A   Appendix

This online appendix provides supplementary material for "House Price Fluctuations: The Role of Housing Wealth as Borrowing Collateral." Much of the appendix focuses on discussing alternative expenditure data in the PSID to households' NHE and the results from using these alternative spending measures to estimate the relationship between consumption and housing wealth. The appendix also discusses in detail the PSID active saving data and also includes supplementary tables as mentioned in the main text.

A.1   Consumption Data Evaluation

A.1.1   Overview

Starting in 1999, the PSID recorded data on households' mortgage payments, health expenditures, child care expenditures, utilities and transportation related expenses. Questions regarding expenditures on recreation, vacations, (minor) home repairs and household furnishings were added to the PSID starting in 2005.[1] For simplicity, these expenditures will be referred to as "PSID consumption." According to Charles et al. (2007) these data cover a large portion of household expenditures, although Cooper (2010) shows that they are still much less comprehensive than the measure of non-housing expenditures (NHE) used in the main analysis in the paper. Still, these data are reported by households rather than imputed, which potentially results in less noise.

In addition, Blundell, Pistaferri, and Preston (2006) (BPP) propose an alternative approach for imputing household expenditure data in the PSID. In particular, they estimate the relationship between food expenditures and total nondurable expenditures in the *Consumer Expenditure Survey* (CEX) and then use this observed relationship along with the PSID food consumption data to impute households' nondurable expenditures.[2] This approach is similar to an earlier method used by Skinner (1989), and it is beneficial because it generates a measure of household expenditures in any PSID wave that contains food consumption data (all years except 1988 and 1989). BPP's methodology can also be used to impute other spending measures available in the CEX such as total household expenditures excluding housing.

A.1.2   Evaluation

Cooper (2010) evaluates the different methods for imputing household expenditure data in the PSID. Among other things, that paper extends BPP's imputation methodology through 2007 and

---

[1]Large household home repair expenditures such as a kitchen remodeling are included as part of households' saving in housing.

[2]BPP's measure of non-durable expenditures includes food, household utilities, public transportation costs, clothing, tobacco, personal care products, rent and personal services expenditures.

compares imputed NHE and the BPP data to the relevant NIPA per capita consumption data.[3] Figure 3 in the main text is a slightly updated version of Figure 7 in Cooper (2010). Overall, the imputed NHE data line up reasonably well with aggregate per capita non-housing expenditures, especially compared to alternatives such as using BPP's methodology to infer households' total non-housing consumption based on the available spending data in the CEX. Similarly, the top panel of Table A.1 shows that annualized NHE are $15000 to $28000 higher than the next highest expenditure measure except for 2007.[4] These results confirm that households' NHE data are the broadest spending data available in the PSID over time.

Figure A.1 shows that BPP's approach does succeed in matching imputed nondurable expenditures in the PSID with the data in the CEX. The nondurable expenditure data in both datasets, however, are a good bit lower than the relevant aggregate benchmark. This outcome is consistent with the CEX's tendancy to under-report household expenditures relative to the aggregate data.[5]

In addition, this paper's NHE imputation approach relies on households accurately reporting their income and saving. The bottom portion of Table A.1 shows that PSID mean and median after-tax family income and saving per person are low relative to the equivalent NIPA data. This average under-reporting in the PSID appears to cancel out, however, when calculating households' total expenditures given that the NHE data are roughly in line with the NIPA data.

The discussion in Bosworth and Anders (2008) raises some additional concerns regarding the wealth and saving data in the PSID. In particular, the authors show that the PSID is useful for capturing the wealth of typical families but not high net worth families. Such households are not the marginal borrower, however, when it comes to evaluating the borrowing collateral role of housing wealth, so the authors' results are not a major concern for this paper's analysis. Bosworth and Anders (2008) also argue that household saving rates in the PSID are high relative to the NIPA personal saving rate, and do not exhibit the observed secular decline over the last few decades. To the extent saving is too *high* in the PSID, then calculated NHE may be too low, all else equal, and this paper's results could potentially be biased toward finding no housing wealth effect when in fact a wealth effect exists. The summary statistics in Table A.1, however, argue against this concern. In particular, the *level* of saving over this paper's estimation range is too *low* relative to the aggregate data.

In addition, Table A.2 reports mean and median saving rates in the PSID both for all PSID respondents as well as this paper's specific estimation sample. The data do not exactly match the aggregate saving rate data, but they exhibit a downward trend over time, and they are not

---

[3]Blundell, Pistaferri, and Preston (2006) only impute non-durable consumption expenditures in the PSID through 1992. Per capita data in the PSID are calculated by dividing expenditures by family size.

[4]The baseline estimation sample does not include the 2007 data because of the timing of the empirical approach.

[5]See Sabelhaus (2010), among others, for a discussion of the shortcomings of the recent CEX data and ongoing work to improve them.

consistently too high.[6]

A.1.3 Results using Alternative Consumption Data

Table A.3 shows the baseline estimates that use the PSID consumption data as the dependent variable. The sample starts in 2001, even though the consumption data begin in 1999, in order to control for households' financial wealth and housing equity prior to their consumption decisions.[7] Overall, the estimated effect of home equity on consumption in column 1 is smaller than previously estimated—households' spending increases 2-cents per dollar increase in their housing equity compared with 6-cents in the main results. Households' estimated MPC out of income is also smaller. These effects are consistent with the reported PSID consumption data capturing a narrower basket of expenditures than households' imputed NHE.

The remaining columns in Table A.3 split the sample based on whether households are potentially borrowing constrained. The point estimates in columns 2 and 3 show that the MPC out of housing wealth is greater for households with above median LWY than households with below median LWY. This finding contrasts with the baseline results, but the estimated effects across LWY groups are not statistically different from one another. Splitting the sample based on households' DSR also does not show a differential consumption response to housing wealth changes. Dividing high DSR households further based on their LWY holdings yields a similar pattern of results as splitting the sample based on households' LWY alone. The evidence in Table A.3 that is consistent with the borrowing collateral role for housing wealth is that the estimated housing wealth effects are higher for high EYG households than low EYG households. These estimates, however, lack precision. Overall, the results using the PSID consumption data show a small effect of housing wealth on consumption across all households and little evidence of different effects across household groups.

As an additional check, I impute a basket of expenditures in the PSID equivalent to reported non-housing expenditures in the CEX (imputed CEX expenditures) using BPP's methodology but with the PSID consumption data as a base for the imputation rather than just food consumption. The results using these data are shown in Table A.4. The estimates are virtually identical to those in Table A.3. Even though households' imputed CEX expenditures are greater than the actual PSID consumption data, virtually all of the within-household variation in these expenditures comes from households reported consumption. This is due to the fact that the only time varying component of BPP's imputation procedure is the consumption measure available in both the PSID and CEX.

---

[6]The results are not very sensitive to the treatment of outliers. In addition, augmenting the wealth and saving data with the bracketed wealth information like in Bosworth and Anders (2008) also has little impact on the saving rate estimates.

[7]The PSID consumption data are annualized and include the additional reported expenditure data that become available in the 2005 wave.

This finding highlights an additional reason why using households' NHE data is appropriate for the baseline analysis —the data vary within households over time in ways that are not directly tied to the existing (narrower) expenditure data in the PSID. At the same time, the correlation between NHE and PSID consumption is 0.32, which suggests that the variation is NHE is related to households' actual expenditures and is not completely spurious.

The results in Table A.5 use imputed non-durable expenditures as the dependent variable. Since non-durable expenditures are imputed based on households' food consumption, they are available prior to 1999. Non-durable expenditure data for 1989, 1994, and 1999 are included in the regressions, in addition to the relevant data from 2001 onward, for easy comparison to the baseline results.[8] Housing equity is measured two years prior to the consumption period for all years (e.g. 1992 for 1994 expenditures). This approach maintains consistent timing of housing wealth relative to consumption across all years and accounts for the fact that non-durable expenditures are measured for a particular year (e.g. 1994) compared to annualized NHE expenditures. The estimates in Table A.5 show a small, if any, impact of housing wealth on households' consumption. This finding contrasts with the small but precisely estimated effect of housing wealth on NHE in the baseline estimates with the same sample horizon and data timing (see Table 6 column 1).

The non-durable expenditure results also show little evidence of housing wealth having a larger impact on household expenditures during the easy credit period in the early 2000s. Households' MPC out of housing wealth also does not appear to vary much across potentially constrained versus unconstrained household groups. Households' non-durable expenditures are a relatively narrow basket of goods, however, and likely do not capture all of the margins on which households adjust their spending in response to changes in their housing equity. Alternative, broader imputed measures of household expenditures using BPP's methodology, such as total consumption excluding housing, yield very similar results because all of the within-household variation in these expenditure data is based on the within-household variation in food consumption. Most households are likely not paying for their food expenditures by extracting housing equity.

A final set of supplemental results incorporates additional years of spending data prior to 1999. Recall that the baseline results have annualized NHE for 1989, 1994 and 1999 only. The alternative expenditure data are based on BPP's imputation method and are available for every year prior to 1999 except 1988, 1989 and 1998.[9] The estimates in Table A.6 cover 1984 to 2005 and use imputed expenditures equivalent to the spending categories covered by the PSID consumption data in 2005 (imputed PSID expenditures).[10] The empirical setup for the estimates in Table A.6 is also slightly different from the baseline results due to data availability. In particular, households' asset income

---

[8]Imputed non-durable expenditures from 1990 are substituted for 1989 expenditures since food consumption data were not collected in the PSID in 1989, and thus non-durable expenditures cannot be imputed in that year.

[9]Food consumption data were not collected in 1988 and 1989 and the PSID survey did not occur in 1998.

[10]Other imputed expenditure measures yield very similar results.

(dividends, interest, and rental income) is substituted for households' financial wealth since asset income data are available in each PSID wave.[11] The wealth data (asset income and housing equity) are measured at the beginning of the expenditure period conditional on data availability (e.g. 1999 for 2001 expenditures, 1992 for 1993 expenditures, and so on.)

Column 1 in the table shows the full sample results. Once again, the estimated effect of housing wealth on consumption is small and imprecisely estimated despite the additional years of data. Households' MPC out of housing wealth is slightly larger (2 cents per dollar increase in housing equity) and more precisely estimated for the pre-2001 sample period (column 2). In contrast to the baseline results, housing wealth does not impact household spending from 2001 to 2005. In columns 4 through 7 the sample is split based on whether households have above or below median asset income relative to total income (AYY). This approach proxies for households that have low versus high financial resources since households with higher asset income likely have greater financial wealth holdings. Households with below median asset income are therefore potentially constrained, like households with low LWY. The results in columns 4 and 5 suggest that housing wealth has a larger impact on consumption for households with low AYY prior to 2001. This finding is broadly consistent with the borrowing collateral channel for housing wealth, although the estimated effects for high versus low AYY households are not statistically different from one another.

Overall, the results in Table A.6 show some evidence that housing equity matters for households' consumption decisions and in some instances may matter more for potentially constrained households. The estimates using the additional spending data find evidence of housing wealth impacting household spending prior to 2001 unlike the baseline estimates that are potentially limited by the the long time spans over which NHE are measured.

Taken together, the results using the alternative consumption data are mixed. The estimated impact of housing wealth on consumption is close to zero, which is small relative to the baseline findings as well as the existing literature, and there is limited evidence of housing wealth affecting consumption through the borrowing collateral channel. These results could be interpreted as suggesting that the baseline findings are not robust. Focusing on these alternative consumption results, however, requires arguing that housing wealth has a very small or nonexistent effect on consumption in contrast to recent cross sectional findings in the literature. In addition, the empirical evidence suggests that all of the alternative consumption data cover a relatively narrow basket of household expenditures compared to households' NHE and have limited within-household variation.

---

[11]A three year average of households' asset income is used to reduce measurement error.

FIGURE A.1: Comparison of Non-durable Expenditure Data to Aggregate Benchmark
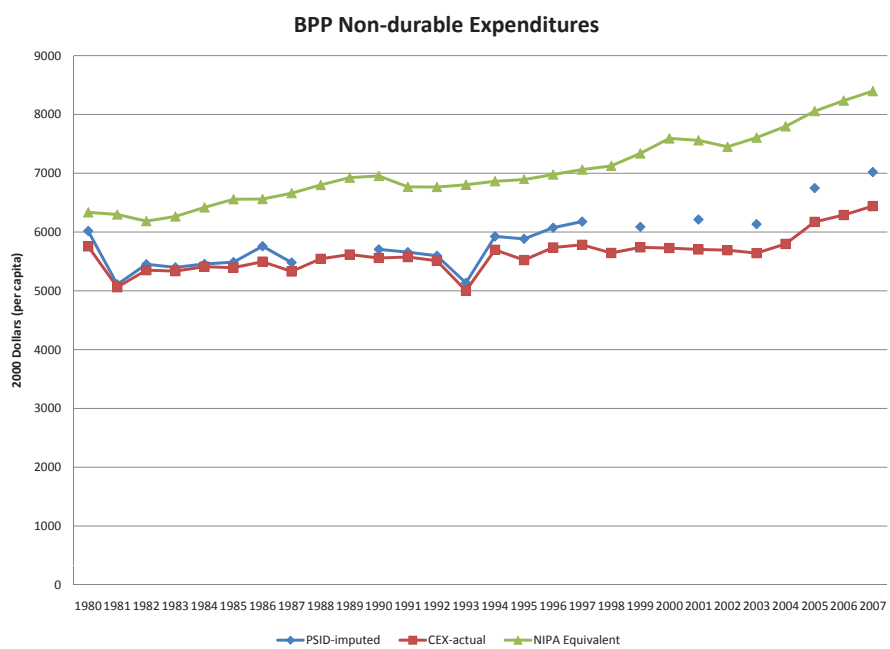

BPP Non-durable Expenditures

TABLE A.1: CONSUMPTION, SAVING AND INCOME STATISTICS

Panel A: Expenditure Data

	1989	1994	1999	2001	2003	2005	2007
Imputed Non-housing Expenditures (NHE)							
mean	41231	45369	55833	54538	63856	58109	45275
median	36738	40586	47807	46270	54879	48693	38398
PSID Consumption							
mean			26009	23709	23585	32669	34066
median			20720	20608	20550	28619	29175
Non-housing Expenditures (BPP)							
mean			39182	37629	35916	43277	42846
median			34197	32330	31225	38531	38737
Non-durable Expenditures (BPP)							
mean	19469	16749	16988	16965	16395	17865	19951
median	18851	16350	15791	15943	15490	16954	19352
N	3544	3491	3072	3409	3585	3882	3552

Notes: NHE are households' non-housing expenditures as implied by their budget constraint; The PSID consumption data are based on households' reported expenditure data starting in 1999. These expenditure data were expanded in 2005. The remaining two expenditure series are imputed using the method discussed in Blundell, Pistaferri, and Preston (2006). Non-housing expenditures are imputed based on households' PSID consumption data and non-durable expenditures are imputed based on households' food consumption. Data are deflated by the PCE deflator (2000 base year).

Panel B: Saving and Income Data

	1989	1994	1999	2001	2003	2005	2007
Disposable Family Income (p.c.)							
mean	18094	19053	25247	22766	26181	25749	27160
median	14853	15407	20725	18815	21441	21345	22259
PSID Saving (p.c.)							
mean	4189	3396	-5722	-602	-1946	-2585	-497
median	2285	1675	1000	667	250	50	750
PSID Saving Rate							
mean	6.4	2.4	-3.2	-3.1	-5.4	-5.9	-2.5
median	5.4	3.4	1.7	2.5	0.9	0.1	2.0
NIPA Disposable Income (p.c.)	23385	24517	27805	29299	30442	31318	32693
NIPA Personal Saving (p.c.)	10712	10275	7439	7181	9964	4311	7109
NIPA Personal Saving Rate	6.6	5.2	3.1	2.7	3.5	1.4	2.1
N	3544	3491	3072	3409	3585	3882	3552

Notes: p.c. - per capita; NIPA data are divided by the total U.S. population while the PSID data are divided by family size. Imputed NHE are households' non-housing expenditures as implied by their budget constraint; The PSID saving data include adjusted household saving in stocks based on households' reported stock market wealth and the implied change in the stock market index between wealth supplements. The NIPA personal saving rate is the reported annual rate; Data are deflated by the PCE deflator (2000 base year) where applicable.

TABLE A.2: PSID SAVING RATE DATA

	1989	1994	1999	2001	2003	2005	2007
	Full Sample (Outlier Approach 1)						
Saving Rate							
mean	6.1	4.5	2.5	6.7	1.2	5.2	4.8
median	1.7	0.0	0.0	0.0	0.0	0.0	0.0
Alt. Saving Rate							
mean	6.0	4.6	-2.3	4.1	-2.5	-0.3	6.6
median	1.7	0.0	0.0	0.0	0.0	0.0	0.0
N	7114	10765	6997	7406	7822	8002	8289
	Full Sample (Outlier Approach 2)						
Saving Rate							
mean	6.0	3.6	1.8	3.5	1.8	2.3	4.3
median	1.7	0.0	0.0	0.0	0.0	0.0	0.0
Alt. Saving Rate							
mean	5.9	3.6	-2.2	2.1	-1.5	-1.5	5.9
median	1.7	0.0	0.0	0.0	0.0	0.0	0.0
N	6970	10549	6857	7256	7664	7840	8123
	Estimation Sample						
Saving Rate							
mean	7.5	5.3	4.6	1.5	-0.9	-2.1	
median	6.0	4.5	4.2	4.3	1.5	0.6	
Alt. Saving Rate							
mean	7.3	6.0	-0.7	-1.9	-4.1	-5.5	
median	6.1	5.4	2.2	3.6	0.0	0.0	
N	1674	1554	1540	1589	1587	1647	

Notes: This table reports saving rate data from the PSID; The denominator is households' after tax family income; The "Alt. Saving Rate" data include households' imputed saving in stocks in place of their reported saving. This approach is discussed in section A.2.1; "Outlier Approach 1" follows the method in Bosworth and Anders (2008) and trims the 10 highest and 10 lowest saving observations in each asset class for a given year; "Outlier Approach 2" trims the top and bottom 1 percent of the saving rate distribution; The full sample results include all households in the PSID except those with outlying observations; 2007 data are not included in the paper's estimation sample.

TABLE A.3: HOUSING EQUITY AND CONSUMPTION: USING PSID CONSUMPTION DATA (2001 TO 2005)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log Income	0.16***	0.14**	0.18***	0.12	0.25***	0.21**	0.29***	0.38**	0.17***
	(0.04)	(0.06)	(0.06)	(0.08)	(0.06)	(0.09)	(0.09)	(0.16)	(0.06)
(Financial Wealth)/Income (in 100s)	-0.44	0.77	-0.49	0.21	-0.44	-0.38	0.01	5.40***	-0.13
	(0.31)	(1.61)	(0.36)	(0.65)	(0.71)	(1.57)	(0.94)	(2.00)	(0.68)
(Housing Equity)/Income	0.02*	0.01	0.04**	0.02	0.01	-0.02	0.05*	0.07	0.02
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)	(0.02)	(0.06)	(0.02)
Expected Labor Income Growth	-0.01	-0.04	-0.01	-0.04	0.02	0.03	0.01	-0.31*	0.02
	(0.03)	(0.06)	(0.05)	(0.07)	(0.05)	(0.08)	(0.06)	(0.16)	(0.06)
Restrictions:									
Below Med. Liq. Wealth		X				X			
Above Med. Liq. Wealth			X				X		
Below Med. DSR				X					
Above Med. DSR					X	X	X		
High Expected Income Growth								X	
Low Expected Income Growth									X
N	5219	2741	2478	2209	2674	1634	1040	1822	3397
Adj. R^2	0.23	0.19	0.29	0.20	0.29	0.26	0.37	0.40	0.32
Std. Error Regression	0.23	0.20	0.20	0.21	0.20	0.18	0.15	0.10	0.18

Notes: Med. - Median; DSR is a household's debt-service-ratio as defined in Johnson and Li (2010); The dependent variable is households' reported expenditures in the PSID using the questions added to the survey starting in 1999; Estimates control for household specific effects using a linear fixed effects estimator; Additional controls include: age, age squared and, age cubed, family size, and year fixed effects; Expected income growth is measured as ex-post realized income growth between the current and subsequent period; Households with high expected income growth are those with growth in the top quartile of the distribution. Robust standard errors clustered at the household level are in parentheses; *** significant at the 1-percent level, ** significant at the 5-percent level, * significant at the 10-percent level.

TABLE A.4: HOUSING EQUITY AND CONSUMPTION: NON-HOUSING EXPENDITURES (2001-2005)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log Income	0.13***	0.13**	0.10	0.10	0.24***	0.19**	0.27***	0.28	0.14**
	(0.04)	(0.07)	(0.06)	(0.08)	(0.06)	(0.09)	(0.09)	(0.18)	(0.06)
(Financial Wealth)/Income (in 100s)	-0.61*	0.59	-0.74*	0.04	-0.27	-0.37	0.24	4.26**	-0.13
	(0.34)	(1.72)	(0.39)	(0.62)	(0.78)	(1.65)	(1.08)	(1.95)	(0.70)
(Housing Equity)/Income	0.02	0.01	0.03*	0.01	0.01	-0.01	0.04	0.06	0.02
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)	(0.03)	(0.06)	(0.02)
Expected Labor Income Growth	-0.02	-0.05	-0.00	-0.04	0.02	0.03	0.02	-0.25	0.01
	(0.03)	(0.06)	(0.05)	(0.06)	(0.05)	(0.08)	(0.06)	(0.16)	(0.06)
Restrictions:									
Below Med. Liq. Wealth		X				X			
Above Med. Liq. Wealth			X				X		
Below Med. DSR				X					
Above Med. DSR					X	X	X		
High Expected Income Growth								X	
Low Expected Income Growth									X
N	4959	2599	2360	2122	2547	1556	991	1741	3218
Adj. R^2	0.11	0.08	0.16	0.09	0.15	0.13	0.21	0.25	0.18
Std. Error Regression	0.23	0.20	0.20	0.21	0.19	0.18	0.15	0.10	0.18

Notes: Med. - Median; DSR is a household's debt-service-ratio as defined in Johnson and Li (2010); The dependent variable is imputed total household expenditures excluding housing; The data are imputed based on households' additional reported expenditures in the PSID starting in 1999; Estimates control for household specific effects using a linear fixed effects estimator; Additional controls include: age, age squared and, age cubed, family size, and year fixed effects; Expected income growth is measured as ex-post realized income growth between the current and subsequent period; Households with high expected income growth are those with growth in the top quartile of the distribution; Robust standard errors clustered at the household level are in parentheses; *** significant at the 1-percent level, ** significant at the 5-percent level, * significant at the 10-percent level.

TABLE A.5: HOUSING EQUITY AND CONSUMPTION: NONDURABLE EXPENDITURES

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log Income	0.09***	0.07***	0.06**	0.09***	0.09**	0.05	0.12**	0.10***	0.11	0.09**
	(0.01)	(0.03)	(0.03)	(0.02)	(0.04)	(0.04)	(0.05)	(0.04)	(0.13)	(0.04)
(Financial Wealth)/Income	-0.04***	-0.36	-0.40	-0.03***	-0.78	-0.15	0.62**	0.22	-1.27	0.77**
	(0.01)	(0.22)	(0.57)	(0.01)	(0.89)	(0.25)	(0.29)	(0.50)	(1.45)	(0.38)
(Housing Equity)/Income	0.00	0.01	-0.00	-0.00	-0.00	0.01	0.02	0.01	0.03	-0.00
	(0.00)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.04)	(0.02)
Expected Labor Income Growth	0.00	-0.00	-0.03	0.02	0.00	-0.02	0.02	-0.03	-0.22*	0.02
	(0.02)	(0.02)	(0.03)	(0.02)	(0.04)	(0.04)	(0.03)	(0.04)	(0.12)	(0.04)
Restrictions:										
Year $\geq$ 2001		X			X	X	X	X		
Below Med. Liquid Wealth			X		X					
Above Med. Liquid Wealth				X		X				
Below Med. DSR							X			
Above Med. DSR								X		
High Expected Income Growth									X	
Low Expected Income Growth										X
N	9735	4915	4770	4965	2524	2391	2100	2513	1717	3198
Adj. R^2	0.15	0.07	0.11	0.19	0.07	0.08	0.06	0.08	0.18	0.08
Std. Error Regression	0.16	0.15	0.16	0.14	0.14	0.12	0.12	0.14	0.06	0.12

Notes: Med. - Median; DSR is households' debt-service-ratio as defined in Johnson and Li (2010); The dependent variable is imputed non-durable expenditures following the approach in Blundell, Pistaferri, and Preston (2006); Estimates control for household specific effects using a linear fixed effects estimator; Additional controls include: age, age squared, and age cubed, family size, and year fixed effects; Expected income growth is measured as ex-post realized income growth between the current and subsequent period; Households with high expected income growth are those with growth in the top quartile of the distribution; Robust standard errors clustered at the household level are in parentheses; *** significant at the 1-percent level, ** significant at the 5-percent level, * significant at the 10-percent level.

TABLE A.6: HOUSING EQUITY AND CONSUMPTION: IMPUTED EXPENDITURES (1984 TO 2005)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log Income	0.19***	0.19***	0.07	0.23***	0.18***	0.10	0.02	0.16***	0.20***
	(0.02)	(0.03)	(0.06)	(0.05)	(0.04)	(0.08)	(0.10)	(0.06)	(0.03)
(Asset Income)/Income (in 100s)	0.11	0.18	-0.01	46.17	0.15	7.56	0.11	0.31***	0.00
	(0.13)	(0.17)	(0.28)	(134.95)	(0.19)	(187.03)	(0.33)	(0.09)	(0.09)
(Housing Wealth)/Income	0.01	0.02*	-0.02	0.04**	0.01	-0.06	-0.01	-0.01	0.02*
	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.03)	(0.03)	(0.02)	(0.01)
Expected Labor Income Growth	-0.03	-0.05*	-0.04	-0.11*	0.02	-0.06	-0.01	-0.13	-0.00
	(0.02)	(0.03)	(0.05)	(0.06)	(0.03)	(0.07)	(0.10)	(0.08)	(0.04)
Restrictions:									
Year $\leq$ 1999		X		X	X				
Year $\geq$ 2001			X			X	X		
Below Med. Asset Income				X		X			
Above Med. Asset Income					X		X		
High Expected Income Growth								X	
Low Expected Income Growth									X
N	19401	13918	5483	6027	7891	3206	2277	4633	14787
Adj. R^2	0.80	0.82	0.01	0.78	0.85	0.01	0.01	0.79	0.81
Std. Error Regression	0.52	0.50	0.41	0.51	0.43	0.40	0.37	0.36	0.49

Notes: Med. - Median; The dependent variable is imputed household expenditures equivalent to the basket of spending recorded in the PSID in 2005; The data are imputed based on households' food consumption and cover every year between 1984 and 2005 for which food consumption data are available in the PSID; Estimates control for household specific effects using a linear fixed effects estimator; Additional controls include: age, age squared, and age cubed, family size, and year fixed effects; Expected income growth is measured as ex-post realized income growth between the current and subsequent period; Households with high expected income growth are those with growth in the top quartile of the distribution; Robust standard errors clustered at the household level are in parentheses; *** significant at the 1-percent level, ** significant at the 5-percent level, * significant at the 10-percent level.

A.2 Measuring Active Saving in the PSID

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

$$AS_{t-1,t}^{i,j} = I_{t-1,t}^{i,j} - R_{t-1,t}^{i,j} \ , \tag{A.1}$$

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

Households' active saving in stocks is initially calculated using equation (A.1). The accuracy of the stock saving data is of particular concern, however, according to the PSID administrators. Households cannot easily distinguish between capital gains in stocks and excess income they invested in equities over a 2-year or 5-year period. As a result, a counterfactual measure of households' active saving in stocks is constructed using households' reported value of stock market wealth and the *actual* change in the stock market between the wealth supplements. This approach yields an arguably more reliable measure of households' active saving in stocks and is discussed in more detail below.

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

$$AS_{t-1,t}^{i,j} = V_t^{i,j} - V_{t-1}^{i,j} \ , \tag{A.2}$$

where V_t^j is the value of asset j in time t.

The remaining active saving category is housing $(j = h)$. A household's amount of saving in housing depends on whether or not it moves. Households who do not move save by paying down their mortgage principal, while households who move potentially save or dis-save by altering the amount of equity in their homes.

$$AS_{k-1,k}^{i,h} = \begin{cases} D_{k-1}^{i,h} - D_k^{i,h} & \text{if move} =0 \\ E_k^{i,h} - E_{k-1}^{i,h} & \text{if move} =1 \ , \end{cases} \tag{A.3}$$

where $D_k^{i,h}$ is a household's amount of outstanding mortgage debt in period k, $E_k^{i,h}$ is the amount of equity a household has in its home at time k, and *move* is an indicator variable that equals 1 if a household moved between $k-1$ and k and is 0 otherwise. I use k as the time subscript to distiguish that the time horizon for active saving in housing is different from the other assets.

13

Prior to 1999, housing data are available yearly and the difference between k and $k-1$ represents 1 year while $t-1$ to t covers 5 years. After 1999, the housing and active saving data cover 2-year horizons and $t = k$. More formally:

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

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

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

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

$AS_{t-1,t}^{i} = S_{t-1,t}^{i}$ in equation (2) in the main text.

A.2.1 Alternative Approach for Measuring Active Saving in Stocks

Generally, households have a decent sense of the value of their stock portfolio at a 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, this paper constructs an alternative measure of households' active saving in stocks based on their reported portfolio values and the market rate of return between period $t-1$ and period t.

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

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

where $V_t^{i,m}$ is the implied value of a household's portfolio based on the market return, V_{t-1}^{i} is the value of the household's reported equity holdings at time $t-1$, and $g_{t-1,t}$ is the stock market growth rate.[12] A household's implied active saving in equities is the difference between its reported stock portfolio value in period t and its implied portfolio value $V_t^{i,m}$ from equation (A.6). More specifically,

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

where $\bar{A}S_{t-1,t}^{i,s}$ is the household's imputed measure of active saving in stocks. This measure is used

---

[12]Stock market growth is calculated based on the total market index published by CRSP (Center for Research in Security Prices).

in place of households' reported active saving in stocks in this paper's analysis.

A.3 Self-Reported House Prices

House values (and hence housing wealth) in the PSID are self-reported, which raises concerns about potential measurement error. Benítez-Silva et al. (2008) show that households' self-reported house prices are reasonably accurate relative to actual prices based on self-reported home price and actual home price sale data data from the *Health and Retirement Survey*. Self-reported house values are appropriate for the analysis in this paper, to the extent households' consumption responds to their perceived housing wealth gains or losses.

Figure A.2 compares the mean reported house price growth in the PSID to the year-over-year house price growth based on the FHFA (formerly 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 FHFA/OFHEO data. In addition, the aggregate housing wealth data in the PSID are relatively consistent with the aggregate housing wealth data reported in the FOF accounts (not shown). Overall the data suggest that households' self-reported house values in the PSID are reasonably accurate. Lovenheim (2011) reaches a similar conclusion about the housing data in the PSID using a slightly different approach.

A.4 Supplementary Tables
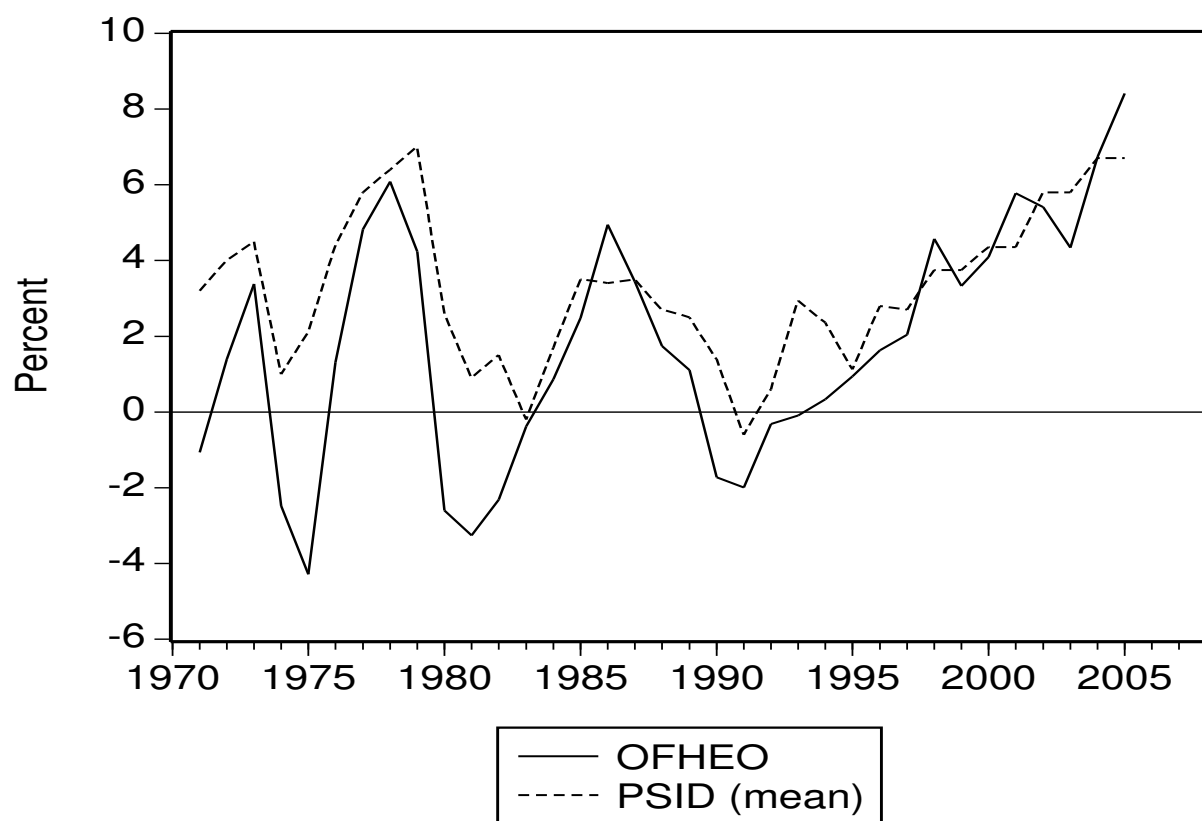
Sources: Author's calculations based on OFHEO/FHFA and PSID data.

TABLE A.7: HOUSING EQUITY AND CONSUMPTION: OLS ESTIMATES

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log Income	0.74***	0.76***	0.67***	0.68***	0.69***	0.71***	0.69***	0.69***	0.71***
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
(Financial Wealth)/Income		0.04***	0.03***	0.03***	0.04***	0.04***	0.04***	0.04***	0.04***
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
(Housing Wealth)/Income		0.03***	0.02***	0.02***	0.02**	0.02***	0.02**	0.02**	0.02***
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Average (permanent) Income			0.15***	0.14***	0.13***	0.12***	0.13***	0.13***	0.12***
			(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Expected Labor Income Growth				0.09***	0.08***	0.07***	0.08***	0.08***	0.07***
				(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
MSA Income (p.c.)					0.01				0.01
					(0.03)				(0.03)
MSA Unemployment Rate						-0.00			-0.00
						(0.00)			(0.00)
MSA Income Growth (p.c.)							-0.55		-0.82**
							(0.35)		(0.37)
Expected MSA Income Growth (p.c.)								0.55*	0.88***
								(0.30)	(0.31)
N	9665	9665	9665	9665	6656	6223	6656	6656	6223
Adj R^2	0.49	0.51	0.52	0.52	0.51	0.51	0.51	0.51	0.52
Std. Error Regression	0.45	0.44	0.44	0.44	0.43	0.44	0.43	0.43	0.44

Notes: Households' average income is included as a proxy for their permanent income since these estimates do *not* control for households specific effects; Additional controls include: age, age squared, and age cubed, family size, 5-year birth cohort dummies, state fixed effects, and year fixed effects; MSA data are on a per capita (p.c.) basis as noted; Expected income growth is measured as ex-post realized income growth between the current and subsequent period; Robust standard errors are in parentheses; *** significant at the 1-percent level, ** significant at the 5-percent level, * significant at the 10-percent level.

	(1)	(2)	(3)	(4)	(5)	(6)
			Full Sample Results			
Log Income	0.63***	0.65***	0.72***	0.65***	0.66***	0.65***
	(0.09)	(0.04)	(0.18)	(0.09)	(0.07)	(0.05)
(Financial Wealth)/Income	0.05**	0.07***	0.06**	0.05*	0.07***	0.10***
	(0.02)	(0.01)	(0.03)	(0.03)	(0.01)	(0.03)
(Housing Equity)/Income	0.09**	0.06***	0.16**	0.11***	0.04**	0.06***
	(0.04)	(0.01)	(0.07)	(0.02)	(0.02)	(0.02)
Expected Labor Income Growth	0.01	-0.01	-0.44*	0.39***	-0.01	0.03
	(0.13)	(0.05)	(0.24)	(0.11)	(0.08)	(0.06)
Restrictions:						
High Expected Income Growth	X		X	X		
Low Expected Income Growth		X			X	X
Below Med. Liquid Wealth				X		X
Above Med. Liquid Wealth			X		X	
N	2354	7341	1113	1241	3742	3599
Adj. R^2	0.31	0.26	0.28	0.54	0.24	0.31
Std. Error Regression	0.17	0.28	0.19	0.09	0.29	0.20

Notes: Table reports full sample results for the estimates in Table 6 in text; Estimates control for household specific effects using a linear fixed effects estimator; Additional controls include: age, age squared, and age cubed, family size, and year fixed effects; Expected income growth is measured as ex-post realized income growth between the current and subsequent period; Robust standard errors clustered at the household level are in parentheses; *** significant at the 1-percent level, ** significant at the 5-percent level, * significant at the 10-percent level.