance policies and other miscellaneous assets, money in private annuities or Individual Retirement Accounts (IRAs), and home equity—less the balance of non-collateralized debts. Out of those wealth components, PSID directly asked respondents about the amounts of purchases and sales during the previous two years for the following assets: stocks and stock fund holdings, IRA assets, nonhome real estate, and private businesses. The first two are in the domain of financial wealth, while the last two belong to real wealth.

Active saving in these assets can be defined as the balance of the purchases and sales a household made during the interval. Capital gain is calculated as the difference between wealth change and active saving, for example, for asset a from year $t-2$ to t:

$$\text{Capital Gain}_t^a = W_t^a - W_{t-2}^a - \text{Active Saving}_t^a, \tag{2}$$

where W_t^a is the value of asset a at time t, W_{t-2}^a at $t-2$, and Active Saving_t^a is the amount of active saving from $t-2$ to t.

Two complications arise concerning measurement error in capital gains by using (2), as noted by Juster et al. (2006). In the first, these households reported to have received wealth transfers (e.g., inheritances, assets or debts brought in or removed by family members move-in or move-out) but did not acknowledge which assets these transfers took place through. These transfers (positive or negative) likely entered into the changes of wealth, and could either overstate or understate the true capital gains. To alleviate such contamination, I control for these transfer variables in the estimation of capital gains for all assets.

The second complication, and perhaps a more serious one, stems from the definitional identity that capital gain plus active saving equals wealth change. This

because they presumably occurred less frequently but would come in large amounts once occurred. They also both resemble some sorts of human capital investments with returns distributed over future years. Of these two, medical expenses were asked at two-year intervals, whereas schooling expenses were asked at one-year intervals. I convert the former into a one-year measure to align with the frequency of other spending items.

identity dictates that the sign of measurement error in capital gains is bound to be opposite that in active savings, holding wealth changes constant. If this dimension of measurement error dominates, one is prone to find more capital gains in the assets that experienced fewer active savings, or vice versa. While this suggests, on one hand, that abundant caution should be exercised in interpreting any superb capital gains when not much active savings had taken place, on the other hand, the true effect of capital gains should be greater than what appears, when both the capital gains and active savings point to the same direction with significant magnitudes.

Beginning in 2001, PSID also asked about the amount (if greater than $\$10,000$) spent on home additions or improvements, which is notably different from the question of spending on home repairs and maintenance.[15] Due to the sizable dollar amount to which this variable refers, and following the literature, I place this variable in the active saving category rather than in the spending category.

2.3 Summary Statistics

Table 1 presents the summary statistics of the homeowners in my sample. For the whole sample (Column (1)), the median home value for the period from 2001 to 2015 was slightly above 150 thousand dollars. The vast majority of the net worth of these homeowners was tied to their home equity at about 73 thousand dollars, whereas their financial net worth was less than $\$7,000$. For any of the two-year intervals in the period from 2001 to 2015, these homeowners on average

[15] In 2011, for example, the main question concerning the spending on home additions and improvements was as follows:

> W69. (Since January, 2009, did you [or your family living there]) make additions or improvements totaling $\$10,000$ or more to any homes or other real estate (you/any of you) owned? Do not count general maintenance or upkeep.

If the respondent's response was affirmative, then a follow-up question will be posed to inquire about the dollar amount spent. As the question indicates, the solicited amount may include spending on improvement projects in other nonhome real estate, but we cannot tell how much is for each.

In comparison, the question concerning spending on home repairs and maintenance is phrased differently and shows up in another section of the questionnaire:

> F87. [...] How much did you (and your family living there) spend altogether in 2010 on home repairs and maintenance, including materials plus any costs for hiring a professional?

(as measured by the median) actually paid down their mortgages by just above $\$1,000$.

Columns (2) and (3) present the statistics of HEW households in comparison with non-HEW households. HEW households were on average doing less well than non-HEW households: by the measure of median, HEW households had about $\$23,700$ less in their total net worth ($p < 0.01$ for the difference), $\$2,350$ less in their net worth exclusive of home equity ($p < 0.01$), and $\$3,000$ less in their financial wealth (net of non-collateralized debts) ($p < 0.01$), than non-HEW households.[16] Consistent with their HEW behavior, HEW households' home value was higher than non-HEW households' by $\$25,000$ ($p < 0.01$). Interestingly, HEW households possessed $\$1,077$ more than non-HEW households in real wealth (the sum of the values of private businesses, non-primary-residence real estate, and vehicles, net of debts owed on them). The HEW subsample had on average higher annual total income (by $\$4,270$, $p < 0.01$) than the non-HEW subsample, and spent about $\$2,800$ more ($p < 0.01$). Concerning their demographic differences, HEW households were slightly younger, less likely to be college educated, more likely to be married or selfemployed. These differences are statistically but not economically significant. Last but not the least, the degree of risk tolerance in HEW and non-HEW households is not statistically different.[17]

3 SPECIFICATIONS AND BASELINE RESULTS

3.1 Empirical Specifications

To exploit the panel feature of PSID, this article employs the following generic regression specification to estimate the contemporaneous effect (from $t-2$ to t):

$$Y^i_{t-2,t} = \beta_0 + \beta_1 \,\mathrm{HEW}^i_{t-2,t} + \boldsymbol{X}^i_{t-2}\beta_2 + \triangle \boldsymbol{X}^i_{t-2,t}\beta_3 + \alpha_i + u_t + \varepsilon^i_{t-2,t}\,, \tag{3}$$

where i indexes a household, and the subscript pair $(t-2, t)$ refers to the change of a variable from $t-2$ to t ($t = 2001, \cdots, 2015$). $Y^i_{t-2,t}$ is the dependent variable of interest, such as consumption and wealth changes, active saving, capital gains, and so on.

[16] All of the reported p-values in Table 1 are based on the non-parametric two-sample Wilcoxon rank-sum test, regardless of whether the displayed statistics are median or mean values.

[17] See Kimball, Sahm, and Shapiro (2009) for further details about estimating the degree of risk tolerance in PSID data.

The key independent variable is $\text{HEW}^i_{t-2,t}$, the amount of home equity withdrawal by household i during the period of $t-2$ to t.[18] Given the level specification, the coefficient of HEW can be readily interpreted as how much to spend (or save) out of every dollar from home equity extraction, or the marginal propensity to consume (MPC) (or save). The variable of home equity is also one of the other right-side variables alongside with HEW in the regressions so the effect on consumption via HEW can be separated from the effect via the remaining home equity. This specification differs from those in Adelino, Schoar, and Severino (2015), Cooper (2013), Mian, Rao, and Sufi (2013), Mian and Sufi (2014) and others in which the effect under investigation is via house value overall.

I include both the baseline levels of the control variables at $t-2$ ($\boldsymbol{X}^i_{t-2}$) as well as the changes of these variables from $t-2$ to t ($\Delta\boldsymbol{X}^i_{t-2,t}$) whenever reasonable. α_i is the unobserved, time-invariant idiosyncratic effect for the household i; with the fixed-effect panel regression, α_i does not have to be uncorrelated with any of the included observed regressors. u_t is the year dummy of t, capturing macroeconomic conditions common to all households. $\varepsilon^i_{t-2,t}$ captures idiosyncratic random errors pertaining to household i during time period $t-2$ to t. With the fixed-effect estimation, the estimated effect of HEWs is identified from the change in HEWs over time in each household.

To estimate the long-term, post-t effect of home equity extracted prior to t (which is basically a cross-section estimation), (3) only needs to be slightly revised:

$$Y^i_{t,t+s} = \beta_0 + \beta_1 \,\text{HEW}^i_{t-\tau,t} + \boldsymbol{X}^i_{t-\tau}\,\beta_2 + \triangle\boldsymbol{X}^i_{t-\tau,t}\,\beta_3 + \varepsilon^i_{t-\tau,t}\,. \tag{4}$$

$Y^i_{t,t+s}$ is the dependent variable measured from t to $t+s$ while $\text{HEW}^i_{t-\tau,t}$ is the HEW amount from $t-\tau$ to t.

3.2 Baseline Results

Table 2 presents the regression results for the contemporaneous change (from $t-2$ to t) of consumption spending for the whole sample. As discussed, if the collateral value effect is important, I expect that the coefficient of HEW is positive and

[18] I also experiment with the indicator of HEW ($IHEW = 1$ if $HEW > 0$, and $IHEW = 0$ if $HEW \leq 0$)—instead of the amount of HEWs—and its interactions with the liquidity constraint indicators in these regressions, and the results are qualitatively and statistically similar.

statistically significant. The coefficient estimates of HEW in Table 2 are statistically significant in all of the spending categories except for durables. The MPC out of HEW is only 1.6 cents per dollar for spending on utilities and work-related transportation ($p < 0.01$), and is slightly increased to 1.9 cents when purchases of home furnishings and equipment and leisure trips are considered ($p = 0.04$). Homeowners spent more than 2.5 cents in home repairs and maintenance such as fixing the roof or replacing the plumbing, which accounts for the difference between the estimated MPCs of nondurable II and those of nondurable III. However, there is not much evidence that homeowners relied on HEWs for durable expenses (vehicle, tuition, etc.): the corresponding MPC estimate is negligible and not statistically significant.[19] Summed over all of the items of spending available in PSID, the resulting MPC is 4.7 cents ($p < 0.01$). This magnitude of overall MPC for the HEWs of the full sample accords well with that in Cooper (2010) despite the different specification Cooper uses.[20]

In Table 3, the top panel presents the estimates of the contemporaneous change of consumption spending per HEW dollar for subsamples/subperiods. It shows that these households spent 1.6 cents more for each HEW dollar during the housing boom period than during the housing bust period,[21] and 2.1 cents more when they lived in a state with above-average house price growth.[22] Interestingly, all of the consumption spending increases seem to concentrate on those who extracted home equity without initiating any dedicated home equity loans (such as home equity installment loans, home improvement loans or lines of credit).

Home equity extraction increases a homeowner's contemporaneous loan bal-

[19] McCully, Pence, and Vine (2019) provide evidence that consumers rarely use HEW proceeds to directly fund car purchases, but equity extraction may facilitate their car loan originations by overcoming down payment requirements or other credit constraints.

[20] A subtle technical difference is that Cooper (2010) converts two-year HEWs into one-year measures to be consistent with the consumption spending measures, whereas my analysis does not do so at the estimation stage. In the discussion section, spending estimates will be converted into two-year interval units to be compared with others.

[21] The housing bust period refers to the years 2007 to 2013; the housing boom period refers to the years 1999 to 2007 and 2013 to 2015. Defining the boom and bust periods in this way is empirically motivated: the years 2013 to 2015 witnessed a robust housing market (see Figure A.1 of the online appendix), and using the data from this period augments the nondurable category II (and beyond) spending measures that were not available in pre-2005 surveys; otherwise, the subsample size of the boom period would be too limited to permit analysis of the data.

[22] To protect the anonymity of respondents, PSID public releases contain only state-level residence information.

ance, which has to be paid off down the road. During the market downturn, with limited refinancing opportunities, repaying the loans that had been initiated back in the boom years would be inconvenient, to say the least. House market downturn also elevates the leverage and increases the likelihood of future borrowing constraints, which may simply make households uncomfortable about spending more. Through these direct and indirect influences, high leverage will make these households scale back their spending (Dynan and Edelberg, 2013). The bottom panel of Table 3 brings about the long-term change of consumption spending for those homeowners who extracted their home equity during the housing boom years, 2001 to 2005. The results are stark: compared with their 2005 level, these HEW households' total consumption spending fell by 11 cents by 2009, by 12 cents by 2011, and by 13.5 cents by 2015 when the housing market started to mend. The other side of this implication of high leverage on consumption spending means that if a household had an adequate financial cushion, the spending would decline less. The bottom two rows of Table 3 bear out this implication: for HEW households whose financial wealth growth was above the median during the period from 2001 to 2005, their consumption spending declined by 9 cents by 2015, in contrast to the rest HEW households whose spending declined by 15.5 cents.

Next, on to household active saving, Table 4 presents the amounts of households put into other assets in relationship with each HEW dollar. The top panel displays households' contemporaneous active saving at the time they extracted their home equity. Since not all households participate in a particular market, separate regressions are conducted for all household observations as well as for those who do participate (i.e., holding nonzero values of the referred asset). This way, we can gauge the differences in effects due to household market participation.[23] Several findings are worth mentioning. First, households saved the most into financial wealth by 16 cents for each HEW dollar. However, these savings did not go to risky financial assets such as public stocks as one might assume, because households actually took 3 cents out of risky financial assets (4 cents for stockholders). Clearly, borrowers were not swapping home equity for public stocks.[24]

[23]Formally, Tobit or Logit models can estimate the effects of market participation. But they are nonlinear models, which makes it complicated to compare their estimates directly with others (such as consumption spending estimates) from linear models. For reference, the online appendix contains the results from these nonlinear models as well as the implied marginal effects.

[24]I also find that the non-collateralized debt of these borrowers was not reduced statistically

Secondly, households spent 6.7 cents investing in real estate or private businesses (8.6 cents for stakeholders). For nonhome real estate investments, the net inflow amount per HEW dollar is 3.8 cents, not very economically significant if the main purpose of additional borrowing for homeowners was to buy up nonhome properties. Presumably, the effect for market participants in nonhome real estate should be greater (now estimated at 4 cents), but it is not precisely estimated due to fewer observations. Households put an additional 6.9 cents into private businesses at the time of home equity extraction.

The top panel of Table 4 also displays the contemporaneous change for each wealth category: all categories are positive and statistically significant except for private businesses. We should be cautioned, however, against attributing these estimated positive capital gains and wealth changes to households' savviness in investments, since favorable concurrent economic or positive investment shocks that led to market gains may have induced households to engage in *more* HEW activities, not the other way around. Furthermore, if all of the wealth components are counted, the last two rows of the top panel show that the total net worth without home equity increased during the HEW interval, but once the decrease in home equity is counted (one dollar increase in HEW is one dollar decrease in home equity), the total net worth changed little.

The aforementioned reverse causality from wealth shocks to HEW activities would be arguably mitigated if we examine the wealth changes of these households in post-HEW years. To this end, the bottom panel of Table 4 exhibits the post-2005 wealth changes for households that had extracted their home equity in the period from 2001 to 2005. Recall from the top panel of Table 4 that HEW households saved the most in nonrisky financial assets, and, perhaps not coincidentally, their financial wealth declined insignificantly in the period immediately following 2005 to 2009. However, in the long run, their financial wealth still declined by 46 cents. For real wealth that includes nonhome real estate and businesses, these households endured 78.7 cents loss per HEW dollar, but eventually recovered by the year of 2015. Their home wealth also declined by about 40 cents at the nadir of the Great Recession and recovered by 2015. There is no evidence showing that these HEW

significantly during the period of HEW. This finding agrees with Cooper (2010) and Mian and Sufi (2011). Based on regional data, LaCour-Little, Yu, and Sun (2014) find that households may even have increased their total debt or other non-mortgage debts at the time of HEW.

households were more profitable investors than the others in the longer term.

4 HETEROGENEOUS RESPONSES BY CONSTRAINT STATUS

4.1 Liquidity Constraint: A Loan-to-Value Crossing Measure

In this section, I adopt an LTV crossing measure to further classify the HEW households into those with constrained liquidity and those with unconstrained liquidity and to examine their consumption and balance sheet responses separately. Theoretically, to the extent that the housing collateral effect is important for consumption, it would be even more important to liquidity constrained households for consumption smoothing purposes: without this additional channel for obtaining liquidity, the constrained households would have to stay with the current consumption path even if they regard it as suboptimal; with this liquidity channel now available, they can tap into it to increase their consumption if necessary. But home equity extraction by itself is not a sufficient indicator of liquidity constraint: when the after-tax mortgage rates are lower than those from other sources of funding, all homeowners may find it profitable to extract home equity for financial benefits, as we have seen in Table 4. Drawing on mortgage industry practices, Hurst and Stafford (2004) propose and verify the validity of using the signal of a household *crossing* the 0.8 threshold of LTV ratio while extracting home equity as the indicator of liquidity constraint. By this definition, simply possessing an LTV ratio above 0.8 indicates nothing about being constrained or not, a condition that may be determined by credit market conditions; only *the rise* of LTV ratio from below 0.8 to above 0.8 does. Using this measure, Hurst and Stafford find that those that were liquidity-constrained had lower levels of liquid wealth and net wealth, ended up paying higher borrowing rates, and removed larger amounts of home equity than other borrowers.

The reason that this 0.8 threshold is critical has a long and evolving history in association with the evolution of the U.S. mortgage market.[25] For starters, a bona fide mortgage loan is considered "conventional" or "conforming", and can thus be readily packaged and sold in the secondary mortgage market, if the LTV ratio is below 0.8. The predominant buyers of these conforming loans are the government-

[25]McDonald and Thornton (2008) provide an excellent overview of the U.S. mortgage market.

sponsored enterprises: Fannie Mae and Freddie Mac. A loan with an LTV ratio above 0.8 is considered to have high risk and is required by these two government-sponsored enterprises to purchase private mortgage insurance (PMI) before being offloaded to them.[26] The most prominent feature of the PMI premium (in the form of a basis-point-rate premium) is that it is applied to the entire outstanding balance. So, for a household that extracted home equity through refinancing and whose LTV ratio surpassed 0.8, the effective borrowing rate on the extracted equity can easily exceed 20% (Hurst and Stafford, 2004). Therefore, for someone who refinanced from just under a 0.8 LTV ratio to just above, the PMI premium would be calculated based on the new, larger loan balance. An interesting aspect of PMI is that its premium is solely determined by the LTV ratio and the size of the mortgage; no differential consideration of individual default risk is figured into the pricing (Colquitt and Slawson, 1997).

In recent years, due to the increasing popularity of home equity installment loans (HELs) and home equity lines of credit (HELOCs) in the mortgage market,[27] a borrower can work with a lender (or a consortium of lenders) to arrange for a second mortgage to make up for any shortfall and thereby to attain the 0.8 LTV ratio required for the first mortgage to avoid PMI.[28] Since a second-lien mortgage is subordinate to a first-lien mortgage in claim rights, it usually charges a higher interest rate than the rate on the first-lien mortgage, and, in the short run, such a first-/second-lien mortgage bundle may imply higher monthly payments than a standalone, insured first-lien mortgage would do (Eckles, Halek, and Wells, 2006). Therefore, whether it is in the form of a single mortgage with PMI, or multiple-mortgage bundle involving HEL/HELOC, when the LTV rises above 0.8, the borrower has to pay a higher marginal interest rate than the original single mortgage without PMI. This suggests that the traditional LTV ratio threshold 0.8 continues to prove critical, even with the rise of second mortgages. I provide

[26] If the mortgagor has paid down the principal balance to 0.78 LTV in terms of the original property value, the PMI should be automatically removed by the lender.

[27] LaCour-Little, Yu, and Sun (2014) report that during the period from 2000 to 2006, the total balance of home equity loans grew on average 22% annually in 5,488 ZIP codes nationally, of which HELOCs grew at 34% per year, much faster than that of HELs at 13%. Note that the growth of junior mortgage debt started much earlier than the 2000s—it grew at the rate of 23.3% per year during the 1980 to 1987 period (Manchester and Poterba, 1989).

[28] The so-called 80-10-10 mortgage is an example of such arrangements. In such cases, the down payment is 10 percent, 80 percent is financed by the first or primary mortgage, and the remaining 10 percent is financed by a second mortgage, in the form of a HEL/HELOC.

evidence to this effect in what follows.

Table 5 lists the summary statistics of liquidity constrained and unconstrained households in my sample based on this measure. Column (1) lists the statistics for all HEW households, the same as Column (2) in Table 1. Columns (2) and (3) show that constrained HEW households were worse off than unconstrained HEW households in every economic/financial measure, sometimes strikingly so, and these differences are all statistically significant at the level of 0.01 (except for real wealth, wherein the difference comes with a p-value of 0.04). Recall that constrained households are defined as having an LTV ratio below 0.8 at $t-2$ *and* having an LTV ratio above 0.8 at t. Constrained households had about $\$70,000$ less in total net worth, $\$12,600$ less if the net worth excludes home equity, and $\$5,100$ less in financial wealth. The income of constrained households was less than that of unconstrained households by $\$6,700$, and the home value of constrained households was lower than that of unconstrained households by $\$26,500$. Not surprisingly, as a result, constrained households removed more ($\$18,800$) in home equity through borrowing than did unconstrained households. These facts are broadly consistent with the descriptions in Hurst and Stafford (2004). Note that the constrained and unconstrained borrowers do not differ much in demographic factors (including their risk preferences), except that the unconstrained households are slightly more college-educated or selfemployed (by 4 percentage points in both, $p <= 0.02$).

To further substantiate this liquidity constraint measure, I conduct several additional analyses.[29] The first is to compare the medians of various wealth measures of constrained homeowners in PSID with those found in the Survey of Consumer Finances (SCF) at the various years when both surveys were conducted. The liquidity-constrained homeowners in SCF are more easily identified by whether they were turned down for any request for credit in the previous five years. The results are tabulated in Table A.1 in the online appendix. Although the average SCF homeowner had consistently higher total net worth than its PSID counterpart throughout the years because SCF oversamples the top wealth and income families (Bricker et al., 2016), financial wealth, real wealth, and even food spending of constrained SCF homeowners and their PSID counterparts were quite close. This

[29] I thank the anonymous referee for suggestions that led to these analyses. Due to space limitations, I delegate most of these results to the online appendix.

extends credibility to Hurst and Stafford's (2004) criterion.

The second analysis I conduct is the income excess sensitivity test on both the constrained and the unconstrained households in PSID. In theory, the consumption growth of constrained households should respond more to lagged income growth than the consumption growth of unconstrained households (Zeldes, 1989). Table A.2 in the online appendix shows that for the majority of the spending categories (nondurable II, nondurable III, and total spending), the consumption growth for constrained households was indeed excessively sensitive to income growth during the same period, whereas such sensitivity was more muted for unconstrained households.

My third analysis is to offer some insights about how households became liquidity-constrained. Table A.3 in the online appendix tabulates their median growth rates of various wealth measures and income relative to *prior* years. Constrained households saw their financial wealth, real wealth, and net worth fall more precipitously than unconstrained households in the previous 2 to 4 years, even though their income growth rates were not statistically significantly different. Their *ex ante* LTV ratios were also already higher than those of unconstrained households before they engaged in more costly borrowing ($p < 0.01$). All of this evidence suggests that idiosyncratic wealth shocks seem to have played a role in driving the need of constrained homeowners to tap into their home equity despite higher borrowing costs.

My last additional analysis is to confirm that the LTV crossing cutoff value 0.8, which is backed by mortgage industry practices, is indeed a reasonable way to identify constrained households. By varying the LTV crossing cutoff from 1.0 to 0.6 and to 0.4, Table 6 repeats the comparison of the wealth measures of constrained and unconstrained PSID households. When the LTV cutoff is increased from 0.8 to 1.0, the implied constrained households are worse in their wealth position: their median financial wealth level is now *zero*, and their total net worth is below that of the unconstrained households by over $\$98,000$. Not surprisingly, the number of constrained observations is cut by more than half, to 431. When the LTV crossing cutoff is set lower than 0.8, the resulting constrained group exhibits higher levels of wealth measures, as a larger number of richer households are included. At the crossing cutoff of 0.6, for example, the median total net worth for the constrained group is less than that of the unconstrained group by less than $\$12,000$, one fifth

of the original difference when the crossing cutoff is at 0.8. The wealth differences between the two groups also start to lose statistical significance, as is evidenced by more p-values greater than 0.01. When the LTV crossing cutoff is further reduced to 0.4, the signs of the relative wealth differences between the constrained and the unconstrained households begin to *switch*: now the constrained group has *higher* levels of wealth than the unconstrained group.[30] Overall, these results are assuring in that they vindicate the empirical importance of setting the LTV crossing cutoff value at 0.8.

4.2 Contemporaneous and Long-term Effects by Constraint Status

To analyze the marginal effects of HEW separately for constrained and unconstrained households, the specification (3) is modified to interact the HEW variable with the indicator of liquidity constraint:

$$\begin{aligned} Y^i_{t-2,t} = {} & \beta_0 + \beta_{1,\text{nlc}}\,\text{HEW}^i_{t-2,t}\cdot\text{NLC}^i_{t-2,t} + \beta_{1,\text{lc}}\,\text{HEW}^i_{t-2,t}\cdot\text{LC}^i_{t-2,t} + \boldsymbol{X}^i_{t-2}\beta_2 + \triangle\boldsymbol{X}^i_{t-2,t}\beta_3 \\ & + \alpha_i + u_t + \varepsilon^i_{t-2,t}\,, \end{aligned} \tag{5}$$

where

$$\text{LC}^i_{t-2,t} = \begin{cases} 1 & \text{if LTV}^i_{t-2} < 0.8 \text{ and LTV}^i_t >= 0.8\,, \\ 0 & \text{otherwise}\,. \end{cases} \tag{6a}$$

$$\text{NLC}^i_{t-2,t} = 1 - \text{LC}^i_{t-2,t}\,. \tag{6b}$$

The long-term effect estimation equation (4) can be similarly modified.

Table 7 presents the results of comparing the consumption responses of constrained and unconstrained households. The first two rows reveal strikingly that there is *no* evidence that constrained households spent more out of HEWs: the MPC of total spending for the constrained is 3.4 cents, less than the 5.5 cents for the unconstrained. Subsequent rows of the table present the results associated with dividing the sample along different dimensions to investigate the differences between the two groups. For example, constrained households had not used dedicated home equity loans to fund their consumption: constrained households

[30] These patterns are preserved when HEL/HELOC observations are excluded from the tabulations.

with home equity loans saw their consumption spending decrease by 10.3 cents, whereas unconstrained households with home equity loans increased their consumption spending by 7.9 cents. As another example, the consumption smoothing effect of HEWs for the constrained households should have been stronger in the housing bust period than in the boom period (to the extent that their loan requests were approved), but this is not borne out by the data: constrained households' consumption response to HEW was statistically insignificant in both periods, while that of unconstrained households was large and statistically significant in both periods (6.9 cents and 5.5 cents, respectively).

Could this be because constrained homeowners all resided in areas with stagnant or even negative house price growth—and thus their elevated LTV ratio reflected not so much vigorous borrowing as declining home values? In any case, independent of their home values and leverage, the overall depressed house prices in their neighborhoods may have dampened their consumption spending by curbing their future housing price expectations. The last two rows of the top panel in Table 7 show the results when the sample is split along the median of state-level house price growth: once again, any differential effect is almost entirely driven by unconstrained households. Unconstrained households' MPC is 8.5 cents ($p < 0.01$) in high-price-growth states and 6.4 cents ($p = 0.02$) in low-price-growth states, but in both cases it is statistically insignificant for constrained households. Taken as a whole, these results show that the consumption growth response is more significant for unconstrained households than for the constrained, contrary to the theoretical prediction.

Not only did constrained households fail to show a contemporaneous consumption boost from their HEWs, but their long-term consumption spending after HEWs slumped more compared with unconstrained households. For the period from 2001 to 2005, I define a household as being constrained if its LTV ratio was less than 0.8 in 2001 but rose to greater than 0.8 in 2005. The bottom panel of Table 7 shows that a constrained household's consumption spending by 2009 was cut back by nearly 17 cents for each HEW dollar extracted in the period from 2001 to 2005, doubling the degree of decline for an average unconstrained household; by 2015, constrained households' consumption spending was down by 18 cents while that of unconstrained households declined by 11.5 cents.

If constrained households did not fund their consumption as much as expected,

could it be that they used the HEW cash to improve their balance sheet? Table 8 presents the results of comparing the balance sheet changes of these two groups. The most notable category is financial wealth, in which constrained households saved 3.6 cents more than unconstrained households (18.7 cents versus 15.1 cents), which more than offset the divergence in their consumption spending increase; these savings seem to have all gone into the nonrisky type of financial assets, since these constrained households' risky asset savings were negative and not statistically significant. Unconstrained households withdrew 3.6 cents out of their risky financial assets, perhaps because they had more in their accounts to begin with. But the lead in active saving by constrained households ends here: in almost every other wealth category, unconstrained households saved more. On the whole, unconstrained households invested 4.1 cents for home improvement, 5.2 cents for nonhome real estate investments and 3.2 cents for private businesses (7.9 cents if they already had some business ownership). These numbers are not impressive in themselves, but constrained households, which leveraged up more relative to their home values, seem to have played a lesser role in these endeavors by showing even less in active savings in these categories. In the end, if home equity is not counted, the net worth of both constrained and unconstrained households increased, but that of unconstrained households increased 14.5 cents more. If home equity is counted, the total net worth of constrained households fell by 36 cents while unconstrained households' net worth changed little.

Constrained households seem to have only actively saved their financial wealth for cushioning purposes temporarily. To see this, all of the long-term wealth change estimates of the homeowners who extracted their home equity in the years 2001 to 2005 are presented in the bottom panel of Table 8. From 2005 to 2009, the financial wealth of constrained households appears to have declined somewhat but the estimate is not statistically significant. By 2015, though, their financial wealth had declined by a statistically significant 61.7 cents. In contrast, unconstrained households' financial wealth declined by 2011, the nadir of the recession, by 64.3 cents, but it eventually recovered by 2015. These results reveal that constrained households were largely responsible for the overall long-term financial wealth decline from 2005 to 2015 that we saw in Table 4. Nonetheless, the build-up and run-down of the financial wealth of constrained households during this period was accompanied by the rebound of other wealth measures: their real wealth and

both measures of net worth (including or excluding home equity) declined sharply in the initial years (by more than 1 dollar), but increased (though not statistically significantly) in the later years.

5 DISCUSSION

5.1 Limitations

Some limitations of the analysis in this study need to be acknowledged. They are mostly due to the nature of the data available in PSID. First, as is well known, even if the fixed effects are controlled for in the regressions, the time-varying idiosyncratic errors may still correlate with one or more of the right-hand side variables and render the estimates biased. Examples include credit availability in the borrower's local area at the time of HEW, which may correlate with local business opportunities. Thus, without the means of controlling for credit availability, the effect of HEW on private business investments may be overestimated. Secondly, because of the survey design, the calculation of capital gains and wealth changes is mostly aligned with the time frame of two years. Two years is neither a short nor a long term, and there are no rules stipulating that households must aim for an investment return in two years. The analysis is thus biased against households whose investment horizon is longer. Last, the mortgage data in PSID, although rich, is by no means detailed or of superb quality. It does not, for example, enable researchers to pin down the exact timing of refinancing or new borrowings, or the costs involved. Further research with better data sources is warranted to confirm the empirical patterns documented in the present article.

5.2 Reconciling with Hurst and Stafford's (2004) Results

At this point, we can compare my results with those of Hurst and Stafford (2004), who conclude that constrained households spend more of their extracted equity on consumption than do unconstrained households, confirming the main theoretical implication of liquidity constraint. Their finding is inferred from the data on wealth changes, since the more comprehensive household spending data was not yet available at the time of the study. The authors find that the total wealth for those who were liquidity-constrained fell more with removed equity than for the

unconstrained and conclude that the constrained must have spent more of their removed equity on consumption.

This inference is *not* necessarily valid, however. By definition, the change in total net worth (denoted by $\triangle$NW) is

$$\triangle \text{NW} \equiv \triangle\text{NHNW} + \triangle\text{HE} = \triangle\text{NHNW} + \triangle\text{H} - \text{HEW}\,, \tag{7}$$

where $\triangle$NHNW stands for the change in net worth exclusive of home equity, and $\triangle$HE and $\triangle$H stand for the changes in home equity and home value, respectively. A subtle but important feature of the identity equation (7) is that it implies no monotonic relationship with spending when there exist exogenous shocks to NHNW or H. To take a concrete but hypothetical example, if a household spent zero out of one dollar from HEW on consumption and its NHNW and H in total did not change after exogenous shocks (say, the household saved the HEW dollar but its house value declined by exactly one dollar after HEW), the change in NW would be negative one dollar, leading to the incorrect inference that its consumption spending increased by one dollar. On the other hand, if this household spent the whole HEW dollar on consumption, but its NHNW and H received positive shocks and increased in value by one dollar, the change in NW would be zero, again leading to the incorrect inference that its consumption spending was not affected. The change in NW is thus not indicative of how much is spent on consumption.

Getting back to my results, the estimated change in total net worth in response to HEW for constrained households is a negative 36.3 cents in Table 8, compared with a positive (yet not statistically significant) 24.2 cents for unconstrained households. Yet we have seen in Table 7 that constrained households increased their consumption less than the unconstrained. Therefore, the change in total wealth does not perfectly negatively correspond to the change in consumption, as is implied in Hurst and Stafford (2004).

5.3 A Synopsis

Given all of the estimates, how much have we learned about what households did with their HEWs? Even though the surveys never explicitly asked exactly how a household disbursed its HEW proceeds, we can now obtain a more complete picture by aggregating the statistically significant estimates for consumption spending and

active savings to see how much they add up to.

Figure 1 provides a snapshot of such an exercise, for the whole sample as well as for the constrained/unconstrained subsamples. For the whole sample, slightly more than 35 cents out of a HEW dollar are associated with the increase in consumption spending (9.4 cents) and active saving (26 cents).[31] Since consumption spending estimates are in line with the range in the literature, this implies that active saving falls short of accounting for the rest. For the constrained group, even less (30 cents) of the HEW dollar is accounted for by these two categories, while for unconstrained households the figure stands at 38.5 cents. Measurement error may be at issue here: active saving was only surveyed for a subset of household assets, and respondents might not recall the exact amounts of money put in and taken out for a two-year interval. Both factors raise the possibility that, given that the wealth changes are on average positive, a substantial portion of active savings may be misconstrued as capital gains, for which we indeed see much stronger responses associated with HEWs.

6 CONCLUSION

Using a panel sample from the PSID from 1999 to 2015, this article assesses the consumption and balance sheet effects of home equity borrowing at the household level. I find that homeowners' contemporaneous spending and nonhome wealth increased at the time of the HEWs, but their longer-term spending and wealth declined if their home equity was extracted during the period of the housing boom. After the sample is divided into households with constrained and unconstrained liquidity according to Hurst and Stafford's (2004) definition, I find that constrained households not only did not increase their contemporaneous spending in response to HEWs more than did unconstrained households, but their longer-term spending in fact declined more. Both groups saved significantly in nonrisky financial wealth after HEWs, but unconstrained homeowners invested more in nonhome real estate and businesses than constrained homeowners did.

The findings regarding what these households did with the home equity they extracted bear important implications for the relationship between home-based

[31] Consumption spending estimates are converted to a biennial basis in order to align them with active saving estimates.

credit supply and the macroeconomy. The evidence shows that the oft-cited concurrent increase in housing wealth, home equity borrowing, and consumption during the housing boom is indeed observed at the household level—except that no consumption boost is seen among those who appear to have needed it the most. All homeowners chose to put aside the withdrawn housing wealth as a cushion by strengthening their financial balance sheet, consistent with the buffer-stock behavior described by Carroll (1997). After households extracted their home equity during the boom period, however, the longer-term effect on their consumption was not so positive. When the housing bubble burst, all homeowners suffered, and the more leveraged homeowners suffered more.

Meanwhile, homeowners did not plow back the majority of cash-out funds into their own homes and other investment properties. It is hard to argue that average homeowners were the main force behind the unsustainable housing price rise because they invested heavily in nonhome real estate. The evidence is stronger that borrowers invested more in private businesses, consistent with the research that has found that small-business entrepreneurs had difficulty securing alternative, less expensive funding sources elsewhere. Home equity filled in as the collateral for external funding for these borrowers.

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Tables and Figures

Table 1: Summary statistics of the PSID 2001-2015 panel sample

	PSID panel sample: 2001-2015			
	(1)	(2)	(3)	(4)
	All sample	HEW[a]	Non-HEW[a]	HEW = Non-HEW? (p-value)[b]
Sample size	18532	5704	12828	——
Median				
Financial wealth (net of debt)	6533	4552	7535	< 0.01
Real wealth (net of debt)[c]	16017	16955	15878	< 0.01
Net worth (excluding home equity)	33000	31648	34000	< 0.01
Net worth (including home equity)	106164	90000	113711	< 0.01
Total family income	80223	83183	78913	< 0.01
Home value	151941	170000	145000	< 0.01
Amount of home equity removed[d]	-1061	18418	-5514	< 0.01
Consumption spending (annual) on:				
Food	7177	7374	7093	< 0.01
Nondurable III[e]	28480	30147	27822	< 0.01
Durable[f]	4890	5396	4651	< 0.01
Total[g]	34410	36532	33712	< 0.01
Mean				
Risk Tolerance	0.29	0.29	0.29	0.42
Household head age	44.6	43.7	44.9	< 0.01
Number of kids at home	1.04	1.14	1.00	< 0.01
Proportion				
Being married	0.76	0.78	0.74	< 0.01
Head with a high school degree	0.55	0.57	0.54	< 0.01
Head with a college degree	0.33	0.32	0.34	< 0.01
Head or spouse self-employed	0.24	0.25	0.23	< 0.01
Business ownership	0.18	0.19	0.17	< 0.01

Notes:

(a) "HEW" refers to the subsample of the household observations that did not withdraw home equity anytime from year t-2 to year t during the period 2001-2015. "Non-HEW" refers to the subsample of the household observations that did withdraw home equity anytime from year t-2 to year t during the period 2001-2015.

(b) p-value is computed based on the non-parametric two-sample Wilcoxon rank-sum test.

(c) The value of real wealth is calculated as the sum of ownership interest in private businesses, non-primary-residence real estate, and vehicles, net of any debts owned on them.

(d) Negative numbers indicate paying down the mortgage balance instead of borrowing up.

(e) Nondurable I is food expenditure plus expenditures on utilities, transportation, car insurance, property taxes, and homeowner insurance. Nondurable II is nondurable I plus expenditures on home furnishings and equipment, clothing and apparel, travel and vacations, and recreation and entertainment (available beginning in 2005). Nondurable III is nondurable II plus home repairs and maintenance expenditures (available beginning in 2005).

(f) Durable spending is the sum of any schooling expenses, out-of-pocket medical expenses, vehicle purchase down payments, and annualized vehicle loan payments.

(g) Total spending is the sum of nondurable III and durable spending.

Table 2: HEW and consumption spending: various measures

	Contemporaneous change of consumption spending					
	(1)	(2)	(3)	(4)	(5)	(6)
	Food	Nondurable I	Nondurable II	Nondurable III	Durable	Total
HEW (β_1)	0.004**	0.016***	0.019**	0.046***	0.003	0.047***
	(0.002)	(0.004)	(0.009)	(0.012)	(0.005)	(0.014)
Home equity change	0.003***	0.003*	0.006	0.013***	0.001	0.012**
	(0.001)	(0.002)	(0.004)	(0.005)	(0.002)	(0.006)
Net nonhousing wealth change	0.000	0.000	0.002***	0.001**	0.001*	0.002***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)
Total family income change	0.005***	0.006	0.027**	0.043***	0.011**	0.053***
	(0.001)	(0.005)	(0.011)	(0.013)	(0.006)	(0.017)
R^2 within	0.012	0.020	0.013	0.016	0.008	0.017
No. of total sample size	16,133	16,133	9,979	9,848	15,946	9,758
No. of households	4,380	4,380	3,494	3,471	4,359	3,457

Source: Author's regressions on an unbalanced panel sample of homeowners interviewed in the 1999-2015 Panel Study of Income Dynamics (PSID) surveys.

Notes: The samples consist of households with heads who were between 22 and 60 years old and who were not retired at the time. Fixed effects linear regressions are employed with standard errors clustered at the household level. Standard errors are displayed in parentheses. ***, **, and * indicate that the estimated coefficients are statistically significant at the 0.01, 0.05, and 0.10 levels, respectively. Other details are provided in the text.

(a) The dependent variables are the changes in consumption expenditures from t-2 to t. Nondurable I is food expenditure plus expenditures on utilities, transportation, car insurance, property taxes, and homeowner insurance. Nondurable II is nondurable I plus expenditures on home furnishings and equipment, clothing and apparel, travel and vacations, and recreation and entertainment, all of which are available only beginning in 2005. Nondurable III is nondurable II plus home repairs and maintenance expenditures (available beginning in 2005). Durable spending is the sum of any schooling expenses, out-of-pocket medical expenses, vehicle purchase down payments and annualized vehicle loan payments. Total spending is the sum of nondurable III and durable spending.

(b) The independent variables other than those listed above are: whether the head graduated from high school or from college, marital status, number of children at home, a quadratic term of the age of head, and calendar year dummies.

Table 3: HEW and consumption spending: contemporaneous change versus long-term change

	Change of consumption spending		
	(1)	(2)	(3)
Estimates of the coefficient for HEW (β_1)	Nondurable I	Nondurable III	Total
Contemporaneous change [(a)]			
Housing boom period[(b)]	0.019***	0.046*	0.059*
	(0.007)	(0.025)	(0.032)
Housing bust period[(b)]	0.007	0.042**	0.043**
	(0.008)	(0.017)	(0.020)
With home equity loans[(c)]	0.005	0.014	0.003
	(0.015)	(0.023)	(0.035)
Without home equity loans[(c)]	0.018***	0.054***	0.054***
	(0.005)	(0.015)	(0.016)
High house price growth[(d)]	0.018**	0.051**	0.070***
	(0.007)	(0.020)	(0.026)
Low house price growth[(d)]	0.013*	0.048***	0.049**
	(0.007)	(0.019)	(0.020)
Long-term change [(e)]			
2005-2009	-0.036**	-0.079**	-0.105***
	(0.018)	(0.034)	(0.037)
2005-2011	-0.051**	-0.113***	-0.121***
	(0.022)	(0.037)	(0.046)
2005-2015	-0.035***	-0.093**	-0.135***
	(0.011)	(0.040)	(0.045)
High financial wealth increase[(f)]	-0.010	-0.029	-0.089**
	(0.015)	(0.033)	(0.042)
Low financial wealth increase[(f)]	-0.054***	-0.138***	-0.155**
	(0.015)	(0.051)	(0.061)

Source: Author's regressions on an unbalanced panel sample of homeowners interviewed in the 1999-2015 Panel Study of Income Dynamics (PSID) surveys.

Notes: The sample consists of households with heads who were between 22 and 60 years old and who were not retired at the time. Fixed effects linear regressions are employed for contemporary change estimation with standard errors clustered at the household level. Weighted linear regressions are employed for long-term change estimation with robust standard errors. Standard errors are displayed in parentheses. ***, **, and * indicate the estimated coefficients are statistically significant at the 0.01, 0.05, and 0.10 levels, respectively. Other details are provided in the text.

(a) Contemporaneous change is the change in consumption expenditures from t-2 to t.

(b) The housing boom period refers to the years 1999-2007 and 2013-2015. The housing bust period refers to the years 2007-2013.

(c) Households with home equity loans are those who reported having a home equity installment loan, a home improvement loan, or a line of credit loan in the survey of year t. Households without home equity loans are those who reported they had no such loans in the survey of year t.

(d) The states with high house price growth wherein a household resides are defined as those whose FHFA state-level two-year real house price index growth was above the median. The states with low house price growth are defined as those whose FHFA state-level two-year real house price index growth was below the median.

(e) For long-term change analysis, home equity withdrawal is computed for the period 2001-2005.

(f) Households with high financial wealth increase are those whose 2001-2005 financial wealth increase were above the median. Households with low financial wealth increase are those whose 2001-2005 financial wealth increase were below the median.

Table 4: HEW and wealth: contemporaneous change versus long-term change

Contemporaneous change (for HEW between t-2 and t)		(1) Active saving[(a)]	(2) Capital gains[(a)]	(3) Total
Home wealth		0.030***	0.425***	0.458***
Financial wealth		0.163**	0.171**	0.298***
Risky assets[(b)]	(*all*)[(c)]	-0.029***	0.171**	0.183***
Risky assets[(b)]	(*holders*)[(c)]	-0.042**	0.265**	0.267**
Real wealth[(d)]	(*all*)[(c)]	0.067***	0.316**	0.457***
	(*holders*)[(c)]	0.086**	0.673**	0.891***
Real estate	(*all*)[(c)]	0.038*	0.207**	0.244**
	(*holders*)[(c)]	0.040	0.646**	0.659**
Businesses	(*all*)[(c)]	0.029***	0.113	0.209
	(*holders*)[(c)]	0.069**	0.607	0.837
Net worth (excluding home equity)		——	——	0.772***
Net worth (including home equity)		——	——	0.043

Long-term total change (for HEW 2001-2005)[(e)]	(4) 2005-2009	(5) 2005-2011	(6) 2005-2015
Home wealth	-0.402***	-0.410***	-0.332
Financial wealth	-0.003	-0.468*	-0.459*
Real wealth[(d)]	-0.787**	-0.058	0.738
Net worth (excluding home equity)	-0.828**	-0.589	0.387
Net worth (including home equity)	-0.965***	-0.688	0.565

Source: Author's regressions on an unbalanced panel sample of homeowners interviewed in the 1999-2015 Panel Study of Income Dynamics (PSID) surveys.

Notes: The sample consists of households with heads who were between 22 and 60 years old and who were not retired at the time. Fixed effects linear regressions are employed for contemporaneous change estimation with standard errors clustered at the household level. Weighted linear regressions are employed for long-term change estimation with robust standard errors. ***, **, and * indicate the estimated coefficients are statistically significant at the 0.01, 0.05, and 0.10 levels, respectively. Other details are provided in the text.

(a) Active saving in home wealth is defined as the spending on home addtions and improvements totaling $10,000 or more. Active saving in other wealth components is defined as the net purchase of the underlying asset. Capital gain is calculated as the change of the wealth component net of active saving.

(b) Risky assets in financial wealth consist of shares of public stocks, mutual funds, or investment trusts in regular brokerage accounts and in private annuities and IRA accounts.

(c) "All" refers to all household observations. "Holders" refers to housholds holding non-zero values of the referred asset.

(d) Real wealth includes non-home real estate and private businesses.

(e) For long-term change analysis, home equity withdrawal is computed for the period 2001-2005.

Table 5: Summary statistics of constrained and unconstrained households

	PSID panel sample: 2001-2015			
	(1)	(2)	(3)	(4)
	All HEW obs.	Constrained[a]	Unconstrained[a]	Constrained = Unconstrained? (p-value)[b]
Sample size	5704	1028	4676	——
Median				
Financial wealth (net of debt)	4552	1118	6246	< 0.01
Real wealth (net of debt)[c]	16955	15000	17000	0.04
Net worth (excluding home equity)	31648	21349	34000	< 0.01
Net worth (including home equity)	90000	36969	106983	< 0.01
Total family income	83183	77646	84340	< 0.01
Home value	170000	149988	176443	< 0.01
Amount of home equity removed[d]	18418	34680	15921	< 0.01
Consumption spending (annual) on:				
Food	7374	6772	7574	< 0.01
Nondurable III[e]	30147	28697	30554	< 0.01
Durable[f]	5396	4950	5473	< 0.01
Total[g]	36532	34264	37078	< 0.01
Mean				
Risk tolerance	0.29	0.29	0.29	0.86
Household head age	43.7	42.2	44.1	< 0.01
Number of kids at home	1.14	1.21	1.12	0.04
Proportion				
Being married	0.78	0.77	0.79	0.12
Head with a high school degree	0.57	0.58	0.56	0.23
Head with a college degree	0.32	0.28	0.32	< 0.01
Head or spouse self-employed	0.25	0.22	0.26	0.02
Business ownership	0.19	0.19	0.19	0.89

Notes:

(a) "Constrained" households are defined as those who withdrew home equity and whose LTV ratios rose and crossed the corresponding LTV cutoff (0.8) from below. "Unconstrained" households are the remainder of those who withdrew home equity

(b) p-value is computed based on the non-parametric two-sample Wilcoxon rank-sum test.

(c) Calculated as the sum of ownership interest in private businesses, non-primary-residence real estate, and vehicles, net of any debts owned on them.

(d) Negative numbers indicate paying down the mortgage balance instead of borrowing up.

(e) Nondurable I is food expenditure plus expenditures on utilities, transportation, car insurance, property taxes, and homeowner insurance. Nondurable II is nondurable I plus expenditures on home furnishings and equipment, clothing and apparel, travel and vacations, and recreation and entertainment (available beginning in 2005). Nondurable III is nondurable II plus home repairs and maintenance expenditures (available beginning in 2005).

(f) Durable spending is the sum of any school expenses, out-of-pocket medical expenses, vehicle purchase down payments and annualized vehicle loan payments.

(g) Total spending is the sum of nondurable III and durable spending.

Table 6: Descriptive statistics corresponding to different LTV cutoffs for constrained households

Definition of being constrained	PSID panel HEW subsample: 2001-2015								
	Crossing cutoff at LTV=1.0			*Crossing cutoff at LTV=0.6*			*Crossing cutoff at LTV=0.4*		
	Constrained[(a)]	Unconstrained[(a)]	Equality test (p-value)[(b)]	Constrained[(a)]	Unconstrained[(a)]	Equality test (p-value)[(b)]	Constrained[(a)]	Unconstrained[(a)]	Equality test (p-value)[(b)]
Sample size	431	5273	——	1091	4613	——	828	4876	——
Median									
Financial wealth (net of debt)	0	5652	< 0.01	4552	4611	0.79	5652	4396	0.02
Real wealth (net of debt)[(c)]	12745	17012	< 0.01	18127	16767	0.05	18207	16767	0.01
Net worth (excluding home equity)	13271	33909	< 0.01	32993	31083	0.21	34378	31148	< 0.01
Net worth (including home equity)	1000	99226	< 0.01	80063	92308	0.02	96275	88421	< 0.01
Total family income	71740	84095	< 0.01	78038	84242	< 0.01	72126	84639	< 0.01
Home value	134729	175133	< 0.01	154387	175000	< 0.01	132677	177079	< 0.01
Amount of home equity removed	30000	17644	< 0.01	42544	15000	< 0.01	49069	15476	< 0.01

Notes:

(a) "Constrained" households are defined as those who withdrew home equity and whose LTV ratios rose and crossed the corresponding LTV cutoff from below. "Unconstrained" households are the remainder of those who withdrew home equity.

(b) p-value is computed based on the non-parametric two-sample Wilcoxon rank-sum test.

(c) Calculated as the sum of ownership interest in private businesses, non-primary-residence real estate, vehicles, net of any debts owned on them.

Table 7: HEW and consumption spending: constrained versus unconstrained households

		Change of consumption spending		
		(1)	(2)	(3)
Estimates of the coefficient for HEW		Nondurable I	Nondurable III	Total
Contemporaneous change [(a)]				
All: *unconstrained* [(b)]	$\beta_{1,nlc}$	0.021***	0.048***	0.055***
constrained [(b)]	$\beta_{1,lc}$	0.006	0.042**	0.034*
With home equity loans[(c)]:	$\beta_{1,nlc}$	0.012	0.059*	0.079*
	$\beta_{1,lc}$	-0.007	-0.049**	-0.103***
Without home equity loans[(c)]:	$\beta_{1,nlc}$	0.024***	0.051***	0.056***
	$\beta_{1,lc}$	0.005	0.059**	0.052**
Housing boom period[(d)]:	$\beta_{1,nlc}$	0.025***	0.064**	0.069*
	$\beta_{1,lc}$	0.005	-0.008	0.030
Housing bust period[(d)]:	$\beta_{1,nlc}$	0.016*	0.045**	0.055**
	$\beta_{1,lc}$	-0.007	0.038	0.025
High house price growth[(e)]:	$\beta_{1,nlc}$	0.021***	0.059**	0.085***
	$\beta_{1,lc}$	0.005	0.030	0.028
Low house price growth[(e)]:	$\beta_{1,nlc}$	0.017**	0.057**	0.064**
	$\beta_{1,lc}$	0.007	0.034	0.025
Long-term change [(f)]				
2005-2009:	$\beta_{1,nlc}$	-0.029	-0.057**	-0.081***
	$\beta_{1,lc}$	-0.055***	-0.136*	-0.168**
2005-2011:	$\beta_{1,nlc}$	-0.048*	-0.094***	-0.101***
	$\beta_{1,lc}$	-0.058***	-0.162**	-0.171*
2005-2015:	$\beta_{1,nlc}$	-0.030***	-0.066***	-0.115***
	$\beta_{1,lc}$	-0.046**	-0.157*	-0.180*

Source: Author's regressions on an unbalanced panel sample of homeowners interviewed in the 1999-2015 Panel Study of Income Dynamics (PSID) surveys.

Notes: The sample consists of households with heads who were between 22 and 60 years old and who were not retired at the time. Fixed effects linear regressions are employed for contemporary change estimation with standard errors clustered at the household level. Weighted linear regressions are employed for long-term change estimation with robust standard errors. ***, **, and * indicate the estimated coefficients are statistically significant at the 0.01, 0.05, and 0.10 levels, respectively. Other details are provided in the text.

(a) Contemporaneous change is the change in consumption expenditures from t-2 to t.

(b) "Constrained" households are defined as those who withdrew home equity and whose LTV ratios rose and crossed the corresponding LTV cutoff from below. "Unconstrained" households are the remainder of those who withdrew home equity.

(c) Households with home equity loans are those who reported having a home equity installment loan, a home improvement loan, or a line of credit loan in the survey of year t. Households without home equity loans are those who reported they had no such loans in the survey of year t.

(d) The housing boom period refers to the years 1999-2007 and 2013-2015. The housing bust period refers to the years 2009-2013.

(e) The states with high house price growth wherein a household resides are defined as those whose FHFA state-level two-year real house price index growth was above the median. The states with low house price growth are defined as those whose FHFA state-level two-year real house price index growth was below the median.

(f) For long-term change analysis, home equity withdrawal is computed for the period 2001-2005.

Table 8: HEW and wealth: constrained versus unconstrained households

Contemporaneous change (for HEW between t-2 and t)		(1) Active saving[a]	(2) Capital gains[a]	(3) Total
Home wealth: *unconstrained*[b] —	$\beta_{1,nlc}$	0.041***	0.546***	0.589***
constrained[b] —	$\beta_{1,lc}$	0.009*	0.180***	0.189***
Financial wealth:	$\beta_{1,nlc}$	0.151*	0.125	0.227*
	$\beta_{1,lc}$	0.187***	0.262***	0.443***
Risky assets[c] (*all*) [e]	$\beta_{1,nlc}$	-0.036***	0.125	0.139
	$\beta_{1,lc}$	-0.014	0.262***	0.272***
Risky assets[c] (*holders*)[e]	$\beta_{1,nlc}$	-0.052***	0.209	0.217
	$\beta_{1,lc}$	-0.015	0.413***	0.402***
Real wealth[d]: (all)[e]	$\beta_{1,nlc}$	0.083***	0.396*	0.582***
	$\beta_{1,lc}$	0.035**	0.162	0.208*
(*holders*)[e]	$\beta_{1,nlc}$	0.096*	0.851**	1.122***
	$\beta_{1,lc}$	0.064	0.274	0.357
Real estate (*all*)[e]	$\beta_{1,nlc}$	0.052*	0.232*	0.281**
	$\beta_{1,lc}$	0.010	0.154***	0.169***
Real estate (*holders*)[e]	$\beta_{1,nlc}$	0.040	0.734*	0.724*
	$\beta_{1,lc}$	0.042	0.436***	0.497***
Businesses (*all*)[e]	$\beta_{1,nlc}$	0.032***	0.170	0.299
	$\beta_{1,lc}$	0.024**	0.000	0.031
Businesses (*holders*)[e]	$\beta_{1,nlc}$	0.079**	0.865	1.167*
	$\beta_{1,lc}$	0.047	-0.004	0.047
Net worth (excluding home equity):	$\beta_{1,nlc}$	——	——	0.819***
	$\beta_{1,lc}$	——	——	0.674***
Net worth (including home equity):	$\beta_{1,nlc}$	——	——	0.242
	$\beta_{1,lc}$	——	——	-0.363***

Long-term total change (for HEW 2001-2005)[f]		(4) 2005-2009	(5) 2005-2011	(6) 2005-2015
Home wealth:	$\beta_{1,nlc}$	-0.382***	-0.451***	-0.354
	$\beta_{1,lc}$	-0.454***	-0.297	-0.285**
Financial wealth:	$\beta_{1,nlc}$	0.046	-0.643**	-0.384
	$\beta_{1,lc}$	-0.131	0.021	-0.617**
Real wealth[d]:	$\beta_{1,nlc}$	-0.564	-0.426	0.887
	$\beta_{1,lc}$	-1.382**	0.970	0.417
Net worth (excluding home equity):	$\beta_{1,nlc}$	-0.527	-1.093***	0.491
	$\beta_{1,lc}$	-1.629**	0.818	0.167
Net worth (including home equity):	$\beta_{1,nlc}$	-0.736*	-1.286**	0.526
	$\beta_{1,lc}$	-1.575***	0.983	0.647

Source: Author's regressions on an unbalanced panel sample of homeowners interviewed in the 1999-2015 Panel Study of Income Dynamics (PSID) surveys.

Notes: The sample consists of households with heads who were between 22 and 60 years old and who were not retired at the time. Fixed effects linear regressions are employed for contemporary change estimation with standard errors clustered at the household level. Weighted linear regressions are employed for long-term change estimation with robust standard errors. ***, **, and * indicate that the estimated coefficients are statistically significant at the 0.01, 0.05, and 0.10 levels, respectively. Other details are provided in the text.

(a) Active saving in home wealth is defined as the spending on home addtions and improvements totaling $10,000 or more. Active saving in other wealth components is defined as the net purchase of the underlying assets. Capital gains are computed as the change of the wealth component net of active saving.

(b) "Constrained" households are defined as those who withdrew home equity and whose LTV ratios rose and crossed the corresponding LTV cutoff from below. "Unconstrained" households are the remainder of those who withdrew home equity.

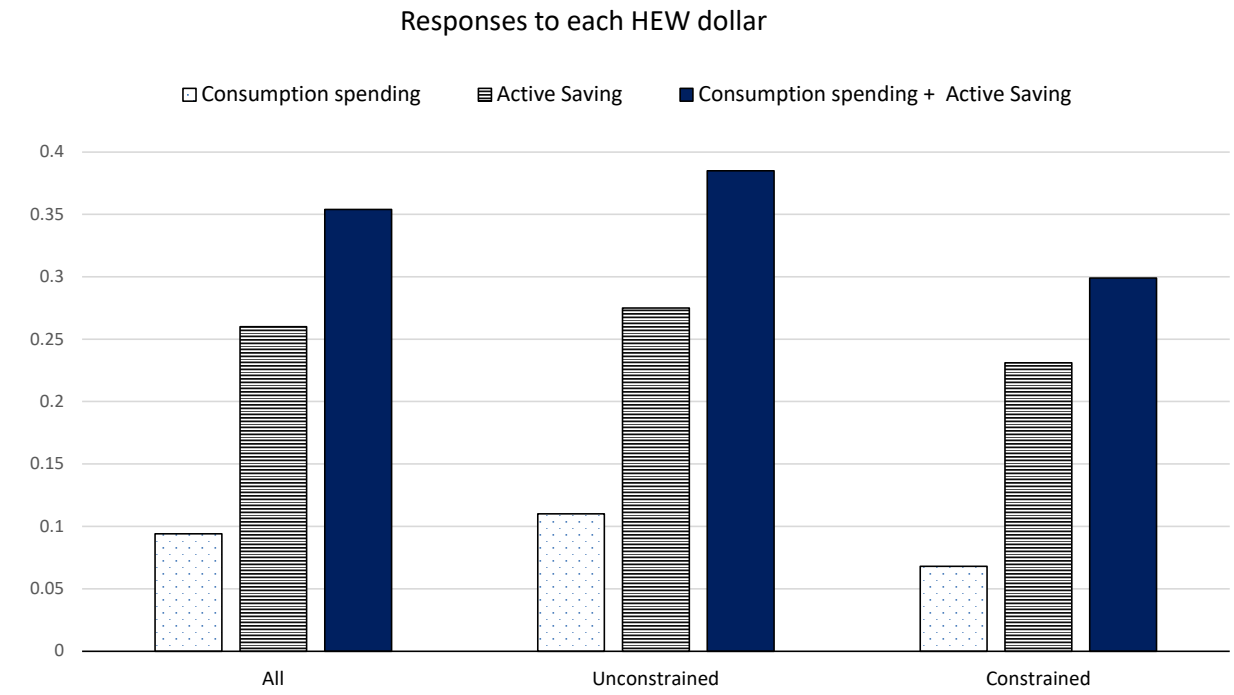
(c) Risky assets in financial wealth consist of shares of public stocks, mutual funds, or investment trusts in regular brokerage accounts and in private annuities and IRA accounts.

(d) Real wealth includes nonhome real estate and private businesses.

(e) "All" refers to all household observations. "Holders" refers to housholds holding nonzero values of the referred asset.

(f) For long-term change analysis, home equity withdrawal is computed for the period 2001-2005.

Figure 1: Consumption spending and active saving: a synopsis



Note: Consumption spending estimates are converted to a biennial basis to align with active saving estimates.