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Impending U.S. Spending Bust? The Role of Housing Wealth as Borrowing Collateral

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Abstract:
Using data from the Panel Study of Income Dynamics, this paper considers the mechanism by which changing house values impact U.S. household spending. The results suggest that house values affect consumption by serving as collateral for households to borrow against to smooth their spending. The results show that the consumption of households who need to borrow against their home equity increases by roughly 11 cents per $1.00 increase in their housing wealth. Changing house values, however, have little effect on the expenditures of households who do not need to borrow to finance their consumption. Based on these results, the paper further finds that declining housing wealth has a relatively small implied negative impact on aggregate consumption expenditures.

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

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1 Introduction

Real house prices rose rapidly in the United States in the first half of the 2000s. Banks willingly and without much scrutiny extended primary mortgages to first-time homeowners and secondary mortgages to existing homeowners who wanted to borrow against their home equity to finance spending. Aggregate U.S. consumption remained robust despite the collapse of the technology bubble in the stock market and the economic slowdown following the events of September 11, 2001. Indeed, the annual personal saving rate continued its downward trend in the early part of the 2000s, and was nearly zero in 2005 before rebounding a little starting in 2006. Many economists and politicians attributed the strong spending and low saving rate to households feeling wealthy as a result of their rapidly appreciating home values. The key question, especially now that U.S. house prices have declined substantially, is how U.S. household consumption will respond?

Figure 1 plots real house price growth and real consumption growth using data from the National Income and Product Accounts (NIPA) and the Federal Housing Finance Agency (formerly OFHEO). The two series exhibit similar patterns especially through the late 1990s, and have an overall correlation coefficient of about 0.4.[1] Despite this positive connection, however, the mechanism that drives the relationship between U.S. house values and U.S. household expenditures is less clear. The purpose of this paper is to use household-level data from the Panel Study of Income Dynamics (PSID) to analyze empirically the two frequently cited reasons for why changes in housing wealth impact household spending. The paper also quantifies the implied aggregate economic impact of falling house prices.[2]

The standard assumption in the literature and in many large scale macroeconomic forecasting models is that housing wealth has a direct or net wealth effect on consumption similar to nonhousing financial wealth. The idea is that households feel richer when their housing wealth increases and thus consume more. Conversely, households feel poorer when house prices decline and therefore reduce their spending. The main alternative argument is that housing wealth can serve as borrowing collateral and relax households' credit constraints. Thus, rising house prices allow homeowners who need to borrow to finance additional spending. In contrast, falling house prices limit such households' ability to use home equity to help finance their expenditures.[3] See Buiter (2008) for a more

[1] To the naked eye, the correlation between the two series appears to weaken somewhat recently; however, the correlation is actually stronger since 2000 than it is historically.

[2] In the paragraph and throughout the paper I use the terms "changes in housing wealth" and "changes in house prices" interchangeably.

[3] A further explanation for the relationship between housing wealth and consumption is wealth redistribution. In particular, house price fluctuations transfer wealth from households who are long housing (current homeowners) to households who are short housing (current renters who wish to buy homes) or

detailed discussion of the possible explanations for the relationship between house prices and consumption. This paper focuses on comparing the net wealth effect channel with the borrowing collateral channel for understanding the connection between changing house values and household expenditures.

The aggregate data from the most recent housing cycle in the United States are broadly consistent with the idea that households borrow against the value of their homes to fund consumption. In particular, real house prices rose 50 percent between 2000 and late 2006 while home equity debt relative to income doubled.[4] The issuance rate for home equity lines of credit (HELOC), which provide homeowners access to their housing wealth to finance spending, also rose substantially. The dollar value of outstanding HELOCs from U.S. commercial banks to households grew at an annual rate of 30 to 40 percent between 2002 to 2005, according to the Federal Reserve Board.[5] These lines of credit are similar to credit cards. Households apply to a bank for revolving home equity credit, and the bank grants them a credit line, based on the amount of their home equity, which they can tap into for spending purposes as needed. Relative to credit cards, HELOCs have greater borrowing limits and much lower interest rates. Indeed, as shown in figure 2, U.S. credit card debt relative to income peaked in 2000 and has trended down somewhat since then as households switched to cheaper forms of credit. In addition, Greenspan and Kennedy (2005) calculate that mortgage equity withdrawal (cash-out refinancing) averaged roughly 6 percent of disposable income from 2000 to 2005. This rate of equity extraction was much higher than during the 1990s.

Understanding whether the role of housing wealth as borrowing collateral matters for households' spending decisions is important given the recent credit crisis. Even before the worst of the credit crunch, in June 2008 the *New York Times* published an article entitled "Shrinking Lines of Credit," which focused on how banks were sharply reducing or suspending billions of dollars worth of existing home equity lines of credit.[6] Anecdotal evidence suggests that home equity borrowing became even more difficult as the credit crisis worsened. Given these credit market changes, the relevant question is how households' consumption is affected by their ability to finance less (or more) spending through home equity borrowing. Investigating the channel(s) through which changes in housing

vice versa. Such wealth redistribution impacts overall consumption to the extent that households' marginal propensity to consume (MPC) out of housing wealth differs across the various holders of housing equity. For instance, older households may be more likely to spend some of their housing gains, especially if they plan to downsize their housing stock, compared with young households who intend to hold onto their housing for a long time.

[4]Appendix section A.1 provides data definitions and discusses the data sources.

[5]Source: H.8 Statistical Release line 12. See http://www.federalreserve.gov/releases/H8/current.

[6]Bob Tedeschi, "Shrinking Lines of Credit," *New York Times*, June 8, 2008. Available at http://www.nytimes.com/2008/06/08/realestate/08mort.html.

wealth impact consumption provides insight into the macroeconomic effects of falling house prices, and provides insight into a potential cause of the current U.S. economic recession.

Using household-level data from the PSID for this analysis allows me to distinguish between those households who likely do and do not have a high demand for borrowing. The PSID's main drawback is that it only consistently contains a direct measure of households' food consumption. One novelty of my approach, however, is to impute households' total nonhousing consumption using their reported income and saving data. I discuss this approach in greater detail in section 3.

The results show that across all households a $1.00 increase in house values leads to a roughly 3.5 cent permanent rise in households' nonhousing consumption. Taking households' borrowing needs into account, however, I find that consumption increases around 11 cents per $1.00 increase in housing wealth for households that potentially need to borrow. In contrast, the spending of households with limited borrowing needs is relatively unaffected by changes in their house values. In other words, there is little evidence of a net housing wealth effect on consumption after controlling for the role housing wealth plays as collateral for household borrowing.

The paper also considers the role of household leverage in the relationship between housing wealth and consumption. This analysis serves as an alternative test of the role housing wealth plays as collateral for borrowing. In particular, highly leveraged households potentially benefit from house price gains that increase their home equity and lower their borrowing costs. The results show that consumption is indeed higher, on average, for highly leveraged households who experience a positive housing capital gain than for their less leveraged counterparts. In addition, households who both potentially need to borrow *and* are highly levered exhibit a particularly strong response to changes in their housing wealth relative to their less levered counterparts. Overall, the results with household leverage reinforce the importance of housing wealth as borrowing collateral.

Finally, I investigate the aggregate implications of the estimated relationship between housing wealth and consumption. The results suggest that the direct impact of falling house prices on aggregate, real nonhousing consumption in 2008 was relatively small. In particular, the roughly 11 percent decline in real housing wealth between 2007:Q4 and 2008:Q4, as reported in the Flow of Funds accounts, caused about a 0.75 percent decrease in aggregate real nonhousing consumption. This estimated effect is robust to alternative calculation approaches. In addition, roughly two-thirds of the decline in U.S. household consumption is due to the role housing wealth has as collateral for borrowing.

There have been a number of previous papers that examine the relationship between consumption and housing wealth. Skinner (1989) quantifies this relationship using data

on food consumption and housing wealth from the PSID, and Lehnert (2004) uses age as a proxy for household credit constraints when considering the relationship between housing wealth and consumption. In addition, Morris (2006) examines the potential life-cycle relationship between house values and household spending using the PSID, while Campbell and Cocco (2007) look at how the housing wealth effect varies based on households' age and tenancy status (renter versus owner) using British household-level data. A paper that is similar in principle to this one is Yamashita (2007), which uses PSID data through 1993 to analyze households' probability of having a second mortgage conditional on state-level house price appreciation. Finally, Hurst and Stafford (2004) consider whether households, especially potentially liquidity constrained ones, take advantage of rising housing wealth through mortgage refinancing. In particular, they analyze a specific module of the PSID in 1996 that asked households questions about their mortgage refinancing activity.[7]

In contrast to the previous literature, this paper takes a broader approach to examining the relationship between housing wealth and consumption, and pays particular attention to the role housing wealth plays as borrowing collateral. In particular, the baseline specifications look directly at the relationship between housing wealth and households' borrowing demand. I identify a household's borrowing needs based on its current income relative to its average or permanent income. This approach differs from that of previous authors who used age and other more indirect measures to capture a household's credit needs. My methodology also incorporates the fact that households' borrowing demand and banks' lending rules are very different now than when Zeldes (1989) looked at the relationship between consumption and households' liquidity needs. Relative to the 1970s and early 1980s, owning a home now no longer means that a household has substantial housing equity and financial resources. Today, homeowners may indeed be constrained and wish to borrow.

The rest of the paper proceeds as follows. Section 2 discusses the theoretical background for this paper and my empirical approach. Section 3 explains the data and the various data measurement issues. Section 4 reports my baseline results and the aggregate implications of falling house prices. Section 5 considers potential extensions. Section 6 concludes.

[7] A related, but separate thread in the literature utilizes a structural approach to evaluate the relationship between consumption and house prices and or housing wealth and household portfolio choice. Examples include Li and Yao (2007), Bajari et al. (2008), Piazzesi, Schneider, and Tuzel (2007), and Lustig and Nieuwerburgh (2005).

2 Empirical Approach

2.1 Background

For households that are homeowners, total consumption, which includes the service flow from housing and other durable goods, should rise, on average, when housing wealth increases given the measurement approach for housing services used in the NIPA accounts. All else equal, rising house prices imply higher owner-occupied rents and hence greater expenditures on housing services for owner-occupants.

Whether or not a homeowner is better or worse off because of changing house prices depends on whether he/she wishes to buy housing (net buyer), downsize or sell his/her housing stock (net seller), or do neither. On average, homeowners who do not intend to move in the near future should be no worse off when prices decline and no better off when prices increase. When house prices decline homeowners can continue to live in their homes and consume the same amount of housing services, all else equal. Homeowners who wish to remain in the same region are also no better off when house prices rise, since an equivalent property to the one the household is living in costs more. Households must downsize and consume less housing services to realize a positive capital gain when house prices rise, and they must purchase more housing at a lower price to benefit when prices decrease. On net, the cross-sectional impact of changing house values on households' consumption should be close to zero if the majority of households do not intend to move in the near future.

Fluctuating housing wealth may indirectly impact households' *nonhousing* consumption, however, because of its role as borrowing collateral. Financial institutions allow households to borrow against their accumulated positive home equity through second mortgages or lines of credit. The interest costs of such collateralized borrowing are substantially lower than other forms of financing like credit cards. In addition, the Tax Reform Act of 1986 raised households' incentives to borrow against their homes by increasing the home mortgage interest deduction and eliminating the deduction for noncollateralized consumer loans. Homeowners who wish to borrow to finance some of their nonhousing consumption therefore benefit from changes in house prices that increase their home equity borrowing capacity. This implies that there should be a positive relationship between house price fluctuations and nonhousing consumption changes for households with high borrowing demand.

The standard approach in the literature is to analyze the direct or net housing wealth effect (NHWE) on homeowners' nonhousing expenditures. The underlying assumption is that all households view fluctuating house prices as permanent changes in their wealth, and they adjust their consumption accordingly. This reasoning suggests that homeowners

should have a positive marginal propensity to consume (MPC) out of housing wealth. Indeed, many existing studies find that, all else equal, household spending increases 3 to 6 cents per $1.00 increase in house prices (see Lasky 2007 for an overview of the existing literature).

The existing literature and many large scale macroeconomic forecasting models, however, fail to distinguish between changes in house values benefiting net sellers and buyers of houses, and how house price appreciation and depreciation impacts upon homeowners' borrowing ability. The fact that existing studies find strong evidence of a positive NHWE could be due to an empirical misspecification. In particular, the estimated MPC out of housing wealth may be capturing the consumption effect of house price changes for homeowners who net to finance consumption through borrowing, rather than identifying a wealth effect across all homeowners. It is therefore important to control for individual household's borrowing needs when evaluating the relationship between housing wealth and nonhousing consumption.

2.2 Baseline Specification

My baseline empirical model accounts for differences in individual households borrowing needs, while incorporating the standard approach in the literature for estimating the NHWE. In particular,

$$\begin{aligned} C^i_{t,t-1} &= \beta_0 + \beta_1 Y^i_\ell + \beta_2 W^i_{t-1} + \beta_3 H^i_{t-1} + \beta_4 \left(H^i_{t-1} \cdot I^i_\ell\right) \\ &+ \beta_5 I^i_{t-1} + \eta \mathbf{Z^i_{t-1}} + \delta_t + e^i_t \ , \end{aligned} \tag{1}$$

where $C^i_{t,t-1}$ is a household's average, real nonhousing consumption over the period $t-1$ through t, Y^i_ℓ is the lagged level of a household's real after tax income, W^i_{t-1}, is a household's real nonhousing financial wealth as of $t-1$, H^i_{t-1} is a household's stock of real housing wealth in $t-1$, I^i_ℓ is an indicator variable that takes a value of 1 if household is borrowing constrained and is 0 otherwise, and $\mathbf{Z^i_{t-1}}$ is a vector of household demographic variables that includes a cubic term in the head of household's age, the number of household members, and the number of children younger than 18 years.[8] Equation 1 also include year fixed effects, δ_t, to account for any potential aggregate macroeconomic

[8]Financial wealth is measured as the total value of a household's nonhousing assets less any noncollateralized debt they may hold. These assets include stocks, bonds, saving accounts, other real estate, vehicles, annuities or individual retirement accounts, and the value of any business or farm the household operates. In addition, using a quadratic in the age of the head of household instead of a cubic does not impact my results.

trends that may impact consumption. The next section discusses the data and the relevant data measurement issues in detail.

I use the the term "borrowing constrained" somewhat loosely. A household is not constrained in the strict sense that they cannot borrow. Instead, a household is "constrained" if it has an increased need or demand for borrowing, and may wish to access the equity in its home. Section 3.3 discusses how I identify these potential borrowers. For ease of discussion I will use the term "borrowing constrained" at times to identify households with high borrowing needs. I will also refer to households who are less likely to need or want to borrow using their accumulated home equity as "unconstrained."

In equation 1 the interaction term between the borrowing constrained indicator variable and housing wealth, $\left(H^i_{t-1} \cdot I^i_\ell\right)$ captures the marginal impact of house values on constrained households' consumption. Fluctuations in house prices allow these households to finance more or less consumption though home equity borrowing. If the role of housing wealth as borrowing collateral is important for household spending, then an increase in housing wealth should have a positive and substantial impact on constrained households' consumption ($\beta_4 > 0$). In addition, the direct effect of housing wealth on the consumption of unconstrained households should be small ($\beta_3 \approx 0$).

Increasing or decreasing housing wealth should not impact unconstrained households' spending if households' home equity borrowing needs are the only factor driving the relationship between house values and consumption. The estimated NHWE (β_3) may be non-zero in equation 1; however, some households are identified as not needing to borrow when the opposite is true. Alternatively, some of the so-called unconstrained households may intend to move in the near future. As a result, such households may rationally adjust their consumption accordingly in response to changing housing prices. For instance, a household that plans to downsize realizes a positive lifetime resource gain when house prices increase.

Even if the direct effect of housing wealth on consumption is non-zero, the estimate of the NHWE (β_3) should be lower relative to estimated NHWE when I do not account for the collateral role housing wealth plays in household borrowing. In particular, if $\beta_4 = 0$ and $\beta_5 = 0$ in equation 1, then the resulting empirical model is similar to the ones used in the existing literature to estimate the NHWE. This model is outlined in equation 2 where consumption is a linear function of income, financial wealth, housing wealth and other household specific controls:

$$C^i_{t,t-1} = \alpha_0 + \alpha_1 Y^i_\ell + \alpha_2 W^i_{t-1} + \alpha_3 H^i_{t-1} + \zeta \mathbf{Z^i_{t-1}} + \delta_t + e^i_t \ . \tag{2}$$

If the collateral role of housing wealth is important to finance consumption, then the estimated MPC out of housing wealth in equation 2 should be attenuated relative to the estimated MPC in my baseline specification ($\beta_3 < \alpha_3$). Section 2.4 discusses the timing in equations 1 and 2 along with other estimation issues.

2.3 Specification with Household Leverage

If households' borrowing needs are important for explaining the relationship between housing wealth and consumption, then there should also be differences in expenditures based on homeowners' existing leverage. For one, banks generally prefer to lend to households that have substantial collateral. Individual household's consumption, conditional on borrowing needs, should also differ based on their existing leverage, which proxies for their borrowing capacity.

The standard measure of a household's housing-related leverage is its loan-to-value (LTV) ratio, which compares the household's outstanding mortgage debt to the current value of its home. In particular,

$$\text{LTV}_t^i = \frac{M_t^i}{V_t^i} \ ,$$

where M_t^i is the amount of a household's outstanding mortgage (primary and secondary) debt, and V_t^i is its house value. A lower LTV ratio implies that a household has little housing debt relative to its house value, while a high ratio implies that the household has a relatively large amount of debt.

The effect of households' LTV ratios (leverage) on the relationship between consumption and housing wealth is likely nonlinear. Generally speaking homeowners with less than 20 percent equity in their homes at the time of purchase must hold private mortgage insurance (PMI), which greatly increases their borrowing costs and impacts their borrowing behavior.[9] As a result, there should be a kink in the relationship between housing wealth, leverage, and consumption at a LTV ratio of 0.8, to the extent that the collateral role of housing wealth matters for household spending.[10]

Households with more than 20 percent equity in their home should have greater and or cheaper access to credit than households with less than 20 percent equity. In comparison, highly leveraged households likely benefit greatly from gains in their home values

[9]Recently some banks have allowed households to pay a higher interest rate instead of PMI. This alternative requirement also increases the cost of borrowing for households with limited initial equity. For a further discussion of household leverage and PMI see Hurst and Stafford (2004).

[10]The LTV requirements for borrowing likely eroded a good bit with the loose lending standards of the early 2000s. My results, however, hold across all time periods. There are also a few households in the data who report LTV ratios above 0.9, so using the standard LTV cut-off of 0.8 in the literature seems reasonable.

that move them beyond the equity cut-off for needing PMI and thus substantially reduce their borrowing costs. These highly leveraged households also likely benefit in general from having additional borrowing capacity regardless of their financing costs.

The following empirical models evaluate the role of household leverage in the relationship between house values and consumption. Equation (3) looks at the impact of positive versus negative house price gains on consumption depending on whether households have high or low leverage. In particular,

$$\begin{aligned} C^i_{t,t-1} &= a_0 + a_1 Y^i_\ell + a_2 W^i_{t-1} + a_3 H^i_{t-1} + a_4 \left(high^i_{t-2} \cdot loss^i_{t-1} \right) \\ &+ a_5 \left(high^i_{t-2} \cdot gain^i_{t-1} \right) + a_6 \left(low^i_{t-2} \cdot gain^i_{t-1} \right) + \eta \mathbf{Z^i_{t-1}} + \delta_t + e^i_t \ , \end{aligned} \tag{3}$$

where $high^i_{t-2} \cdot loss^i_{t-1}$ equals 1 if a household has a LTV ratio greater than 0.8 in period $t-2$ *and* experiences a house price loss between $t-2$ and $t-1$; $high^i_{t-2} \cdot gain^i_{t-1}$ equals 1 if a household has a LTV ratio greater than 0.8 in period $t-2$ *and* experiences a house price gain between $t-2$ and $t-1$; and $low^i_{t-2} \cdot gain^i_{t-1}$ equals 1 if a household has a LTV ratio less than 0.8 in period $t-2$ *and* experiences a house price gain between $t-2$ and $t-1$.

Households' LTV ratios are measured as of $t-2$ to capture the impact of changing house prices on household spending conditional on existing home leverage. If house price increases reduce borrowing costs for highly leveraged households, then these households should have higher consumption, on average, in response to house price gains ($a_5 > 0$). In comparison, the average consumption of other households that either are less leveraged or that experience a house price drop, should be less affected. Indeed, highly leveraged households can borrow and increase their spending when house prices rise but are not necessarily forced to reduce their consumption when house prices fall. Similarly, the consumption of less leveraged households does not necessarily respond to changes in housing wealth since these households should possess sufficient equity to have already financed additional consumption through borrowing independent of any current house price change.

If the borrowing collateral role of housing wealth is important, then household leverage should also matter for the consumption behavior of constrained households in response to changes in their housing wealth. This potential relationship is explored below in equation 4, which is a modified version of the baseline specification in equation 1. In particular, equation 4 includes an additional term that incorporates the potential interaction between housing wealth, household leverage, and individual household's borrowing needs.

$$
\begin{aligned}
C^i_{t,t-1} &= \gamma_0 + \gamma_1 Y^i_\ell + \gamma_2 W^i_{t-1} + \gamma_3 H^i_{t-1} + \gamma_4 \left(H^i_{t-1} I^i_\ell\right) + \gamma_5 I^i_{t-1} \\
&+ \gamma_6 \left(I^i_\ell L^i_{t-1}\right) + \gamma_7 \left(H^i_{t-1} I^i_\ell L^i_{t-1}\right) + \eta \mathbf{Z^i_{t-1}} + \delta_t + e^i_t \ , \qquad (4)
\end{aligned}
$$

where L^i_{t-1} is an indicator variable that takes the value of 1 if the household has a LTV ratio greater than or equal to 0.8 in period $t-1$ and is 0 otherwise. The rest of the variables are the same as before.

Highly leveraged, constrained households potentially benefit greatly from increases in housing wealth that reduce their borrowing costs. As a result, the MPC out of housing wealth for these households is likely greater than for those homeowners with less leverage ($\gamma_7 > 0$). In addition, if the collateral role of housing wealth matters to a household's ability to borrow, then the estimated NHWE for unconstrained households in this model should be attenuated relative to the MPC out of housing wealth when I do not account for household borrowing constraints or leverage ($\gamma_3 < \alpha_3$).

Finally, a household's LTV ratio as of $t-1$ is also potentially endogenous, meaning that households who have borrowed to fund consumption in the past will potentially have both high consumption *and* a high LTV ratio. Such homeowners differ from those whose LTV ratio is *exogenously* high owing to a lack of equity in their home from either a small down-payment or falling house prices. This second group of households is the one that may benefit from house price growth that increases their borrowing capacity, and it is their behavior that is worth examining. Standard tests suggest that households' LTV ratios as of $t-1$ are exogenous with respect to measured nonhousing consumption, and I treat them as such in my analysis.[11]

2.4 Timing in the Empirical Model

The setup in equations 1 through 4 incorporates the fact that the data on nonhousing consumption cover two-year and five-year time horizons (five years prior to 1999 and two years thereafter). The timing of consumption is due to the availability of the saving data in the PSID, which I use for imputing households' nonhousing consumption. The dependant variable in equations 1 through 4 is therefore a household's average consumption over the relevant two-or five-year periods. This allows for pooling all the household spending observations cross-sectionally over time. In addition, the demographic and financial variables included in the empirical models are measured as the consumption period's beginning ($t-1$). For example, household consumption between 1984 and 1988

[11] Using additional lags of a household's LTV ratio as instruments for L^i_{t-1} yields similar empirical results.

measures housing wealth as of 1984. The next section discusses my consumption imputation approach and these timing issues in more detail.

The empirical models also include "lagged" income, Y_ℓ^i, which captures households' income one period prior to the beginning of the consumption period (for example, 1983 for consumption between 1984 and 1988). I include "lagged" income to avoid regressing income on itself, since imputed nonhousing consumption equals disposable income less saving. Household income tends to be highly persistent so lagged income is likely a good proxy for households' average income over the consumption period. A household's borrowing need, I_ℓ^i, is also included with a lag since it too depends on income. Given these timing conventions, for a given household's spending between 1984 and 1988, equation 1 can be written more specifically as follows :

$$\begin{aligned} C_{88,84}^i &= \beta_0 + \beta_1 Y_{83}^i + \beta_2 W_{84}^i + \beta_3 H_{84}^i + \beta_4 \left(H_{84}^i \cdot I_{83}^i \right) \\ &+ \beta_5 I_{83}^i + \eta \mathbf{Z_{84}^i} + \delta_{88} + e_{88}^i \ , \end{aligned} \tag{5}$$

where $C_{88,84}^i$ is the household's average yearly consumption between 1984 and 1988.

I estimate equations 1 through 4 using two-stage least squares (2SLS) in order to control for the potential endogeneity between imputed nonhousing consumption and income due to serially correlated income reporting errors. In particular, I use twice-lagged income as an instrument for Y_ℓ^i (for example, 1982 income as an instrument for 1983 income). An alternative approach would be to include households' average income over the same period as average consumption (period $t-1$ to t), and use an appropriate instrument for $Y_{t,t-1}^i$. The results are similar using this alternative setup. Using lagged income, however, avoids any concerns about measurement error induced by my data construction method for nonhousing consumption.

2.5 Additional Empirical Discussion

I estimate the baseline empirical models in both levels and logs. According to Muellbauer (2007), analyzing the relationship between consumption and housing wealth in levels is important for capturing the long-run interactions between the two series in addition to any short-run variation. A levels setup is also appropriate for my analysis given the type of available nonhousing consumption data. In particular, I impute the *level* of households' consumption and not the change in their spending. This approach requires that households know their income and saving amounts and report them correctly— a reasonable assumption given that James Morgan designed the saving module in the PSID to cap-

ture both households' saving as well as to indirectly obtain households' total spending. Still, there is likely some measurement error in households' nonhousing consumption, and transforming the data any further would likely exacerbate any existing measurement error.

The standard argument against estimating the relationship between house prices and consumption in levels is that such a setup fails to control for households' marginal utility of wealth. A $1.00 change in housing wealth may impact a homeowner who has a small house differently than one with a multi-million dollar house. Conditional on needing to borrow, however, an additional dollar of housing wealth (equity) should benefit households similarly regardless of the initial size of their homes. Since I am interested in investigating the role housing wealth plays as borrowing collateral, estimating the relationship between consumption and housing wealth in levels seems adequate. In addition, the change in households' average consumption over five-year horizons is likely a relatively noisy measure of their spending growth even with a perfect measure of household expenditures.

3 Data and Measurement

3.1 PSID Data

The PSID is a nationally representative, longitudinal survey of U.S. households and their offspring that began in 1968. The survey was conducted annually between 1968 and 1997 and has been collected biennially since 1997. The most recent data are for 2005. Each survey asks homeowners to report their home values as well as the amount of any outstanding mortgage balances.[12] There is also data on family income in every survey, as well as detailed information on households' financial asset holdings as part of wealth supplements in 1984, 1989, 1994, and 1999 onwards. The PSID data also include core information about family structure, employment, marital status, the age and sex of household members, and other household characteristics.

The consumption data in the PSID, however, are somewhat limited. The only consistently available spending measure over time is households' food consumption. Previous authors have used food expenditures as their dependant variable when examining housing wealth effects. Food consumption, however, may not be the margin and or the only margin on which households adjust their spending in response to changes in housing wealth. The PSID added questions starting in 1999 on households' mortgage payments, health care expenditures, child care expenditures, utilities, and transportation-related ex-

[12]Section A.5 in the appendix discusses the variation in households' reported housing wealth.

penses. These data, however, still do not cover all of a household's discretionary spending, and are somewhat limited by their short time horizon.

A more comprehensive measure of household expenditures over time is arguably better at capturing the impact of changing house values on household spending. I therefore impute households' consumption *excluding* housing using the PSID data on households' income and active saving. In particular, I define households' nonhousing consumption as follows:

$$C^i_{t,t-1} = (Y^i_{t,t-1} - T^i_{t,t-1}) - S^i_{t,t-1} \ , \tag{6}$$

where $C^i_{t,t-1}$ is a household's consumption excluding housing between period $t-1$ and t, $S^i_{t,t-1}$ is household saving over the same period, $Y^i_{t,t-1}$ is household income (excluding rental income), and $T^i_{t,t-1}$ is the household's lump sum income tax burden. I obtained data on households' income taxes using the NBER's TAXSIM software. The active saving data in the PSID *exclude* capital gains, which is necessary for obtaining what households save out of their disposable income and calculating equation 6. I discuss the saving data in more detail below.

My consumption imputation approach is based on a household's budget constraint and measures the family's out-of-pocket spending over a given period. Strictly speaking, $C^i_{t,t-1}$ measures household expenditures and not consumption from a national accounting sense, since it does not include the service flow from durable goods. Nonhousing expenditures is the correct measure of consumption, however, for this paper. Consumption including housing services is related to housing wealth by construction, while consumption excluding housing services should not depend on changing house prices. Since this paper seeks to examine how households' nonhousing expenditures respond to changes in their housing wealth, my imputed measure of nonhousing consumption is appropriate for capturing this relationship.[13] The appendix discusses the relationship between my imputed consumption measure and relevant consumption benchmarks.

3.2 Calculating Household Saving

My method for calculating households' active saving follows the approach in Juster et al. (2006). The exact approach is outlined in the appendix. Earlier work using active saving data includes Kosobud and Morgan, eds. (1964), Klein and Morgan (1951), and Holbrook and Stafford (1971). Active saving measures households' net contributions to various financial assets

[13]Imputed nonhousing consumption implicitly includes a household's monthly mortgage payment. Changing house prices, however, should not greatly impact households' debt service expenditures, unless a household refinances its mortgage and uses the proceeds to reduce its monthly payments.

over time, and it *excludes* capital gains. For instance, households who pay off some of their outstanding mortgage principal have positive active saving. In contrast, increases in housing wealth owing to house price appreciation do not count as active saving.

Starting in 1989, the PSID wealth supplements include questions about households' additions to and subtractions from their financial assets since the previous wealth supplement. For example, households report the amount they contributed to 401k or IRA savings plans 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 noncollateralized debt (NCD).[14] Given the timing of the wealth supplements, active saving data is available between the following years: 1984 and 1989, 1989 and 1994, 1994 and 1999, 1999 and 2001, 2001 and 2003, and 2003 and 2005. These data allow me to calculate households' nonhousing consumption using equation 6 over the same time periods.

3.3 Identifying Households' Borrowing Demand

When thinking about households' borrowing demand it is important to distinguish between households with permanently low income that are poor, and those households who experience a temporary decline in their earnings. Poor households have limited if any borrowing capacity, while the other households may want to borrow against future earnings to smooth their consumption. From the viewpoint of a life-cycle model, a household's current income relative to its permanent income is arguably a good indicator of its potential inability to fund its desired amount of current consumption. Homeowners who experience temporary negative income shocks are potential home equity borrowers to the extent they may lack sufficient liquid assets to smooth consumption and/or if other means of financing their spending are more costly or unavailable.

I use the panel structure of the PSID to determine which households are potential borrowers (constrained). In particular, I compare a household's current (lagged) real income with their average income:

$$\iota_{\ell}^{i} = \frac{Y_{\ell}^{i}}{\bar{Y}^{i}} \ , \tag{7}$$

where $\bar{Y}^{i}$ is a household's average real income over time based on all their available family income data in the PSID between 1968 and 2005. Average income measures a household's mean earnings over its lifetimes and serves a proxy for their permanent income. The ratio in equation 7 (ι_{ℓ}^{i}) therefore captures whether a household's current income is

[14] Other real estate includes vacation homes, rental properties, and land holdings. NCD includes credit card debt as well as student loans and other unsecured debt.

above or below their lifetime average earnings.

I identify households as potential borrowers if their current income is at least 10 percent lower than their average income, as expressed in equation 8:

$$I_\ell^i = \begin{cases} 1 & \text{if } \iota_\ell^i < 0.9 \\ 0 & \text{otherwise} \end{cases}. \tag{8}$$

Eberly (1994) uses a similar approach for identifying constrained households when looking at households' durable good purchases. Section 5 considers alternative cut-off levels for determining households' borrowing needs, and shows that the results are not sensitive to my baseline choice. Given this identification approach for households' borrowing needs, homeowners can be cash constrained in one period but not necessarily in the next period. As a result, there is variation both in the number of borrowing constrained households in a given period and in a household's own borrowing demand over time.

I consider alternative measures of households' borrowing demand including their LTV ratios, age, and their liquid wealth relative to income (LWI) ratios. The latter two measures are used frequently in the literature as proxies for borrowing demand (see for example Lehnert (2004) or Yamashita (2007)). Arguably the best method for identifying a household's borrowing needs is a direct survey question about its credit demand. The PSID, however, does not contain such a question. Jappelli, Pischke, and Souleles (1998) impute households' borrowing needs and limitations in the PSID using credit application data available in the Survey of Consumer Finances (SCF). The authors' approach is clever, but it is not clear that their method identifies households who want to borrow because of negative income shocks or other household-specific factors. Having a household-specific measure of borrowing demand is important for analyzing the relationship between housing wealth and consumption.

3.4 Estimation Sample

My estimation sample includes all homeowners in the PSID between 1984 and 2005 where the household head is 65 years old or younger. This sample includes households from the so-called "poverty sample" in 1968, but excludes homeowners who move houses between wealth supplements. Such households potential realize actual capital gains and losses on their housing investment, and the goal of this paper is to investigate how individual households respond to changes in their house's value conditional on their being content with their current amount of housing services.

Where applicable, all household demographic variables are measured for the head of household, and all nominal values are converted to 2000 dollars using the annual personal

consumption expenditure (PCE) deflator from the Bureau of Economic Analysis. The sample begins in 1984 because there is no financial wealth data prior to that PSID survey. The related active saving data were first published in 1989 and cover the period from 1984 to 1989. The sample horizon covers the 1986 Tax Reform Act, which made home equity borrowing much more attractive relative to other forms of credit.

I further restrict the sample by removing households who have missing or incomplete financial and or active saving data. Following the approach in Yamashita (2007), the sample also excludes households that making a living from farming or families who live in mobile homes. Renters are also not included in the sample since by definition they do not have any housing wealth. I also exclude households with negative imputed consumption as well as those with negative reported financial assets.[15] Finally, I remove outliers by eliminating households who have income, financial wealth, or housing wealth in the top or bottom 1 percent of the respective income and wealth distributions.

4 Results

4.1 Baseline Regressions

Table 1 and table 2 report estimates of equations 1 and 2 in levels (dollar value of all relevant variables) and logs, respectively. Overall, the results are qualitatively and quantitatively similar. In particular, the net housing wealth effect is around 3.5 cents on the dollar in the levels specification that does not control for housing wealth's role as collateral for household borrowing (table 1, column 1). Note that the reported coefficients in table 2 for the regressions in logs represent elasticities. For instance the elasticity of consumption with respect to housing wealth is 0.09 (column 1). This is equivalent to an MPC of 3.5 cents per $1.00 of housing wealth as noted in the table's memo line.[16]

The regressions that control for households' borrowing needs, however, show little evidence of a direct housing wealth effect (columns 2 and 3 of both tables). In particular, a $1.00 increase in housing wealth leads to roughly a 11 cent increase in constrained households' nonhousing consumption. This effect is precisely estimated and is a bit larger than

[15] I remove households with negative financial assets because negative financial wealth likely dramatically alters their borrowing and spending capabilities. Including or excluding these households, however, does not substantially alter the results.

[16] I convert the elasticities to MPCs by multiplying them by ratio of households' average consumption relative to the mean of the variable in question. For example, the MPC out of housing wealth, MPC^H, is:

$$MPC^H = 0.09 \cdot \frac{\bar{C}}{\bar{H}}$$

where $\bar{C}$ is average consumption and $\bar{H}$ is average house values.

the corresponding MPC (6 cents per $1.00 of housing wealth) from the log specifications. In contrast, the impact of changing housing wealth on unconstrained households' consumption is small and for the most part not statistically different from zero. In addition, the direct wealth effect is attenuated substantially relative to the specifications that do not control for households' potential borrowing needs.

The results are relatively unchanged when I account for the potential interaction between a household's borrowing needs and their *financial* wealth (column 3 of both tables). The interaction effect itself is essentially zero. This result is consistent with the inherently different nature of financial wealth and housing wealth. Changes in the value of housing do not necessarily make households better off overall, but homeowners do benefit because housing wealth serves as borrowing collateral. Permanent changes in a household's financial assets, however, represent changes to their lifetime resources, and thus it is not surprising that changes in financial wealth have more of a direct impact on household expenditures. Overall, these baseline findings are consistent with the idea that housing wealth acts as collateral for household borrowing.

In addition, the magnitude of the NHWE is roughly inline with previous estimates in the literature (see Lasky 2007 for an overview of these previous results). The size of the NHWE relative to the financial wealth effect depends, however, on whether the model is estimated in levels or logs. The level results suggest that the housing wealth effect is smaller than the financial wealth effect, which is consistent with financial wealth being more liquid than housing wealth. The estimates from the regressions in logs, however, suggest the opposite. Case, Quigley, and Shiller (2001) and others also find a *larger* housing wealth effect than financial wealth effect.

The different estimates of the financial wealth effect relative to the NHWE in tables 1 and 2 could result from the treatment of households who report zero financial wealth (roughly 200 households in the sample). The levels estimates include these "wealthless" households. In the log estimates, however, I give these households a small amount (0.00001) of financial wealth so that they are not dropped from the sample. The estimate of the financial wealth effect in the log regressions is as large if not larger than the housing wealth effect if I drop the zero financial wealth households from the sample. Including or excluding these households, however, has a minimal if any impact on the other estimated relationships. Including the households with zero financial wealth is important, however, because they may have particularly high borrowing demand when they experience a temporary negative income shock. As a result, the remaining tables will only include regression estimates in levels. These level estimates also have the added benefit of being directly interpretable as MPCs.

4.2 Baseline Regressions Across Age Groups

Previous work by authors such as Lehnert (2004) use age as proxy for households' borrowing demand. Young households may be more likely to borrow to smooth their consumption because they have yet to realize their full earnings potential. Lehnert (2004) finds that the (food) consumption of young households is somewhat sensitive to changes in their housing wealth.

I re-estimate equations 1 and 2 by household age group as a potential alternative method of capturing households' borrowing demand. In particular, I divide households into three groups: young households (younger than 35 years old), middle-aged (35 to 50 years old) and nearing retirement (50 to 65 years old). The exact age cut-offs for these groups, however, do not noticeably impact the estimates. Dividing the sample in this way also serves as a robustness check to ensure that the behavior of older households is not driving my results. In particular, changes in house prices for older households represent real gains (or losses) in their lifetime resources if they intend to downsize their housing stock in the near future.

The results in table 3 show that *both* the oldest age group and the middle-aged group have substantial MPCs out of housing wealth after controlling for these households' borrowing demand. As a result, the behavior of older households, who potentially wish to cash-out and to downsize their housing, does not appear to be driving my primary findings. Not surprisingly, there is still a reasonably large direct impact of housing wealth on consumption for the oldest households— even after controlling for their borrowing needs based on income. This suggests that a household's plans to downsize may play a role in their consumption decisions when house prices fluctuate. Yet the results demonstrate how the collateral role of housing wealth does impact the spending of some older households, regardless of their future housing plans.

In addition, there is limited evidence of a direct housing wealth effect among the youngest households, contrary to the findings in Lehnert (2004). Arguably, this finding is not surprising since all of these households are homeowners. Such households are likely unconstrained, on average, since they own property. Recall that the vast majority of unconstrained households in Zeldes (1989) were homeowners. The young property owners in my sample therefore do not necessarily need to borrow simply because of their age. In contrast, the consumption of households who are both young and who need to borrow to finance spending increases 6 cents per $1.00 dollar increase in their housing wealth. This effect is not precisely estimated, but the direct housing wealth effect is noticeably attenuated after controlling for young households' borrowing needs. For middle-aged households the direct housing wealth effect is also noticeably attenuated after controlling for households' borrowing needs, and the consumption of constrained, middle-aged

households increases over 11 cents per $1.00 increase in their housing wealth.

Overall, the results in table 3 suggest that the relationship between housing wealth and consumption cannot be explained just based on life-cycle differences in households' housing tenure and spending needs. Instead, households who need to borrow in all age groups utilize the collateral value of their housing wealth to help finance their consumption.

4.3 Incorporating Household Leverage

Table 4 reports the impact of incorporating household leverage into my analysis. Columns 3 and 4 show the estimates of equation 3, which considers the average consumption of households based on their leverage (high versus low) and whether they experience a positive or negative housing capital gain. The regressions suggest that the average consumption of highly leveraged households is higher in response to a positive housing capital gain, although the effect is not precisely estimated. To the extent households with high leverage are constrained by a lack of equity and/or potentially high borrowing costs, it makes sense that they appear to consume more in response to a positive housing capital gain.

This consumption effect is larger in the specification that also controls for households' borrowing needs, $[I_\ell^i]$, (column 4). In other words, conditional on households who are potentially cash-flow constrained, those households whose borrowing is restricted due to a lack of equity in their house (or high borrowing costs) have higher consumption on average in response to housing capital gains. These results lack precision, but overall they are suggestive that even across alternative measures of households' borrowing needs, the collateral role of housing wealth plays a role in explaining the relationship between house values and consumption.

The last column of table 4 reports the estimates of equation 4 which considers the relationship between housing wealth and consumption for households who are highly leveraged *and* who have low income relative to average. The results are consistent with the empirical predictions in section 2.2 and show that the average consumption of highly leveraged, constrained households is lower than their less leveraged counterparts. In other words, households with more housing collateral can more easily smooth consumption through transitory income shocks and maintain a higher level of consumption. In addition, the MPC out of housing wealth is stronger for constrained households with high leverage than for similar households with less leverage. This finding is consistent with highly leveraged households benefiting a good deal from housing wealth changes that increase their available borrowing collateral and potentially move them above the

threshold where their benefits from borrowing and consuming more outweigh the costs.

4.4 Baseline Results with Alternative Consumption Measures

4.4.1 Food Consumption

As a further robustness check, this section re-estimates the baseline specifications (equations 1 and 2) using food consumption (home and away) rather than households' total nonhousing consumption. This approach is similar to the ones used by Skinner (1989) and Lehnert (2004). I convert the yearly food expenditure data accordingly to cover the same time horizon as the nonhousing consumption data. Table 5 shows that households' MPC out of housing wealth for total food consumption is precisely estimated but small (0.5 cents per $1.00 of housing wealth). This direct housing wealth effect for food consumption is roughly 3 cents per $1.00 smaller than for total nonhousing consumption, which is consistent with food consumption making up a relatively small portion of households' overall expenditures.

The results further show that constrained households' MPC (food) out of housing wealth is nearly double the MPC of unconstrained households in the specifications that account for housing wealth's role as borrowing collateral. The direct housing wealth effect on food consumption is also attenuated slightly from 0.54 cents per $1.00 of housing wealth to 0.47 cents after controlling for households' borrowing needs. Overall, the results with total food consumption are broadly consistent with the role housing wealth plays as borrowing collateral, especially given food consumption's relatively small share of total household expenditures.

The pattern of results for disaggregated food spending (home and away) suggest that much of housing wealth's direct effect on food expenditures is driven by food consumed at home. In particular, the borrowing collateral channel of housing wealth seems to be unimportant for spending on food consumed at home (non-restaurant meals). Perhaps households feel better about their overall future financial prospects when house prices increase, and purchase items like mesclun lettuce rather than iceberg lettuce. It is also not surprising that households do not borrow from housing equity to finance their meals at home since such spending is a necessary expense, and there are nontrivial transaction costs with accessing home equity. On the margin households will likely divert what income they have to such nondiscretionary spending needs and then worry about financing other required but less essential expenditures through other means.

In contrast, changes in housing wealth results in higher spending on food *away* from home only for households that need to borrow to finance current consumption. Arguably, it is somewhat strange that households borrow against their homes to finance restaurant

meals. Households may, however, derive self-worth or utility from their ability to eat out and hence take advantage of their borrowing capacity to fund such expenditures.

4.4.2 Augmented Food Consumption

As noted earlier, there is also additional reported household expenditure data available in the PSID starting in 1999. These data include expenditures on vehicles (purchase costs and loan payments), medical services, transportation expenses, and other related categories. See Charles et al. (2007) for a detailed discussion of these data. I added these data to the food consumption data to form an additional consumption measure (CPSID) that covers roughly 40 percent of overall household expenditures in the Consumer Expenditure Survey, and serves as a further check of my results.[17]

Given the data availability and short time horizon, I measure CPSID at a point in time (such as 1999) rather than as an average over two- or five-year periods. The relevant empirical specification is therefore:

$$\begin{aligned} CPSID_t^i &= \beta_0 + \beta_1 Y_t^i + \beta_2 W_{t-1}^i + \beta_3 H_{t-1}^i + \beta_4 \left(H_{t-1}^i \cdot I_\ell^i \right) \\ &+ \beta_5 I_{t-1}^i + \eta \mathbf{Z_{t-1}^i} + \delta_t + e_t^i \ . \end{aligned} \tag{9}$$

The main difference between this setup and equation 1 is that I include household income contemporaneously since the CPSID data is reported and not imputed.

Table 6 reports the 2SLS estimates of equation 9, where lagged income (Y_{t-1}^i) serves as an instrument for households' current earnings Y_t^i. Overall, the results using CPSID as the dependent variable are qualitatively similar to the baseline results. In particular, the MPC out of housing wealth for constrained households is much larger than for unconstrained households. The direct wealth effect is also attenuated in the regression that controls for households' borrowing demand. In addition, when I restrict the sample to only include the households present in my baseline estimates, changing house values only impact the spending of potential borrowers and there is no evidence of a NHWE. Overall, these results further reinforce the importance of the collateral role of housing wealth in explaining the relationship between house values and household consumption.

[17] I exclude the additional available expenditure data related to housing costs (mortgage payments, taxes etc), child care and schooling. The schooling data exhibit odd patterns as noted in Charles et al. (2007). Housing costs are directly related to housing wealth changes by construction, and child care is not necessarily a discretionary type expenditure.

4.5 Aggregate Implications of Household Level Results

4.5.1 Approach

I use my baseline housing wealth MPC estimates and the PSID housing wealth data to calculate the impact of the decline in real housing wealth between 2007:Q4 and 2008:Q4 on aggregate nonhousing consumption. According to the Flow of Funds accounts, real housing wealth declined about 11 percent over that time period. Since the PSID data is only available through 2005, I project households' house values forward to the end of 2007 using state-level house price growth data from OFHEO. I then apply the relevant housing wealth decline to each household's housing position and calculate the implied nonhousing consumption effect using the estimated MPCs out of housing wealth from equations 1 and 2. I calculate an overall effect by aggregating the household level spending responses using the PSID weights. This requires re-scaling the 2005 PSID weights to account for the fact that in the United States there are roughly 110 million households of which roughly two-thirds are homeowners.

This exercise considers the direct impact of declining house prices on aggregate consumption holding all else equal. Table 7 reports the estimated results. The numbers in parentheses represent a 95-percent confidence interval for the estimated effects. Column 1 in the table shows the "pooled" aggregate consumption effects assuming that the NHWE alone describes households' consumption response to changes in housing wealth. In particular, I use the estimated results from column 1 in Table 1 and calculate spending impact as follows:

$$\Delta C_{2008} = \sum_{i}^{N^h} \omega_i (H_{08}^i - H_{07}^i) * 0.036 \ , \tag{10}$$

where ΔC_{2008} is the change in aggregate consumption in 2008 due to changing house prices, ω_i is a household's adjusted family weight, H_{08}^i is a household's housing wealth at the end of 2008 (after the relevant price decline), and H_{07}^i is a household's imputed housing wealth in 2007. The change in aggregate consumption is summed over all homeowners (N^h) in the PSID.

The second column in table 7 reports the implied aggregate consumption effects based on assuming that only households with high borrowing needs respond to changes in house prices. In particular,

$$\Delta C_{2008} = \sum_{i}^{N^h} \omega_i \left[I_{05}^i \cdot \left(H_{08}^i - H_{07}^i \right) * 0.109 \right] \ , \tag{11}$$

where I_{05}^i is an indicator variable for a household's borrowing demand in 2005. Overall

about 34 percent of households are potential borrowers in 2005.[18] Using households borrowing demand from 2005 for this exercise is not ideal, but household-level information about homeowners' borrowing needs is necessary for this calculation and I am restricted by the available data. Arguably, this approach is reasonable given that a relevant question is what happens to consumption based on people borrowing in the previous period or periods and needing to scale back their spending as house prices fall.

Finally, table 7's third column reports the results that incorporate the behavior of both constrained and unconstrained households. In particular, the results add together impact of changing house prices on the spending of each group of households as outlined below:

$$\Delta C_{2008} = \sum_{i}^{N^h} \omega_i \left[\left(1 - I^i_{05}\right) \cdot \left(H^i_{08} - H^i_{07}\right) * 0.014 + I^i_{05} \cdot \left(H^i_{08} - H^i_{07}\right) * 0.109 \right] \quad . \tag{12}$$

The percent change in aggregate consumption relative to 2007 based on changes in housing wealth is:

$$\%\Delta C = \left(\left(\frac{C_{2007} + \Delta C_{2008}}{C_{2007}} \right) - 1 \right) * 100 \quad .$$

4.5.2 Results

The top half of table 7 reports the implied consumption effects assuming that all households experience the aggregate housing wealth decline reported in the Flow of Funds (FOF). In other words,

$$H^i_{08} = 0.89 H^i_{07} \quad .$$

All else equal, this 11 percent drop in housing wealth leads to a roughly 75 basis point decline in real nonhousing consumption (row 1). The estimated effect is similar for both the pooled data (equation 10) and the analysis that distinguishes the potential behavior of constrained versus unconstrained households (equation 12). Roughly two-thirds of the reported aggregate decline in spending, however, is due to the behavior of households with high borrowing needs (middle column). In other words, much of the aggregate impact of falling house prices results from the housing wealth's diminished role as collateral when home values fall. Controlling for households' borrowing demand therefore demonstrates the mechanism by which changing house prices impact aggregate spending. Arguably, there could be situations, like when lots of households have been borrowing,

[18] The number of potential borrowers varies over my sample depending on the year. On average about 25 percent of households are constrained in a given year.

where controlling for households' borrowing demand matters for producing an accurate estimate of the implied consumption effect of falling house prices on the aggregate U.S. economy.

I also estimate the aggregate consumption effect using the housing wealth MPCs from the estimates where food consumption is the dependent variable (table 5). In particular, I re-scale the these MPCs to account for food's share of total nonhousing consumption expenditures (16 percent). I then calculate the implied spending impact using the procedure outlined above. The results using the food consumption MPCs (table 7-row 2) are consistent with the baseline estimates. As a result, the implied estimates of aggregate consumption declines are not driven by the imputed nonhousing consumption measure. The only difference is that the results using food consumption attribute less of the decline in aggregate spending to the borrowing collateral role of housing wealth. Overall, the estimates using both consumption measures suggest that the direct aggregate impact of falling house prices on household spending is relatively small.

The bottom half of table 7 shows estimates of the implied aggregate consumption effect of declining housing wealth using the actual state-level house price changes for 2008.[19] Overall, the estimates using the state-level data are very similar to the results that assume all households experience an 11 percent decline in housing wealth. Arguably, the aggregate consumption effects might have been larger using the state-level data if the states with large price declines also had a disproportionate number of households with high borrowing demand. In addition, the state-level price data potentially suffer from the fact that the actual price change for households in New York City likely differs a good deal from those households living near Rochester, New York for example. MSA-level household identifiers, however, are not available in the public data set. Regardless, the state-level results reinforce the finding that in 2008 the direct effect of falling house prices on aggregate U.S. consumption was relatively small.

It is also worth noting that the estimates in table 7 are illustrative and are very much a partial equilibrium exercise. In particular, the calculations ignore the fact that the stock market fell along with the housing market in 2008. The decline in the stock market likely also had a negative wealth effect on U.S. consumption. The key point, however, is that the impact of falling housing wealth on aggregate consumption is small regardless of the estimation approach. The implied aggregate effects could even be biased upward somewhat since the calculations also ignore renters who wish to enter the housing market and are better off when house prices decline.

[19]The state-level house price data come from OFHEO.

5 Extensions

5.1 Alternative Cut-Offs for Identifying Households' Borrowing Demand

As a robustness check, I consider alternative income cut-offs for determining households' borrowing needs. The baseline results identify an individual household's borrowing need based on whether its current income is 10 percent or more below its average income. Table 8 shows the baseline regression estimates when the current income cut-off is 5 percent below households' average income as well as 15 percent below its average income. The results are very similar to the baseline case, and thus do not appear to be sensitive to the income cut-off for identifying households' borrowing demand.

I also conduct a so-called false experiment to test the robustness of my results. The goal is to make sure the results in the previous section do not hold for households who should *not* be constrained. For this experiment I identify constrained households as those whose current income is 10 percent or more *above* their average income. These households experience a positive income shock so they should have sufficient funds to finance their current spending, and therefore they should have limited, if any, borrowing demand. The consumption of these households thus should not increase in response to a positive change in their housing wealth. Indeed, the MPC out of housing wealth is essentially zero for households with income 10 percent or more above their average income (table 8, column 4). As a result, it appears that housing wealth matters for households with income shortfalls but not positive income surprises.[20] This finding reinforces that housing wealth's role as borrowing collateral matters for income constrained households but not households in good economic positions.

As an additional check, I re-estimate my baseline specification using households' actual lagged income relative to their average income, ι^i_ℓ, to capture their borrowing needs rather than using an indicator variable. Table 9 reports these results and shows that the interaction term between the continuous borrowing demand variable and housing wealth is negative, substantial, and precisely estimated. In particular, the more income a household has relative to its average income, the lower its MPC is out of housing wealth. For example, those households with current income 25 percent *below* their average income spend 7.6 cents per $1.00 change in their housing wealth. In contrast, the MPC out of housing wealth is essentially zero for a household with income 25 percent *above* its average income. This result is consistent with the collateral role played by housing wealth.

[20]The regression results for this false experiment show a strong direct housing wealth effect. This is coefficient, however, captures the impact of housing wealth on the consumption of households who *want* to borrow, among others, so it is not surprising that there is a strong effect.

Households with sufficient current income have a much lower need to borrow against their housing equity.

The main difference with using a continuous borrowing demand variable versus an indicator variable is that the estimated MPCs out of housing wealth are slightly smaller for households who demand borrowing. For instance, a household with a current income that is 10 percent below its average income has a MPC of 5.8 cents per $1.00 of housing wealth compared with a MPC of more than 10 cents on the dollar in my baseline results. In addition, households who have slightly higher income than average (10 percent) exhibit a small, positive MPC out of housing wealth (3.4 cents on the dollar). These results are still consistent with housing wealth's role as collateral for household borrowing. They imply, however, that the borrowing collateral effect may be most noticeable for households who experience large house price shocks.

5.2 The Role of Households' Liquid Wealth

I also look at how my baseline results vary across households' LWI distribution. In this context, liquid wealth consists of a household's stock market wealth plus its cash holdings less any outstanding noncollateralized debt. Households who have less liquid assets available to smooth consumption in response to a negative income shock should have higher demand for borrowing against their housing wealth. Zeldes (1989) and others have used households' liquid asset holdings as an indicator of so-called liquidity constraints.

Table 10 reports the results from re-estimating my baseline specifications across the quintiles of households' LWI distribution. The estimates suggest that the direct housing wealth effect is strongest and most precisely estimated for households in the lowest quintile of the LWI distribution (top panel). This finding is consistent with the idea that changes in housing wealth matter the most for households with limited alternative liquid financial resources. There is also evidence of a direct wealth effect for households in the third wealth quintile. Households in the highest LWI quintile also exhibit a substantial response to house value changes, but the effect is not precisely estimated.

When I control for households' borrowing needs, the results suggest that the collateral role housing wealth plays even across the LWI distribution. In particular, households who are constrained and in the lowest wealth quintile increase their consumption 9 cents per $1.00 increase in their housing wealth. The direct wealth effect upon these households is also attenuated a good deal. Indeed, households who have low liquid assets *and* low income relative to average are the ones who respond the most to changes in their housing wealth. This finding is consistent with the results in Hurst and Stafford (2004). With

limited financial resources other than housing equity, low-wealth households are the ones who particularly need to access the equity in their homes in response to negative income shocks.

The consumption of constrained households with high levels of liquid assets also responds strongly to changes in their housing wealth. This finding is somewhat surprising, since households with sufficient liquid assets should not need to borrow against their homes to finance consumption. The result, however, may be driven by the behavior of older households. Such households likely have accumulated many assets given their age, and they may respond to changes in their housing wealth because of plans to downsize their housing stock and realize these capital gains. The result is also consistent with a potential preference by all households for using home equity financing because of its relatively low cost. To the extent that U.S. households believe they can earn a higher return on their liquid assets than the interest costs on their collateralized borrowing, then it makes sense to borrow from their housing equity to smooth their consumption rather then spending down their higher yielding assets.

5.3 Other Sensitivity Analyses

An additional potential concern with these results is that my approach for capturing households' borrowing demand may be capturing income changes from households' planned labor market transitions rather than true income shocks. For instance, a spouse may enter when young and newly married and then decide to leave the labor force when he/she has children. If this move is anticipated then it does not represent a shock to the household's spending capabilities and my approach may not identify a household's true borrowing needs. My results are little changed, however, if I eliminate households with labor market transitions from my sample.

I also investigate the sensitivity of my results to how I control for potential macroeconomic trends in household consumption. Accounting for such trends is important because there could be some macroeconomic shock that influences both house prices and household consumption. For example, if households feel better (worse) about their future income prospects, then their spending would likely rise (fall). House prices would increase (decrease) as well in anticipation of a change in the future demand for housing services. As a result, housing wealth and consumption would be positively correlated, but the change in house prices would not be causing the variation in consumption.

My baseline specification accounts for potential macroeconomic trends using year fixed effects. Technically, these dummy variables should pick up changing employment, interest rates, technology shocks, or other time-varying aggregate factors that may influ-

ence both household consumption and house prices. Estimating my baseline specification using the actual change in the unemployment rate or the change in interest rates over the relevant periods in the data rather than the year fixed effects does not noticeably alter the results.[21]

6 Conclusion

This paper investigated the causal relationship between changes in housing wealth and consumption using data from the PSID. In particular, I examined the collateral role housing wealth plays in household borrowing versus the so-called direct or net wealth effect of housing wealth on consumption. Since higher house prices imply a higher cost of housing services, rising house values should theoretically impact consumption to the extent that these increases allow households the opportunity to smooth consumption by borrowing against their home equity. The data do not cover the most recent housing slump, but they do span previous housing cycles. Results from the previous housing cycles, however, are used to analyze the aggregate implications of the recent housing market collapse.

The estimation results support the borrowing collateral role of housing wealth. In particular, a $1.00 increase in housing wealth leads to roughly 11 cents higher consumption for households with potentially high borrowing needs. In contrast, changes in housing wealth have little impact on the expenditures of households whose borrowing demand is low. Results from empirical specifications that also incorporate household leverage further reinforce the important role of housing wealth as collateral for borrowing. Finally, my back-of-the-envelope calculations show that the direct impact of the 2008 decline in U.S. house prices on aggregate nonhousing consumption is relatively small. In particular, the roughly 11 percent decline in real housing wealth leads to a 3/4 of 1 percent decrease in real nonhousing consumption. The decrease in constrained households ability borrow against their home equity due to falling house prices accounts for roughly two-thirds of this aggregate consumption effect.

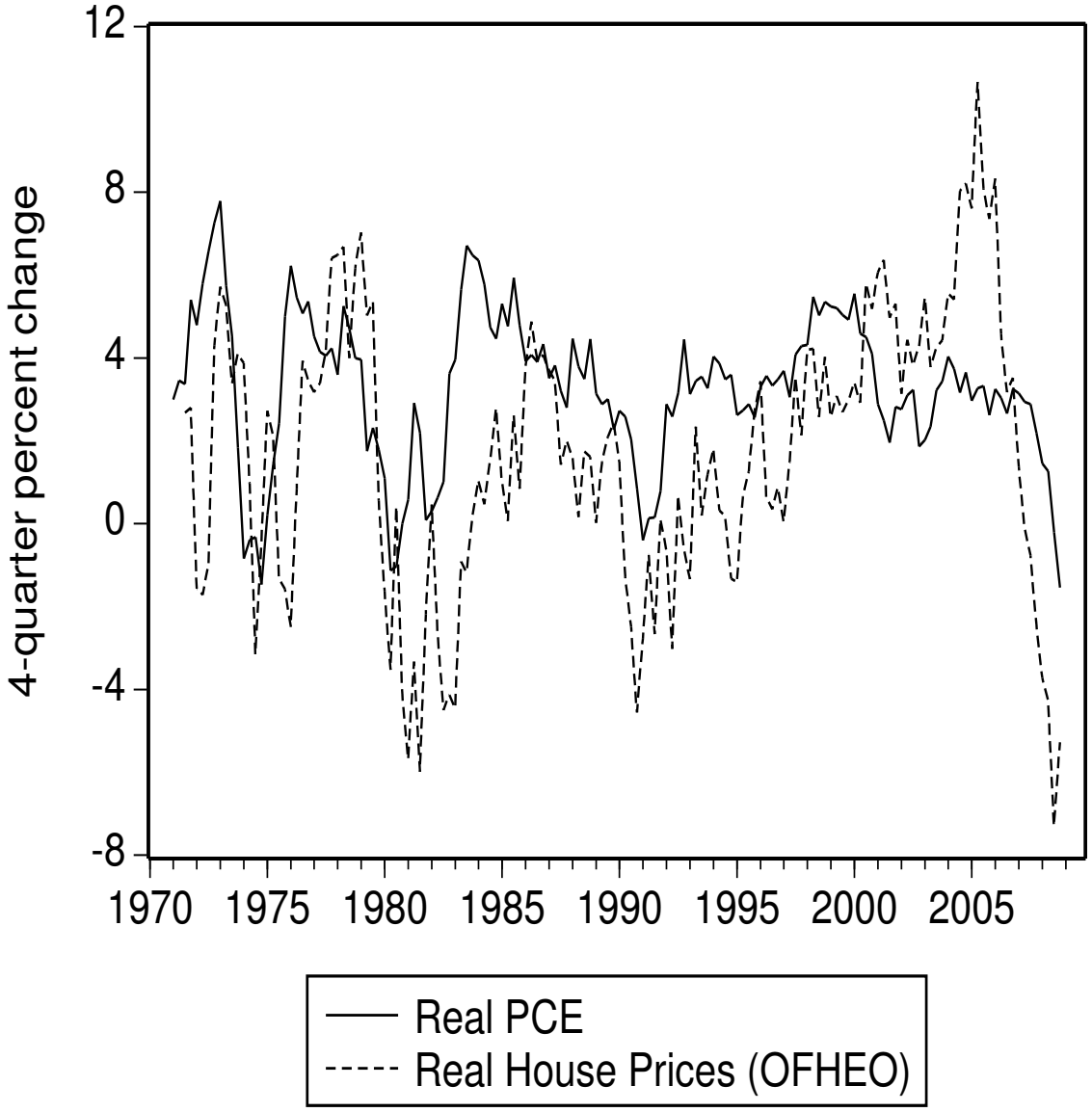
Given my results, an interesting and related question is on what margin or margins do households adjust their consumption in response to a decline in housing wealth after a period of robust house price growth and high levels of home equity financed borrowing? In particular, does the consumption of households who borrowed during the "good times" return to its pre-boom level or do these households have to substitute some of their pre-boom spending for increased debt service costs? Unfortunately, the PSID does not have the necessary detailed consumption data to consider households' marginal spending adjustments in response to house price changes. A dataset such as the Consumer

[21] These results and others that are not reported in this section are available upon request.

Expenditure Survey has the necessary detailed consumption data for such analysis, but lacks adequate information about individual households' lifetime earnings and other information. Considering what areas of consumption are impacted by falling house prices is worthwhile because it provides information as to which sector(s) of the economy may be effected the most by declining home values. I leave these considerations, however, to future research based on better available data.

Figure 1

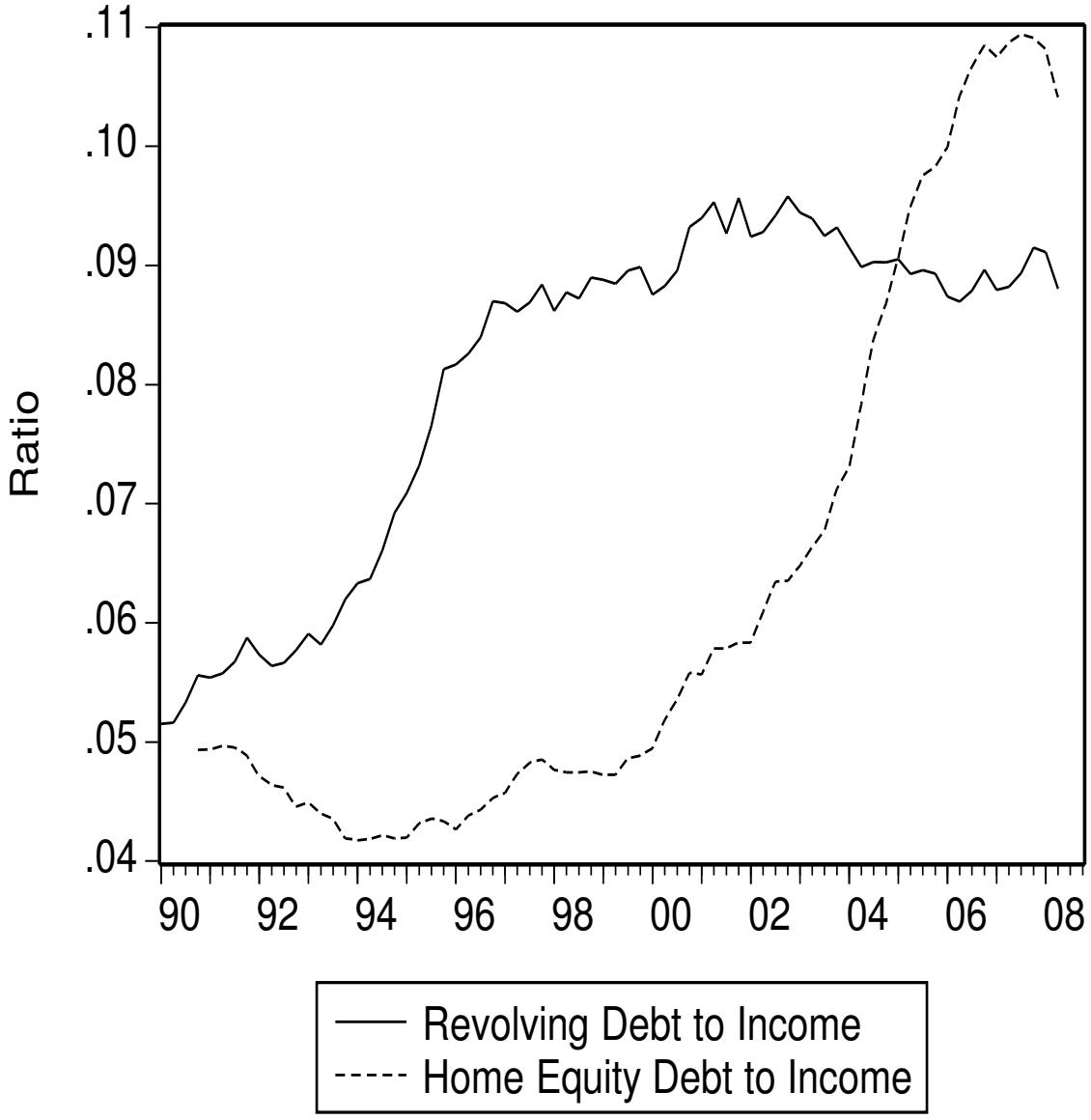
U.S. Real Consumption Growth versus U.S. Real House Price Growth



Source: Author's calculations based on NIPA data (Real PCE) and house price data (OFHEO).

Figure 2

U.S. Home Equity Debt and U.S Credit Card Debt Relative to Income



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

Table 1

Baseline Regressions

Levels

Regressor	(1)	(2)	(3)
Lagged Income (Y_ℓ)	0.824^{***}	0.903^{***}	0.901^{***}
	(0.054)	(0.060)	(0.061)
Financial Wealth$_{t-1}$	0.065^{***}	0.063^{***}	0.064^{***}
	(0.006)	(0.006)	(0.007)
Housing Wealth$_{t-1}$	0.036^{***}	0.014	0.014
	(0.010)	(0.012)	(0.012)
I_ℓ		2735.0	2887.8
		(2816.8)	(2845.0)
Housing Wealth$_{t-1} \cdot I_\ell$		0.094^{***}	0.097^{***}
		(0.025)	(0.024)
Financial Wealth$_{t-1} \cdot I_\ell$			-0.004
			(0.015)
Memo:			
MPC Housing Wealth $\mid I_\ell = 1$		0.109^{***}	0.110^{***}
		(0.022)	(0.022)
N	6172	6172	6172

Source: Author's calculations.
Notes: Y_ℓ is households' lagged income, and I_ℓ is an indicator variable that takes a value of 1 if a household is a potential borrower and is 0 otherwise. All regressions treat income as endogenous and are estimated using two-stage least squares (2SLS). Each specification also controls for year fixed effects, a cubic term for the age of the household head, the number of household members, and the number of children younger than 18. 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 2

Baseline Regressions

Logs

Regressor	(1)	(2)	(3)
Lagged Income (Y_ℓ)	0.826^{***}	0.942^{***}	0.942^{***}
	(0.036)	(0.040)	(0.040)
Financial Wealth$_{t-1}$	0.010^{***}	0.009^{***}	0.008^{***}
	(0.004)	(0.002)	(0.002)
Housing Wealth$_{t-1}$	0.090^{***}	0.033^{*}	0.035^{*}
	(0.019)	(0.020)	(0.020)
I_ℓ		-0.945^{*}	-0.799^{*}
		(0.445)	(0.458)
Housing Wealth$_{t-1} \cdot I_\ell$		0.121^{***}	0.105^{***}
		(0.039)	(0.041)
Finacial Wealth$_{t-1} \cdot I_\ell$			0.005
			(0.005)
Memo:			
MPC Financial Wealth	0.005^{***}	0.005^{***}	0.004^{***}
	(0.001)	(0.001)	(0.001)
MPC Housing Wealth	0.036^{***}	0.013^{*}	0.014^{*}
	(0.007)	(0.008)	(0.008)
MPC Housing Wealth $\mid I_\ell = 1$		0.060^{***}	0.054^{***}
		(0.016)	(0.016)
N	6167	6167	6167

Source: Author's calculations.
Notes: Y_ℓ is households' lagged income, and I_ℓ is an indicator variable that takes a value of 1 if a household is a potential borrower and is 0 otherwise. All regressions treat income as endogenous and are estimated using two-stage least squares (2SLS). Each specification also controls for year fixed effects, a cubic term for the age of the household head, the number of household members, and the number of children younger than 18. 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 3

Baseline Regressions by Age Group

Regressor	age ≤ 35		$35 <$ age ≤ 50		$50 <$ age ≤ 65	
	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Income (Y_ℓ)	0.987^{***}	1.069^{***}	0.890^{***}	0.959^{***}	0.695^{***}	0.769^{***}
	(0.153)	(0.171)	(0.079)	(0.088)	(0.083)	(0.095)
Financial Wealth$_{t-1}$	0.044^{**}	0.048^{*}	0.060^{***}	0.056^{***}	0.075^{***}	0.075^{***}
	(0.020)	(0.028)	(0.009)	(0.010)	(0.009)	(0.011)
Housing Wealth$_{t-1}$	0.026	0.003	0.016	-0.005	0.070^{***}	0.051^{***}
	(0.021)	(0.024)	(0.015)	(0.017)	(0.017)	(0.019)
I_ℓ		7961.1		1004.8		3331.6
		(5664.9)		(4305.5)		(4780.5)
Housing Wealth$_{t-1} \cdot I_\ell$		0.058		0.114^{***}		0.075^{*}
		(0.053)		(0.033)		(0.039)
Financial Wealth$_{t-1} \cdot I_\ell$		-0.018		0.008		-0.008
		(0.036)		(0.027)		(0.020)
Memo:						
MPC Housing Wealth $\mid I_\ell = 1$		0.061		0.109^{***}		0.126^{***}
		(0.049)		(0.031)		(0.035)
N	948	948	3160	3160	2064	2064

Source: Author's calculations.
Notes: Y_ℓ is households' lagged income, and I_ℓ is an indicator variable that takes a value of 1 if a household is a potential borrower and is 0 otherwise. All regressions treat household income as endogenous and are estimated using 2SLS. Each specification also controls for year fixed effects, a cubic term for the age of the household head, the number of household members, and the number of children younger than 18. 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

Baseline Regressions with Household Leverage

Regressor	(1)	(2)	(3)	(4)	(5)
Lagged Income (Y_ℓ)	0.824^{***}	0.901^{***}	0.825^{***}	0.891^{***}	0.897^{***}
	(0.054)	(0.061)	(0.054)	(0.060)	(0.061)
Financial Wealth$_{t-1}$	0.065^{***}	0.064^{***}	0.066^{***}	0.063^{***}	0.064^{***}
	(0.006)	(0.007)	(0.006)	(0.006)	(0.007)
Housing Wealth$_{t-1}$ (h_{t-1})	0.036^{***}	0.014	0.034^{***}	0.026^{**}	0.015
	(0.010)	(0.012)	(0.011)	(0.011)	(0.012)
I_ℓ		2887.8		$1.5e+04^{***}$	4198.1
		(2846.0)		(1997.6)	2994.9
Housing Wealth$_{t-1} \cdot I_\ell$		0.097^{***}			0.086^{***}
		(0.024)			(0.025)
Financial Wealth$_{t-1} \cdot I_\ell$		-0.004			-0.004
		(0.015)			(0.015)
$LTV_{t-2} \geq 0.8, \Delta p^H_{t-1} < 0$			-1879.3	-1315.0	
			(1862.0)	(1841.4)	
$LTV_{t-2} \geq 0.8, \Delta p^H_{t-1} \geq 0$			2699.3	3415.9^{*}	
			(1920.8)	(1933.7)	
$LTV_{t-2} < 0.8, \Delta p^H_{t-1} \geq 0$			1179.2	1402.6	
			(1114.8)	(1122.2)	
L_{t-1}					1346.3
					(1674.7)
$L_{t-1} \cdot I_\ell$					$-1.7e+04^{***}$
					(1674.7)
$h_{t-1} \cdot L_{t-1} \cdot I_\ell$					0.145^{***}
					(0.054)
Memo:					
MPC HW $\mid I_\ell = 1^a$		0.110^{***}			0.101^{***}
		(0.022)			(0.022)
MPC $\mid I_\ell = 1 \& L_{t-1} = 1$					0.245^{***}
					0.049
N	6172	6172	6172	6172	6172

Source: Author's calculations.

Notes: ^{a} MPC out of housing wealth. Y_ℓ is households' lagged income, I_ℓ is an indicator variable that takes a value of 1 if a household is a potential borrower and is 0 otherwise, L_{t-1} is a indicator that equals one if a household's LTV ratio is greater than 0.8 and is zero otherwise, and Δp^H_{t-1} is the change in house prices between time $t-2$ and $t-1$. The positive and negative price changes correspond to the $loss$ and $gain$ variables in equation 3. Similarly, $LTV_{t-2} \geq 0.8$ or $LTV_{t-2} < 0.8$ signifies that a households' leverage is $high$ or low respectively. See text for a further discussion. All regressions treat household income as endogenous and are estimated using 2SLS. Each specification also controls for year fixed effects, a cubic term for the age of the household head, the number of household members, and the number of children younger than 18. 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

Baseline Regressions with Food Consumption

Regressor	Total Food		Food at Home		Food Away	
	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Income (Y_ℓ)	0.029^{**}	0.031^{*}	0.021^{***}	0.022^{***}	0.008	0.009
	(0.014)	(0.016)	(0.004)	(0.004)	(0.013)	(0.015)
Financial Wealth$_{t-1}$	0.000	0.000	-0.000	-0.000	0.000^{**}	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Housing Wealth$_{t-1}$	0.0054^{***}	0.0047^{***}	0.0046^{***}	0.0043^{***}	0.0008	0.0004
	(0.0013)	(0.0012)	(0.0005)	(0.0006)	(0.0012)	(0.0011)
I_ℓ		-547.8		-42.8		-492.9
		(640.5)		(213.2)		(592.5)
Housing Wealth$_{t-1} \cdot I_\ell$		0.004^{**}		0.001		0.003^{**}
		(0.002)		(0.001)		(0.001)
Financial Wealth$_{t-1} \cdot I_\ell$		0.001^{*}		0.001^{**}		0.000
		(0.001)		(0.000)		(0.000)
Memo:						
MPC Housing Wealth $\mid I_\ell = 1$		0.0088^{***}		0.0052^{***}		0.0036^{***}
		(0.0014)		(0.0009)		(0.0008)
N	6148	6148	6155	6155	6161	6161

Source: Author's calculations.
Notes: Variables, regression setup and notation are the same as defined in previous tables.

Table 6

Baseline Regressions with Additional PSID Consumption Data (1999-2005)

Regressor	(1)	(2)	(3)	(4)
Income (Y_t)	0.201^{***}	0.207^{***}	0.209^{***}	0.218^{***}
	(0.012)	(0.012)	(0.017)	(0.017)
Financial Wealth$_{t-1}$	0.001^{*}	0.001	0.003^{**}	0.002
	(0.000)	(0.001)	(0.001)	(0.001)
Housing Wealth$_{t-1}$	0.008^{***}	0.005^{**}	0.004	0.002
	(0.002)	(0.003)	(0.003)	(0.003)
I_ℓ		-1.3e+03		-957.4
		(732.8)		(866.5)
Housing Wealth$_{t-1} \cdot I_\ell$		0.013^{**}		0.011^{*}
		(0.005)		(0.006)
Financial Wealth$_{t-1} \cdot I_\ell$		-0.000		0.003
		(0.001)		(0.003)
Memo:				
MPC Housing Wealth $\mid I_\ell = 1$		0.018^{***}		0.012^{**}
		(0.005)		(0.005)
N	5879	5879	4392	4392
Sample	Unrestricted		Restricted	

Source: Author's calculations.
Notes: "Unrestricted" regressions use all the available consumption data minus outliers as discussed in the text; the "restricted" sample is limited to those households who are also in my baseline regressions. All regressions treat household income as endogenous and are estimated using 2SLS. The rest of the setup is the same as defined in previous tables.

Table 7

Implied Aggregate Nonhousing Consumption Change in 2008

Real Price Change	Pooled[a]	Constrained Only[b]	Separating Constrained & Unconstrained[c]
	Percent Change		
Aggregate Price Data			
11 % Decline[d]	-0.73 (-0.70 -0.76)	-0.47 (-0.42 -0.52)	-0.71 (-0.68 -0.74)
11 % Decline[d] *(w/ converted food MPCs)*[e]	-0.69 (-0.66 -0.71)	-0.24 (-0.21 -0.26)	-0.71 (-0.68 -0.74)
State by State Data			
Actual Price Decline[f]	-0.69 (-0.64 -0.73)	-0.45 (-0.39 -0.51)	-0.66 (-0.60 -0.72)
Actual Price Decline[f] *(w/ converted food MPCs)*[e]	-0.65 (-0.60 -0.69)	-0.23 (-0.20 -0.26)	-0.67 (-0.62 -0.71)

Source: Author's calculations.

Notes: [a] Aggregate effects ignoring the borrowing collateral role of housing wealth; [b] aggregate effects assuming just constrained households are impacted by change in housing wealth; [c] aggregate effects incorporating borrowing collateral role of housing wealth for both constrained and unconstrained households; [d] based on aggregate Flow of Funds data for 2008; [e] results based on using converted food consumption housing wealth MPCs as discussed in the text; [f] actual state level house price declines based on reported OFHEO data.

Table 8

Sensitivity of Baseline Results to Borrowing Demand Indicator Cut-offs

Regressor	Baseline (1)	Cutoff (¡ 0.95) (2)	Cutoff (¡ 0.85) (3)	Cutoff (¿1.10) (4)
Lagged Income (Y_ℓ)	0.901^{***}	0.912^{***}	0.902^{***}	0.920^{***}
	(0.061)	(0.063)	(0.061)	(0.064)
Financial Wealth$_{t-1}$	0.064^{***}	0.066^{***}	0.064^{***}	0.056^{***}
	(0.007)	(0.008)	(0.007)	(0.009)
Housing Wealth$_{t-1}$	0.014	0.009	0.013	0.071^{***}
	(0.012)	(0.012)	(0.012)	(0.014)
I_ℓ	2887.7	3149.6	2210.0	$-4.4e+03^{**}$
	(2847.0)	(2467.7)	(3173.6)	(2042.9)
Housing Wealth$_{t-1} \cdot I_\ell$	0.097^{***}	0.093^{***}	0.122^{***}	-0.067^{***}
	(0.024)	(0.021)	(0.026)	(0.017)
Financial Wealth$_{t-1} \cdot I_\ell$	-0.004	-0.012	-0.009	0.012
	(0.015)	(0.013)	(0.015)	(0.012)
Memo:				
MPC Housing Wealth $\mid I_\ell = 1$	0.110^{***}	0.095^{***}	0.124^{***}	0.010
	(0.022)	(0.017)	(0.022)	(0.013)
N	6172	6172	6172	6172

Source: Author's calculations.

Notes: The cut-off value refers to the level of current income relative to average income that determines households' borrowing demand. In particular, a cut-off of 0.95 means that current income is at least 5 percent lower than average income. The cut-off in my baseline specification is 0.90. The cut-off of 1.10 is the false experiment as discussed in the text. All regressions treat household income as endogenous and are estimated using 2SLS. Each specification also controls for year fixed effects, a cubic term for the age of the household head, the number of household members, and the number of children younger than 18. 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

Baseline Regressions with Continuous Borrowing Demand Variable

Regressor	(1)	(2)
Lagged Income (Y_ℓ)	0.824^{***}	1.074^{***}
	(0.054)	(0.071)
Financial Wealth$_{t-1}$	0.065^{***}	0.058^{***}
	(0.006)	(0.007)
Housing Wealth$_{t-1}$	0.036^{***}	0.047^{***}
	(0.010)	(0.012)
ι_ℓ		-1.4e+04***
		(3625.3)
Housing Wealth$_{t-1} \cdot \iota_\ell$		-0.119^{***}
		(0.030)
Financial Wealth$_{t-1} \cdot \iota_\ell$		0.008
		(0.013)
N	6172	6167

Source: Author's calculations.
Notes: ι_ℓ is households' lagged income relative to their average income in logs. The rest of the setup is the same as discussed previously.

Table 10

Housing Wealth Effects by Liquid Wealth to Income Quintile

Regressor	First Quintile (1)	Second Quintile (2)	Third Quintile (3)	Fourth Quintile (4)	Fifth Quintile (5)
Lagged Income (Y_ℓ)	0.783^{***}	0.726^{***}	0.672^{***}	0.796^{***}	1.043^{***}
	(0.121)	(0.104)	(0.106)	(0.098)	(0.135)
Financial Wealth$_{t-1}$	0.066^{***}	0.071^{*}	0.074^{***}	0.052^{***}	0.054^{***}
	(0.016)	(0.036)	(0.023)	(0.015)	(0.008)
Housing Wealth$_{t-1}$	0.043^{***}	0.020	0.032^{**}	0.005	0.051
	(0.015)	(0.023)	(0.016)	(0.016)	(0.035)
N	1254	1205	1236	1242	1235

Regressor	First Quintile (1)	Second Quintile (2)	Third Quintile (3)	Fourth Quintile (4)	Fifth Quintile (5)
Lagged Income (Y_ℓ)	0.850^{***}	0.737^{***}	0.729^{***}	0.831^{***}	1.212^{***}
	(0.139)	(0.116)	(0.104)	(0.107)	(0.163)
Financial Wealth$_{t-1}$	0.069^{***}	0.090^{*}	0.055^{***}	0.052^{***}	0.051^{***}
	(0.017)	(0.047)	(0.019)	(0.019)	(0.009)
Housing Wealth$_{t-1}$	0.027^{*}	0.013	0.029^{*}	-0.010	0.002
	(0.016)	(0.026)	(0.016)	(0.017)	(0.046)
I_ℓ	7503.1^{*}	5459.5	3906.0	-2.4e+03	5200.5
	(3910.6)	(3524.8)	(4041.0)	(5640.4)	(9486.2)
Housing Wealth$_{t-1} \cdot I_\ell$	0.055^{*}	0.030	-0.027	0.088^{**}	0.160^{**}
	(0.028)	(0.039)	(0.025)	(0.045)	$0.066)$
Financial Wealth$_{t-1} \cdot I_\ell$	-0.027	-0.087^{*}	0.129^{***}	-0.010	0.000
	(0.038)	(0.048)	(0.049)	(0.031)	(0.017)
Memo:					
MPC Housing Wealth $\mid I_\ell = 1$	0.082^{***}	0.043	0.001	0.077^{*}	0.162^{***}
	(0.027)	(0.032)	(0.025)	(0.042)	(0.051)
N	1254	1205	1236	1242	1235

Source: Author's calculations.
Notes: Quintiles are determined based on the distribution of households' liquid wealth relative to income in the baseline sample. Variable definitions are the same as discussed in previous tables. All regressions treat household income as endogenous and are estimated using 2SLS. Each specification also controls for year fixed effects, a cubic term for the age of the household head, the number of household members, and the number of children younger than 18. 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.

A Appendix

A.1 Data Definitions

Real House Prices: Published by the Office of Housing Enterprise Oversight (OFHEO). The house price index is constructed based on a repeat sales methodology using conforming loan data from Freddie Mac and Fannie Mae. The current ceiling for conforming home loans in most jurisdictions is $417,000. See http://www.ofheo.gov/HPI.aspx for more details regarding the construction of the house price index. The nominal data are deflated using the personal consumption expenditure (PCE) deflator excluding housing. This deflator is based off of the published price deflators for total PCE and total housing services consumption in the National Income and Product Accounts (NIPA).

Real Consumption Excluding Housing: Calculated using the Fisher aggregation method given the NIPA data on total PCE and total housing services.

Aggregate Real Housing Wealth: Comes from the Flow of Funds (FOF) accounts published by the Federal Reserve Board (Table B.100 line 4). I deflate the nominal data from the FOF, where applicable, using the PCE deflator excluding housing.

Total Household Wealth: Comes from the Flow of Funds (Table B.100 line 1).

Home Equity Debt Relative to Income: Data on households' home equity debt comes from the Flow of Funds (Table L.218 line 22). The income data is households' disposable income (total income less taxes) from the NIPA accounts.

A.2 Measuring Active Saving in the PSID

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

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

where $I^{i,j}_{t-1,t}$ is the amount invested by 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.

I initially calculate active saving in stocks using equation A.1. The validity of the stock active saving data in the PSID are somewhat questionable, however, because stock prices change rapidly and households cannot easily remember amounts invested or withdrawn. Arguably, households cannot easily distinguish between capital gains in stocks and excess income they invested in equities over a two-or five-year period. As a result, I construct a counter-factual measure of households' active saving in stocks using their reported portfolio values in the wealth supplements and the actual change in stock prices between the data periods. This approach yields a potentially more reliable measure of active saving in stocks, and I discuss it in more detail below.

For asset categories where capital gains are not a factor, active saving is 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 NCD. In particular,

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

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

The remaining active saving category is housing ($j = h$). The actual calculation of such saving depends on whether or not a household moves. Households who do not

move "save" by paying down their mortgage principal, while households who move potentially save or dissave by altering the amount of equity in their homes.

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

where $D^{i,j}_k$ 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 one if a household moved between $k-1$ and k and is zero otherwise. I use k as the time subscript to represent the fact that the time horizon for active saving in housing is different from the other assets. Prior to 1999, housing data are available yearly and the difference between k and $k-1$ represents one year while $t-1$ to t covers 5 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 saving its saving in the individual asset components.

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

Given this measure of household saving out of current income, I calculate a household's nonhousing consumption using a modified version of equation 6.

$$C^{i}_{t-1,t} = (Y^{i}_{t-1,t} - T^{i}_{t-1,t}) - AS^{i}_{t-1,t} \tag{A.6}$$

A.2.1 Alternative Approach for Active Saving in Stocks

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

In particular, I take the value of a household's stock portfolio at time $t-1$ and calculate the household's implied portfolio value in period t based on the actual stock market growth rate between $t-1$ and t. This yields a measure of the household's stock portfolio value at period t excluding any additions to or subtractions from the account. More formally,

$$V_t^{i,m} = (1 + g_{t-1,t})V_{t-1}^i \tag{A.7}$$

where $V_t^{i,m}$ is the implied value of a household's portfolio based on the market return, V_{t-1}^i is the value of the household's reported equity positions at time $t-1$, and $g_{t-1,t}$ is the stock market growth rate.[22] I assume that a household's active saving in equities is the difference between its reported portfolio value in period t and its implied portfolio value $V_t^{i,m}$ from equation A.7. In particular,

$$\bar{AS}_{t-1,t}^{i,s} = V_t^i - V_t^{i,m} \tag{A.8}$$

where $\bar{AS}_{t-1,t}^{i,s}$ is the implied measure of active saving in stocks for each household. I use this saving measure in place of households' reported measure of active saving in stocks in my analysis.

[22] I use the equal weighted, total market index published by CRSP (Center for Research in Security Prices) to calculate the stock market growth rate.

A.3 Data Comparisons to Various Benchmarks

A.3.1 House Prices

Housing wealth in the PSID is self-reported, which raises potential measurement error concerns. Benítez-Silva et al. (2008) show however that households' self-reported house prices are reasonably accurate relative to actual prices using data on self-reported prices and actual home sale prices from the Health and Retirement Survey. Self-reported house values are appropriate for the analysis in this paper, to the extent a household's consumption responds to its perceived change in home value.

Figure A.1 compares the mean reported house price growth in the PSID to the year-over-year house price growth based on the OFHEO data. The two series track each other nicely over time, although the growth downturns in the PSID data are not as severe as in the OFHEO data. In addition, the aggregate housing wealth data in the PSID is relatively consistent with the aggregate housing wealth data reported in the FOF accounts (not shown). Overall the data suggest that households self-reported housing wealth data in the PSID is reasonably accurate. Lovenheim (2009) reaches a similar conclusion about the housing wealth data in the PSID using a slightly different approach. Section A.4 discusses the variation in house prices across households and across space in the PSID in more detail.

A.3.2 Consumption

I evaluate the reasonableness of my imputed nonhousing consumption measure in two ways. First, I compare spending cross-sectionally by household age groups with the relevant data in the Consumer Expenditure Survey (CEX). The CEX data are used for calculating much of the Consumer Price Index, and are considered by many to be the most complete and comprehensive measure of micro level household spending. Figure A.2 graphs the relevant consumption-age profiles.

Both the PSID and CEX profiles show the expected hump shaped patterns over the

age distribution. My imputed consumption measure, however seems on average to be a bit lower than the CEX data for younger households. In contrast, consumption in the PSID is a good bit higher for older households. Nonhousing consumption peaks later in the PSID than the CEX, but this is true even for actual reported consumption measures in the PSID post-1999 (see Charles et al. 2007 for more details). Overall the age profile for imputed nonhousing consumption looks reasonable. Nonhousing spending in the PSID is not dramatically too low or too high relative to the CEX. The fact that there is too much consumption for older households is not a huge concern since I limit my estimation sample to households younger than 65. My results also hold across different age groups.

I also aggregate the imputed nonhousing consumption data and compare them with the relevant nonhousing consumption data in the NIPA accounts. These results appear in Table A.1. Again, the implied aggregate nonhousing consumption data from the PSID is not orders of magnitude different from the NIPA data. The PSID data, however, are a good bit lower than the NIPA data and they do not monotonically increase over time. A possible explanation for this pattern is that the PSID weights are designed for comparing sample means to population means and not sample aggregates to population aggregates. Overall, the evidence in figure A.2 and table A.1 suggest that the imputed consumption data are a reasonable measure of households' nonhousing expenditures.

A.4 PSID versus Actual House Price Variation

In order to identify the relationship between housing wealth and consumption at the household level, there needs to be sufficient variation in reported house values in the PSID both across households and over time. This section discusses the variation in actual house prices over my sample period based on the OFHEO data as well as the reported house value changes in the PSID.

Figure A.3 shows the real, year-over-year growth rates of the OFHEO house price index from 1971 until the present. The actual OFHEO index begins in 1975; however I overlay data from the Freddie Mac Conventional Mortgage House Price Index (CMHPI)

which begins earlier.[23] The benefit of using the OFHEO or CMHPI house price indexes to analyze trends in U.S. house prices is that they control for changes in housing quality over time. In addition, the the indexes have much broader geographic coverage compared to the Case-Shiller index.

The data suggest that prior to the run-up in house prices in the mid-1990s there were two previous housing cycles. One cycle occurred in the late 1970s and the other from the mid-1980s until the early 1990s. Neither of these previous episodes exhibit the extended run-up in house price growth that occurred during the most recent housing boom. Both earlier cycles, however, included periods of high positive and high negative house price growth. The PSID data in this paper thus cover a period where house prices rose sharply (late 1980s) and declined considerably (early 1990s).

In addition, actual house prices at the local level vary greatly over my sample period. Table A.2 shows the relative peaks and troughs of real, four-quarter OFHEO house price growth for selected MSAs between 1980 and 2006. The table also reports the cumulative, real price growth in each MSA between the first quarter of 1980 and the fourth quarter of 2005. The data suggest that large house price growth fluctuations occurred in MSAs on both coasts over this period while interior MSAs experienced more modest price changes. The MSA data also show that periods of strong price growth or large price declines did not occur simultaneously across areas of the country. For instance, while the Los Angeles MSA witnessed more than a 11 percent decline in prices in late 1994, Denver experienced a period of robust price *growth*. Similarly, MSAs like Denver and St. Louis experienced large price growth declines in the late 1980s while other MSAs had substantial price appreciation. In addition, prices declined in late 2001 in the Rochester MSA at a time when elsewhere house prices rose considerably. Overall, these data show that my sample covers a period with noticeable actual house price variation.

The question remains though whether there is adequate reported house price fluc-

[23]The CMHPI follows the same repeat sales methodology as the OFHEO index, but includes a smaller number of housing transactions.

tuations in the PSID data to exploit the actual house price variation for identifying the relationship between housing wealth and consumption. I cannot directly compare the actual MSA house price growth to the reported house price changes in the PSID because the public PSID data do not have MSA level identifiers. I can, however, examine variation based on households' state of residence. Table A.3 shows that there is indeed substantial fluctuations in reported house value changes in the PSID across states and over time. For example, roughly 41 percent of households in Michigan report price declines greater than 10 percent between 1982 and 1984. In contrast, only 16 percent of households in Massachusetts reported price drops of the same magnitude over that period. This trend is consistent with the price growth reported by OFHEO at the MSA level for Detroit versus Boston in the early 1980s (see table A.2). Notice as well that some households report large price declines during the early 2000s when overall house price growth in the United States shot up. As a result, my sample includes variation in reported house values even during the recent price boom. In addition, there is plenty of within state housing wealth fluctuations. California and Tennessee are particularly good examples.

Table A.4 shows the percentage of households in my sample for selected states. The data in the table suggest that there is adequate household representation in the PSID across the regions that experienced the largest house price fluctuations over time. Arguably, only knowing a household's state of residence is a potential concern since there is a big difference in housing trends between cities such as New York and Rochester that are in the same state. This data limitation should not adversely impact my results, however, to the extent that households in Rochester and New York City recognize that their local house value fluctuations differ from other areas of the state.

Table A.1

Average U.S. Household Consumption Excluding Housing per Period
Billions of 2000 Dollars

Period	NIPA	PSID
1984-1989	3570	3640 (3530 3760)
1989-1994	4105	3570 (3470 3670)
1994-1999	4874	4560 (4400 4720)
1999-2001	5690	4750 (4600 4900)
2001-2003	6061	4630 (4500 4760)
2003-2005	6467	4700 (4560 4840)

Source: Author's calculations.
Notes: Numbers in parentheses represent a 95-percent confidence interval for the PSID totals. The table reports average expenditures over the relevant period.

Table A.2

Peak and Trough Real U.S. House Price Growth for Selected MSAs

Boston		Cincinnati		Chicago		Dallas		Denver	
1982:Q2	-2.2	1982:Q3	-10.9	1981:Q4	-8.9	1978:Q4	11.9	1978:Q4	15.8
1985:Q2	26.3	1987:Q3	8.3	1985:Q2	4.7	1987:Q4	-11	1982:Q1	4.9
1990:Q4	-12.8	1991:Q3	-0.3	1990:Q4	-2.3	1998:Q3	5.3	1987:Q4	-7.7
2002:Q2	12.5	2004:Q4	9.0	2002:Q2	4.3	2001:Q4	5.1	1994:Q2	10.7
2006:Q3	-2.5			2006:Q3	-1.2	2004:Q4	-0.7	2000:Q1	12.2
								2003:Q3	-0.4
269.4		21.9		89.7		-4.4		63.3	
Detroit		**Houston**		**Los Angeles**		**New York City**		**Philadelphia**	
1979:Q1	16.4	1982:Q2	11.5	1982:Q3	-6.2	1982:Q2	-1.1	1982:Q1	-6.9
1982:Q4	-22	1987:Q3	-12.8	1989:Q3	19.3	1986:Q4	22.6	1987:Q3	16.2
1987:Q1	11.3	1999:Q4	6.2	1994:Q4	-11.5	1990:Q4	-11.1	1995:Q1	-6
1990:Q4	-0.9	2004:Q4	0.5	2006:Q4	28.3	1997:Q1	-0.3	2004:Q3	14.5
1998:Q1	7.6					2004:Q3	15.8		
2006:Q3	-5.4								
52.5		-13.5		183.4		231.9		119.6	
Pittsburgh		**Rochester**		**San Francisco**		**St. Louis**		**Tucson**	
1981:Q1	-14.3	1983:Q1	13	1979:Q3	15.1	1981:Q2	-15.6	1981:Q2	13.3
1987:Q3	3.7	1990:Q4	-5.6	1982:Q1	-6.3	1987:Q2	4.7	1982:Q4	-14.9
1995:Q1	-3.2	1995:Q1	-6.2	1988:Q4	20.3	1990:Q4	-5.7	1986:Q2	6.6
1998:Q1	4.8	1998:Q2	3.3	1991:Q1	-8.8	2005:Q2	5.9	1990:Q4	-5.4
1994:Q4	-1.7	2001:Q4	-3.5	2000:Q3	21.5			1994:Q3	8.0
2003:Q4	3	2004:Q2	2.5	2003:Q3	1.4			1997:Q2	-0.2
				2005:Q2	18.4			2005:Q4	25.2
20.0		24.8		220.0		50.2		82.3	

Source: Office of Federal Housing Enterprise Oversight (OFHEO).

Notes: The second column in each cell lists the real four-quarter growth rate for house prices (in percentage points) as of the given quarter in column one. Prices are deflated using the personal consumption expenditure deflator excluding housing. The number at the bottom of each cell is the cummulative percent change in real house prices between 1981Q1 and 2005Q4. Cell headings are abbreviated. The official MSA names are: Boston: Boston-Quincy, MA ; Chicago: Chicago-Naperville-Joilet, IL; Cincinnati: Cincinnati-Middletown, IN-OH-KY; Dallas: Dallas-Plano-Irving, TX; Denver: Denver-Aurora, CO; Detroit: Detroit-Livonia-Dearborn, MI; Houston: Houston-Sugarland-Baytown, TX; Los Angeles: Los Angeles-Long Beach-Glendale, CA; New York City: New York City-White Plains-Wayne, NY-NJ; Philadelphia: Philadelphia, PA; Pittsburgh: Pittsburgh, PA; Rochester: Rochester, NY; San Francisco: San Francisco-San Mateo-Redwood City, CA; St. Louis: St. Louis, MO-IL; Tucson: Tucson, AZ.

Table A.3

Distribution of Self-Reported Real House Price Changes in the PSID for Selected U.S. States

House Price Change	1982-1984	1987-1989	1992-1994	1997-1999	1999-2001	2001-2003
				Texas		
Decrease more than 10 %	23	23.4	15.5	17.6	14.4	13.8
Decrease 0 to 10 %	5.9	14.2	14.2	12.4	12.4	13.6
Rise 0 to 10 %	7	3.1	8.3	12.8	8.1	11
Rise more than 10 %	64.2	59.3	61.9	57.2	65.1	61.6
				Tennessee		
Decrease more than 10 %	39.8	19.9	24.6	15	17.5	24
Decrease 0 to 10 %	9.8	22.1	14.6	14.2	16.8	14.9
Rise 0 to 10 %	8.9	8.4	8.2	11	10.7	8.4
Rise more than 10 %	41.5	49.6	52.7	59.8	55	52.6
				New York		
Decrease more than 10 %	14.2	14.9	14.1	11.8	12.4	11.6
Decrease 0 to 10 %	4.4	15.7	20.4	19.5	7.3	6.7
Rise 0 to 10 %	10.5	11.6	13.1	10.4	7.6	8.6
Rise more than 10 %	71	57.8	52.4	58.4	72.7	73.1
				Missouri		
Decrease more than 10 %	34.7	17.3	12.8	18.8	15.6	16.8
Decrease 0 to 10 %	9.4	20.8	17.3	16.1	12.7	8.6
Rise 0 to 10 %	10.3	9.4	20.5	13.4	9.3	12.1
Rise more than 10 %	45.5	52.5	49.4	51.6	62.5	62.5
				Michigan		
Decrease more than 10 %	40.6	20.6	16.7	9.3	10	12.8
Decrease 0 to 10 %	8.3	16.4	17	7.7	9.4	14.7
Rise 0 to 10 %	5.6	7.1	13	13	11.7	9
Rise more than 10 %	45.6	55.9	53.3	70	68.9	63.5
				Masachusetts		
Decrease more than 10 %	16	13.9	21	9.3	4.1	10.1
Decrease 0 to 10 %	7.1	13.9	32.4	16.1	7.5	7.2
Rise 0 to 10 %	13.5	8.3	12.4	13.6	10.9	8.6
Rise more than 10 %	63.5	63.9	34.3	61	77.6	74.1
				Illinois		
Decrease more than 10 %	24	13.2	9.6	15.4	12.3	8.9
Decrease 0 to 10 %	11.1	6.9	16.6	12.2	7.6	8.9
Rise 0 to 10 %	9.2	11.3	10.8	14.9	12.3	8.5
Rise more than 10 %	55.8	68.6	63.1	57.5	67.8	73.6
				California		
Decrease more than 10 %	24.8	11.2	25.7	11.4	7.7	9.3
Decrease 0 to 10 %	11.9	8.2	11.4	10.4	8.8	7.2
Rise 0 to 10 %	6.4	7	5.7	8.7	6.2	6.8
Rise more than 10 %	56.9	73.7	57.1	69.5	77.3	76.7
				Pennsylvania		
Decrease more than 10 %	24.4	16	14.6	14.2	14.5	20.3
Decrease 0 to 10 %	7.6	15.4	15	21.2	18.3	11.4
Rise 0 to 10 %	6.5	8.2	10.8	12.7	11.4	9.5
Rise more than 10 %	61.5	60.4	59.6	51.9	55.8	58.9

Source: Author's calculations using PSID data.
Notes: The chosen years for price changes correspond to years preceding the periods of active saving and non-housing consumption in my sample. Arguably, these are the price changes that potentially influence households' consumption decisions.

Table A.4

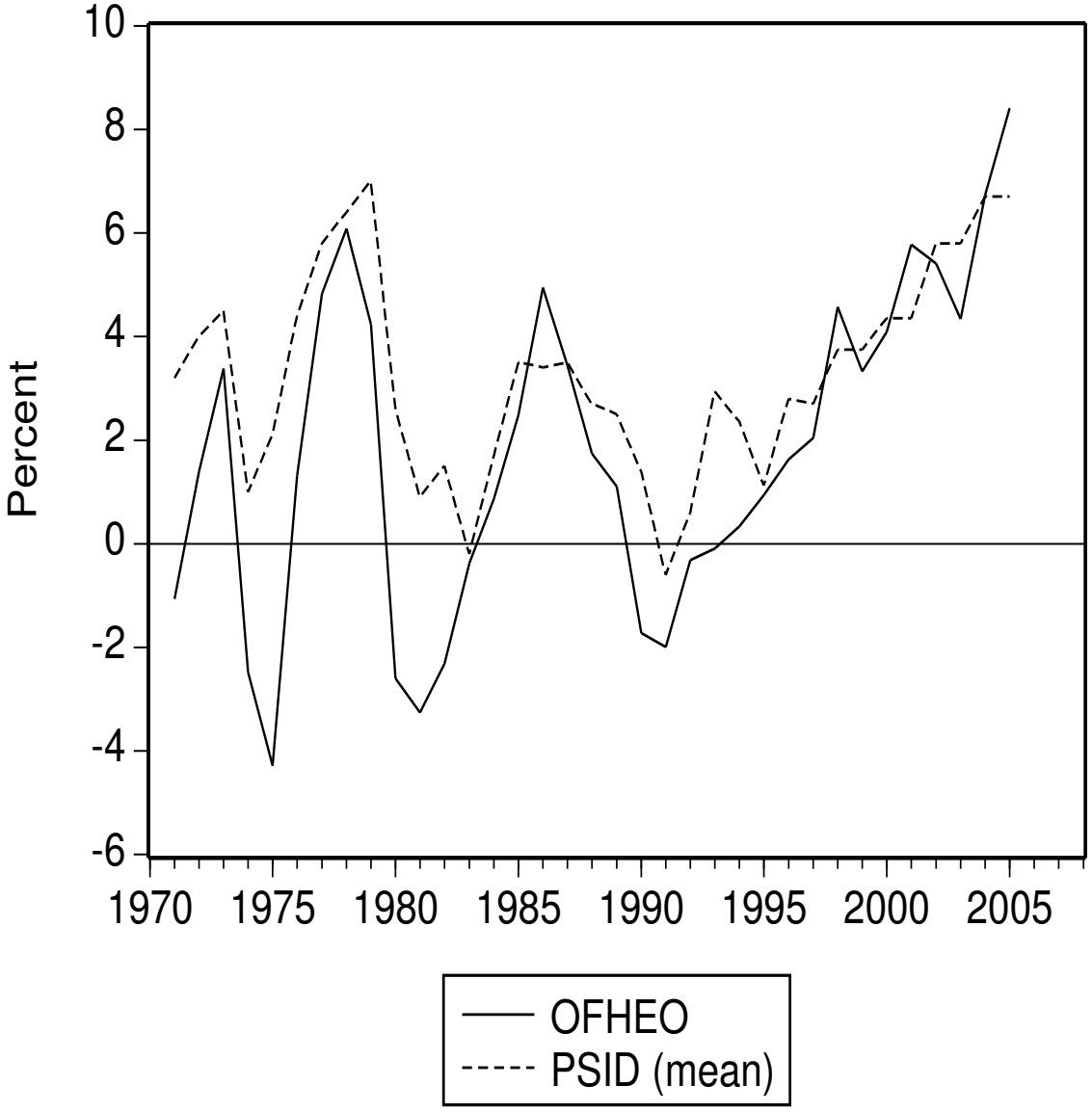
Percent of PSID Sample in Selected U.S. States by Sample Year

	1984	1989	1994	1999	2001	2003	2005
CA	9.5	8	6.8	6.7	5.6	5.9	7.6
CO	1.1	1.6	1.7	1.9	2	2	2.1
IL	3.1	3.1	2.9	3	3.5	3.3	3.2
MA	2.1	2.9	3	2.9	3	2.5	3.1
MI	5	5.2	5.3	5.9	5.1	5.2	4.8
MO	3.1	2.6	3.2	3.2	3.3	3.1	3.3
NY	4.3	4.1	3.6	3.8	3.9	3.7	4.2
OH	4.4	4.9	4.9	5.4	5.4	5.3	5.3
PA	5.2	4.4	5.7	5	4.6	5.1	4.1
TN	1.5	1.9	2.3	2.1	2	2.1	1.7
TX	6.1	4.1	4.3	3.5	3.7	4.8	4.9
% Total Sample	45.4	42.8	43.7	43.4	42.1	43	44.3

Source: Author's calculations using PSID data.

Figure A.1

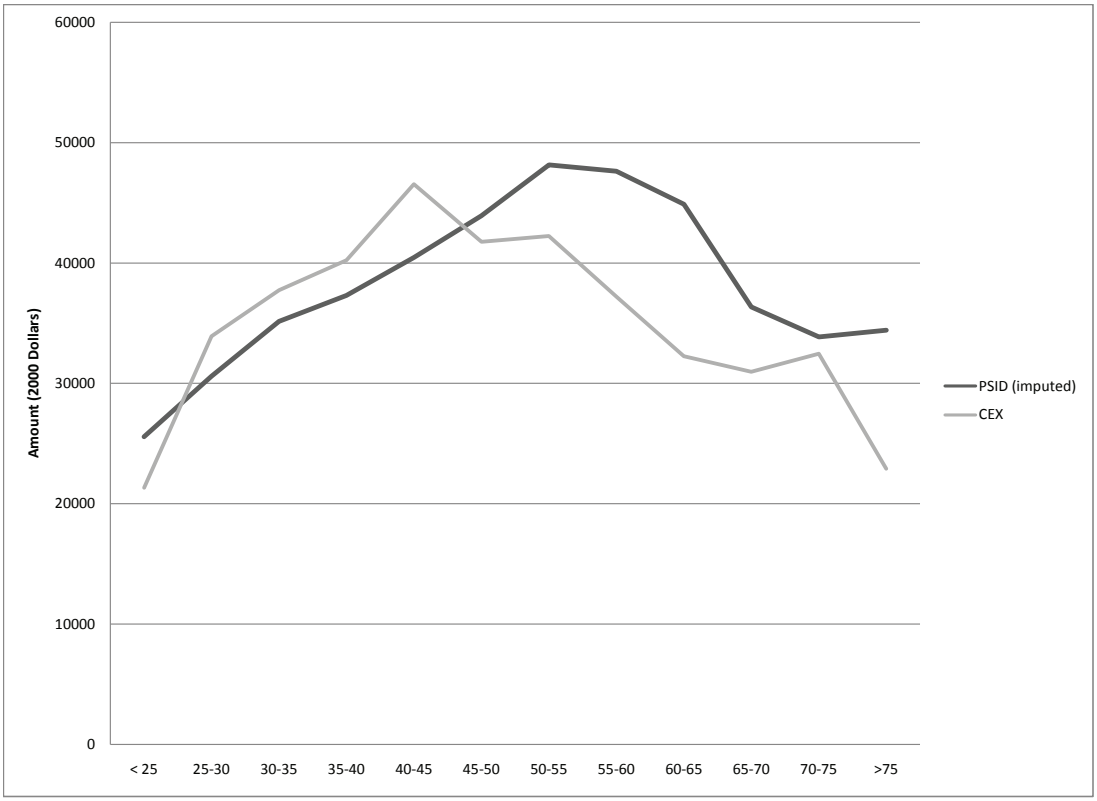
Real Annual U.S. House Price Growth: OFHEO versus PSID



Source: Author's calculations based on OFHEO and PSID data.

Figure A.2

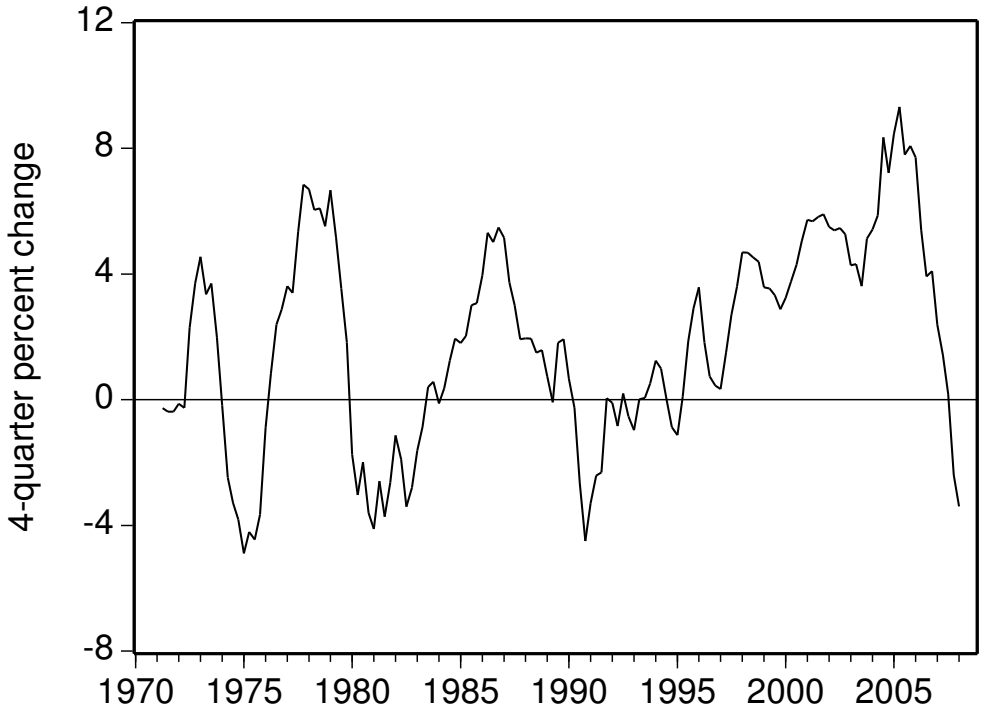
Imputed PSID Spending Data and CEX Data by Age (2001)



Source: Author's calculations based on CEX and PSID data.

Figure A.3

U.S. Real House Price Growth



Source: Author's calculations based on OFHEO and CMHPI data.

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