Home Equity Borrowing and Household Behavior in the 2000s

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Abstract

Using data from the 1999 to 2009 Panel Study of Income Dynamics, this paper examines how households' home equity extraction during the previous decade affected their spending, saving and residential investment behavior. The results show that during the height of the house-price boom (2003–2005 period) a one-dollar increase in equity extraction led to 17 cents' higher household expenditures. Households saved roughly 19 cents of each dollar extracted through balance-sheet reshuffling, and households who made home improvements also spent 16 cents of their extracted equity on such repairs and additions. The spending, saving, and residential investment patterns are similar during the 2001-to-2003 and 2005-to-2007 periods. Overall, households' saving and residential investment response to equity extraction is roughly double their consumption response. In general, the paper finds a relatively small impact of equity extraction impact on household spending, in contrast to the recent literature.

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1 Introduction

According to work by Greenspan and Kennedy (2007), U.S. households' net equity extraction from their homes averaged nearly 6 percent of disposable income between 2001 and 2005. Indeed, households' equity extraction increased rapidly starting in the late 1990s and peaked with the end of the house price boom in 2006, as shown in Figure 1. Cooper (2009) shows that housing wealth impacts consumption by serving as borrowing collateral for households during periods of income shortfalls. This paper provides a broader and more detailed analysis of how equity extraction impacted household spending, balance sheets, and residential investment during the housing boom.

There are a number of reasons that households may borrow against their homes other than to smooth consumption. These include financing personal business or entrepreneurship, purchasing other property, consolidating non-collateralized debt, and funding residential investment (home improvement) projects. Equity extraction is an unique and attractive form of financing because the interest costs are relatively low and are tax advantaged for the vast majority of borrowers.[1] Anecdotal evidence from the house-price boom suggests that households took advantage of low cost home equity borrowing to consolidate high cost non-collateralized debt.[2] Households also upgraded kitchens, added rooms, and/or otherwise improved their homes. In principle, households can also extract equity and invest the proceeds in financial assets to the extent they believe the risk-adjusted asset returns are greater than the tax-adjusted cost of borrowing.

Analysis of the destination of households' extracted equity is important because it provides insight into what sectors of the economy were impacted by the borrowing tied to the increase in house prices; an endeavor that has many policy implications. This information combined with the relative size of the effects is useful for understanding the drag that falling house prices and declining home equity had and will have on the macroeconomy. For example, if a relatively small amount of extracted equity went directly toward consumption then one can infer that the drop in household spending during the great recession was due primarily to aggregate demand effects, such as rising unemployment, and not to households' being unable to borrow any more against their homes to finance expenditures.

Recent work by Mian and Sufi (2009) argues that as house prices rose all of households' home equity borrowing went toward consumption and home improvement projects. The authors, however, cannot identify the split between these two destinations due to data limitations. In fact, the Equifax data they use do not contain information on household

[1] Home equity loans that are used to purchase or improve a property are tax deductible. Home equity lines of credit used for other purposes are deductible up to $100,000.

[2] The ratio of revolving (credit card) debt to income trended down as households' home equity borrowing relative to income shot up starting around 2000 (see Figure 2).

consumption or home improvement expenditures. Instead, the authors examine the relationship between house prices and households' collateralized debt growth, and they infer that equity extraction went to consumption and residential investment because they find no evidence that equity extraction went toward purchases of other real estate or paying down non-collateralized debt. In addition, the authors' point estimates suggest (taken at face value) that rising house prices account for around 100 percent of the increase in nominal consumption between 2002 and 2006. Altering the assumed split between consumption and home improvement spending still results in equity extraction having a very substantial impact on consumption. Section 5 discusses Mian and Sufi's analytical approach and these implied effects in more detail.

Mian and Sufi have excellent data on household debt and credit, but their analysis is hindered by the fact that they have no data on household spending and very limited data on household investments. The ideal dataset for examining the destination of households' extracted equity contains data on household expenditures as well as information on their investments, income and changes in debt. The Panel Study of Income Dynamics (PSID) contains all these data, and this paper uses them to determine how much of households' extracted equity was directed toward consumption, residential investments and balance sheet reshuffling. The results show that the impact of equity extraction on household spending is relatively small. In particular, home equity borrowing explains roughly 7 percent of the increase in *real* consumption between 2002 and 2006. As a result, this paper has a very different implication for the drag on consumption caused by falling house prices and households' diminished housing equity compared to the results in Mian and Sufi (2009).

More specifically, the empirical results in this paper show that a one-dollar increase in equity extraction between 2003 and 2007 led to an 8-cent to 18-cent increase in overall nonhousing expenditures for homeowners who did not move houses.[3] This effect appears strongest in the 2003 and 2005 periods (covering equity extraction in 2001-to-2003 and 2003-to-2005, respectively), which preceded the downturn in house prices in 2006.[4] Equity extraction had a much smaller impact on spending in 1999 and 2001.

The results also show that equity extraction led to greater residential investment (home improvement spending) as well as increased household saving. During the 2003–2005 and 2005–2007 periods, a one-dollar increase in equity extraction led to a roughly 13-cent to 16-cent increase in capital spending on home additions and improvements for households who

[3]Households that moved from one owner-occupied dwelling to another were arguably more likely than nonmovers to extract equity to help fund their house purchase rather than finance consumption. Including these households in the analysis, not surprisingly, lowers the consumption effect of equity extraction somewhat.

[4]The equity extraction data cover a two-year horizon, whereas the spending data are only for one year. This difference in timing is accounted for in the analysis and is discussed in more detail in Section 3.

undertook such investment. Household saving increased by a slightly larger amount over these time intervals, and in general there is a positive relationship between equity extraction and household saving. The exact balance-sheet location for the increased saving varies by period, but overall households extracted equity to invest in personal businesses as well as other real estate. This balance-sheet reshuffling is consistent with households' using the equity in their homes to help finance other capital investments. There is also evidence that households transferred some of the equity extracted to liquid financial assets, especially in the 2003–2005 period. The results show little evidence, however, that households extracted equity to repay noncollateralized debt.

The fact that relatively equal amounts of equity extraction went toward increased spending, home improvements, and balance-sheet reshuffling suggests that households did not borrow against their homes solely to finance consumption. Instead, a good chunk of the money extracted went toward financial or residential investments. The results do not, however, explain the entire destination of each dollar of equity extracted during the house-price boom. This is likely the result of measurement error or data timing issues. It could also occur because the data do not adequately account for households that extracted equity to help finance the purchase of a new primary residence. The implied aggregate consumption effects based on the results in this paper will still be substantially smaller than in Mian and Sufi (2009) even if the consumption results are biased downward due to measurement error and the true point estimates are actually two or three times larger than observed. Overall, the results in this paper are much more in line with the survey evidence in Canner et al. (2002) than the results in Mian and Sufi (2009).

The remainder of the paper proceeds as follows. Section 2 presents the empirical approach. Section 3 discusses the data and reports summary statistics about equity extraction and households' characteristics. Section 4 presents the empirical results. Section 5 compares this papers results to the existing literature, and section 6 concludes.

2 Impact of Equity Extraction on Household Behavior

This paper uses an empirical approach to address how equity extraction impacted households' spending, investment, and balance sheets. The subsections that follow discuss the econometric approach for determining the degree to which equity extraction facilitates consumption as well as the present the empirical models used to determine the destination of households' extracted equity.

2.1 Consumption

2.1.1 Background

The general link between housing wealth (house prices) and consumption has received much attention in the literature because of the dual role of housing as a consumption good that provides a service flow to households and as a financial asset that can serve as borrowing collateral. The general role of housing wealth as borrowing collateral is analyzed empirically in Cooper (2009), and is addressed using a structural model in Iacoviello (2004). Analyzing the direct relationship between equity extraction and household spending is important to determine the extent to which equity extraction facilitated consumption as house prices rose in the early 2000s. As noted earlier, home equity borrowing is potentially quite attractive to homeowners for facilitating consumption and other needs because of its low cost and tax advantages relative to other forms of credit. Understanding the relationship between equity extraction and consumption during the housing boom also provides insight into how much declining home equity contributed to the drop in consumption during the recent economic downturn.

Using household level panel data is important for this analysis because it allows one to not only capture changes in households' borrowing over time, but also to account for idiosyncratic income shocks and other household-specific factors that may impact households' borrowing and spending decisions. The data provide time series variation in households' decisions to extract equity one year versus another. Identification of the relationship between equity extraction and consumption also comes from cross-sectional variation. Amongst a group of households that are similar in terms of their location, existing housing equity, and other factors in a given year, some households decide to extract equity while others do not. The next subsection provides a framework for estimating the extent to which equity extraction facilitates consumption.

2.1.2 Theoretical Framework

Suppose households live in a frictionless world where the Permanent Income Hypothesis (PIH) holds and they consume the annuity value of their lifetime resources (permanent income) like in Friedman (1957). More specifically, for a given household i,

$$c_t^i = \alpha y_t^{p,i} \,, \tag{1}$$

where $y_t^{p,i}$ is the household's permanent income, and $\alpha \in [0,1]$ is the per period fraction of resources the household consumes. Households can borrow and lend freely to meet their consumption needs. Further assume that a household's actual consumption in a given period

may diverge from the annuity value of its lifetime resources due to a random transitory (taste) shock ν_t^i. This taste shock represents a one-time desired expenditure by the household that is uncorrelated with its current or future permanent income.

In this framework the data generating process for household consumption is written as follows:

$$c_t^i = \alpha y_t^{i,p} + \nu_t^i \, . \tag{2}$$

Since the taste shock is assumed to be uncorrelated with permanent income, ($E[y_t^{i,p} nu_t^i] = 0$), it will not impact estimates of α. There is simply an unobserved component of household spending. Even though the taste shock is unobserved, the extra household spending has to be financed somehow, and using equity extraction makes sense because of its low cost and tax deductibility compared to other forms of borrowing. Adding equity extraction (x_t^i) to equation 2, therefore, is a valid way to determine the extent to which equity extraction facilitates consumption beyond what a household finances with savings, consumer credit, borrowing from family members or other means.[5]

In particular, assume that a portion λ^i of a household's taste shock is financed by equity extraction, such that

$$x_t^i = \lambda^i \nu_t^i, \tag{3}$$

and the remaining $1 - \lambda^i$ of the shock is financed through other means. Arguably, different households will choose different proportions of their taste shock to finance with equity extraction. Some households may even extract equity for non-consumption purposes in which case $\lambda^i = 0$. If the econometrician includes equity extraction in (2) to try to capture the unobserved taste shock and estimates

$$c_t^i = b_1 x_t^i + b_2 y_t^{i,p} + e_t^i \, , \tag{4}$$

then the estimate of b_1 equals the average proportion across households of the transitory consumption shock that is financed with equity extraction. In other words, $\hat{b}_1 = \bar{\lambda}$.[6]

In reality there are few data sets that capture households' permanent income. Therefore

[5]Households conceivably may finance taste shocks with consumer credit even though it is more expensive than home equity borrowing to the extent they are lazy and/or the taste shock is small enough that it is not worth the time and other costs involved with obtaining home equity credit.

[6]There is potentially some noise in the amount of equity a household extracts to fund its taste shock,

$$x_t^i = \lambda \nu_t^i + u_t^i \, ,$$

where u_t^i is white noise. This situation does not impact the results, however, assuming u_t^i is uncorrelated with the amount of equity households extract as well as with their permanent income.

the econometrician often must proxy for permanent income using a household's current income (y_t^i) or average income. In particular,

$$c_t^i = d_1 x_t^i + d_2 y_t^i + e_t^i \,. \tag{5}$$

The analysis above still holds, however, and $\hat{d}_1 = \bar{\lambda}$ provided that a household's current income is uncorrelated with the transitory consumption shock. Issues regarding estimating households' marginal propensity to consume out of income (d_2) are discussed in the next section.

2.1.3 Discussion

The analysis in the previous section shows that adding equity extraction to a consumption function (permanent income) framework is a valid way to estimate the extent to which equity extraction facilitates consumption. The framework holds even if additional variables, such as household wealth and age, are added to equation (5) to better proxy for permanent income as long as these variables are uncorrelated with the taste shock. The approach is also useful because it does not rely on liquidity constraints for generating a relationship between consumption and income conditional on households' income. As noted above, identification comes from using panel data and exploiting variation in both the time series and cross section dimension of households' borrowing decisions.

Arguably, the empirical framework in the previous section is based on a simplified view of the world, and ignores some econometric issues. The principal econometric issue is that current income is potentially correlated with the unobserved shocks separate from taste shocks that also influence consumption. An example would be a credit shock that causes economic downturns and job losses. This endogeneity can be dealt with in a straightforward manner by using an instrumental variable estimation approach for equation (5) or variations of it.

In addition, the empirical framework assumes that households can borrow and lend freely and are thus not liquidity constrained. In reality, this is an implausible assumption. Campbell and Mankiw (1989) find that roughly 40 to 50 percent of households are liquidity constrained using aggregate data. Homeowners tend to be better off financially than the average household so perhaps 20 to 30 percent of homeowners are constrained. Such households will want to extract equity to smooth their inter-temporal consumption rather than finance a taste shock. Even if this is the case, the empirical approach in (5) is still valid. Constrained households who extract equity will spend their current income and then extract equity to make up the difference between their current cash flow and their consumption needs ($x_t^i = c_t^i - y_t^i$). For these households each additional dollar of equity extracted goes

towards consumption and $d_1 = 1$. The more liquidity constrained homeowners, the closer the estimated relationship between equity extraction and consumption will be to 1. Of course, if the estimated coefficient is large it will be difficult to determine whether households are constrained or whether they are financing all of their taste shocks with equity extraction. Doing so would require trying to identify households who are constrained. A coefficient closer to zero, however, would suggest that there are likely a limited number of households extracting equity because they are constrained.

2.1.4 Additional Endogeneity Concerns

There is an additional endogeneity concern that has not yet been mentioned. An expected future positive shock to permanent income would cause both consumption and equity extraction to be higher. The permanent income shock is what drives consumption, and not the fact that house prices are rising and households can borrow more against their homes. Instead, households need to borrow to smooth their consumption in response to the expected future income shock, and they turn to equity extraction. If such borrowing were not available, households would turn to a different source. The presence of such unobserved permanent income shocks would make inference about the impact of rising and falling prices on equity extraction and the macro-economy incorrect.

Since expected future permanent income shocks are unobserved, it is quite difficult to control for them empirically, especially at the household level. If households' expectations of future permanent income shocks are time invariant then they can be accounted for using panel data and controlling for household-specific effects assuming there is a reasonably short time dimension to the data as there is in this paper. This approach is probably more reasonable for younger households who suddenly find out they have gotten into graduate school which will boost their earnings potential a number of years down the road. This expectation would play a constant role in such households' spending decisions until the actual earnings potential is realized.

A better approach is to use instrumental variable analysis and find an instrument that is correlated with the amount of equity households extract, but is uncorrelated with future income expectations. One arguably reasonable instrument is Saiz's housing supply elasticity measure (Saiz (2010)). This metric accounts for the amount of buildable land and other geographic factors in a given location and capture the ease with which housing supply can be increased. As a result, housing demand shocks induced by expectations of future income or other factors will have a greater effect on prices in areas where supply is limited. By construction, Saiz's housing elasticity measure is uncorrelated with income but should be correlated with households' ability to extract equity.

Both household fixed effects and an instrumental variable approach are used as robust-

ness checks for the empirical results in Section 4. If anything, these approaches make the consumption and equity extraction results somewhat weaker and less precisely estimated. These findings are broadly consistent with the notion that an omitted variable could be causing the relationship between equity extraction and consumption. Recall, however, that the ultimate goal of this paper is to determine households uses of extracted equity, and to see the extent to which equity extraction facilitates consumption. The paper does not make the claim of trying to explain what causes equity extraction to increase consumption (to the extent that it does) or what the causal relationship is between house prices and consumption. In addition, the paper seeks to uncover whether the impact of household borrowing on consumption is as large as is implied by Mian and Sufi (2009).

2.1.5 Empirical Specifications

The empirical models used to estimate the impact of equity extraction on consumption are based on the setup in equation 5. Additional variables are added, such as age and household wealth to control for where households are in the life-cycle and their financial resources. The baseline empirical model is:

$$c^i_{t+1} = b_0 + b_1 x^i_{t,t+1} + b_2 y^i_{t+1} + b_3 w^i_{t+1} + b_4 h^i_{t+1} + \zeta \mathbf{R^i_t} + \gamma \mathbf{Z^i_t} + \epsilon^i_{t+1} \,, \tag{6}$$

where c^i_{t+1} is a household's nonhousing consumption in period $t+1$; $x^i_{t,t+1}$ is the amount of equity that a household extracts from its home between period t and $t+1$[7]; w^i_{t+1} is a household's real financial wealth; h^i_{t+1} is a household's real housing wealth in period t; and y^i_{t+1} is a household's disposable income in period $t+1$. Finally, $\mathbf{R^i_t}$ and $\mathbf{Z^i_t}$ are vectors of regional dummy variables and household demographic covariates, respectively.

Equation 6 is estimated using two stage least squares (2SLS) to account for potential endogeneity between consumption and current income. In particular, lagged current income (y^i_t) is used as an instrument for (y^i_{t+1}) as is standard in the literature. Lagged income should be uncorrelated with unobserved current macroeconomic shocks that impact consumption. Section 3 discusses the data used to estimate equation 6 in more detail.

In addition, some households may extract equity in the process of moving from one home to another to help fund the purchase, and thus their equity extraction may facilitate something other than consumption, especially compared to nonmovers. A slightly modified version of equation 6 accounts for this possibility:

[7]Note that measured equity extraction in the data is available only over two-year horizons, while the spending data cover a one-year period. The equity extraction data are converted to an annual frequency (averaged) to take this timing difference into account.

$$
\begin{aligned}
c^i_{t+1} &= d_0 + d_1 x^i_{t,t+1} + d_2 y^i_{t+1} + d_3 w^i_{t+1} + d_4 h^i_{t+1} + d_5 M^i_{t+1} + d_6 \left(M^i_{t+1} \cdot x^i_{t,t+1}\right) \\
&\quad + \zeta \mathbf{R^i_t} + \gamma \mathbf{Z^i_t} + \epsilon^i_{t+1} \,,
\end{aligned} \tag{7}
$$

where M^i_{t+1} is an indicator variable that equals 1 if a household moves between period t and period $t+1$ and is 0 otherwise. If households that move use more of the money they extract for home purchase financing than for consumption, then the marginal effect of equity extraction on consumption for movers $(d_1 + d_6)$ should be smaller than for nonmovers (d_1). If movers do indeed extract less equity for consumption purposes than nonmovers, then the estimated effect should be larger when moving is taken into account than when it is not $(d_1 > b_1)$.

2.2 Residential Investment

As noted earlier, households may also extract equity to finance home improvements and/or additions. Such expenditures are classified in the national accounts as residential investment.[8] Distinguishing between spending and residential investment is important because a household extracting equity to pay for a new kitchen or addition is different from extracting equity to finance current spending. By replacing a roof or upgrading a kitchen, a household makes a capital investment in its property that it hopes will generate a return in the long run and/or add to the longevity of its home. Financing current consumption through borrowing satisfies a much more short term need. This is not to say that one use of the funds from equity extraction is necessarily better or worse than the other; they just have different implications.

The PSID asks homeowners whether they have made additions or capital improvements to their home since the previous survey, and if so, how much money they spent. These data allow for an investigation of the relationship between equity extraction and residential investment in a manner similar to the empirical approach in equation 6. The exact empirical model is:

$$
i^i_{t,t+1} = e_0 + e_1 x^i_{t,t+1} + e_2 y^i_t + e_3 w^i_t + e_4 h^i_t + \zeta \mathbf{R^i_t} + \gamma \mathbf{Z^i_t} + \epsilon^i_{t,t+1} \,, \tag{8}
$$

where $i^i_{t,t+1}$ is the amount spent on home improvements or additions between time t and

[8] The National Income and Product Accounts (NIPA) classify home improvements, such as a remodeled kitchen, as residential investment. Spending solely on new kitchen appliances, however, is categorized as durable good consumption.

time $t+1$ and $x^i_{t,t+1}$ is the amount of equity extracted over that same time horizon.[9] The remaining wealth and demographic variables are dated as of the beginning of the equity extraction period to avoid any potential endogeneity.[10]

The home improvement expenditure data in the PSID are bottom censored at $ 10,000 conditional on households reporting that they undertook residential investment. The estimates of equation 8 take this censoring into account.[11] If households extract equity to help finance home improvement projects, then there should be a positive relationship between home equity borrowing and home improvement spending ($e_1 > 0$).

2.3 Balance Sheets

Households that borrow against their homes need not spend any or all of what they extract on consumption or home improvements. For instance, households may use their extracted equity to pay down their higher-cost noncollateralized debt.[12] Alternatively, households may borrow in order to invest in other assets, such as a second home. Households that refinance and cash out equity may also place some or all of the money in their savings account to spend as needed, especially if they cash out more than they intend to spend immediately. If there are such balance-sheet effects of equity extraction in addition to, or instead of, consumption effects, then one should observe dis-saving in housing and *increased* saving in other assets, and/or the repayment of noncollateralized debt.

The relevant empirical approach for estimating the impact of equity extraction on households' balance sheets is:

$$s^{i,j}_{t,t+1} = g_0 + g_1 x^i_{t,t+1} + g_2 y^i_{t,t+1} + g_3 w^i_t + g_4 h^i_t + \alpha \mathbf{R^i_t} + \psi \mathbf{Z^i_t} + \epsilon^i_{t,t+1} \,, \tag{9}$$

where $s^{i,j}_{t,t+1}$ is a household's amount of active saving in asset type j (or saving across all assets) between between periods t and $t+1$, and $y^i_{t,t+1}$ is a household's real, after-tax income level between periods t and $t+1$. The rest of the variables were defined previously. This empirical setup controls for a household's level of financial wealth and housing wealth at the beginning of the saving period in case households' saving behavior varies between t and $t+1$, based on their existing asset levels. The empirical estimates of equation 9 also control for the potential endogeneity between household income and saving. The regressions over multiple

[9] Home improvement spending, like extracted equity, is measured between wealth supplements given data availability.

[10] Including contemporaneous control variables does not noticeably impact the estimates of relationships between income or equity extraction and consumption.

[11] Arguably, one should include income contemporaneously (between t and $t+1$) in equation 8 and control for endogeneity using an instrumental variable approach. This proves difficult with the censored regressor, however, as the IV estimates will not converge.

[12] Noncollateralized debt includes credit card debt as well as student loans and other unsecured debt.

periods control for household-specific effects since some households may be predisposed to be savers while others may be spendthrifts.

The asset classes available for analyzing saving in the PSID are: other real estate, businesses or farms, cash, stocks, bonds, vehicles, (reduced) noncollateralized debt, and IRA/401k accounts. The next section discusses the household saving data in more detail. To the extent that households extract equity and move the proceeds to other portions of their balance sheets, there should be a positive relationship between equity extraction and total active saving as well as positive relationships between equity extraction and the particular asset category or categories that are affected by the balance-sheet reshuffling ($g_1 > 0$). Conceivably, households may extract equity and *reduce* saving in some asset categories while increasing saving in other assets. Such reshuffling may occur to the extent that households rethink the overall risk profile of their balance sheets as they take on more debt.

3 Data

3.1 Data Construction

The PSID is a nationally representative, longitudinal survey of households and their offspring that began in 1968. The survey was conducted annually between 1968 and 1997 and has occured every other year since 1997. The most recent data are for 2007, although some data covering mortgages, foreclosures, and household wealth have been pre-released for the 2009 survey.[13] Each wave asks homeowners to report their home values, the amount of any outstanding mortgage balances, and whether they have moved since the previous survey. The PSID also includes "wealth supplements" that contain detailed information on households' nonhousing financial assets in 1984, 1989, 1994, and 1999 onwards. As mentioned earlier, these assets include other real estate, businesses or farms, cash, stocks, bonds, vehicles, noncollateralized debt, and IRA/401k accounts. There are also data on households' so-called "active saving" in 1989, 1994, and 1999 onwards. These data are discussed in more detail below.

3.1.1 Equity Extraction

Households that extract equity are identified based on the mortgage and moving data in the PSID. The estimation sample for all the analysis in this paper is restricted to homeowners, since renters by definition do not have housing equity to borrow against. In particular, households that extract equity are either those households that did *not* move, but increased their mortgage debt or households that moved from one owner-occupied property to another

[13] The remaining data should be available in late 2010.

and reduced the amount of equity in their new home relative to their old one. For example, a household that moves and had $ 30,000 of equity in its old home but has only $ 20,000 in its new home, extracts $ 10,000 of equity.

Let $E^i_{t,t+1}$ be an indicator variable for whether a household extracts equity from its home between periods t and $t+1$. In particular,

$$E^i_{t,t+1} = \begin{cases} 1 & \text{if } m^i_{t+1} > m^i_t \ \& \ \text{move}^i_{t+1} = 0 \\ 1 & \text{if } e^i_{t+1} < e^i_t \quad \& \ \text{move}^i_{t+1} = 1 \\ 0 & \text{otherwise} , \end{cases}$$

where m^i_t is the household's mortgage debt in period t, e^i_t is the household's amount of home equity in period t, and move^i_{t+1} is an indicator variable that takes a value of 1 if the household moves between t and $t+1$ and is 0 otherwise. A household's home equity is defined as the value of its house ($p^{h,i}_t$) less any outstanding mortgage debt (m^i_t)

$$e^i_t = p^h_t - m^i_t \, .$$

In addition, let $x^i_{t,t+1}$ be the actual (dollar) amount of equity a household extracts:

$$x^i_{t,t+1} = \begin{cases} m^i_{t+1} - m^i_t & \text{if } E^i_{t,t+1} = 1 \ \& \ \text{move}^i_{t+1} = 0 \\ e^i_t - e^i_{t+1} & \text{if } E^i_{t,t+1} = 1 \ \& \ \text{move}^i_{t+1} = 1 \\ 0 & \text{otherwise} . \end{cases}$$

3.1.2 Household Saving

The PSID wealth supplements contain "active" saving data that can be used to calculate households' saving out of their current income. Active saving measures households' net contributions to various financial assets over time, *excluding* capital gains.[14] For example, households that pay off some of their outstanding mortgage principal have positive active saving. In contrast, housing wealth gains due to house-price appreciation do *not* count as active saving.

Starting in 1989, households report the amount they contributed to 401k or IRA saving plans since the previous wealth supplement, as well as the amount they withdrew from such plans. Other active saving categories include: investment in businesses or farms, checking and saving accounts, bond holdings, stock holdings, housing, other real estate, vehicles, and

[14] One gray area in the PSID regarding the exclusion of capital gains from the active saving data involves households' bond holdings. Active saving in bond holdings is defined analogously to active saving in cash and is simply the difference in the amount of households' bond holdings between successive wealth years. Bond holdings are subject to gains and losses like stocks, however, especially if they are not held until maturity, and thus active saving in bonds could implicitly include some passive saving.

noncollateralized debt.[15] The approach for measuring active saving in this paper follows the one in Juster et al. (2005) and others.

Given the timing of the PSID wealth supplements, the active saving data cover the following years: 1984 and 1989, 1989 and 1994, 1994 and 1999, 1999 and 2001, 2001 and 2003, 2003 and 2005, 2005 and 2007, and 2007 and 2009. The exact definition of active saving between successive wealth years depends on the type of asset. See the appendix for additional details on these definitions and calculations.

3.1.3 Consumption and Income

The only spending data that are consistently available in the PSID since its inception are household expenditures on food at home and food away from home. Starting in 1999, however, the PSID added additional questions about household expenditures to obtain a more comprehensive picture of household consumption. The breadth of the spending data was further expanded in 2005. According to Charles et al. (2007), adding these data brought the expenditure data in the PSID roughly in line with the spending categories available in the Consumer Expenditure Survey (CEX), which is widely regarded as the broadest survey of U.S. household level spending.[16]

Starting in 1999, in addition to food consumption, the PSID contains data on households' health care expenses, transportation expenses, child care expenses, schooling costs, automobile costs, and utilities. Transportation expenses include public transit, cabs, and other costs of getting from one place to another. Automobile costs include monthly loan or lease payments, vehicle maintenance costs, and insurance costs. Down payment outlays on newly acquired vehicles are also included in this measure. The PSID also includes data on household mortgage payments and/or rental payments, along with homeowners' insurance. These data are excluded from the analysis, since households' mortgage payments and overall housing expenses most often increase by definition when they extract equity.

The additional categories added in 2005 include home maintenance and repairs, home furnishings, recreation expenditures, clothing, and vacations. The home maintenance and repair expenditure data are different from the home improvement (investment) data available in the wealth supplements. The former data focus on ordinary maintenance and repairs costs rather than longer-term home improvements and additions. Charles et al. (2007) provide a detailed discussion about the additional spending data added from 1999 to 2003. In particular, they compare the PSID data with the CEX data and find that they line up

[15] Other real estate includes vacation homes, rental properties, and land holdings.

[16] There is some concern that the quality of the CEX data has deteriorated over time and that there is underreporting of household spending and income (see for example Sabelhaus (2010)). These problems, however, are mainly a concern in terms of comparing the CEX data to the aggregate NIPA data especially over time. The CEX still however captures cross-sectional household expenditure data reasonably well.

reasonably well. Cooper and Weingarten (2010) extends the analysis in that paper through 2007 and reaches similar conclusions. In addition, they find that the PSID data line up reasonably well with the relevant per capita consumption data from the NIPA.

The income data used in this paper are households' reported total family income in the PSID. The data are converted to disposable income, using data on household taxes based on the NBER's Taxsim module. These household level income data are beneficial because they capture households' idiosyncratic income shocks. Both the consumption and income data are converted to real 2000 dollars using the PCE deflator from the NIPA. Other dollar-valued variables are converted to real dollars using the same deflator.

3.2 Data Validity

3.2.1 Summary Statistics

Table 1 reports the distribution of equity extraction over time, conditional on homeowners who borrowed. The analysis includes equity extraction amounts based on the recently released 2007–2009 data. The results in Table 1 show that the average amount of equity extraction was relatively flat in the late 1990s and early 2000s and then increased steadily over time through the decade as house prices rose. The increasing amount of equity extracted is consistent with aggregate data reported in Greenspan and Kennedy (2007). Somewhat surprisingly, the average (and/or median) amount of equity extracted does not fall off between 2007 and 2009, even though real house prices declined sharply.

One possible explanation for the discrepancy between the micro data and the aggregate data is that some households potentially borrowed against their homes in anticipation of prices falling further in the future. In other words, households took advantage of home equity borrowing opportunities while they still could. Consistent with this idea, the data show that equity extraction between 2007 and 2009 is strongly, positively correlated with households who reported increased house prices over that time period, and there is no correlation between equity extraction and households who said their house prices fell.[17] In addition, small business credit was virtually non-existent over this time period, so some households may have borrowed to help finance their business needs. As the bottom panel of Table 2 shows, the business holdings of borrowers were less valuable on average as of 2007 than non-borrowers.

The data also suggest that even though the amount of equity extraction rose somewhat between 2001-to-2003 and 2003-to-2005, and between 2003-to-2005 and 2005–2007, fewer households actually borrowed than during the 2001–2003 period. In other words, households extracted larger amounts of equity, conditional on borrowing, during the primary years of

[17]These results are not reported but are available upon request

the housing boom, rather than more households' borrowing. This finding is consistent with households that needed to borrow having more equity available to extract as house prices rose. In addition, the distribution of equity extracted relative to house values was relatively similar over time. This further suggests that households were extracting additional amounts of equity over time in line with house-price growth. Finally, of the households who borrowed between 1997 and 2009 roughly 45 percent borrowed more than once. This behavior is consistent with households utilizing home equity lines of credit, which they could borrow against as needed.

Table 2 compares the sample means of various household demographic and financial variables for households that did and did not borrow against their homes. Overall, households that extracted equity in the early 2000s tended to have similarly aged household heads but somewhat larger family sizes than those that did not borrow. A much greater percentage of equity extractors were also married. Together, these results suggest that larger households were the ones that borrowed against their homes. Larger households likely have a more difficult time coping with income shortfalls, and thus these statistics are broadly consistent with households' extracting equity to finance and smooth consumption.

In addition, households that extracted equity had higher loan-to-value (LTV) ratios, on average, than those households that did not borrow, but a somewhat smaller percentage of extractors had less than 20 percent equity in their homes. The higher actual LTV ratio for borrowers suggests that they are potentially at a stage in their life cycle when they need to take on more debt and/or have had limited time to pay off their existing mortgage. The fact that fewer extractors than nonextractors had extremely high LTV ratios, is consistent with the added costs and greater difficulty of borrowing against one's home when one has limited existing equity. For example, households with LTV ratios greater than 0.8 are almost always required to purchase private mortgage insurance which noticeably increases their borrowing costs.

The unconditional results also show little evidence of income changes playing a role in households' decisions to extract equity. The average change in income for extractors versus nonextractors is similar over time, as is the average weeks of unemployment for heads and spouses. This finding runs counter to the idea that households extracted equity to finance income shortfalls. In contrast, reported health care expenditures are, on average, higher for households who borrow than those who do not. A greater percentage of equity extractors also have children in college than nonextractors. These results are broadly consistent with households extracting equity to help fund large expenses.

Households that extracted equity also had less liquid wealth, on average, than those households that did not.[18] This finding is broadly consistent with households' being more

[18]Liquid wealth is defined as cash holdings and stock market wealth net of any noncollateralized debt.

likely to borrow against their home when they lack other options, such as liquid savings, to finance their needed spending and investment. In contrast, households that extracted equity had much higher illiquid wealth holdings (excluding housing) than nonextractors. This finding could be in part the result of borrowing households being more likely to have businesses or second homes in which they need or want to invest money. The bottom panel of Table 2 confirms that equity extractors have greater business and real estate holdings than nonextractors. In addition, extractors had substantially higher amounts of noncollateralized debt on average than nonextractors (bottom panel-Table 2). This finding is broadly consistent with the idea that households borrowed against their homes to consolidate higher-cost debt.

3.2.2 Predictors of Equity Extraction

As a further check of the data, this subsection looks at the conditional relationship between equity extraction and households' assets and demographic characteristics. Households' decisions to extract equity is modeled as a zero or one binary choice and are analyzed using the following econometric specification:

$$\begin{aligned} E^i_{t,t+1} &= a_0 + a_1 lw^i_t + a_2 iw^i_t + a_3 v^i_t + a_4 L^i_t + a_5 he^i_t + a_6 \Delta y^i_{t+1} \\ &+ a_7 U^i_t + a_8 \Delta p^i_{t+1} \beta \mathbf{R^i_t} + \eta \mathbf{Z^i_t} + \epsilon^i_{t,t+1} \, . \end{aligned} \tag{10}$$

The dependent variable, $E_{t,t+1}$ is an indicator variable that takes a value of 1 if a homeowner extracts equity from his or her home between period t and period $t+1$ and is 0 otherwise; lw^i_t is a household's real liquid financial wealth; iw^i_t is a household's real illiquid financial wealth; he^i_t is a household's amount of home equity at the beginning of the equity extraction period; U^i_t is an indicator variable that takes a value of 1 if the household suffers a spell of unemployment in period t and is 0 otherwise;[19] v^i_t is a household's housing loan-to-value (LTV) ratio; L^i_t is an indicator variable that takes a value of 1 if a household's LTV ratio is greater than 0.8 and is 0 otherwise; Δy_{t+1} is a household's percent change in income over the equity extraction period; Δp^i_t is the change in the household's home value between t and $t+1$; $\mathbf{R^i_t}$ is a vector of dummy variables for the region in which the household lives; and $\mathbf{Z^i_t}$ is a vector of household demographics and other covariates, such as the number of college age children in the household. The vector of covariates also includes a cubic term for the age of the household head.[20]

Table 3 reports the results from estimating equation 10 using a probit specification that

[19] A household is deemed unemployed if either the head or spouse reports 13 or more weeks out of work.

[20] Including additional covariates such as dummy variables for the household head's education level and marital status does not noticeably affect the estimates or fit of the empirical model.

takes into account the potential endogeneity between equity extraction and income. Households must own a home at the beginning and end of the equity extraction period (for example, in both 2001 and 2003) in order to be included in the estimation sample. Extreme outliers, such as households that report over $2 million dollars of increased housing debt, are eliminated from the sample. The coefficient estimates in Table 3 report the *marginal* impact of the given variable on the dependent variable in question. These marginal effects are evaluated at the mean of the other independent variables. The estimates are pooled over the entire sample horizon (1997 -2007), and the different columns in the table include alternative specifications for house price growth. Period by period results are shown in appendix Table A.1.

The results in Table 3 show that, as expected, households with higher levels of *liquid* assets had a lower predicted probability of extracting equity from their homes.[21] The negative relationship between liquid wealth holdings and equity extraction is particularly strong in the early 2000s (see appendix Table A.1). This relationship is also stronger for younger households. Such households have lower financial resources, on average, than older households and thus those with limited liquid wealth likely had an increased need to borrow. In addition, households in the top two liquid wealth quintiles are anywhere from 6 percentage points to 20 percentage points less likely to extract equity than households in the bottom liquid wealth quintile.[22] In comparison, households' nonhousing illiquid wealth has a much smaller and less precisely estimated impact on their probability of borrowing. Overall, these findings are consistent with households' borrowing against their homes when they lacked other liquid financing options.

Not surprisingly, there is also a strong, positive relationship between house price growth and equity extraction. For a fixed amount of mortgage debt, households' collateralizable housing equity grows along with house prices. The estimates in the first column of Table 3 measure house price growth based on the percent change in the Federal Home Finance Agency (FHFA) house price index for the MSA in which each household lives. The results suggest that households who experienced one percentage point higher house price growth had a roughly 9 percentage point higher predicted probability of equity extraction. Lagged house price growth (column 3) has an even larger impact on households' predicted probability of equity extraction than contemporaneous growth. This finding suggests that households were more likely to decide to borrow based on increases in equity that already had occurred especially given the lead time for securing a loan. Finally, the results in column 4 show that households who experienced robust house price growth in their own MSA relative to average growth across all MSAs also had a higher predicted probability of equity extraction.

[21] Households' liquid assets equal their cash plus stock holdings less any outstanding noncollateralized debt.
[22] The age and wealth quintile results are not reported but are available upon request.

This confirms, that households borrowed in areas where house price growth was particularly strong.

As expected, a households' level of equity at the beginning of the equity extraction period also has a positive impact on its borrowing decision. Households living in West region of the country also have a higher predicted probability of equity extraction than those living in the Northeast. This finding is consistent with the boom in house prices and lending that occurred in California and other western states during the early to mid-2000s. In contrast, there is little evidence that households' income needs played a role in their equity extraction decisions. In particular, income growth has the wrong predicted sign, although it is not precisely estimated. Contemporaneous income growth, however, may not be a good measure of households' borrowing needs. There is a positive relationship between unemployment spells, but this effect is imprecisely estimated. Overall, the predictors of households' equity extraction behavior are consistent with what one would expect, and the equity extraction data seem reasonable.

4 Results

4.1 Equity Extraction and Overall Household Spending

4.1.1 Baseline Results

The top panel of Table 4 reports the estimates of equations 1 and 2. The results examine the impact of equity extraction on households' nonhousing consumption over the full sample and for selected subsamples. The full sample results use only the consumption data that are available consistently from 1999 forward. The same data are used for the 1999–2003 and 2005–2007 sample splits in the middle of the upper panel. The estimates for 2005–2007 in the last two columns of the table include the additional consumption data added to the PSID starting in 2005.

Overall, the full sample results show that a one-dollar increase in equity extraction led to a roughly 5-cent increase in nonhousing consumption over the full sample. This increase in spending by households that extracted equity was driven by those households that extracted equity but did *not* move. Such nonmovers spent nearly 8 cents of every additional dollar extracted on nonhousing expenditures, while the impact of equity extraction on movers' spending was essentially zero. This finding is consistent with anecdotal evidence that suggested households who moved from one owner-occupied unit to another, during the housing boom, often extracted equity to help finance the purchase of their new home rather than for consumption purposes.

Households' exhibit a positive spending response to equity extraction across the two sub-

samples of the data, but the spending effects are larger and more precisely estimated for the 2005—2007 sample split. This difference in effects between the two periods is statistically significant. In addition, households' spending response to equity extraction is somewhat larger in the 2005-to-2007 period when the additional consumption data are included in the analysis (last column). In particular, the spending of nonmovers increases by about 17 cents per dollar increase in equity extraction, while movers exhibit no spending response. The higher estimated consumption response with the additional spending data is not surprising since the data provide a more comprehensive measure of household expenditures and include more discretionary, higher-cost items, such as home furnishings and vacations, that households may finance in part through equity extraction. In addition, the difference in spending responses between the two sample periods is consistent with households extracting more equity for consumption purposes during the peak years of the housing boom.

Table 5 shows the estimates of equation 2 by year. The results suggest that the impact of equity extraction on consumption was strongest for non-movers from 2003 onward, and the consumption effect for movers was essentially zero. Prior to 2003 the spending effects were similar for movers and non-movers. These findings are consistent with more households using equity extraction to help finance the purchases of new properties as the decade progressed. In addition, to the extent that nonmoving homeowners focused on equity extraction as a way of financing expenditures as their house prices continued to rise, it is not overly surprising that the impact of home equity borrowing on household spending was the largest during the later years of the house-price boom. Indeed, between the end of 2002 and the end of 2006, aggregate real house prices rose nearly 23 percent, before beginning to decline in 2007. Prior to the heart of the house-price boom, households perhaps extracted equity primarily for investment purposes or to consolidate other debts.

The important feature of the results in Tables 4 and 5, however, is that only a relatively small portion of households' equity extraction went toward consumption. The impact of equity extraction on household spending was no more than 17 cents on the dollar, even in 2005 and 2007, when the PSID spending measures reportedly cover nearly all the components of households' nonhousing expenditures. The data used in this analysis do not completely capture durable good expenditures, such as car purchases; however, the size of the results are broadly consistent with households using equity extraction to fund a portion of their taste shocks. The findings are inconsistent with the notion households spent the vast majority of the equity they extracted during the housing boom.

4.1.2 Possible Endogeneity Issues

As noted earlier house prices are likely endogenous with respect to consumption, which arguably could lead to endogeneity between equity extraction and consumption. Section

2.1.3 discussed this issue, and argued that such endogeneity is not necessarily a concern given the empirical approach and goal of this paper. It is important, however, to take this potential endogeneity into account as a robustness check. If consumption and equity extraction are endogenous then there would appear to be a casual relationship between borrowing and spending when in fact the true relationship is smaller and/or non-existent.

A number of papers, including Mian and Sufi (2009), suggest using the degree of housing supply inelasticity in a given location as an instrument for housing prices and household borrowing. The idea is that for a given demand shock, house prices should respond more strongly in areas with inelastic housing supply. Therefore, households living in inelastic locations should have greater amounts of equity to borrow against than households in relatively elastic locations. Such differential variation in house values is arguably independent of any variation in consumption due to the macro shock.

Table 6 repeats the analysis in Table 4, but treats the amount of equity households' extract as endogenous and uses Saiz's housing supply elasticity measure as an instrument (see Saiz (2010) for more details on the elasticity measure). The housing supply inelasticity in the MSA in which a household resides is reasonably correlated with the amount of equity households extract. The first stage results for the full sample are reported in Table 6a.[23] The estimated equity extraction effects on consumption in Table 6 are mixed and the standard errors are very large, so that none of the estimated effects are statistically distinguishable from zero and it is hard to draw strong conclusions. The point estimates show a slightly negative impact of equity extraction on consumption for the overall sample. The most recent period results (2005–2007) show a positive relationship between household borrowing and spending. The size of this effect is similar to the OLS estimates, but it is much smaller than the consumption effect implied by Mian and Sufi's findings over a relatively similar time horizon. Looking at the IV estimates on a period by period basis yield similar results. Section 5 discusses the differences in our results in greater detail.

Overall, the IV estimates continue to suggest that the impact of equity extraction on consumption is small, if not essentially zero. If anything, this IV analysis implies that the OLS estimates discussed in the previous section are, if anything, potentially biased upwards. An argument against this conclusion is that the OLS results could be biased downward due to measurement error. There could be attenuation bias in the estimates of the equity extraction effect to the extent households' equity extraction decisions are *exogenous*, but their self-reported changes in mortgage debt are inaccurate leading to measurement error in $e^i_{t,t+1}$. Conceivably these different biases could offset, but regardless it seems unlikely based

[23] Mian and Sufi (2009) use the housing supply elasticity for the MSA in which a household lives as of 1997 for their instrument to avoid potential issues of households endogenously choosing to move to inelastic, high price areas. Using this 1997 measure as an instrument versus the elasticity from the MSA in which the household currently lives yields virtually identical results.

on the results in Tables 4 and 6 that households' spent the vast majority of the equity they extracted.

4.1.3 Controlling for Unobserved Household Characteristics

The consumption function approach for estimating equations 1 and 2 is useful because it provides an easy to interpret estimate of the marginal impact of equity extraction on household expenditures. A critique of this approach is that it fails to capture unobserved household heterogeneity that may influence household behavior such as differences in households' marginal utility of wealth. Alternatively, households may have different (unobserved) attitudes to borrowing in general. Some may never borrow out of principle regardless of their available equity, while others may borrow as much as possible to finance their expenditures regardless of the source of funds. The key is to make sure that the estimated relationship between equity extraction and consumption is not simply picking up these unobserved characteristics.

The estimates of equations 1 and 2 in Table 7 replicate those in Table 4, but utilize a within group fixed effects estimator to control for household-specific effects. These estimates continue to treat income as endogenous, and use an unbalanced panel.[24] With the fixed effects estimator, the coefficient on equity extraction can still be interpreted as an MPC. The results that control for household heterogeneity are similar to the baseline findings. The consumption response to equity extraction is generally positive (except for the 1999-2003 period). The magnitudes of the effects are slightly smaller than in the baseline case and are imprecisely estimated. Nonmovers continue to exhibit a much larger consumption response to equity extraction, than households who move.

Regressions that control for both household-specific effects as well as the potential endogeneity of equity extraction yield estimates of the equity extraction effect that are implausibly large and negative with enormous standard errors (not reported). The impact of income on consumption in these regressions is also implausible. Analysis of the first stage suggests that the housing supply elasticity has limited explanatory power for households' amount of borrowing when fixed effects are included (F-stat around 2). It is possible that the number of households in certain MSAs is limited, and the fixed effects soak up much of the variation in equity extraction created by the instrument.

Overall, the findings in Table 7 reinforce the fact that equity extraction has a relatively small impact on household spending. If anything, this effect is smaller than in the baseline case after controlling for household-specific effects.

[24]Balanced panel estimates yield similar results. The sample sizes are much smaller,however, so the results are even less precise.

4.1.4 Alternative Reasons for Equity Extraction

The results discussed thusfar are broadly consistent with households using equity extraction to finance a portion of their consumption taste shocks. The question remains, however, whether the results are capturing other reasons why households may extract equity. In particular, the results could be identifying some sort of age effect where older households are borrowing against their homes because they plan to downsize their housing stock as they near or enter retirement. Extracting equity would allow such households to access the housing wealth gains that they expect to realize in the near future, and in turn smooth their consumption. Alternatively, households may extract equity because of an income shortfall (idiosyncratic income shock) or other financial need.

The results in Table 8 analyze the relationship between equity extraction and consumption across household age groups as well as by controlling for households that experience bad income shocks. The panel nature of the PSID allows one to identify individual income shocks by comparing households' current labor income to their average labor income over time.[25] Households are identified as experiencing a bad income shock [BIS] (and potentially needing to borrow) if the household head's current labor income is 2 standard deviations or more below its average income. Using income data from household heads only avoids problems of spouses voluntarily entering and leaving the labor force. Alternative approaches, such as identifying bad income shocks based on a household's total labor income (husband and spouse) being 15 percent or more below average, yield very similar results.

The results based on the age of the household head suggest that the direct impact of equity extraction on consumption is driven mainly by the behavior of households aged fifty to sixty-five. In particular, there is little difference in behavior between older households that experience a bad income shock and those who do not. This finding is not incredibly surprising since older households' in general are more financially secure than younger households and likely have sufficient assets to make up for income shortfalls. Taken together, these results are consistent with the relationship between equity extraction and consumption being driven, at least in part, by older households accessing their housing equity to consume some of their housing wealth gains.

There is also evidence that of a relationship between equity extraction and consumption for younger households who experience a bad income shock. In particular, thirty-five to fifty year old households that have a bad income shock raise their spending by roughly 16 cents per dollar increase in equity extraction. In contrast, the consumption of similarly aged households who do not experience a bad income shock is relatively unaffected by equity extraction. It makes sense that younger households would have a greater borrowing need to

[25]Households' average labor income is measured using all available labor income data for the household in the PSID.

smooth their consumption in response to bad income shocks than older households. This finding is broadly consistent with adverse income shocks driving the relationship between equity extraction and consumption for some homeowners. Overall, it appears that both age effects and negative income shocks play a role in driving the relationship between equity extraction and household spending.

4.2 Residential Investment (Home Improvements)

The results in Table 9 show the estimated impact of equity extraction on households' home improvement expenditures. The findings are conditional on households' reporting they made residential investments, and take into account that the home improvement data are bottom censored at $ 10,000.

The first column shows the results over the entire sample period, while the other columns report the results for the relevant two-year periods between PSID waves. Conditional on a household's making home improvements, nearly 14 cents per dollar it extracted went toward such residential investment. This effect is fairly large and very precisely estimated, given the relatively small portion of households in the sample (around 14 percent) that made home improvements between 1997 and 2009. The result is consistent with anecdotal evidence that suggests that households borrowed against their homes and/or cash-out equity in order to finance home improvements.[26]

Based on the bi-yearly data, the impact of equity extraction on home improvement spending was largest between 1997 and 1999, 2003 and 2005, and 2005 and 2007. Between 2001 and 2003 the effect was smaller and between 1999 and 2001 and after 2007 the estimates are essentially zero. The fact that there was a strong positive relationship between equity extraction and home improvement spending during the height of the house-price boom is not surprising, given the boom in construction and renovation spending that accompanied the rise in house prices. Between 1997 and 1999, house prices rose more modestly, however, so it is interesting to find such a large effect of equity extraction on residential investment. The prime rate of interest, to which most home equity loans and lines of credit are pegged, was also higher at the end of the 1990s than earlier in that decade or in the subsequent years. It may simply be the case that households focused on their existing stock of equity rather than on house-price changes or interest rates when considering how to finance home improvements during that time.

Overall, the results in Table 9 suggest that a good portion of each dollar of equity extracted went toward home improvements for households who made such investments especially during the height of the house price boom. This finding further suggests that

[26]Estimating the residential investment effect across all households not surprisingly results in point estimates that are roughly half as large.

households focused on longer-term residential investment projects and not just their current spending needs when extracting equity from their homes.

4.3 Equity Extraction and Household Balance Sheet Effects

The top panel of Table 10 reports the estimates of the relationship between equity extraction and overall household saving by period.[27] Overall, there appears to have been a positive relationship between equity extraction and household saving from 2001 to 2007. This effect is particularly strong, and precisely estimated during the 2003–2005 and 2005–2007 periods, which coincide with the height of the house price boom. These findings confirm that households did not extract equity to just fund consumption expenditures.

Equity extraction does, however, result in lower saving between 1999 and 2001. Looking at the disaggregated data suggests that this result was driven primarily by the negative impact of equity extraction on households' saving in bonds. It seems somewhat odd that households would borrow against their home and reduce their fixed income holdings at the same time. If anything, risk-averse households might shift some savings into less risky, more liquid assets when their debt burden increases, as a hedge against the inability to make debt service payments in the future. Given that the PSID data ignore potential capital gains in bonds, however, the results might be picking up some of the turmoil in the financial markets at the turn of the century.

The overall regression results in Table 10 seem reasonable, as the other coefficient estimates have sensible magnitudes for micro data saving behavior and the expected signs.[28] A potential concern with any saving analysis is that the saving of some households may be high because those households tend to be savers, while other households may save very little. The estimates in the bottom panel of Table 10 consider household saving behavior over multiple time periods and control specifically for household-specific fixed effects. If anything, the relationship between equity extraction and household saving becomes somewhat stronger after controlling for household-specific saving behavior. Over the entire sample, a one-dollar increase in equity extraction leads to roughly a 20-cent rise in household saving.

The estimates in Table 11 show the impact of equity extraction on the disaggregated saving categories. These results also control for household-specific effects, and are divided into two sample periods, 1999–2003 and 2003–2007, to see whether households' saving behavior changes over time.[29] The most frequent saving destination for extracted equity over both subsamples was investment in other real estate. In particular, a one-dollar increase in equity

[27] The terms household saving and nonhousing investment are used interchangeably.

[28] Households tend to report higher saving rates out of income in micro level data than is observed in the aggregate data. In addition, the timing of the income data in the 2007-to-2009 analysis is slightly different, due to data availability.

[29] Period by period results are located in the appendix. The overall pattern of results is very similar.

extraction resulted in roughly 11 cents higher saving in other real estate in both periods. This finding is consistent with the idea that households borrowed against their primary residence to either help purchase additional real estate or to make upgrades and/or expand other properties that they already owned. Equity extraction also appears to have led to increased cash holdings. This may be the result of households' cashing out more equity than they wish to spend immediately and choosing to hold it temporarily as cash. Households between 2003 and 2007 also appear to have invested some of their extracted equity in personal businesses and farms. This is consistent with anecdotal evidence that some households used equity extraction as an alternative way to finance entreprenuership.

The results further show equity extraction resulted in lower savings in retirement accounts between 1999 and 2003. Savings in nonretirement stock and bond accounts, however, increased somewhat during this time period, so perhaps households that borrowed switched from retirement-based saving to nonretirement accounts. The latter accounts are more liquid should households become increasingly cash flow constrained. Overall, the impact of equity extraction on household saving further reinforces the idea that households used the money they borrowed against their homes for investment purposes as much or more so than they did for household expenditures.

4.4 Summary

Table 12 summarizes the destination of a dollar of equity extraction in the early 2000s, in terms of households' consumption, investment, or saving. Many of the results have already been discussed, but not all on a period-by-period basis. The spending data cover a one-year period, while the residential investment and saving results cover a two-year period. For example, the column headed "2001" includes spending data from 2000 to 2001, and saving and investment data from 1999 to 2001. All the results are annualized.

The table is useful for viewing the overall portion of equity extraction that went toward household spending, investment, and saving, as tracked with the PSID. During the height of the house-price boom from 2005 to 2007, the results account for the destination of between roughly 45 and 55 cents of each dollar of home equity extracted. In addition, the amount of extracted resources destined for longer-term investments, such as home improvements and saving, was roughly double the amount that went toward household expenditures. This suggests that during the house-price boom, households were borrowing against their homes with future-oriented investments in mind and not just borrowing to finance current consumption needs.

The results do a somewhat poorer job of explaining the destination of households' extracted equity in the late 1990s and early 2000s, although there is certainly still evidence

that households' borrowed for home improvement and spending purposes. It is difficult to draw broad conclusions from this inability to capture where households' equity extraction dollars were headed, as there are no saving data to analyze for the 1997-to-1999 period. In addition, the negative impact of equity extraction on saving in the 1999–2001 period seems to have been driven primarily by a reduction in bond holdings. As discussed earlier, this could be the result of turmoil in the financial markets at that time and not a pure equity extraction effect, given the way the PSID measures active saving in bonds.

There are two points to take away from Table 12. First, a relatively small portion of households' extracted equity went toward household expenditures especially during the peak years of the housing boom. Second, the results at most explain about half of the entire destination of each dollar of equity extraction. If the table included the consumption effects based on the household fixed effect regressions or the IV regressions then the consumption portion of each dollar extracted would be smaller, and the results would explain somewhat less of the destination of extracted equity.

One way of dealing with the fact that the coefficients do not add to one, is to estimate a series of seemingly unrelated regressions (SUR) with consumption, residential investment and savings as the dependent variables and constrain the coefficients to add to one. These results are shown in Table 13. Even with the SUR approach, household spending still makes up a relatively small portion of the destination of extracted equity.[30] The vast majority of household borrowing went toward saving and investment and not consumption, especially prior to 2007.

It is not clear a priori, however, that the coefficients in Table 12 should add to one. A big issue with self-reported household level data is measurement error (noisy data). Underreported borrowing data will tend to lead to attenuation bias and the estimated equity extraction effect will be smaller than the true effect. Similarly if consumption is underreported, especially in categories households finance spending through equity extraction such as durable goods, then there may also be downward biased equity extraction effect. This measurement error issue, however, applies to the saving and residential investment data as well as the consumption data. There is little evidence suggesting that the saving and residential investment data are measured more accurately than the consumption data or vice versa. Indeed, Bosworth and Anders (2008) has documented how the wealth and saving data in the PSID do not adequately capture the trends in the aggregate data either. As a result, it would be unfair to argue that all of unaccounted for extracted equity during the house price boom went to consumption due to measurement error.

There are a few additional reasons why the results in this paper may not explain all of the

[30]The residential investment effects are lower than in Table 12 because the results are not conditional on households who made home improvements.

destination of extracted equity. In particular, there is no direct way to capture households in the PSID who extracted equity to help finance the purchase of a new home. Such behavior occurred during the housing boom according to anecdotal evidence. Not observing such borrowing is potentially an issue given the observed differences in behavior between movers and nonmovers. An additional issue is timing. For example, there is no evidence that households used their extracted equity to pay down higher cost noncollateralized debt (NCD) despite the findings in Canner et al. (2002) and anecdotal reports to the contrary. The PSID does not capture exactly when households extract equity, so it is possible that a household could extract equity to consolidate credit card debt at the beginning of a sample period and then slowly build that debt back up as needs arise over the 2 year sample horizon. Such a household would appear not to have paid down its revolving debt despite using some of its extracted equity for NCD repayment, and the overall estimated relationship between equity extraction and NCD would be zero.

5 Existing Literature

5.1 Overview

There are three papers that are closely related to this one: Mian and Sufi (2009), Disney and Gathergood (2009), and Canner et al. (2002). The first two use recent data, while the third is based on data from 2001 and 2002. In particular, Canner et al. (2002) use survey data about mortgage refinancing from questions added to the monthly Survey of Consumers (SOC) to focus on, among other things, households' uses of their liquified home equity. The authors report that roughly 16 percent of the dollars extracted went toward consumer purchases, 35 percent to home improvements, 26 percent to the repayment of other debt, and the remaining portion to stock market and business investments. These are average effects, rather than the marginal effects of equity extraction discussed in this paper. The relatively small share of consumption compared to other uses of equity extraction, however, is consistent with the results in this paper. In contrast, Canner et al. (2002) find a substantial portion of households extracted equity for NCD repayment compared to no observed relationship in this paper.

Mian and Sufi (2009) use Equifax loan level data from 2002—2006 to look at the impact of house price changes on households' home leverage growth at the zip code level. The Equifax data also allow Mian and Sufi to look at the impact of house price growth and household home debt growth on homeowners' purchases of investment properties as well as NCD repayment. Similar to this paper, but unlike Canner et al. (2002), Mian and Sufi find little evidence that households' home equity borrowing went toward repaying other debts. They also do not find

evidence of such borrowing being used for investment in additional real estate. By process of elimination they therefore argue that the vast majority of extracted equity between 2002 and 2006 went toward consumption and home improvement spending. Such a destination of funds they argue has a real and substantial macroeconomic impact. The authors do not, however, have actual data on consumption or home improvement expenditures.

An advantage of Mian and Sufi's data compared to the PSID is that they have detailed loan information at the individual level. Such data allow them to calculate individuals' amount of borrowing (and outstanding debt) directly from credit reports rather than based on households' self-reported debt levels. Mian and Sufi's data therefore likely provide a more accurate picture of individuals' credit positions and leverage changes over time. The Equifax data however suffer from two main drawbacks in addition to not having data on household outlays. First, an "individual" in Mian and Sufi's paper is really a group of 5 individuals who are randomly assigned based on data that are initially sorted by zip code and FICO score. This procedure arguably leads to relatively homogenous groupings, but it precludes the authors from controlling for individual specific effects or characteristics. All of the controls in Mian and Sufi's analysis are at the zip code level (using Census and IRS data), including household income which is not available from Equifax between 2002 and 2006. The second shortcoming of the authors' data is that they cannot directly identify homeowners versus renters. They distinguish between individuals based on whether or not they have a mortgage account or had a mortgage account in the past. The resulting rate of homeownership is 43 percent compared to an standard estimates of around 65 percent. Mian and Sufi attribute this discrepancy to the fact they observe individuals and not households, but acknowledge that their measure is imperfect.

Disney and Gathergood (2009) also analyze households' equity extraction behavior. In particular, they look at the relationship between changes in house prices and changes in households' secured debt holdings in both the U.S. and the U.K. They find that equity extraction due to rising house prices was much more prevalent in the U.S., especially among households they identify as collateral constrained. They further observe that U.K. households extracted equity primarily to repay unsecured debt such as credit card liabilities. Despite using data from the PSID, Disney and Gathergood also do not look directly at households' spending patterns in response to equity extraction. They conclude, however, that much of the extracted equity went toward household expenditures because the growth in secured debt accrued primarily to likely collateral constrained households.[31]

The contribution of this paper relative to both Mian and Sufi's and Disney and Gathergood's is twofold. First, the paper looks directly at the relationship between equity extraction

[31]Disney and Gathergood identify households as collateral constrained if the loan-to-value ratio on their housing exceeds 0.7.

and household spending and saving during the housing boom instead of inferring household behavior. Second, this paper focuses on a much more standard household optimization problem with the empirical analysis than the other two papers. In particular, households normally optimize over consumption (or saving) or whether or not to refinance a loan. Indeed, households often borrow to finance their expenditures or investment, but their decision is over how much they want to consume or invest and not how much they want to raise their debt burden in response to rising house prices. The latter decision making process is the one implied by the empirical analysis in Mian and Sufi (2009) and Disney and Gathergood (2009). The approach in this paper does a better job of capturing what economists think of as standard household optimizing behavior and in turn households' destination of extracted equity.

Other related research on equity extraction and household expenditures includes Hurst and Stafford (2004). In that paper, the authors use survey data from the PSID about households' mortgage refinancing activity between 1991 and 1994 to examine the relationship between consumption and home equity borrowing. They analyze households' decisions whether or not to refinance and find evidence that households refinance to smooth spending in response to income shocks. They do not, however, consider the impact of refinancing on households' balance sheets. This paper expands on Hurst and Stafford's work by examining the relationship between equity extraction and household expenditures during the 2000s as well as taking a boarder look at the destination of households' extracted funds.

5.2 Implied Aggregate Effects

Mian and Sufi (2009) calculate the aggregate impact of house prices on household debt growth between 2002 and 2006 and find that their results explain 53 percent of the growth in total household debt. In dollar terms, this represents a $1.25 trillion rise in household indebtedness. As the authors note, the actual dollar amount depends on the coefficient estimate(s) used. An earlier draft of the paper had the increase at $1.4 trillion based on a slightly different approach. The authors used actual house price growth by zip code and/or MSA for their calculations and then aggregated up the effects. Mian and Sufi do not extend their analysis and look at the implied aggregate demand effects of the debt growth despite claiming that the increase in debt likely went to household outlays.

The calculations outlined in Table 14 take a slightly different approach to looking at the implied aggregate effects of Mian and Sufi's analysis. In particular, they make use of Mian and Sufi's finding that a 1 dollar increase in house prices lead to a 25 cent gain in household debt. According Flow of Funds (FOF) accounts house values increased roughly $8 trillion between 2002 and 2006 due to rising house prices. This implies that household borrowing

was $2 trillion higher in 2006 than 2002. This implied effect is somewhat larger than the ones reported in Mian and Sufi (2009), however, it avoids having to make assumptions about house price growth in areas for which there is not data.[32] Regardless of the method used, the household debt growth implied by Mian and Sufi's results is quite substantial.

The calculations in Table 14 extend Mian and Sufi's results and consider the aggregate demand implications. According to the NIPA data, nominal consumption and residential investment rose roughly $2.1 trillion between 2002 and 2006.[33] Mian and Sufi's results using the FOF data approach, therefore, implies that rising house prices explain nearly all of the economic growth in consumption and residential investment between 2002 and 2006. Even if one use Mian and Sufi calculations, which are arguably more conservative, house prices explain the vast majority of the run up in household outlays.

This aggregate implication of Mian and Sufi's results seems rather extreme. In particular, the result ignores the boom in new construction spending between 2002 and 2006 (a large part of residential investment) as well as substantial growth in nominal income (around $2 trillion). Instead, it attributes all the growth in household outlays to house price changes. In addition, the split between residential investment and consumption spending is unknown. If one attributes more than 10 or 20 percent of the debt increase to residential investment, depending on the aggregate debt gain figure used, the implied increase is larger than the entire gain in residential investment over those 4 years (see Table 14). This suggests that the vast majority of the debt increase had to be for consumption purposes.

Having house price growth explain between 80 to 100 percent of the increase in consumption between 2002 and 2006 is implausible. Even having house prices contribute 50 to 70 percent to the rise in consumption, based on the more conservative estimates, is arguably also a stretch. These calculations also ignore the feedback channel between consumption and income. Higher income leads to higher consumption, and higher spending increases the income of business owners who can then spend more themselves. If there were indeed primarily only a relationship between consumption and house prices between 2002 to 2006, then the fundamental relationship between consumption and income would have needed to break down. If such a fundamental change occurred, income would not also have gained nearly $2 trillion dollars.

The implied aggregate demand effect of equity extraction based on the results in this paper is shown in the bottom portion of Table 14. The calculations assume a MPC out of equity extraction of 0.15 which is on the higher end of the estimates in this paper. The findings also make use of the data on households' actual dollars of equity extracted given

[32]Mian and Sufi assume house prices were unchanged in these locations. This makes their estimates more conservative than those in Table 14.

[33]The majority of home improvement spending is classified as residential investment in the national accounts. Nominal figures are used in the Table to match the nominal data used in Mian and Sufi's paper.

this paper's empirical approach. Overall, the relationship between equity extraction and household spending explains roughly 7 percent of the rise in *real* consumption between 2002 and 2006.[34] The implied aggregate demand effects are still relatively small compared to Mian and Sufi's estimates even if you assume measurement error reduces the coefficient estimates in this paper twofold or threefold. For the reasons outlined above, the aggregate effect implied by the results in this paper are more reasonable than those in Mian and Sufi

6 Conclusion

This paper examines the relationship between home equity extraction and household behavior during the 2000s and late 1990s, using data from the PSID. The goal is to analyze how extracted equity impacts households' expenditures, residential investment and balance sheets. In particular, the paper tries to understand the reasons households extracted equity from their homes and distinguish whether they borrowed to meet their short-term spending needs versus borrowing for investment purposes.

Overall, the results show that the nonhousing consumption impact of equity extraction is relatively small. One dollar of equity extracted leads to no more than 17 cents of increased household expenditures. In contrast, the amount of equity extracted that goes toward saving or home improvement investment is nearly double that of consumption during the 2003-to-2005 and 2005-to-2007 periods. As a result, the results are inconsistent with households' extracting equity only to fund personal outlays during the house-price boom. Indeed, the positive, and relatively substantial, empirical relationship between equity extraction and home improvement investment, as well as between equity extraction and increases in business and other real estate investment, suggests that households took advantage of rising home equity to invest in the future as well.

In addition, the results do not find evidence of large swings in household behavior with regard to equity extraction before versus during the house-price boom. In other words, households do not appear to have radically altered their motivation for extracting equity as house prices continued to rise in the mid-2000s. It will be interesting to see how household behavior with regards to home equity borrowing changed with the recent drop in house prices and households' housing equity. The pre-release 2009 data provide a glimpse of what happened, but they are limited and it is difficult to draw strong conclusions. What little data there are suggest that some of the household saving patterns in response to equity extraction observed in this paper remain, but are, not surprisingly, less strong.

[34]The aggregate effect of residential investment spending is not calculated since the estimates are conditional on households who choose to make home improvements which cannot be observed in the aggregate data. The dollar value of this effect is likely to be relatively small based on the argument earlier in this section.

An additional question worth considering in future work is the extent to which the timing of the data matters for capturing the relationship between equity extraction and household spending and investment behavior. In particular, this paper and the one by Mian and Sufi find no empirical relationship between equity extraction and noncollateralized debt repayment, despite the potential cost savings of credit card debt repayment using equity extraction. In contrast, the more timely direct survey data used in Canner et al. (2002) finds that a relatively large portion of extracted equity goes to noncollateralized debt repayment. Given these discrepancies, the larger question is whether one gains additional insight into household equity extraction behavior by trying to pin down households' spending and investment decisions at the exact moment they choose to extract home equity. Such detailed data currently do not exist, however, and this issue is left for consideration in future work.

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Table 1

Distribution of Equity Extraction by Period

For Homeowners who Extract Equity

	1997-1999	**1999-2001**	**2001-2003**	**2003-2005**	**2005-2007**	**2007-2009**
mean	28107	27977	31246	36449	41337	57906
median	15698	18221	18479	19627	22121	29293
1^{st} Percentile	547	1012	973	493	885	837
5^{th} Percentile	1047	1012	1945	935	1770	1674
25^{th} Percentile	5756	6074	6808	6542	8406	8370
75^{th} Percentile	31397	35430	38904	45797	49550	71141
95^{th} Percentile	94191	89080	108930	130848	145850	207564
99^{th} Percentile	209312	172087	204244	275715	283144	407596
% Homeowners who Extracted Equity	23.0	21.7	27.0	24.2	23.1	32.5
N(Homeowners)[a]	4184	4482	4754	4778	4817	4685

Source: Author's calculations using PSID data. [a] Number of homeowners in sample. The sample is restricted to households owning a home at the beginning and end of the equity extraction period. Households that report more than 2 million dollars of equity extracted are also dropped.

Equity Extraction Relative to House Values

	1997-1999	**1999-2001**	**2001-2003**	**2003-2005**	**2005-2007**	**2007-2009**
mean	0.226	0.230	0.199	0.196	0.195	0.287
median	0.134	0.138	0.123	0.120	0.122	0.171
1^{st} Percentile	0.002	0.003	0.004	0.002	0.004	0.006
5^{th} Percentile	0.011	0.011	0.012	0.008	0.010	0.014
25^{th} Percentile	0.057	0.052	0.051	0.044	0.052	0.064
75^{th} Percentile	0.300	0.333	0.248	0.257	0.254	0.407
95^{th} Percentile	0.786	0.764	0.685	0.728	0.636	0.947
99^{th} Percentile	1.150	1.080	1.130	1.043	1.115	1.316
% Homeowners who Extracted Equity	23.0	21.7	27.0	24.2	23.1	32.5
N(Homeowners)[a]	4184	4482	4754	4778	4817	4685

Source: Author's calculations using PSID data. [a] Number of homeowners in sample. The sample is restricted to households owning a home at the beginning and end of the equity extraction period. Households that report more than 2 million dollars of equity extracted are excluded, as are those households with relative equity ratios above 1.5.

Table 2

Summary Statistics: Households Who Do and Do not Extract Equity

(Mean Values)

Household Demographics and Financial Assets

Variable	1997-1999		1999-2001		2001-2003		2003-2005		2005-2007		2007-2009	
	EE[a]	No EE[b]	EE[a]	No EE[b]	EE[a]	No EE[b]	EE[a]	No EE[b]	EE[a]	No EE[b]	EE[a]	No EE[b]
Age of Household Head	44.2	44.6	45.2	45.1	45.1	45.1	45.5	45.1	46.7	45.5	43.6	45.6
Number in Family Unit	3.3	2.8	3.3	2.9	3.2	2.8	3.1	2.8	3.1	2.7	2.9	2.6
Married (%)	76.6	51.8	75.3	51.2	76.2	48.7	74.4	48.6	74.3	48.4	71.0	51.6
Avg. Weeks Head Unemployed	0.5	1.4	0.6	1.4	0.7	1.4	0.7	1.4	0.9	1.4	0.9	1.4
Avg. Weeks Spouse Unemployed	0.3	0.6	0.7	0.6	0.7	0.7	0.5	0.7	0.9	0.7	0.7	0.7
Have Kids in College (%)	19	10	19	11	18	11	19	10	17	10		
Disposable Income	58667	41152	75538	52939	71208	47148	82045	52492	84225	55682	81385	56037
% Change Income	0.19	0.16	-0.10	-0.06	0.11	-0.01	-0.01	-0.05	0.01	0.02	N.A	N.A.
% Change House Prices	0.08	0.12	0.13	0.10	0.10	0.10	0.10	0.22	0.03	-0.04	-0.07	-0.16
% Change MSA House Prices	0.07	0.07	0.08	0.08	0.09	0.09	0.17	0.15	-0.01	-0.00	N.A.	N.A.
Home Equity	151722	140108	132283	142381	141076	178725	149344	182784	202728	227292	105771	66121
LTV Ratio	0.49	0.38	0.47	0.42	0.51	0.40	0.52	0.41	0.51	0.40	0.47	0.40
LTV Ratio ≥ 0.8 (% with)	15.9	17.8	16.3	19.5	16.2	19.0	18.5	20.0	19.0	17.8	17.3	18.3
Value of Liquid Assets	N.A	N.A	20764	47580	26924	30945	22082	32768	26684	29677	18903	21488
Value of Illiquid Assets[c]	N.A.	N.A.	101126	76137	109245	67324	97842	67511	101088	80626	58206	44786
Health Expenditures	N.A	N.A.	3740	2564	4560	3077	4407	3407	5548	3927		

Source: Author's calculations based on PSID data. N.A. Not available; [a]Households that extract equity; [b]Households that do not extract equity; [c]Excludes housing wealth. Homeowners who do and do not extract equity are identified as discussed in the text. All variables are measured at the beginning of each period and are in real 2000 dollars where applicable. The change in house prices and income is calculated over the equity extraction period. Illiquid assets exclude housing wealth.

Detailed Non-Housing Asset Positions

Variable	1997-1999		1999-2001		2001-2003		2003-2005		2005-2007		2007-2009	
	EE[a]	No EE[b]	EE[a]	No EE[b]	EE[a]	No EE[b]	EE[a]	No EE[b]	EE[a]	No EE[b]	EE[a]	No EE[b]
Other Real Estate	N.A.	N.A	28521	16609	27150	17720	26622	18387	29109	21637	31348	17071
Farm/Business Value	N.A.	N.A	24036	24446	32162	17938	26852	18740	29365	24926	-19275	-7443
Cash Holdings	N.A.	N.A	12141	10356	10872	12685	12388	12991	9505	13660	13770	13854
Stock Holdings	N.A.	N.A	18205	42064	25080	23816	18652	25623	27150	22530	17863	15311
Bond Holdings	N.A.	N.A	11755	6554	9182	5556	9671	5031	5901	6908	6412	5532
Vehicle(s)	N.A.	N.A	15303	10410	16653	9924	15216	9543	14745	9687	13279	9386
Noncollateralized debt	N.A.	N.A	9583	4840	9028	5556	8959	5846	9971	6513	12730	7676
IRA/Retirement Account	N.A.	N.A	21511	18118	24098	16186	19481	15810	21968	17468	26443	20240

Source: Author's calculations based on PSID data. N.A. Not available; [a]Households that extract equity; [b]Households that do not extract equity; [c]Excludes housing wealth. Homeowners who do and do not extract equity are identified as discussed in the text. All variables are measured at the beginning of each period and are in real 2000 dollars where applicable. The change in house prices and income is calculated over the equity extraction period. Illiquid assets exclude housing wealth.

Table 3

Predictors of Equity Extraction 1997-2007
Probit Regressions

Regressor	1	2	3	4
% ΔIncome$_{t,t+1}$	0.043	0.022	0.038	0.027
	(0.035)	(0.025)	(0.035)	(0.038)
Liquid Fin. Wealth$_t$ [†]	−0.017**	−0.024***	−0.017**	−0.016**
	(0.007)	(0.006)	(0.007)	(0.007)
Illiquid Fin. Wealth$_t$ [†]	−0.003	−0.004*	−0.002	−0.001
	(0.002)	(0.002)	(0.002)	(0.003)
Housing Equity$_t$ [†]	0.016***	0.020***	0.011*	0.013*
	(0.006)	(0.004)	(0.006)	(0.007)
% ΔHouse Prices (MSA)$_{t,t+1}$ [‡]	0.087*			
	(0.046)			
% ΔHouse Prices (self-reported)$_{t,t+1}$		0.030**		
		(0.013)		
% ΔHouse Prices (MSA)$_{t-1,t}$ [‡]			0.183***	
			(0.054)	
% Relative House Price Growth$_{t,t+1}$ [‡]				0.102***
				(0.033)
Unemployment Spell$_{t,t+1}$ [a,b]	0.014	0.006	0.014	0.023
	(0.015)	(0.011)	(0.015)	(0.015)
LTV Ratio$_t$	0.146***	0.129***	0.139***	0.159***
	(0.023)	(0.017)	(0.023)	(0.024)
LTV $\geq 0.8_t$ [a]	−0.149***	−0.138***	−0.147***	−0.157***
	(0.015)	(0.011)	(0.015)	(0.015)
College Age Kids$_t$ [a]	0.002	0.011	0.003	0.009
	(0.015)	(0.011)	(0.015)	(0.016)
Midwest Region$_t$ [a]	0.011	0.018	0.013	0.006
	(0.018)	(0.013)	(0.018)	(0.018)
South Region$_t$ [a]	−0.007	0.001	−0.007	−0.006
	(0.017)	(0.012)	(0.017)	(0.018)
West Region$_t$ [a]	0.039**	0.046***	0.033*	0.049**
	(0.020)	(0.014)	(0.020)	(0.020)
N	7961	14148	7961	7254

[†] In 100000s; [‡] House-price data based on FHFA MSA-level house-price indexes. Relative house price growth equals MSA growth in the location the household lives less average growth across all MSAs; [a] Indicator variable that takes the value of 1 if the statement is true and is 0 otherwise; [b] Dummy variable equals 1 if head or spouse reports more than 13 weeks of unemployment during the relevant sample period. The table reports marginal effects evaluated at the mean of the other variables. All variables are in 2000 dollars where applicable. The regressions also include a cubic in the age of the household head. Including additional demographic variables does not impact the overall results. Robust errors are in parentheses: * indicates significance at the 10-percent level, ** indicates significance at the 5-percent level, and *** indicates significance at the 1-percent level.

Table 4

Dollar Impact of Equity Extraction on Household Spending Over Time

Regressor	**Full Sample**		**1999-2003**		**2005-2007**		**2005-2007**[a]	
Amount Extracted $(AE)_{t,t+1}$	0.051^{***}	0.075^{***}	0.020	0.038	0.074^{***}	0.102^{***}	0.124^{***}	0.165^{***}
	(0.012)	(0.017)	(0.022)	(0.029)	(0.015)	(0.020)	(0.022)	(0.031)
Income_{t+1}	0.145^{***}	0.145^{***}	0.179^{***}	0.180^{***}	0.118^{***}	0.117^{***}	0.184^{***}	0.182^{***}
	(0.012)	(0.012)	(0.026)	(0.026)	(0.011)	(0.011)	(0.018)	(0.018)
$\text{Financial Wealth}_{t+1}$	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001	−0.002	−0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
$\text{Housing Equity}_{t+1}$	0.006	0.005	−0.005	−0.005	0.012^{***}	0.012^{***}	0.020^{***}	0.020^{***}
	(0.005)	(0.005)	(0.014)	(0.014)	(0.003)	(0.003)	(0.004)	(0.004)
Moved_{t+1}		1232.621		−837.145		3680.703		7557.815^{**}
		(1711.258)		(974.442)		(3519.349)		(3810.936)
Moved x $AE_{t,t+1}$		-0.072^{***}		−0.040		-0.101^{***}		-0.162^{***}
		(0.023)		(0.035)		(0.033)		(0.045)
Memo:								
AE Conditonal $\text{Move}_{t,t+1}$		0.002		−0.002		0.000		0.003
		(0.016)		(0.024)		(0.026)		(0.032)
N	18312	18311	10723	10722	7589	7589	7149	7149

[a] Spending measure includes additional consumption data available only from 2005 onward. The dependent variable is households' consumption excluding housing over the period in question as reported in the PSID. The amount extracted is averaged over the relevant time period to be consistent with the coverage period for consumption. Income is treated as endogenous. All variables are in 2000 dollars where applicable. The regressions also include a cubic in the age of the household head as well as year fixed effects. Including additional demographic variables does not impact the overall results. Robust errors are in parentheses: * indicates significance at the 10-percent level , ** indicates significance at the 5-percent level, and *** indicates significance at the 1-percent level.

Table 5

Dollar Impact of Equity Extraction on Household Spending by Year

Regressor	**1999**	**2001**	**2003**	**2005**[a]	**2007**[a]
Amount Extracted $(AE)_{t,t+1}$	0.046	−0.010	0.076**	0.168***	0.162***
	(0.084)	(0.053)	(0.031)	(0.049)	(0.036)
$Income_{t+1}$	0.127***	0.232***	0.156***	0.189***	0.181***
	(0.019)	(0.025)	(0.052)	(0.028)	(0.025)
$Financial\ Wealth_{t+1}$	−0.000	−0.002	0.001	−0.008	0.002
	(0.002)	(0.002)	(0.003)	(0.009)	(0.002)
$Housing\ Equity_{t+1}$	0.011	−0.002	−0.011	0.028***	0.013**
	(0.011)	(0.005)	(0.027)	(0.007)	(0.005)
$Moved_{t+1}$	-1.5e+03	367.6	-480.9	3845.0**	1.2e+04
	(2423.1)	(1271.0)	(1171.3)	(1547.5)	(7999.1)
Moved x $AE_{t,t+1}$	0.022	−0.046	−0.094***	−0.154**	−0.164***
	(0.090)	(0.108)	(0.035)	(0.066)	(0.061)
Memo:					
AE Conditonal $Move_{t,t+1}$	0.068***	−0.056	−0.018	0.014	−0.002
	(0.024)	(0.095)	(0.028)	(0.034)	(0.051)
N	3277	3621	3824	3668	3481

The dependent variable is households' consumption excluding housing in the period in question as reported in the PSID. [a] Spending measure includes additional consumption data available only from 2005 onward. The amount extracted is averaged over the relevant time period to be consistent with the coverage period for consumption. Income is treated as endogenous. "Moved" is a dummy variable that takes a value of 1 if the household has changed residences since the previous survey, and is 0 otherwise. All variables are in 2000 dollars where applicable. The regressions also include a cubic in the age of the household head as well as year fixed effects. Including additional demographic variables does not impact the overall results. Robust errors are in parentheses: * indicates significance at the 10-percent level , ** indicates significance at the 5-percent level, and *** indicates significance at the 1-percent level.

Table 6

Dollar Impact of Equity Extraction on Household Spending Over Time
IV Estimates

Regressor	Full Sample		1999-2003		2005-2007		2005-2007[a]	
Amount Extracted (AE)$_{t,t+1}$	−0.009	−0.018	0.085	0.109	−0.078	−0.121	0.101	0.111
	(0.199)	(0.271)	(0.412)	(0.563)	(0.172)	(0.235)	(0.202)	(0.284)
Income$_{t+1}$	0.154***	0.153***	0.173***	0.174***	0.135***	0.135***	0.214***	0.212***
	(0.018)	(0.018)	(0.034)	(0.033)	(0.015)	(0.015)	(0.024)	(0.024)
Financial Wealth$_{t+1}$	−0.003	−0.003	−0.003	−0.003	−0.003	−0.004	−0.005	−0.005
	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)	(0.004)	(0.006)	(0.006)
Housing Equity$_{t+1}$	0.004	0.004	−0.007	−0.007	0.010**	0.011**	0.018***	0.018***
	(0.007)	(0.007)	(0.016)	(0.016)	(0.004)	(0.004)	(0.006)	(0.006)
Moved$_{t+1}$		1341.2		-1.5e+03		4330.2		9585.6**
		(2151.5)		(2715.3)		(3467.9)		(3895.0)
Moved x AE$_{t,t+1}$		0.027		−0.083		0.114		−0.118
		(0.266)		(0.562)		(0.215)		(0.265)
Memo:								
AE Conditonal Move$_{t,t+1}$		0.009		0.026		−0.007		−0.007
		(0.022)		(0.028)		(0.034)		(0.040)
N	12321	12320	7103	7102	5218	5218	4925	4925

[a] Spending measure includes additional consumption data available only from 2005 onward. The dependent variable is households' consumption excluding housing over the period in question as reported in the PSID. The amount extracted is averaged over the relevant time period to be consistent with the coverage period for consumption. Income is treated as endogenous. All variables are in 2000 dollars where applicable. The regressions also include a cubic in the age of the household head as well as year fixed effects. Including additional demographic variables does not impact the overall results. Robust errors are in parentheses: * indicates significance at the 10-percent level , ** indicates significance at the 5-percent level, and *** indicates significance at the 1-percent level.

Table 6a

First Stage Results

Dependant Variable	Amount Extracted ($)
Housing supply inelasticity	1592.2***
	(250.65)
Constant	4514.1***
	(286.2)
N	13041
R^2	0.01

Table 7

Dollar Impact of Equity Extraction on Household Spending Over Time
Regressions that Control for Household-Specific Effects

Regressor	**Full Sample**		**1999-2003**		**2005-2007**		**2005-2007**[a]	
Amount Extracted $(AE)_{t,t+1}$	0.031	0.048	−0.027	−0.033	0.032	0.071	0.016	0.057
	(0.032)	(0.039)	(0.065)	(0.072)	(0.051)	(0.060)	(0.058)	(0.070)
$Income_{t+1}$	−0.119	−0.118	−0.061	−0.061	0.027	0.024	0.005	0.000
	(0.085)	(0.085)	(0.052)	(0.052)	(0.048)	(0.048)	(0.053)	(0.053)
Financial $Wealth_{t+1}$	0.007	0.007	0.003	0.003	0.002	0.002	0.003	0.003
	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.005)	(0.005)
Housing $Equity_{t+1}$	0.014*	0.014*	0.012	0.012	−0.004	−0.006	0.001	−0.003
	(0.008)	(0.008)	(0.017)	(0.017)	(0.016)	(0.016)	(0.018)	(0.018)
$Moved_{t+1}$		2566.8		-98.6		6299.5**		1.1e+04***
		(1722.2)		(3121.2)		(2916.4)		(3278.3)
Moved x $AE_{t,t+1}$		−0.067		0.032		−0.148		−0.172
		(0.067)		(0.158)		(0.100)		(0.114)
Memo:								
AE Conditonal $Move_{t,t+1}$		−0.019		−0.001		−0.077		−0.116
		(0.056)		(0.142)		(0.086)		(0.096)
N	18227	18226	10662	10661	7565	7565	7130	7130

[a] Spending measure includes additional consumption data available only from 2005 onward. The dependent variable is households' consumption excluding housing over the period in question as reported in the PSID. The amount extracted is averaged over the relevant time period to be consistent with the coverage period for consumption. Income is treated as endogenous, and all specifications are estimated using a fixed effects panel estimator. All variables are in 2000 dollars where applicable. The regressions also include a cubic in the age of the household head as well as year fixed effects. Including additional demographic variables does not impact the overall results. Robust errors are in parentheses: * indicates significance at the 10-percent level , ** indicates significance at the 5-percent level, and *** indicates significance at the 1-percent level.

Table 8

Dollar Impact of Equity Extraction on Household Spending by Age
Includes Income Shocks

Regressor	Less than 35 yrs		35 yrs to 50 yrs		50 yrs to 65 yrs	
Amount Extracted (AE)$_{t,t+1}$	0.018	0.013	0.051*	0.035	0.094***	0.098***
	(0.023)	(0.029)	(0.026)	(0.029)	(0.018)	(0.021)
Income$_{t+1}$	0.111***	0.108***	0.134***	0.122***	0.147***	0.154***
	(0.032)	(0.033)	(0.019)	(0.019)	(0.016)	(0.019)
Financial Wealth$_{t+1}$	−0.001***	−0.000***	−0.000	−0.000	0.000	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Housing Equity$_t$	0.019	0.018	0.009**	0.013**	−0.002	−0.008
	(0.014)	(0.014)	(0.005)	(0.005)	(0.013)	(0.017)
Bad Income Shock (BIS)$_{t+1}$[a]		-574.0		2174.6*		2286.2**
		(1173.6)		(1206.4)		(1004.0)
AE x BIS$_{t+1}$		0.015		0.127*		0.024
		(0.030)		(0.071)		(0.080)
Memo:						
AE | BIS$_{t,t+1}$		0.028		0.162**		0.123
		(0.028)		(0.066)		(0.077)
N	2579	2422	7102	6495	5346	4370

[a] Indicator variable that takes a value of 1 if a household's current labor income is 2 standard deviations or more below its average income. The dependent variable is households' consumption excluding housing over the period in question as reported in the PSID. The amount extracted is averaged over the relevant time period to be consistent with the coverage period for the spending measure. Income is treated as endogenous. All variables are in 2000 dollars where applicable. The regressions also include a cubic in the age of the household head as well as year fixed effects. Including additional demographic variables does not impact the overall results. Robust errors are in parentheses: * indicates significance at the 10-percent level , ** indicates significance at the 5-percent level, and *** indicates significance at the 1-percent level.

Table 9

Effect of Equity Extraction on Residential Investment
Results Conditional on Households Making Home Improvements

Regressor	Full Sample	1997-1999	1999-2001	2001-2003	2003-2005	2005-2007	2007-2009
Amount Extracted $(AE)_{t,t+1}$	0.139^{***}	0.237^{***}	-0.010	0.060^{*}	0.160^{***}	0.130^{***}	0.010
	(0.016)	(0.036)	(0.042)	(0.034)	(0.032)	(0.033)	(0.023)
$\text{Income}_{t-1,t}$	0.034^{***}	0.050^{***}	0.015^{***}	0.038^{***}	0.055^{***}	0.058^{***}	0.049^{***}
	(0.004)	(0.014)	(0.005)	(0.010)	(0.005)	(0.014)	(0.011)
$\text{Financial Wealth}_t$	0.002^{***}	0.001	0.009^{***}	0.004^{*}	0.005^{*}	0.007^{*}	-0.003
	(0.001)	(0.001)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)
Housing Equity_t	0.001	0.035^{***}	-0.011	-0.002	0.004^{*}	-0.000	0.027^{***}
	(0.001)	(0.012)	(0.010)	(0.002)	(0.002)	(0.002)	(0.009)
N	2628	622	397	500	504	609	465

The data are bottom coded at $ 10,000 and the results are estimated taking into account this data censoring. The values reported in the table represent the marginal effect of the independent variable on the unconditional expected value of the amount spent on home improvements. All variables are in 2000 dollars where applicable. The regressions also include a cubic in the age of the household head. Including additional demographic variables does not impact the overall results. Robust errors are in parentheses: * indicates significance at the 10-percent level, ** indicates significance at the 5-percent level, and *** indicates significance at the 1-percent level.

Table 10

Dollar Impact of Equity Extraction on Household Saving Over Time

Regressor	1999-2001	2001-2003	2003-2005	2005-2007	2007-2009
Amount Extracted$_{t,t+1}$	-0.152^{*}	0.118	0.193^{**}	0.163^{**}	0.001
	(0.092)	(0.082)	(0.095)	(0.075)	(0.037)
Income$_{t,t+1}$	0.210^{***}	0.076^{**}	-0.012	0.122^{**}	
	(0.073)	(0.033)	(0.057)	(0.055)	
Income$_t$					0.112^{***}
					(0.030)
Financial Wealth$_t$	-0.043^{**}	-0.022	-0.025	-0.022^{**}	-0.000
	(0.017)	(0.020)	(0.024)	(0.009)	(0.000)
House Value$_t$	-0.000	0.000	0.000	0.001	0.002
	(0.036)	(0.001)	(0.001)	(0.019)	(0.013)
N	2506	2696	2914	3090	3653

The dependent variable is households' total active saving excluding housing over the period in question. To control for outliers, the top and bottom 1 percent of households in the active saving distribution in a given year are excluded from the analysis.The setup in column 5 is slightly different due to data availability and does not include households that extracted equity while selling one home and purchasing another between 2007 and 2009. In columns one through four, income is treated as endogenous. All variables are in 2000 dollars where applicable. The regressions also include a cubic in the age of the household head. Including additional demographic variables does not impact the overall results. Robust errors are in parentheses: * indicates significance at the 10-percent level , ** indicates significance at the 5-percent level, and *** indicates significance at the 1-percent level.

Dollar Impact of Equity Extraction on Household Saving Regressions that Control For Household-Specific Effects

Regressor	1999-2007	1999-2003	2003-2007
Amount Extracted$_{t,t+1}$	0.197^{***}	0.172^{*}	0.224^{***}
	(0.039)	(0.093)	(0.066)
Income$_{t,t+1}$	0.152^{*}	-0.094	0.112
	(0.082)	(0.066)	(0.091)
Financial Wealth$_t$	-0.078^{***}	-0.155^{***}	-0.070^{***}
	(0.005)	(0.012)	(0.007)
House Value$_t$	-0.001	-0.003	0.003
	(0.002)	(0.004)	(0.003)
N	13606	6307	7299

The dependent variable is households' total active saving excluding housing over the period in question. To control for outliers, the top and bottom 1 percent of households in the active saving distribution are excluded from the analysis. Income is treated as endogenous. All variables are in 2000 dollars where applicable. The households control for household-specific fixed effects and also include a cubic in the age of the household head. Including additional demographic variables does not impact the overall results. Robust errors are in parentheses: * indicates significance at the 10-percent level , ** indicates significance at the 5-percent level, and *** indicates significance at the 1-percent level.

Table 11

Dollar Impact of Equity Extraction on Household Saving by Type of Saving (1999-2003)
Regressions that Control for Household-Specific Effects

Regressor	Other Property	Business or Farm	Cash	Stocks	Bonds	Vehicles	Reduced Debt	IRA/ 401k
Amount Extracted$_{t,t+1}$	0.111***	0.005	0.089*	0.042	0.044	−0.062***	−0.005	−0.052***
	(0.027)	(0.013)	(0.043)	(0.072)	(0.052)	(0.024)	(0.019)	(0.011)
Income$_{t+1}$	−0.071***	−0.023*	−0.067*	0.028	0.020	0.053***	−0.021	−0.012
	(0.020)	(0.010)	(0.031)	(0.052)	(0.037)	(0.017)	(0.014)	(0.008)
Financial Wealth$_t$	0.015***	0.001	−0.065***	−0.076***	−0.024***	−0.007*	−0.004	0.004***
	(0.004)	(0.002)	(0.006)	(0.009)	(0.007)	(0.003)	(0.002)	(0.001)
House Value$_t$	−0.001	−0.001*	−0.003*	0.000	0.001	−0.000	−0.000	0.001*
	(0.001)	(0.001)	(0.002)	(0.003)	(0.002)	(0.001)	(0.001)	(0.000)
N	6307	6307	6307	6307	6307	6307	6307	6307

Dollar Impact of Equity Extraction on Household Saving by Type of Saving (2003-2007)
Regressions that Control for Household-Specific Effects

Regressor	Other Property	Business or Farm	Cash	Stocks	Bonds	Vehicles	Reduced Debt	IRA/ 401k
Amount Extracted$_{t,t+1}$	0.114***	0.039***	0.058*	0.000	−0.018	−0.004	0.022	0.013
	(0.022)	(0.013)	(0.032)	(0.053)	(0.032)	(0.014)	(0.015)	(0.013)
Income$_{t+1}$	−0.015	−0.002	0.132***	−0.049	0.032	0.017	−0.001	−0.002
	(0.031)	(0.019)	(0.044)	(0.073)	(0.045)	(0.019)	(0.021)	(0.017)
Financial Wealth$_t$	−0.032***	0.008***	0.001	−0.014*	−0.026***	−0.005***	−0.006***	0.002*
	(0.002)	(0.001)	(0.003)	(0.006)	(0.003)	(0.001)	(0.002)	(0.001)
House Value$_t$	0.001	0.000	−0.001	0.001	0.000	0.001	0.001	0.000
	(0.001)	(0.001)	(0.002)	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)
N	7299	7299	7299	7299	7299	7299	7299	7299

The dependent variable is households' active saving in the relevant asset. To control for outliers, the top and bottom 1 percent of households in the active saving distribution are excluded from the analysis. Income is treated as endogenous. All variables are in 2000 dollars where applicable. The households control for household-specific fixed effects and also include a cubic in the age of the household head. Including additional demographic variables does not impact the overall results. Robust errors are in parentheses: * indicates significance at the 10-percent level , ** indicates significance at the 5-percent level, and *** indicates significance at the 1-percent level.

Table 12

Destination for $ 1 of Equity Extraction

Item	1999	2001	2003	2005	2007	2009
Consumption (Non-Movers)						
Non-housing Expenditures	0.046	-0.010	**0.076**	**0.168**	**0.162**	N.A.
Residential Investment[a]	**0.237**	-0.010	0.060	**0.160**	**0.130**	0.010
Saving						
Total Active Saving[b]	N.A.	**-0.152**	0.118	**0.193**	**0.163**	0.001
Business/Farm Investment	N.A.	-0.022	0.115	0.051	0.043	0.013
Other Real Estate	N.A.	-0.005	0.005	0.028	**0.031**	**0.047**
Cash	N.A.	-0.003	0.024	-0.025	**0.138**	-0.039
Stocks	N.A.	0.028	-0.008	0.067	0.000	-0.035
Bonds	N.A.	-0.083	0.017	**0.059**	-0.041	**0.040**
Vehicles	N.A.	-0.049	**-0.024**	0.005	-0.008	0.000
NCD Repayment	N.A.	0.007	0.008	0.007	0.009	-0.013
IRA/401k	N.A.	-0.010	**-0.018**	-0.002	-0.009	**0.013**
Total Amount Explained	N.A.	-0.17	0.25	0.52	0.36	N.A.

Estimates in boldface are statistically significant at conventional levels—see earlier tables for additional information; The residential investment and saving data cover the period between waves of the survey (i.e., 2001 data cover 1999-2001); [a] Results conditional on households that report such expenses. The data are bottom coded at $ 10,000 and the results are estimated taking into account this data censoring; [b] Numbers may not add exactly due to rounding; [c] noncollateralized debt.

Table 13

Destination for $ 1 of Equity Extraction
Seemingly Unrelated Regressions: Coefficients Constrained to Add to 1

Item	Overall	2001	2003	2005	2007
Consumption (Non-Movers)					
Non-housing Expenditures	0.365	0.223	0.130	0.223	0.527
Residential Investment	0.072	0.040	0.046	0.069	0.103
Saving					
Total Active Saving[a]	0.546	0.705	0.801	0.691	0.367
Business/Farm Investment	0.026	*0.015*	0.033	0.043	0.028
Other Real Estate	0.078	*0.016*	0.148	0.086	0.038
Cash	0.097	0.150	0.117	0.060	0.141
Stocks	0.222	0.377	0.284	0.308	0.113
Bonds	0.099	0.127	0.197	0.143	0.032
Vehicles	0.018	0.064	0.019	0.027	*0.010*
NCD[b] Repayment	0.014	0.016	0.033	0.022	*0.001*
IRA/401k	0.009	0.007	*-0.008*	0.019	*0.014*

Estimates in italics are **not** statistically significant at conventional levels—see earlier tables for additional information; The residential investment and saving data cover the period between waves of the survey (i.e., 2001 data cover 1999-2001); [a] Numbers may not add exactly due to rounding; [b] noncollateralized debt.

Table 14

Actual and Implied Effects of Equity Extraction (2002-2006)
Based on Mian and Sufi's Results
Billions of Dollars

Implied Aggregate Effects:	
Approximate housing wealth increase (2002 - 2006)	8000
Mian & Sufi Implied Debt Increase (2002 - 2006) (MPB[1] home value = 0.25)	2000
Amount used for spending & and home improvement (2002 - 2006)	2000
Actual Data:	
Increase in consumption (2002 - 2006)	1884
Increase in residential investment (2002- 2006)	250.3
Combined Increase	*2134.3*
Memo:	
Change in nominal income	1906
Change in personal saving (2002-2006)	-47.2
Percent change in personal saving (%)	-17

Source: Author's calculations. [1]Marginal Propensity to Borrow.

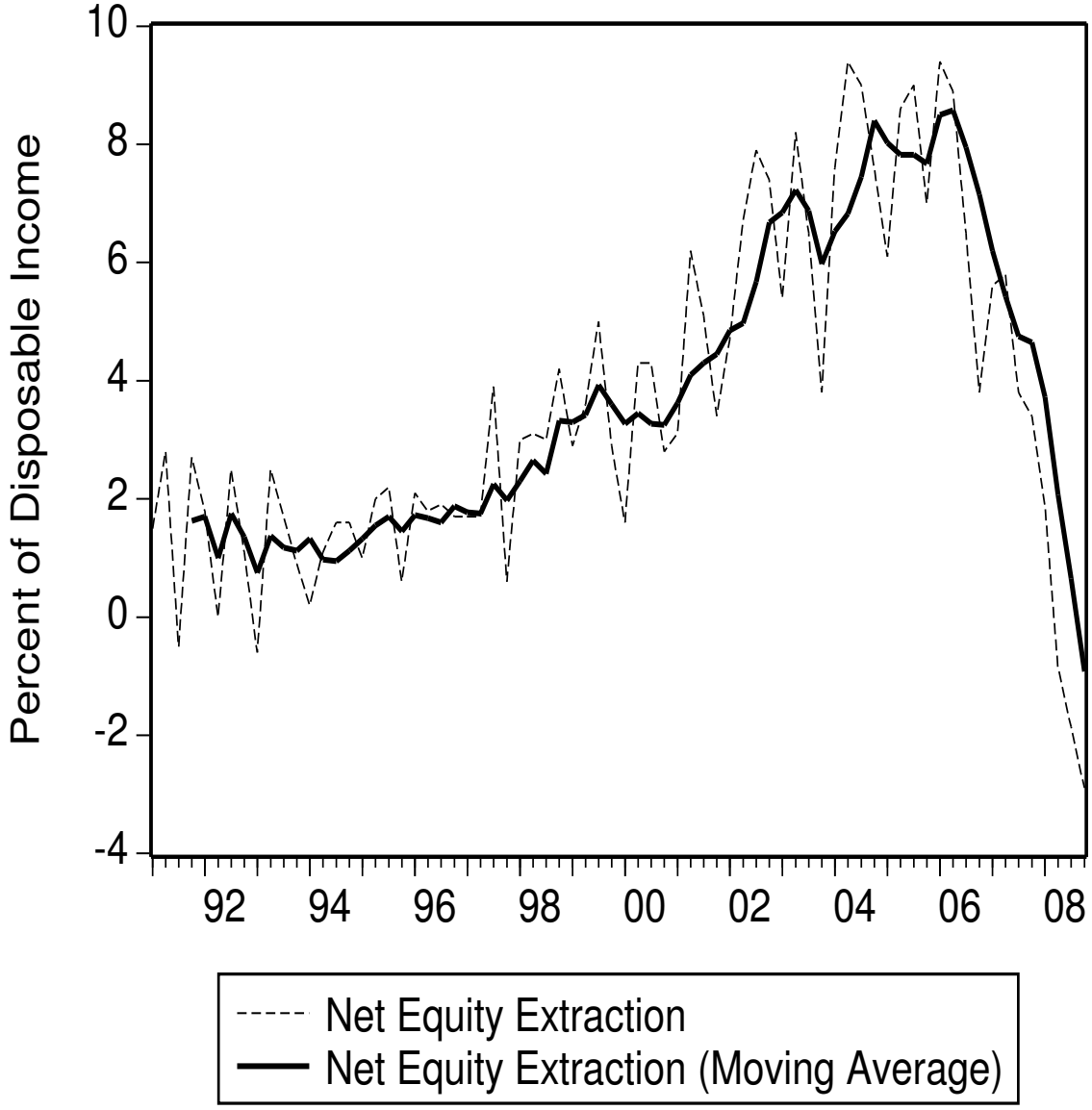
Actual and Implied Effects of Equity Extraction (2002-2006)
Based on this Paper's Results
Billions of 2000 Dollars

Implied Aggregate Effects:	
Approximate increase extracted equity (2002 - 2006)	500
Implied Real Consumption Increase (2002 - 2006) (MPC = 0.15)	75
Actual Data:	
Increase in real consumption (2002 - 2006)	1051.6
Memo:	
Contribution of Equity Extraction to consumption growth (2002 - 2006) [%]	7

Source: Author's calculations.

Figure 1

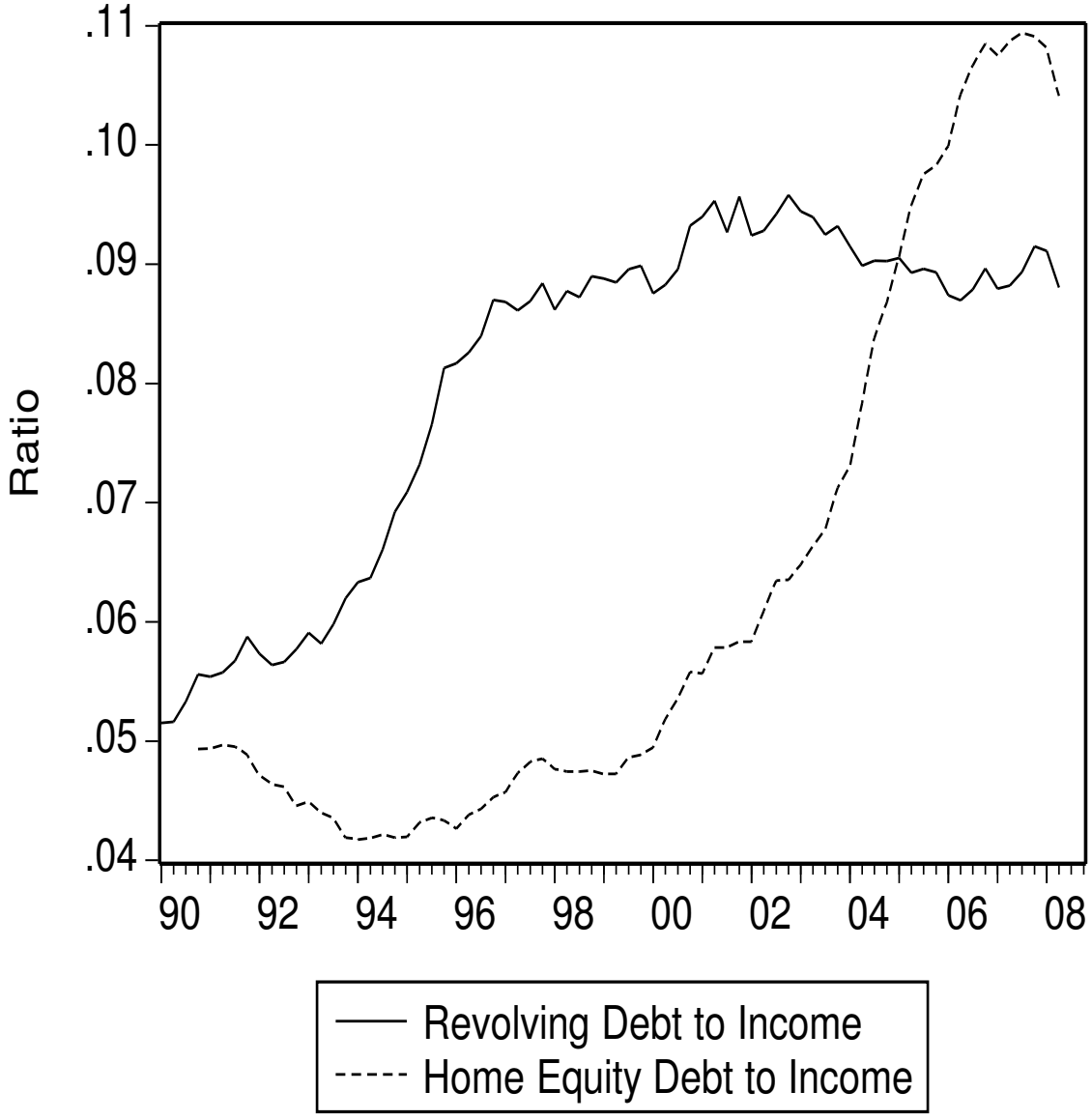
Equity Extraction over Time



Source: Greenspan and Kennedy (2007).

Figure 2

Home Equity and Credit Card Debt



Sources: Income - NIPA; Home Equity Debt - Federal Reserve Z.1 release; Revolving Debt - Federal Reserve G.19 release.

A Appendix

A.1 Detailed Active Saving Calculations

Calculating households' active saving in the PSID depends on the asset in question. In particular, active saving for assets with potentially large capital gain components, such as stocks, IRA accounts or annuities, other real estate, and investment in businesses or farms 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 $as^{i,j}_{t-1,t}$ is active saving for household i in asset j, $I^{i,j}_{t-1,t}$ is the amount invested by household i 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.

For asset categories where capital gains are not a factor, active saving is simply the difference in a household's reported asset value in period t compared with its value in period $t-1$. These assets include: households' checking and saving 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 at time t. The remaining active saving category is housing ($j = h$). The actual calculation of households' saving in housing depends on whether or not a household moves. Households that do not move "save" by paying down their mortgage principal, while households that move may potentially save or dis-save by altering the amount of equity in their homes. In particular,

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

where $D^{i,j}_{k}$ is a household's amount of outstanding mortgage debt in period k, $E^{i,j}_{k}$ 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 represent the fact that the time horizon for active saving in housing is different than for 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:

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

I sum yearly active saving in housing prior to 1999 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 the individual asset components.

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

A.2 Equity Extraction Estimates with Transitory Consumption Shocks

Recall from Section 2.2 that the data-generating process of interest is

$$c^i_t = b_0 + b_2 y^i_t + \epsilon_t + \nu^i_t \, , \tag{A.6}$$

where ϵ_t is a macroeconomic shock and ν^i_t is a transitory shock to household spending. Suppose that the econometrician estimates the following regression

$$c^i_t = b_0 + b_1 x^i_t + b_2 y^i_t + u^i_t \, , \tag{A.7}$$

where x^i_t is the amount of equity extracted and u^i_t is the composite estimation error term ($u^i_t = \epsilon_t + \nu^i_t$).

For illustration purposes, assume that $b_0 = 0$ and $E[y^i_t u^i_t] = 0$, so that y^i_t can be dropped from the discussion for simplicity. The estimate of the equity extraction effect across all households, $\hat{b}_1$, is therefore defined as follows:

$$\begin{aligned} \hat{b}_1 &= (x'_t x_t)^{-1} x_t c_t \\ &= (x'_t x_t)^{-1} x_t (b_1 x_t + u_t) \, . \end{aligned} \tag{A.8}$$

Note that I drop the i superscripts because OLS averages across all households. Further suppose that $x_t = \lambda \nu_t$, which implies that $(1 - \lambda)$ of the transitory shock remains in the composite error term $u_t = \epsilon_t + (1 - \lambda)\nu_t$. This implies that

$$
\begin{aligned}
\hat{b}_1 &= (x_t' x_t)^{-1} x_t (b_1 x_t + \epsilon_t + (1-\lambda)\nu_t) \qquad \text{(A.9)} \\
&= b_1 + (x_t' x_t)^{-1} x_t \epsilon_t + (x_t' x_t)^{-1} x_t (1-\lambda)\frac{x_t}{\lambda} \\
&= b_1 + \frac{1-\lambda}{\lambda} + (x_t' x_t)^{-1} x_t \epsilon_t \\
\Rightarrow E[\hat{b}_1] &= b_1 + \frac{1-\lambda}{\lambda} \, .
\end{aligned}
$$

The last equation holds, since equity extraction is assumed to be uncorrelated with the macroeconomic shock and $E[x_t \epsilon_t] = 0$. This result implies that the estimate of the equity extraction effect is biased upward relative to the true value, assuming $\lambda < 1$.

Table A.1

Predictors of Equity Extraction by Period

Regressor	1997-1999	1999-2001	2001-2003	2003-2005	2005-2007
% ΔIncome$_{t,t+1}$	−0.083	0.040	−0.008	−0.008	0.072
	(0.088)	(0.069)	(0.079)	(0.068)	(0.088)
Liquid Fin. Wealth$_t$ [†]		−0.061***	−0.022*	−0.018	−0.008
		(0.017)	(0.011)	(0.013)	(0.008)
Illiquid Fin. Wealth$_t$ [†]		0.009*	−0.001	−0.007	−0.008*
		(0.005)	(0.005)	(0.005)	(0.005)
Housing Equity$_t$ [†]	0.003	0.043**	0.022	0.014	0.007
	(0.018)	(0.018)	(0.015)	(0.012)	(0.010)
% ΔHouse Prices (MSA)$_{t,t+1}$ [‡]	−0.042	0.005	0.042	0.087	−0.277*
	(0.222)	(0.202)	(0.142)	(0.080)	(0.153)
Unemployment Spell$_{t,t+1}$ [a,b]	−0.011	0.034	−0.015	−0.002	0.032
	(0.032)	(0.031)	(0.030)	(0.028)	(0.028)
LTV Ratio$_t$	0.128***	0.018	0.265***	0.142***	0.179***
	(0.048)	(0.045)	(0.048)	(0.045)	(0.046)
LTV $\geq 0.8_t$ [a]	−0.189***	−0.133***	−0.225***	−0.130***	−0.106***
	(0.028)	(0.030)	(0.028)	(0.030)	(0.030)
College Age Kids$_t$ [a]	0.003	−0.033	−0.004	0.012	0.027
	(0.031)	(0.028)	(0.030)	(0.030)	(0.032)
Midwest Region$_t$ [a]	0.058	0.098**	0.049	−0.057*	−0.061*
	(0.037)	(0.039)	(0.038)	(0.034)	(0.034)
South Region$_t$ [a]	0.035	0.067*	0.006	−0.099***	0.008
	(0.035)	(0.036)	(0.036)	(0.033)	(0.034)
West Region$_t$ [a]	0.108**	0.041	0.065	−0.024	0.053
	(0.045)	(0.042)	(0.040)	(0.040)	(0.038)
N	1689	1831	2019	2093	2018

[†] In 100000s; [‡] House-price data based on FHFA MSA-level house-price indexes. Relative house price growth equals MSA growth in the location the household lives less average growth across all MSAs; [a] Indicator variable that takes the value of 1 if the statement is true and is 0 otherwise; [b] Dummy variable equals 1 if head or spouse reports more than 13 weeks of unemployment during the relevant sample period. The table reports marginal effects evaluated at the mean of the other variables. All variables are in 2000 dollars where applicable. The regressions also include a cubic in the age of the household head. Including additional demographic variables does not impact the overall results. Robust errors are in parentheses: * indicates significance at the 10-percent level, ** indicates significance at the 5-percent level, and *** indicates significance at the 1-percent level.

Table A.2

Dollar Impact of Equity Extraction on Household Saving by Type of Saving: 2005-2007

Regressor	Other Property	Business or Farm	Cash	Stocks	Bonds	Vehicles	Reduced Debt	IRA/ 401k
Amount Extracted$_{t,t+1}$	0.043	0.031**	0.138**	0.000	−0.041	−0.008	0.009	−0.009
	(0.046)	(0.014)	(0.058)	(0.041)	(0.025)	(0.012)	(0.015)	(0.010)
Income$_{t,t+1}$	0.046	0.015	−0.040	0.032	0.037**	0.005	−0.000	0.027***
	(0.029)	(0.010)	(0.026)	(0.029)	(0.018)	(0.009)	(0.015)	(0.009)
Financial Wealth$_t$	0.001	−0.003	−0.003	−0.007	−0.007**	−0.002	−0.003	0.001
	(0.003)	(0.004)	(0.004)	(0.006)	(0.003)	(0.002)	(0.003)	(0.001)
House Value$_t$	0.024	−0.004	−0.003	−0.004	−0.009	0.002	−0.003	−0.002
	(0.015)	(0.004)	(0.013)	(0.016)	(0.006)	(0.003)	(0.005)	(0.003)
N	3089	3089	3089	3089	3089	3089	3089	3089

The dependent variable is households' active saving in the given category between 2005 and 2007. To control for outliers, the top and bottom 1 percent of households in the active saving distribution in a given year are excluded from the analysis. Income is treated as endogenous. All variables are in 2000 dollars where applicable. The regressions also include a cubic in the age of the household head. Robust errors are in parentheses: * indicates significance at the 10-percent level , ** indicates significance at the 5-percent level, and *** indicates significance at the 1-percent level.

Dollar Impact of Equity Extraction on Household Saving by Type of Saving: 2003-2005

Regressor	Other Property	Business or Farm	Cash	Stocks	Bonds	Vehicles	Reduced Debt	IRA/ 401k
Amount Extracted$_{t,t+1}$	0.051	0.028	−0.025	0.067	0.059*	0.005	0.007	−0.002
	(0.043)	(0.019)	(0.046)	(0.082)	(0.034)	(0.015)	(0.011)	(0.008)
Income$_{t,t+1}$	0.014	−0.024	0.038	−0.019	−0.053	−0.016	0.003	0.017**
	(0.013)	(0.019)	(0.027)	(0.039)	(0.081)	(0.010)	(0.009)	(0.007)
Financial Wealth$_t$	−0.010	0.013	0.003	−0.022*	−0.008	0.002	−0.002	0.003
	(0.008)	(0.011)	(0.004)	(0.013)	(0.007)	(0.003)	(0.001)	(0.004)
House Value$_t$	−0.000	−0.000	0.000	−0.000	0.000	0.000	0.000	−0.000
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
N	2914	2914	2914	2914	2914	2914	2914	2914

The dependent variable is households' active saving in the given category between 2003 and 2005. To control for outliers, the top and bottom one percent of households in the active saving distribution in a given year are excluded from the analysis. Income is treated as endogenous. All variables are in 2000 dollars where applicable. The regressions also include a cubic in the age of the household head. Robust errors are in parentheses: * indicates significance at the 10-percent level , ** indicates significance at the 5-percent level, and *** indicates significance at the 1-percent level.

Table A.3

Dollar Impact of Equity Extraction on Household Saving by Type of Saving: 2001-2003

Regressor	Other Property	Business or Farm	Cash	Stocks	Bonds	Vehicles	Reduced Debt	IRA/ 401k
Amount Extracted$_{t,t+1}$	0.115**	0.005	0.024	−0.008	0.019	−0.024*	0.008	−0.018**
	(0.052)	(0.007)	(0.036)	(0.059)	(0.031)	(0.014)	(0.012)	(0.008)
Income$_{t,t+1}$	−0.018	0.004	−0.034	0.104*	0.019	0.002	−0.013	0.013***
	(0.016)	(0.010)	(0.055)	(0.056)	(0.013)	(0.008)	(0.012)	(0.004)
Financial Wealth$_t$	0.017	−0.003	0.003	−0.028*	−0.012**	−0.002	0.003	0.001
	(0.011)	(0.004)	(0.012)	(0.015)	(0.005)	(0.002)	(0.002)	(0.001)
House Value$_t$	−0.000	−0.000	0.000	0.000	0.000	0.000	−0.000	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	2696	2696	2696	2696	2696	2696	2696	2696

The dependent variable is households' active saving in the given category between 2001 and 2003. To control for outliers, the top and bottom 1 percent of households in the active saving distribution in a given year are excluded from the analysis. Income is treated as endogenous. All variables are in 2000 dollars where applicable. The regressions also include a cubic in the age of the household head. Robust errors are in parentheses: * indicates significance at the 10-percent level , ** indicates significance at the 5-percent level, and *** indicates significance at the 1-percent level.

Dollar Impact of Equity Extraction on Household Saving by Type of Saving: 1999-2001

Regressor	Other Property	Business or Farm	Cash	Stocks	Bonds	Vehicles	Reduced Debt	IRA/ 401k
Amount Extracted$_{t,t+1}$	−0.022	−0.005	−0.003	0.028	−0.083*	−0.049*	0.007	−0.010
	(0.036)	(0.009)	(0.033)	(0.070)	(0.045)	(0.020)	(0.031)	(0.009)
Income$_{t,t+1}$	0.000	−0.000	0.000	−0.000*	0.000	0.000	−0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Financial Wealth$_t$	0.006	0.003*	0.006	−0.047***	−0.001	−0.002	−0.003	0.000
	(0.006)	(0.002)	(0.008)	(0.018)	(0.016)	(0.004)	(0.002)	(0.001)
House Value$_t$	0.041	−0.002	0.021*	−0.042	0.028	0.010	0.006	0.016***
	(0.035)	(0.005)	(0.011)	(0.039)	(0.024)	(0.007)	(0.006)	(0.004)
N	2886	2886	2886	2886	2886	2886	2886	2886

The dependent variable is households' active saving in the given category between 1999 and 2001. To control for outliers, the top and bottom one percent of households in the active saving distribution in a given year are excluded from the analysis. Income is treated as endogenous. All variables are in 2000 dollars where applicable. The regressions also include a cubic in the age of the household head. Robust errors are in parentheses: * indicates significance at the 10 percent level , ** indicates significance at the 5 percent level, and *** indicates significance at the 1 percent level.

Table A.4

Dollar Impact of Equity Extraction on Household Saving by Type of Saving: 2007-2009

Regressor	Other Property	Business or Farm	Cash	Stocks	Bonds	Vehicles	Reduced Debt	IRA/ 401k
Amount Extracted$_{t,t+1}$	0.013	0.047*	−0.039	−0.035	0.040*	0.000	−0.013	−0.013*
	(0.008)	(0.024)	(0.036)	(0.027)	(0.024)	(0.006)	(0.010)	(0.007)
Income$_{t+1}$	0.005	0.014	0.048*	0.007	0.011	0.002	0.009	0.017*
	(0.007)	(0.019)	(0.024)	(0.024)	(0.015)	(0.006)	(0.006)	(0.007)
Financial Wealth$_t$	0.000	−0.000	0.000	−0.000	0.000	0.000	−0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
House Value$_t$	−0.001	−0.006	0.015*	0.003	−0.001	−0.005*	−0.005*	0.002
	(0.002)	(0.006)	(0.008)	(0.012)	(0.005)	(0.002)	(0.003)	(0.003)
N	3653	3653	3653	3653	3653	3653	3653	3653

The dependent variable is households' active saving in the given category between 2007 and 2009. To control for outliers, the top and bottom one percent of households in the active saving distribution in a given year are excluded from the analysis. The setup for these equations is slightly different than in other years due to data availability and does not include households who extracted equity while selling one home and purchasing another between 2007 and 2009. All variables are in 2000 dollars where applicable. The regressions also include a cubic in the age of the household head. Robust errors are in parentheses: * indicates significance at the 10 percent level , ** indicates significance at the 5 percent level, and *** indicates significance at the 1 percent level.