THE HOUSING BUBBLE AND RETIREMENT SECURITY

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Abstract

House prices rose 60 percent between 2000 and 2007 before the housing bubble burst. The question is whether the housing bubble made people better or worse prepared for retirement. Theory says that infinitely-lived households experience no increase in their real net worth when housing prices increase and would therefore have no reason to borrow against the increment in their home equity to increase their consumption. Two pieces of evidence suggest that they did tap their equity: the big increase in mortgage borrowing has accompanied the run-up in house prices, and a number of studies have reported a positive relationship between house prices and consumption. Using the 2004 Survey of Consumer Finances (SCF) this paper investigates the probability of households extracting home equity through an increase in housing-related debt, the probability that they use their housing-related borrowing for consumption, and finally the factors that determine the level of consumption spending out of their increased debt. The results show that while homeowners appear to take the present discounted value of future rents into account, many of them extracted equity and used it for consumption. A substantial proportion – perhaps 30 percent – of older households will be less secure in retirement because of the housing bubble.

Introduction

House prices rose 60 percent between 2000 and 2007 before the housing bubble burst. The question is whether the housing boom made people better or worse prepared for retirement. If they extracted the equity from their home through some form of housing-related debt and consumed all their borrowings, they will be left with additional debt and no additional assets and probably will be worse off in retirement. If they did not borrow and consume their equity, they will have more wealth to tap and will be better off in retirement.

Theory says that infinitely-lived households experience no increase in their real net worth when housing prices increase; the value of their home increases but so does the present discounted value of future implicit rent payments. Therefore, they would have no reason to borrow against the increment in their home equity and increase their consumption.

But two pieces of evidence suggest that they did tap their equity. First, the run-up in house prices has been accompanied by a big increase in borrowing – particularly mortgage borrowing. Second, a number of studies have reported a positive relationship between house prices and consumption.

This paper explores how the rise in house prices affected individual households. Section I discusses the impact of an increase in house prices on the homeowner's balance sheet and speculates about how households might respond. Section II describes the evidence to date suggesting that the housing boom led to an increase in debt and to increased consumption. Section III uses the 2004 *Survey of Consumer Finances* (SCF) to explore the actual response of individual households. The analysis investigates the probability of households extracting home equity through an increase in housing-related debt, the probability that they use some or all of their housing-related borrowing for consumption, and finally the factors that determine the level of consumption spending out of their increased debt. The results show that while homeowners appear to take the present discounted value of future rents into account, many of them extracted equity and used it for consumption. Section IV discusses events since the 2004 SCF – the continued inflating of the housing bubble and its ultimate bursting in 2007 – and illustrates the

effects of the increase of mortgage debt on the balance sheets of households nearing retirement. Section V concludes that a substantial proportion – perhaps 30 percent – of older households will be less secure in retirement because of the housing bubble.

I. The Impact of Rising House Prices on the Household's Balance Sheet

Determining how households would respond to a change in housing prices is more complicated than would be the case with a standard financial asset. The challenge arises because the house is both an asset and a consumption good. The housing asset (net of mortgage debt) shows up on the traditional balance sheet. But households also have an implicit liability for housing services, since they must live somewhere. For households with infinite lives, the value of the house – the asset – equals the value of the liability minus the present discounted value of all future implicit rents.

Now consider a doubling of house prices within this framework. A doubling of house prices increases the homeowner's *nominal* wealth as measured on the conventional balance sheet. This is evident in Table 1, where the value of assets rises from $300,000 to $600,000. But the increase in the value of the house is offset by an increase in future rents. As a result, households experience no increase in *real* wealth and therefore are not better off. No matter how large the swings their real wealth does not change.[1]

With no change in real wealth, infinite-lived households would have no reason to increase their debt or their consumption. But real households do not live forever, so their liability is limited to the future rents they will pay over their expected lifetimes. That is, future rental liabilities do not fully offset the value of the house, and the extent to which the house exceeds the liability varies by age. While young households may look very much like the infinite lived households, older households will have lower life-time rent liabilities. As a result when house prices double, older households will have more "housing net worth" and therefore will gain much more in dollar terms than their younger counterparts. In the example in Table 2, younger households will gain only $10,000 when housing prices double; age 55 households will gain $70,000; and age 75 households

[1] This conclusion is fully consistent with Sinai and Souleles (2005) argument that homeowners with expected long tenures are fully hedged against fluctuations in rents and home prices.

will gain $210,000. Thus, the older the household is the more likely it is to benefit from a result of an increase in home prices. Renters and the next generation of homebuyers are worse off because they will have to pay more to secure housing services (Sinai and Souleles 2007).

The question then becomes how the household's reaction to these increases in house prices affect its well-being in retirement. The 75-year old homeowner could – in theory at least – access roughly two thirds of the value of the house through a reverse mortgage, realizing most of the gain, and increase non-housing consumption in retirement. (See BOX for discussion of reverse mortgages.) This increase in consumption, however, comes at the expense of the next generation who will not inherit the higher housing equity but who will face the higher housing liability.

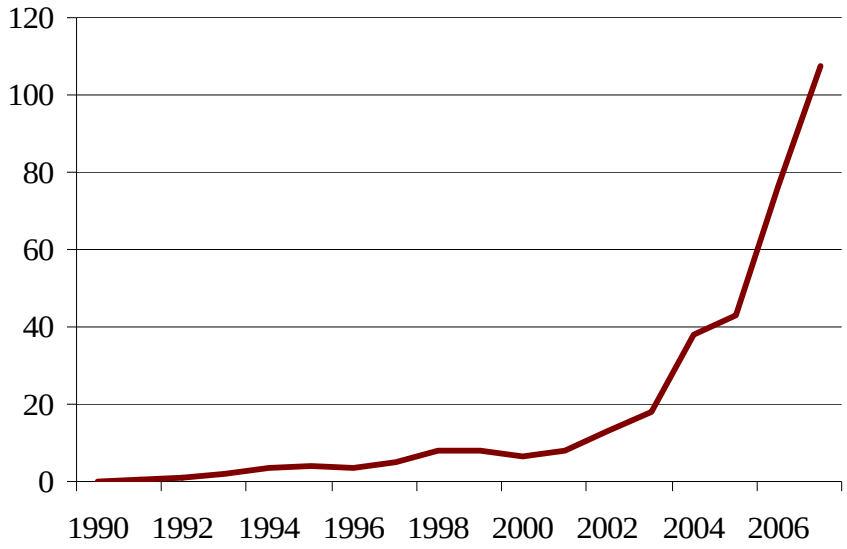
Households under age 62 generally do not have access to reverse mortgages. They can access their increased net worth only by refinancing their mortgage for a larger amount, taking out a second mortgage, or adding a home equity loan. The question then is what the borrower does with the proceeds. If the household consumes the money extracted from the house, it will enter retirement with the outstanding loan but no additional resources. The household could actually be worse off. Consider the 55-year-old household shown in Table 2. Before the doubling of housing prices, that household could have extracted roughly fifty percent of the $300,000 value of the house through a reverse mortgage, augmenting non-housing consumption by $150,000. After the doubling of housing prices, the household could extract about fifty percent of $600,000, or $300,000, through a reverse mortgage. If the mortgage taken during the working years exceeds $150,000, the household will be worse off during retirement. It will have to pay off the mortgage with the $300,000 reverse mortgage and will end up with less than the $150,000 for non-housing consumption in the base case.

BOX – Reverse Mortgages
Reverse mortgages are mechanisms that allow older people to consume their housing equity without selling their homes. Unlike a regular mortgage or a home equity loan, a reverse mortgage does not require periodic payments. With reverse mortgages, households borrow against the equity in their home, and they repay the loan and accumulated interest when they die, move out, or sell the house.

The most widely used reverse mortgage is the Home Equity Conversion Mortgage (HECM). The HECM program emerged from the National Housing Act of 1987. From the outset, Fannie Mae agreed to purchase all HECM loans and today is still the sole purchaser. HECM loans are available to homeowners age 62 or older who hold their primary residence free and clear or who can pay off their mortgage easily with the proceeds of the loan. The loan can be taken as a lump sum, line of credit, lifetime income, or as a payment for a specific period. To date, the line of credit has been the most popular option.

The number of HECM loans granted has grown exponentially over the last few years (See BOX Figure 1). Despite the rapid growth, the market for reverse mortgages is relatively undeveloped. Part of the problem may be homeowners' reluctance to take on new debt in retirement and a desire to maintain their home as insurance against future medical expenses or to leave as a bequest. Also reverse mortgages have high fees and provide relatively little equity for homeowners with higher priced houses. But given that many baby boomers will reach retirement with insufficient wealth, reverse mortgages are likely to become more prevalent in the future.

BOX Figure 1. *HECM Loans Granted 1990-2007, in thousands*

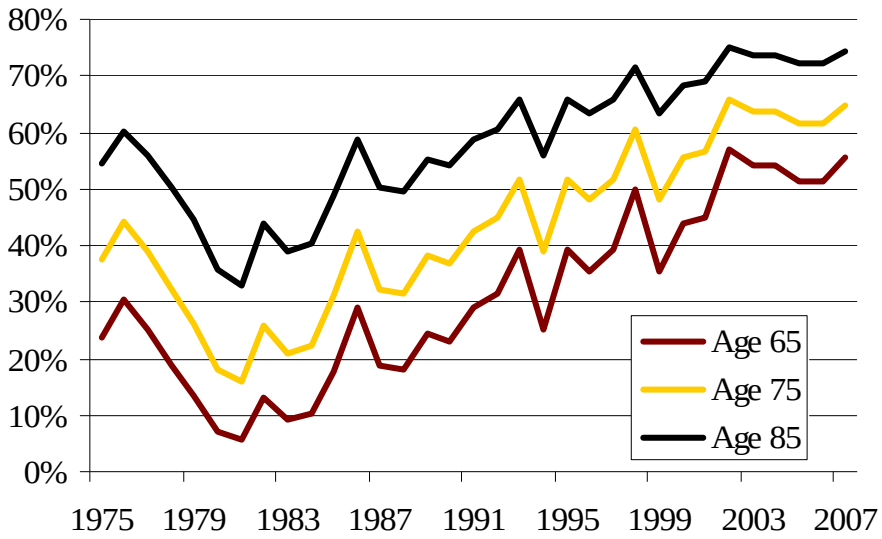


Source: National Reverse Mortgage Lenders Association Annual HECM Production Chart.
Note: Data are in federal fiscal years (FY 2006: Oct. 1, 2005 – Sept. 30, 2006).

The amount available to a homeowner depends on three factors – the value of the house, the interest rate, and the age of the borrower. The more valuable the house, the larger the loan subject to the particular limitations. Since interest rates are added to the loan principal, lenders will offer a smaller percentage of the value of the home as interest rates rise. Finally, as for age, loans for older borrowers are expected to remain outstanding and accrue interest for a shorter period of time before repayment. With less interest per dollar of loan, the lender can grant a larger loan.

BOX Figure 2 shows how interest rates and age affect the percentage of the house value that could be borrowed over the period 1975-2007 assuming reverse mortgages were available during the entire period. The percentage ranges from 5 percent in 1981 to about 55 percent today for a household aged 65. The amounts for older homeowners are significantly greater since they will accrue interest over a short period of time. The bottom line for discussion purposes is that, today, a 65-year-old homeowner with no mortgage and whose house price falls below the HECM limits could extract roughly 50 percent of the value through a reverse mortgage.

BOX Figure 2. *Percentage of House Value That Could Be Borrowed at Ages 65, 75, and 85, 1975-2007*



Sources: Updated data based on Eschtruth, Sun, and Webb (2006).
Notes:
1) This figure assumes a $200,000 house, a 1.5 percent lender's margin and the closing cost estimates used in AARP's online reverse mortgage loan calculator.
2) HECM loans have only been available since 1990, so amounts for 1975 to 1989 represent the percentages that could have been borrowed had they been available.

In order to assess the impact of the housing bubble on retirement security, it is important to determine how households reacted to the increase in housing prices after 2000.

II. Housing Prices, Aggregate Debt, and Consumption

The effect of changing house prices on the household balance sheet could be substantial, because the house is a major component of wealth for the typical household in the United States. According to the 2004 SCF, housing accounts for more than 20 percent of total assets for the typical household approaching retirement (see Figure 1). Total assets in this case are defined very broadly to include the present discounted value of benefits from Social Security and defined benefit pensions. Excluding these two benefit streams, the house accounts for about half of the typical household's wealth.

House prices surged during the housing boom that began in 2000. Both the S&P/Case-Shiller Home Price Index (hereafter referred to as the "Case-Shiller Index") and that provided by the Office of Federal Housing Enterprise Oversight (OFHEO) measure house price appreciation from repeat sales of the same houses and thus control for changes in the quality of houses and both show a very similar picture. The Case-Shiller Index suggests that house prices were more than 60 percent higher at the peak than they had been in 2000; the OFHEO index more than 40 percent (see Figure 2). Prices only began to turn down in the wake of the subprime mortgage crisis in 2007.

The question is whether a big increase in the price of the typical household's major asset has provoked a big response in terms of increased debt and consumption spending. The discussion above suggests that the effect might be substantially muted because of the offsetting increase in the rental liabilities. But the aggregate data indicate that the increase in home prices has been accompanied by a big run-up in mortgage debt. A number of studies also suggest that a rise in housing prices is associated with increased consumption.

Aggregate Data

Accompanying the run-up in house prices has been a major surge in debt relative to income. The Federal Reserve Flow of Funds shows total debt rising from about 60 percent of disposable personal income in 1983 to 80 percent in the early 1990s and soaring to 120 percent of income in 2007. Most of the increase in debt has been associated with home mortgages (see Figure 3).

It is hard to prove that the housing bubble caused the run-up in mortgage debt, but the pattern of the two is remarkably similar (see Figure 4). Moreover, a recent study explored other potential explanations for the increase in mortgage debt and ruled out most of them (Dynan and Kohn 2007). Within the life-cycle model, people could take on more debt if they may become less willing to substitute later consumption for consumption today; if they felt more secure and needed less pre-cautionary saving; or if they had easier access to borrowing. But historical data from the SCF show no evidence of changes in people's views on horizons for spending or savings decisions or attitudes towards the use of credit and only a slight decline in the need for precautionary saving. Interest rates could also affect borrowing, but here the effect could go either way. Lower rates, which mean less reward for postponing consumption, could lead to less asset accumulation and more debt accumulation as people increase current spending. Or people could increase their saving to compensate for the lower return, which implies they would accumulate more assets and less debt. On balance, the Dynan and Kohn's model suggests that the decline in interest rates increased can explain only a tiny fraction of the total rise in the debt-to-income ratio. Thus, by default if nothing else, the rise in housing prices appears to have spurred the run-up in debt.

It also appears that households are taking their money out of housing. One measure of home equity extraction is the difference between the net increase in mortgage borrowing and net residential investment. The intuition is that this value would be zero on balance, since the only reason for an increase in net mortgage debt is to purchase new housing or make improvements to existing houses. And indeed, net mortgage borrowing less residential investment – measured as a percent of income in Figure 5 – fluctuated around zero until 2000, at which point it rose sharply. This suggests that households are extracting equity from their homes.

Housing Prices and Consumption

If the housing boom caused more people to increase their borrowing, the question remains whether they invested those proceeds or spent them on consumption. A number of studies suggest a strong positive relationship between swings in the value of houses and aggregate consumption. The calculations generally involve the estimation of the

marginal propensity to consume housing wealth – the increase in consumption that occurs with an increase in house values. Skinner (1996), Davis and Polumbo (2001), and Belsky and Prakken (2004) find that a dollar increase in housing wealth increases consumption by about six cents (a marginal propensity to consume of 6 percent). Case, Shiller, and Quigley (2005), who analyze a panel of 14 countries and a panel of U.S. states, find the effect of housing wealth upon household consumption to be between four to nine cents on the dollar. Carroll, Otsuka, and Slacalek (2006) suggest the effect may be as large as ten cents on the dollar. The pattern appears to be the same in the United Kingdom. For example, Muellbauer and Murphy (1997) conclude that house price increases and financial innovation stimulated a consumption boom in the UK in the late 1980s.

A few studies use micro data to investigate the relationship between housing and consumption. Engelhardt (1996) uses the Panel Study of Income Dynamics and finds that the marginal propensity to consume housing wealth is about 3 percent. Campbell and Cocco (2007), analyzing the UK family expenditure survey, find a large response of household consumption to house prices for older home owners, but none for young renters. This is the pattern one would expect if households recognized the implicit liability for future rents on the other side of their balance sheets. The authors estimate a marginal propensity to consume housing wealth of about 8 percent at the median.

Thus, the existing macro and micro evidence suggests that the housing boom caused people to increase their borrowing, to extract equity from their homes, and to raise their level of consumption. The following section explores these issues in more detail for the United States during 2001 and 2004.

III. Rising House Prices and the Extraction of Housing Equity

The following section uses the Federal Reserve's 2004 SCF to identify the number of households who extracted money from their primary residence during the first part of the housing boom (2001-2004), the factors that determined which households extracted money, and a sense of how that money was used.[2] The SCF is a triennial, nationally

[2] The *Survey of Consumer Finances* also includes information on other residential real estate such as land contracts, time shares, and vacations homes. These properties are excluded from the analysis because the SCF does not include sufficient data to separate money extracted from refinancing – the survey only asks about the total amount "borrowed or refinanced." Only 12 percent of homeowners own more than one

representative survey that collects asset, liability, income and demographic data from about 5,000 households.

The SCF includes questions about household mortgage activity. It asks households about the value of the primary residence, and whether the household took out a first mortgage, a second mortgage, a home equity loan, or a home equity line of credit. Table 3 shows the number and value of outstanding mortgages on primary residences in 2004. For each of these loans, the questionnaire asks the date in which the loan was obtained. It further asks whether the loan was used to refinance a previous mortgage or to borrow additional money. Figure 6 shows the mortgage activity on the primary residence between 2001 and 2004 for all homeowners (See Appendix Table 1 for more details). About 30 percent do not have an outstanding mortgage. Another 30 percent of homeowners have a mortgage but did not report any refinancing or additional borrowing. About 40 percent of homeowners had mortgage activity – 15 percent reported some form of refinancing and 25 percent reported that they extracted home equity.

The use of mortgages to extract home equity varied across age groups (see Figure 7). For households younger than 62, the pattern is consistent with the concept of the present discounted value of future rents presented above – older households gain more from house price increases and should be expected to access their home equity more aggressively than younger households. Households older than 62, however, report low levels of additional borrowing. These low levels of additional borrowing debt reflect the fact that most these older households have no outstanding mortgages and might be reluctant to be exposed to additional debt.

The Probability of Extracting Home Equity

A probit regression is used to analyze why about 30 percent of homeowners under age 62 extracted equity from their primary residence during the period 2001-2004.[3] Age 62 was selected as an upper bound because homeowners older than 62 have the ability to

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residence, and the median income of those with a secondary home is nearly twice of that of one-house homeowners. This group may react quite differently than single homeowners.

[3] See Appendix Table 1 for the statistics on homeowners who extracted equity from their primary residence during 2001-2004.

purchase a reverse mortgage.[4] Also, the focus of the analysis is to determine whether those approaching retirement were helped or hurt by the housing boom and bust. The dependent variable takes the value of 1 if a household reports that it borrowed more money than that required to refinance its existing mortgage during 2001-2004. Households taking on a mortgage in the same year they purchased a house – new home purchases – and households with mortgages obtained or refinanced before 2001 were coded as a zero. The regression results measure the effects of different explanatory variables on the probability of extracting home equity.

Real house price appreciation to income. Households that experience large gains in their house value are expected to take cash out to realize some of these gains. The appreciation of the house is measured as the difference between the current value of the house and the original purchase price (in 2004 dollars), scaled by current household income. The expected sign is positive.

Present discounted value of future rents to income. This variable reflects the fact that the household has a liability on the other side of its balance sheet. The present discounted value of future rents equals:

$$\text{PDV of rents} = \left(1 - \left(\frac{1+g}{1+r}\right)^{T}\right) * Home\,Value$$

where g is the growth rate of house prices (1 percent), r is the discount rate (6 percent) and T is the remaining life expectancy (we use a life expectancy of 85). The first two assumptions (growth rate and discount prices) are set to generate an imputed rent equal to about 5 percent of the gross value of the house.[5] If these liabilities are large, the household gains little in a housing boom and is unlikely to extract equity. Thus, the coefficient of this variable is expected to be negative.

[4] The regression results do not change in their significance or magnitude by including homeowners older than 62.
[5] See Munnell and Soto (2005) for more details.

Presence of children in the household. Homeowners with children might be more likely to increase their borrowing from mortgages to pay education and other expenses. The expected sign of this variable is positive.

Risk aversion. Household have different levels of tolerance towards debt – which reflects the risk preferences of the household. The measure of preferences for risk comes from responses to the following SCF question:

"Which of the statements… comes closest to the amount of financial risk that you and your (husband/wife/partner) are willing to take when you save or make investments?

1. Take substantial financial risks expecting to earn substantial returns [4 percent of homeowners under age 62];
2. Take above average financial risks expecting to earn above average returns [21 percent];
3. Take average financial risks expecting to earn average [45 percent];
4. Not willing to take any financial risks [30 percent]."

Households who selected option 4 are characterized as being risk averse. Since risk averse households would be less likely to take on debt and extract equity, the expected sign of the coefficient is negative.

Credit constraints. All else equal, households with limited access to credit might benefit from tapping their home equity to finance current consumption. The SCF asks respondents whether they have been turned down for a credit application in the 5 years prior to the survey.[6] This indicator for limits to credit is included in the regression. The expected sign is positive.

Long planning horizon. Households with a long planning horizon would be more likely to rebalance their portfolio by extracting home equity. A household is characterized as having a long planning horizon if it answers 4 or 5 to the following SCF question:

[6] Cox and Japelli (1993) use the 1983 SCF and find that this variable is a good indicator of credit constraints – the predicted (desired) debt of credit constrained households is 75 percent higher than their actual debt.

"In planning (your/your family's) saving and spending, which of the time periods …is most important…?

1. Next few months [15 percent of homeowners under age 62];
2. Next year [11 percent];
3. Next few years [25 percent];
4. Next 5-10 years [31 percent];
5. Longer than 10 years [18 percent]."

   The expected coefficient is positive.

Age. This variable is included to clarify that the present discounted value of rents reflects something more than age – that is, young people have high presented discounted values relative to income and therefore are less likely to extract equity. Holding all else constant, it is unclear what effect age would have on the probability of extracting home equity. Prudent older households approaching retirement may preserve their housing equity as a reserve against contingencies in retirement and therefore be less likely to extract equity. Or older households with most of their responsibilities out of the way may take out equity to invest in order to enhance their retirement security.

Education. Education and income are closely correlated. Households with greater education and therefore presumably higher income may have less need to tap their home equity. Therefore, the expected effect of having a college degree is negative.

Race. The ability to extract home equity depends on access to banking services. If this access varies by race, then race will affect borrowing. The variable included is set equal to one if the household head is nonwhite. Based on previous literature, the expected sign of the coefficient is negative.[7]

The results from the regression are presented in Figure 8 (see Appendix Table 2 for detailed statistics). All of the coefficients have the expected signs and are statistically significant. The magnitudes vary significantly, however. For the first two variables, a

[7] See Munnell et al. (1996).

useful way to interpret the coefficients is in terms of a standard deviation change. A one standard deviation change in the ratio of house gains to income increases the probability of extracting home equity by 8.8 percentage points. A comparable change in the ratio of the present discounted value of rents to income reduces the probability by 1.2 percentage points. Being risk averse substantially lowers the probability of extracting equity, while being credit constrained increases it by almost the same magnitude. The effect of these two variables plus and minus 7 to 8 percentage points are quite large give the only 28 percent of all households under age 62 extracted equity. Planners appear more likely to extract equity, while college educated and presumably higher income households are less likely. Age has a small positive effect. Being nonwhite markedly reduces the likelihood of extracting equity.

The message from these results is that homeowners who extracted equity from their primary residences during the period 2001-2004 did so for predictable reasons. These households appeared to recognize the liability associated with future rents, but the PDV of future rents served as only a modest deterrent.

Probability of Consuming Extracted Equity

For assessing the impact of the housing boom on retirement, it is not enough to know that households extracted home equity. The key question is: What did they do with the money? Did they invest it or consume it?

The SCF asks detailed questions about what households did with the money they extracted from their primary residence. So the analysis focuses on that component. These responses were classified into the categories used by Canner et al (2002) when reporting on a Survey Research Center Survey of refinancings in 2001 and 2002. The results are shown in Table 4. In the 2004 SCF, homeowners claim that they spent 10.5 percent of the total on consumption, 23.5 percent to pay off past debts, 32.2 percent for home improvement and 33.8 percent for investment in the stock market, real estate, or business. The pattern is not dramatically different with earlier findings, although SCF respondents appear to have invested somewhat more of the proceeds than did participants in the earlier survey.

The question arises as to how to classify repayment of non-mortgage debt, which consists largely of credit card loans. Greenspan and Kennedy (2007) treat this debt as bridge financing for previous personal consumption expenditures and therefore classify debt repayment as consumption. The notion is that households recognize the increase in their home equity and increase consumption in response. Initially, households use credit card debt, but then cover this borrowing with extracted home equity.[8] Following this categorization, Table 5 shows total extraction and consumption by age. The most money extracted and the highest consumption rate is found among those in their fifties and early 60s.

Using the variables described above, it is possible to estimate a probit regression to determine what factors affect the probability that a household would consume its extracted funds. The coefficients of most variables remain statistically significant (See Figure 9, full results are presented in Appendix Table 3). The exceptions are the presence of children, long planning horizon, and race. The variable with the greatest impact is being credit constrained. These households apparently need liquidity to cover consumption expenses and have no where else to go.

The other variable with a large impact is "risk averse." At first it may seem strange that risk averse households have a great probability of consuming their equity extractions. But the story appears to be that risk seekers tap their home equity to invest in the market or elsewhere and therefore are disinclined to spend the proceeds on consumption. Indeed, an alternative formulation of the risk variable was the percent of financial assets in equities, and the coefficient of this variable was statistically significant and negative. In other words, those who do not tap their home equity to invest in the stock market have a greater probability of consuming their extractions.

Whereas the coefficients of the house-related variables appear small, their impact is significant when considered in terms of a one standard deviation change. A one standard deviation increase in the ratio of house gains to income increases the probability of consuming the extraction by 14 percentage points. A one standard deviation increase in the ratio of the present discounted value of future rents to income reduces the

[8] Reviewers of this article suggested to treat debt repayments as saving. While this alternative assumption is plausible, the data show that the increase in mortgage debt was not offset by a reduction of other debt (see Figure 3), suggesting no surge in the repayment of credit card debt.

probability of consuming the extractions by 3.8 percentage points. The result suggests that future rents do limit households' propensity to consume, but again the impact is modest.

The final issue is what determines the amount consumed. Figure 10 shows consumption amounts for those who consumed some or all of their home equity extraction. The median amount consumed was $20,500 and the average was $28,000. The question is what explains the variation in the amount consumed.

To answer that question, the dollar amounts for the households that consumed some or all of their extracted equity were entered as the dependent variable and the explanatory variables included the dollar amount of housing gains, the present discounted value of future rents, and the household's income. The amounts are entered in multiples of $10,000. The equation also included the variables from the earlier regressions – whether the household included children under 18, was risk averse, was credit constrained, had a long planning horizon, as well as the age education and race of the head.

The results are shown in Figure 11 (see Appendix Table 3 for detailed statistics). Most of the variables have a statistically significant coefficient and enter with the expected sign. Even after controlling for income, an indication of the household's consumption needs, both housing variables enter with the expected signs. The dollar amount of consumption is positively related to the size of the gain and negatively related to the present discounted value of expected rents. Specifically, a $10,000 increase in housing gains would increase the amount consumed by $4,210, while a $10,000 increase in the present discounted value of rents would reduce consumption by $4,610. Being credit constrained increases consumption by $47,700, but having a long planning horizon reduces it by a roughly equal amount.

Taken as a whole the descriptive information from the 2004 SCF and the three regressions suggest the following. 1) Nearly thirty percent of all homeowners age 20-64 extracted equity from their primary residences during the period 2001-2004 (See Appendix Table 1). 2) These households behaved in a predictable fashion. They were more likely to extract equity if they enjoyed large gains on their house, had children under 18 at home, and were credit constrained. They were less likely to do so, if they

were risk averse (not comfortable with financial markets), college educated, or nonwhite. The present discounted value of future rents also had a negative effect on the probability of extracting equity but the magnitude was modest. 3) About half of those who extracted equity used some or all of the proceeds for consumption (See Appendix Table 1). Again, homeowners behaved in a predictable fashion. If they had large gains, were risk averse, or credit constrained, they were more likely to consume. And the present discounted value of future rents acted as a modest deterrent. 4) The dollar amount consumed was positively related to gains, income, risk aversion and being credit constrained. Having a long planning horizon and the present discounted value of future rents appeared to put a substantial break on the dollar amount of spending for those who consumed some or part of their extracted equity.

But the picture that emerges from the 2004 SCF is only a partial one because the survey focuses on only primary residences, because the housing boom continued for more than two years after the 2004 survey was fielded, and because the housing bubble eventually burst.

IV. Developments Since 2004

During the period 2001-2004, the aggregate value of primary residences increased by $4,164 billion.[9] Households extracted $783 billion, out of which $267 billion was used to finance consumption and $516 billion were divided between home improvements and other investments. These numbers imply an aggregate marginal propensity to consume (MPC) from housing wealth of about 6.4 percent – of each additional dollar of housing wealth, households consume 6.4 cents. Similar to Campbell and Cocco (2007), the results suggest that older households are generally more likely to consume from increases in housing equity (see Table 6) .[10]

[9] Between the third quarter of 2001 and the third quarter of 2004, the Case-Shiller Index reports a real increase of 28.7 percent. The real increase in primary housing wealth from the SCF 2001 to the SCF 2004, controlling for the increase in homeownership, is 27.8 percent.

[10] This estimate of the MPC is consistent to previous studies. Belsky and Prakken (2004) use aggregate data from the National Income and Product Accounts and the Flow of Funds and estimate the MPC to be about 5.5 percent; Campbell and Cocco (2007) use micro-data from households in the United Kingdom and estimates a MPC of about 8 percent; Engelhardt (1996) uses the Panel Study of Income Dynamics and finds that the MPC is about 3 percent; Case, Quigley and Shiller (2001) use U.S. state-level data and estimate the

But the increases in house prices did not stop in 2004. The Case-Shiller index of house values continued to rise for another two years after the 2004 SCF – by about 12 percent from the third quarter of 2004 to the third quarter of 2006. If behavior was roughly similar, house values would have increased by another $2,250 billion and homeowners might have extracted and additional $400 billion and consumed about $150 billion. Thus, the housing boom from 2001-2006 resulted in an increase of housing wealth of about $6.5 trillion. Households responded to this increase by extracting about $1,200 billion of their home equities, out of which more than $400 billion were used to finance consumption. Table 7 extends the results from Table 6 from 2004 to the third quarter of 2006 – the peak of the housing market.

Since the focus of this paper is the impact of the housing bubble on retirement security, it is worth considering those aged 50-62 in 2004. For the entire housing boom (2001-2006), these homeowners extracted $380 billion from their primary residences – $231 equally divided between home improvements and investments, and $149 consumed directly (see Table 7). That means that boomer households will enter retirement with $380 billion more of debt than they would have had otherwise.

The question is whether this increase in debt affects retirement security. To answer this question, we examine the balance sheet of a typical household approaching retirement.[11] In 2001, these households had a net worth of about $48,900 – about $232,900 in assets and about $184,000 in liabilities, including imputed rent (see Figure 12, detailed tables are provided in Appendix Table 5).[12]

The evolution of net worth over time depends on how these households respond to changes in house prices. If the typical household nearing retirement did not respond to the increase in house prices, net worth rises to about $56,900 in 2004 and reaches about $56,800 in 2008.[13] This increase in net worth between 2001 and 2008 is mostly due to the growth of house prices. If, however, the typical household extracted and consumed as shown in Table 6 – households aged 50-62 are assumed to extract 16.1 cents and

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MPC of housing to be between 4 and 9 percent; Skinner (1996) uses aggregate U.S. data and estimates the MPC to be around 6 percent.

[11] The "typical household nearing retirement" refers to the mean of the middle 10 percent of the sample of households headed by an individuals aged 50-62 in 2004.

[12] See Appendix Table 5 for detailed assets and liabilities.

[13] Housing peaked in the third quarter of 2006 and financial assets peaked in the third quarter of 2007; both have come down significantly

consume 6.3 cents out of every dollar increase in house prices –, net worth would have declined by $6,900 or 14 percent.[14] For these households, the gains in housing equity were nearly offset by the additional consumption.

Averages may not tell the whole story, however, since only 30 percent of homeowners extracted home equity between 2001 and 2004.[15] If the same households continued the process of extracting and consuming for another two years, they would have a net worth of about $35,000 in 2008, 36 percent less than the net worth of the household that did not extract or consume home equity. That is, after the housing bubble, households who extracted have a net worth considerably lower than they did in 2001.

V. Conclusion

Households responded to the extraordinary growth of house prices by increasing their debt exposure. In the aggregate, households extracted about 19 cents and consumed 6 cents out of every dollar of increased home values. In dollar terms, the overall result of the housing boom was an increase of mortgage debt of about $1.2 trillion during 2001-2008 and increased consumption of $410 billion. Housing booms are good things for consumers because they can extract equity without hurting their balance sheet. But when housing booms are followed by housing busts, many households will have borrowed against gains that they may never realize. Hence, housing "bubbles" can damage balance sheets.

Households who extracted equity behaved in a predictable fashion. They were more likely to extract equity if they enjoyed large gains on their house, had children under 18 at home, and were credit constrained. They were less likely to do so if they were risk averse (not comfortable with financial markets), college educated, or nonwhite. The present discounted value of future rents also had a negative effect on the probability

[14] The propensities are applied to the growth of housing prices between 2001 and the third quarter of 2006, when housing prices peaked.

[15] The intuition is that the marginal propensity is calculated as the ratio of the amount extracted or consumed to the change in the value of housing. The calculation of the propensity to extract for households who extracted keeps the same numerator – amount extracted – but reduces the denominator – change in the value of housing. For these households, the propensities are much higher: a propensity to extract of 48 percent and a propensity to consume of 19 percent.

of extracting equity but the magnitude was modest. About a third of the extracted equity was used for consumption.

The increase in mortgage debt exposure has affected the retirement preparedness of households. For the typical household aged 50-62 in 2004, the extraction of home equity during the housing boom resulted in a 14 percent decline in net worth – accounting for the present discounted value of future rents – between 2001 and 2008. If the extraction of home equity continued to be concentrated among the 30 percent of older households who extracted equity during 2001-2004, the decline in net worth would be much larger for the affected group – a loss of about 35 percent in net worth. For older households, the housing boom provided some liquidity. But a significant proportion will now enter retirement with a fragile balance sheet in a time of depressed home prices and poor financial market returns.

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Table 1. *Balance Sheet of an Infinite-lived Household*

Assets House	*Liabilities* PDV of future liabilities
Original	
$300,000	$300,000
After a doubling of house prices	
$600,000	$600,000

Source: Authors' calculations.

Table 2. *Balance Sheet of Younger and Older Households*

Household Head Age 35

Assets House	*Liabilities* PDV of future liabilities	*Net worth*
Original		
$300,000	$290,000	$10,000
After a doubling of house prices		
$600,000	$580,000	$20,000

Household Head Age 55

Assets House	*Liabilities* PDV of future liabilities	*Net worth*
Original		
$300,000	$230,000	$70,000
After a doubling of house prices		
$600,000	$460,000	$140,000

Household Head Age 75

Assets House	*Liabilities* PDV of future liabilities	*Net worth*
Original		
$300,000	$90,000	$210,000
After a doubling of house prices		
$600,000	$180,000	$420,000

Source: Authors' calculations.

Table 3. *Mortgage Loans on Primary Residences in the 2004 Survey of Consumer Finances*

	Number of loans (thousands)	Aggregate value (billions)
First mortgage	50,409	$6,137
Second mortgage	2,973	108
Home equity loan	1,892	94
Home equity line of credit	9,608	382
Total	64,882	6,651

Source: Authors' calculations from the 2004 Survey of Consumer Finances.

Table 4. *Use of Home Equity as a Percent of Total Extracted, 2004 and 2001/20002*

Use	2004 SCF	SRC Survey of 2001 and Early 2002 Refinancings
Consumer expenditures	10.5%	16.0%
Repayment of other debts, taxes	23.5	28.0
Home improvement	32.2	35.0
Stock market or other financial investment, real estate or business	33.8	21.0

Source: Authors' estimates from the 2004 Survey of Consumer Finances and Canner et al. (2002).

Table 5. *Home Equity Extracted from Primary Residences and Consumption out of Extracted Home Equity, 2001-2004, in 2004 Dollars*

Age in 2004	Home equity extracted (billions)	Consumption out of extracted home equity (billions)	Consumption as a percent of extracted equity
<30	$18	$6	33
30-39	109	32	29
40-49	242	75	31
50-62	264	103	39
63-79	140	49	35
80+	11	1	9
All	783	267	34

Source: Authors' estimates based on the 2004 Survey of Consumer Finances.

Table 6. *Marginal Propensities to Extract and Consume from Increases in Housing Wealth, by Age Group, 2001-2004*

Age in 2004	Value of home in 2004 (billions)	Value of homes in 2001 (billions)	Gains (billions)	Amount extracted from home equity (billions)	Amount consumed from home equity (billions)	Marginal propensity to extract housing wealth	Marginal propensity to consume housing wealth
<30	689	377	312	18	6	5.9%	1.9%
30-49	2,644	1,927	717	109	32	15.2%	4.5%
40-49	4,663	3,601	1,062	242	75	22.8%	7.1%
50-62	6,158	4,519	1,639	264	103	16.1%	6.3%
63-79	3,708	3,287	420	140	49	33.2%	11.7%
80+	1,250	886	364	11	1	3.0%	0.3%
Total	19,112	14,948	4,164	783	267	18.8%	6.4%

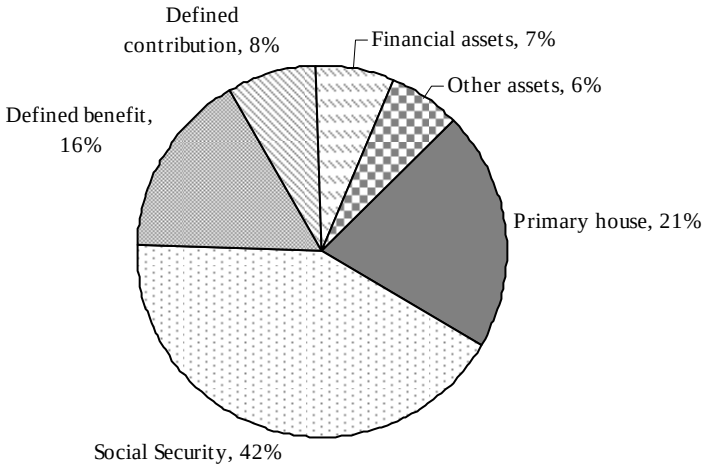
Source: Authors' estimates based on the 2001-2004 Survey of Consumer Finances.

Table 7. *Amount Extracted and Consumed from Increases in Housing Wealth, by Age Group, 2001-2006*

Age in 2004	Value of home in 2006 (billions)	Value of homes in 2001 (billions)	Gains (billions)	Amount extracted from home equity (billions)	Amount consumed from home equity (billions)
<30	769	377	392	23	8
30-49	2,954	1,927	1,027	156	46
40-49	5,210	3,601	1,608	366	114
50-62	6,879	4,519	2,360	380	149
63-79	4,142	3,287	855	284	100
80+	1,396	886	510	15	1
Total	21,350	14,948	6,402	1,205	410

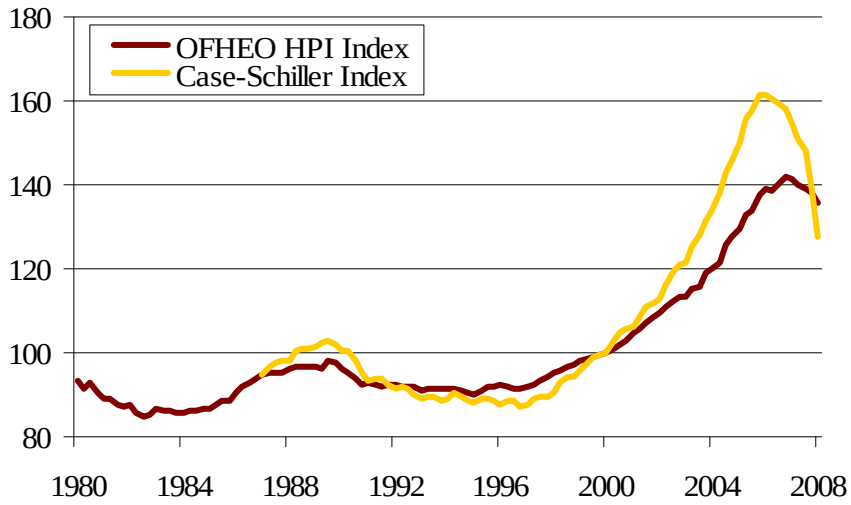
Source: Authors' estimates based on S&P/Case-Shiller U.S. National Home Price Values; BLS CPI-All Urban Consumers; and 2001-2004 Survey of Consumer Finances.

Figure 1. *Wealth Holdings of a Typical Household Aged 55-64, 2004 Survey of Consumer Finances*



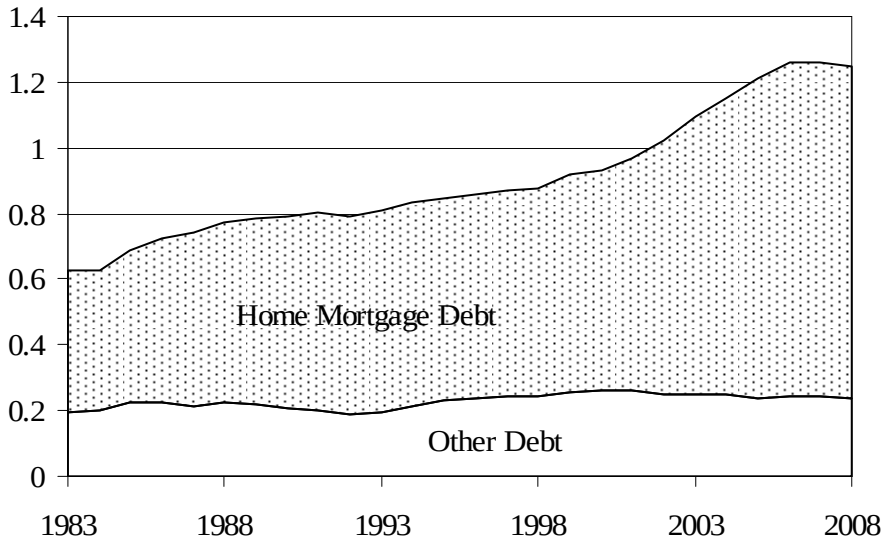
Note: The "typical household aged 55-64" refers to the mean of the middle 10 percent of the sample of households headed by an individual aged 55-64.
Source: Munnell and Sundén (2006).

Figure 2. *S&P/Case-Shiller and OFHEO Mortgage House Price Indexes, 1980-2008 (2000 Dollars)*



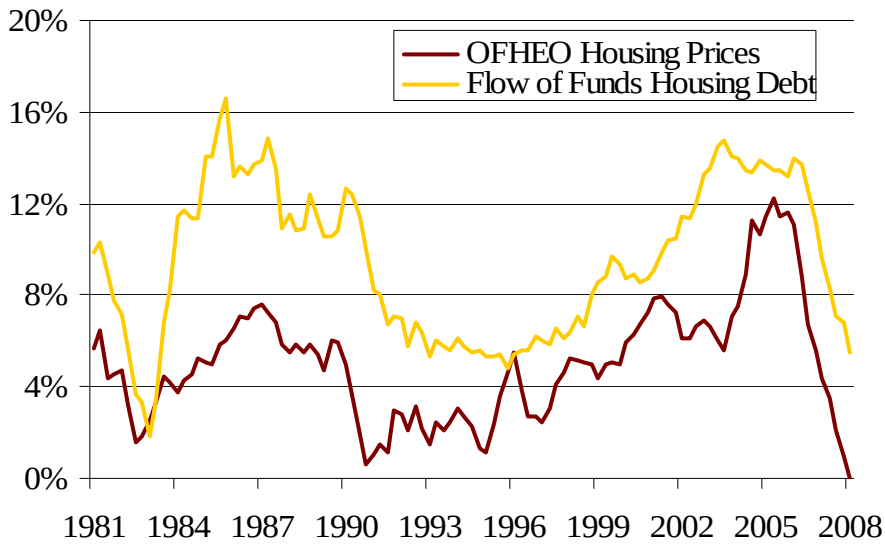
Note: Housing values are indexed at nominal house values of 2000Q1=100.
Source: OFHEO Conventional Mortgage House Price Index (1980-2008); S&P/Case-Shiller U.S. National Home Price Values (1980-2008); and U.S. Department of Labor, Consumer Price Index (CPI)-All Urban Consumers (1980-2008).

Figure 3. *Ratio of Debt to Income for All Households 1983-2008*



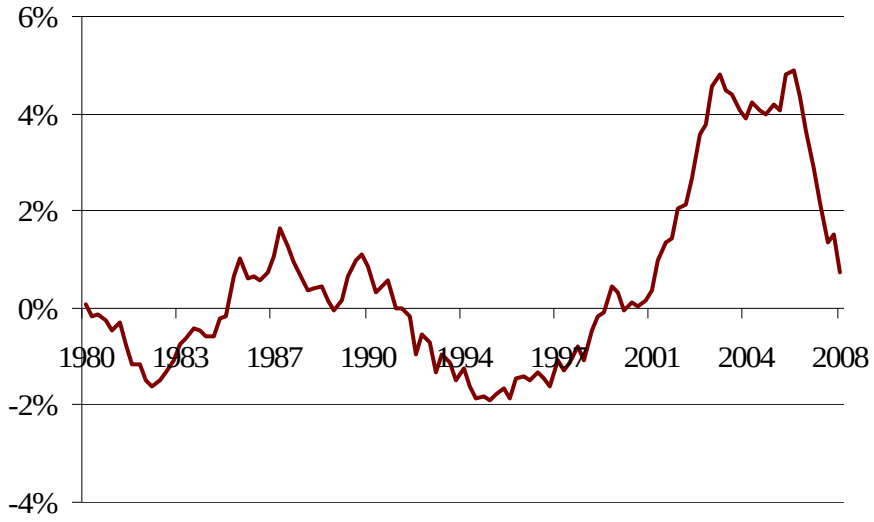
Sources: U.S. Board of Governors of the Federal Reserve System (2008).

Figure 4. *Percent Change in Home Mortgage Debt and House Prices, 1981-2008*



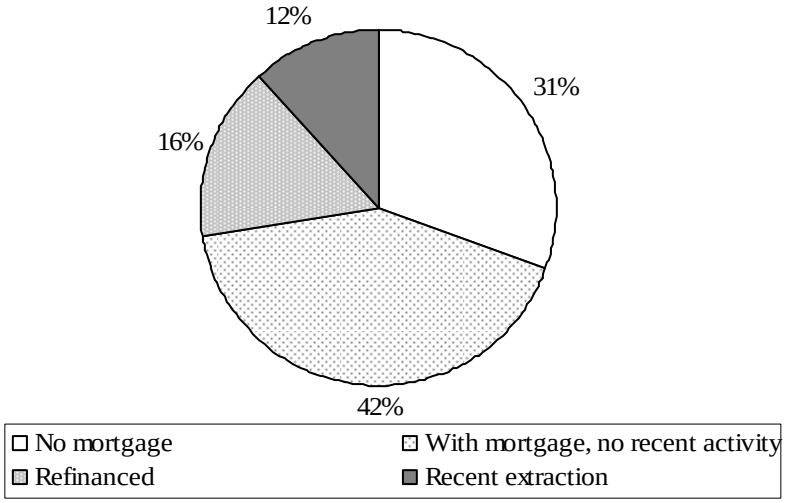
Sources: U.S. Board of Governors of the Federal Reserve System (2008) and OFHEO Conventional Mortgage House Price Index.

Figure 5. *Net Mortgage Borrowing Less Residential Investment as a Percentage of Disposable Personal Income, 1980-2008*



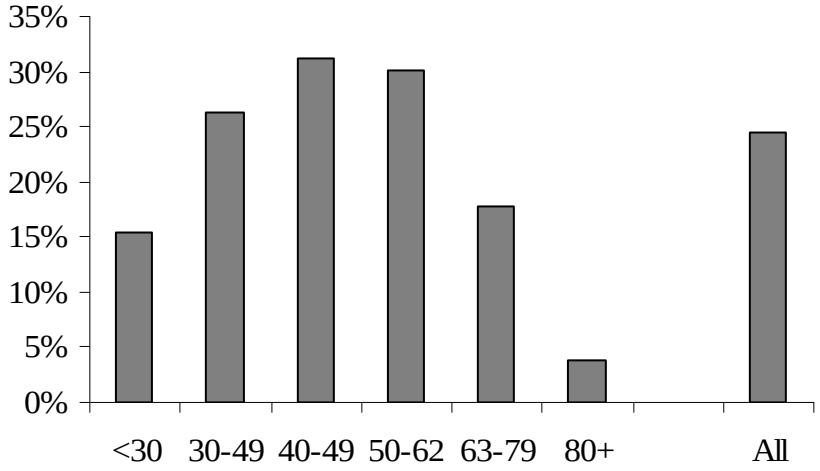
Source: U.S. Board of Governors of the Federal Reserve System (2008).

Figure 6. *Percent of Homeowners with Mortgage Activity on Their Primary Residence, All Households, 2001-2004*



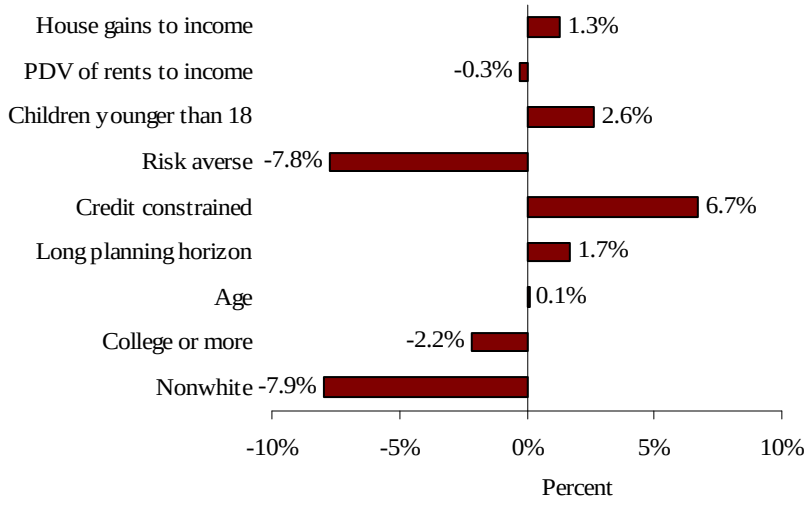
Source: Authors' calculations from the U.S. Board of Governors of the Federal Reserve System, 2004 *Survey of Consumer Finances* (SCF).

Figure 7. *Percent of Homeowners Extracting Equity from Primary Residence, Between 2001 and 2004, by Age Group*



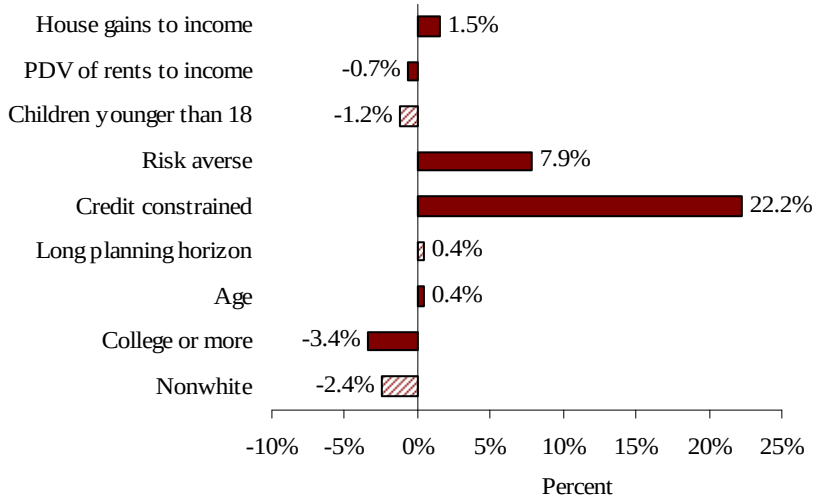
Source: Authors' calculations from the 2004 SCF.

Figure 8. *Effect on Likelihood of Having Extracted Home Equity, Homeowners under Age 62, 2001-2004*



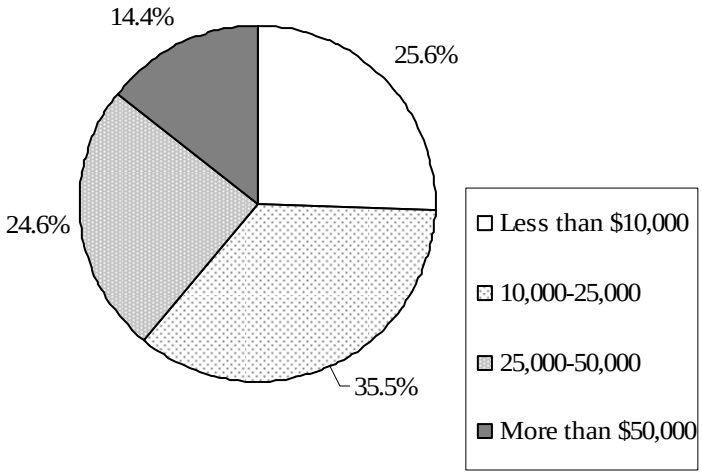
Source: Authors' calculations from the 2004 SCF.

Figure 9. *Effect on Likelihood of Consuming Equity Extracted from Primary Residence, Homeowners under Age 62 Who Extracted Equity, 2001-2004*



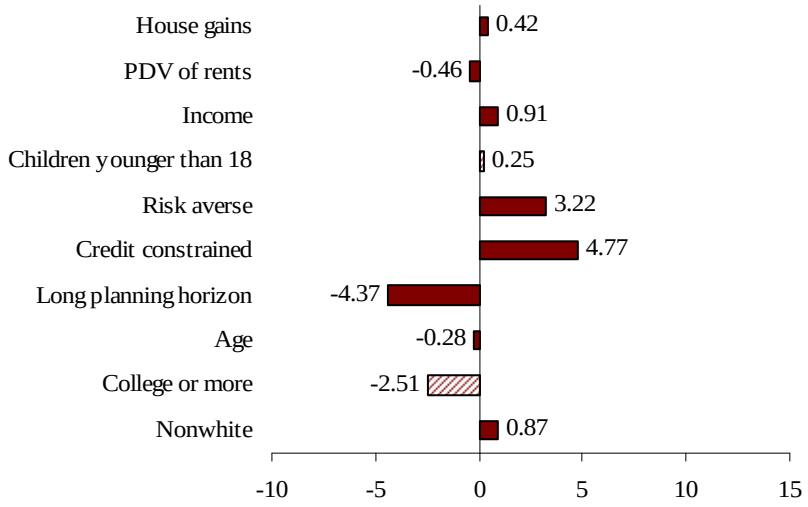
Source: Authors' calculations from the 2004 SCF.

Figure 10. *Amount Consumed from Home Equity, Homeowners under Age 62 Who Consumed Equity from their Primary Residences, 2001-2004*



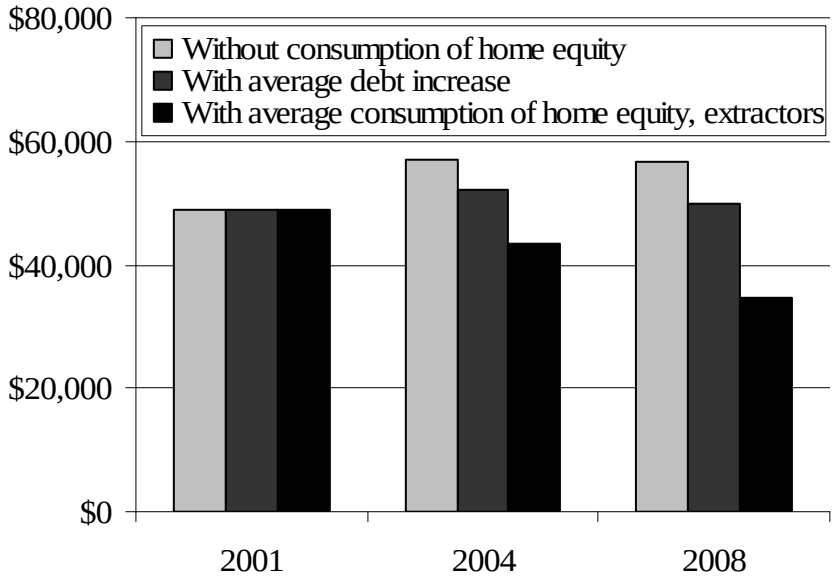
Source: Authors' calculations from the 2004 SCF.

Figure 11. *Factors that Affect the Amount Consumed, Homeowners Aged 20-62 Who Consumed Equity from their Primary Residences, 2001-2004*



Source: Authors' calculations from the 2004 SCF.

Figure 12. *Net Worth of a Typical Household Nearing Retirement, With and Without Consumption of Home Equity Dues to Increase in Home Prices, 2001-2008*



Note: The "typical household nearing retirement" refers to the mean of the middle 10 percent of the sample of households headed by an individuals aged 50-62 in 2004.
Sources: Authors' estimates based on the 2001-2004 *Survey of Consumer Finances*, U.S. Board of Governors of the Federal Reserve System (2008), and the Case-Shiller Home Index.

Appendix Table 1. *Number of Households with Mortgage Activity, by Age Group, 2001-2004.*

	Homeowners (thousands)	Homeowners with mortgages (thousands)	Homeowners with recent refinancing or borrowing activity (thousands)	Homeowners who extracted money from their home equity (2001-2004) (thousands)	Homeowners who financed consumption with their home equity (2001-2004) (thousands)
<30	4,526	4,055	1,126	699	283
30-39	12,474	11,607	6,019	3,273	1,363
40-49	18,049	16,060	9,460	5,637	2,880
50-62	20,781	14,811	9,409	6,261	3,185
63-79	16,267	6,558	4,365	2,901	1,533
80+	5,317	597	427	202	45
All	77,414	53,689	30,805	18,973	9,288

Source: Authors' calculations from the 2004 SCF.

Appendix Table 2. *Effect on Likelihood of Extracting Equity from Primary Residence 2001-2004, Homeowners under age 62*

Age group	Coefficient	z	Mean	Median	Std. deviation
House gains to income	0.013	7.020	3.284	2.191	6.789
PDV of rents to income	-0.003	-3.140	1.026	0.433	4.117
Children younger than 18	0.026	2.900	0.487	0.000	0.500
Risk averse	-0.078	-7.380	0.300	0.000	0.458
Credit constrained	0.067	5.960	0.253	0.000	0.435
Long planning horizon	0.017	1.990	0.493	0.000	0.500
Age	0.001	1.910	44.929	46.000	10.142
College or more	-0.022	-2.460	0.404	0.000	0.491
Nonwhite	-0.079	-7.040	0.217	0.000	0.412
R-square					0.0178
Observations					11,933
Dependent variable: Extracted money from home equity			0.284	0.000	0.451

Source: Authors' calculations from the 2004 SCF.

Appendix Table 3. *Effect on Likelihood of Consuming Equity Extracted from Primary Residence, Homeowners Aged 62 and Younger Who Extracted Equity, 2001-2004*

Age group	Coefficient	z	Mean	Median	Std. deviation
House gains to income	0.015	3.020	3.452	2.272	9.309
PDV of rents to income	-0.007	-2.670	1.407	0.640	5.460
Children younger than 18	-0.012	-0.570	0.533	1.000	0.499
Risk averse	0.079	3.110	0.206	0.000	0.405
Credit constrained	0.222	9.780	0.243	0.000	0.429
Long planning horizon	0.004	0.220	0.553	1.000	0.497
Age	0.004	3.670	46.074	47.000	8.977
College or more	-0.034	-1.810	0.440	0.000	0.496
Nonwhite	-0.024	-0.830	0.143	0.000	0.350
R-square					0.0351
Observations					3,181
Dependent variable: Consumed from extracted home equity			0.484	0.000	0.500

Source: Authors' calculations from the 2004 SCF.

Appendix Table 4. *Factors that Affect the Amount Consumed 2001-2004, Homeowners Aged 20-62 Who Consumed Equity from their Primary Residences*

Age group	Coefficient	z	Mean	Median	Std. deviation
House gains	0.421	14.960	10.189	4.871	21.869
PDV of rents	-0.461	-13.750	23.533	16.738	22.879
Income	0.915	78.020	9.330	7.599	9.113
Children younger than 18	0.248	0.210	0.523	1.000	0.500
Risk averse	3.224	2.400	0.249	0.000	0.432
Credit constrained	4.773	3.970	0.330	0.000	0.470
Long planning horizon	-4.369	-4.030	0.547	1.000	0.498
Age	-0.284	-4.160	46.790	48.000	8.674
College or more	-2.514	-2.130	0.402	0.000	0.491
Nonwhite	0.874	0.540	0.146	0.000	0.353
Constant	12.878	3.400			
R-square					0.9526
Observation					1,447
Dependent variable: Amount consumed			2.809	2.053	38.750

Source: Authors' calculations from the 2004 SCF.

Appendix Table 5. *Balance Sheet of a Typical Household Nearing Retirement, With and Without Debt Increase Due to Increase in Home Prices, 2001-2008*

Baseline - No Change in Mortage Debt				**Case 1 - Change in Debt Reflects Aggregate Marginal Propensities**			
2001 - SCF - Mean for the middle 10 percent				2001 - SCF - Mean for the middle 10 percent			
Assets		Liabilities		Assets		Liabilities	
Real estate	137,624	Mortgage	67,903	Real estate	137,624	Mortgage	67,903
Financial assets	65,998	Other debt	9,994	Financial assets	65,998	Other debt	9,994
Other assets	29,257	PDV of rents	106,065	Other assets	29,257	PDV of rents	106,065
Total assets	232,879	Total debt	183,962	Total assets	232,879	Total debt	183,962
Net worth	154,982			Net worth	154,982		
Net worth (net of imputed rent)	**48,917**			Net worth (net of imputed rent)	**48,917**		
2004 - SCF - Mean for the middle 10 percent				2004 - SCF - Mean for the middle 10 percent			
Assets		Liabilities		Assets		Liabilities	
Real estate	182,708	Mortgage	67,903	Real estate	185,031	Mortgage	75,536
Financial assets	57,423	Other debt	12,613	Financial assets	59,745	Other debt	12,613
Other assets	34,900	PDV of rents	137,634	Other assets	34,900	PDV of rents	139,384
Total assets	275,031	Total debt	218,151	Total assets	279,677	Total debt	227,533
Net worth	194,515			Net worth	191,528		
Net worth (net of imputed rent)	**56,880**			Net worth (net of imputed rent)	**52,144**		
2008 - SCF - Mean for the middle 10 percent				2008 - SCF - Mean for the middle 10 percent			
Assets		Liabilities		Assets		Liabilities	
Real estate	160,998	Mortgage	67,903	Real estate	164,382	Mortgage	79,024
Financial assets	59,916	Other debt	13,323	Financial assets	63,301	Other debt	13,323
Other assets	38,348	PDV of rents	121,280	Other assets	38,348	PDV of rents	123,830
Total assets	259,262	Total debt	202,506	Total assets	266,031	Total debt	216,177
Net worth	178,036			Net worth	173,684		
Net worth (net of imputed rent)	**56,756**			Net worth (net of imputed rent)	**49,855**		

Note: The "typical household nearing retirement" refers to the mean of the middle 10 percent of the sample of households headed by an individuals aged 50-62 in 2004.
Source: Authors' estimates based on the 2001-2004 *Survey of Consumer Finances*, U.S. Board of Governors of the Federal Reserve System (2007), and the S&P/Case-Shiller U.S. National Home Price Values.

Appendix Table 5 – continued. *Balance Sheet of a Typical Household Nearing Retirement, With and Without Debt Increase Due to Increase in Home Prices, 2001-2008*

Case 2 - Change in Debt Reflects Marginal Propensities for Households who Extracted Money from their Home Equity

2001 - SCF - Mean for the middle 10 percent

Assets		Liabilities	
Real estate	137,624	Mortgage	67,903
Financial assets	65,998	Other debt	9,994
Other assets	29,257	PDV of rents	106,065
Total assets	232,879	Total debt	183,962
Net worth	154,982		
Net worth (net of imputed rent)	**48,917**		

2004 - SCF - Mean for the middle 10 percent

Assets		Liabilities	
Real estate	189,338	Mortgage	89,724
Financial assets	64,053	Other debt	12,613
Other assets	34,900	PDV of rents	142,629
Total assets	288,292	Total debt	244,966
Net worth	185,954		
Net worth (net of imputed rent)	**43,325**		

2008 - SCF - Mean for the middle 10 percent

Assets		Liabilities	
Real estate	170,889	Mortgage	100,455
Financial assets	67,865	Other debt	13,323
Other assets	38,348	PDV of rents	128,731
Total assets	277,102	Total debt	242,509
Net worth	163,324		
Net worth (net of imputed rent)	**34,592**		

Note: The "typical household nearing retirement" refers to the mean of the middle 10 percent of the sample of households headed by an individuals aged 50-62 in 2004.
Source: Authors' estimates based on the 2001-2004 *Survey of Consumer Finances*, U.S. Board of Governors of the Federal Reserve System (2007), and the S&P/Case-Shiller U.S. National Home Price Values.

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