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Wealth Effects Revisited 1975–2012*

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ABSTRACT

We re-examine the links between changes in housing wealth, financial wealth, and consumer spending. We extend a panel of U.S. states observed quarterly during the seventeen-year period, 1982 through 1999, to the thirty-seven year period, 1975 through 2012Q2. Using techniques reported previously, we impute the aggregate value of owner-occupied housing, the value of financial assets, and measures of aggregate consumption for each of the geographic units over time. We estimate regression models in levels, first differences and in error-correction form, relating per capita consumption to per capita income and wealth. We find a statistically significant and rather large effect of housing wealth upon household consumption. This effect is consistently larger than the effect of stock market wealth upon consumption.

In our earlier version of this paper, we found that households increase their spending when house prices rise, but we found no significant decrease in consumption when house prices fall. The results presented here with the extended data now show that declines in house prices stimulate large and significant decreases in household spending.

The elasticities implied by this work are large. An increase in real housing wealth comparable to the rise between 2001 and 2005 would, over the four years, push up household spending by a total of about 4.3%. A decrease in real housing wealth comparable to the crash which took place between 2005 and 2009 would lead to a drop of about 3.5%.

* On May 12, 2012, John Quigley passed away. He was one of the giants in the economics profession and a true friend to both Robert Shiller and Karl Case. He will be sorely missed. We would like to thank a number of others who made significant contributions to this revision. Marc Van Audenrode was responsible for much of the econometric work. Rachel Bechek, Anne Kinsella Thompson, Semida Munteanu, Gregory Bird, and Ivet Bell provided research assistance. Mark Zandi of Moody's provided a substantial amount of data.

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1 Introduction

In the winter of 2000–2001, we made presentations at several professional meetings in which we sought to link household consumption expenditures to incomes and wealth, by relying on aggregate panel data on United States (U.S.) states and fourteen different countries. A formal paper was ultimately presented at the Summer Institute of the National Bureau of Economic Research (NBER) in July of 2001, and it was circulated as NBER working paper #8606 that fall.

That research attempted to measure average consumption, income, housing wealth, and stock market wealth over time for U.S. states and foreign countries. The statistical relationship between consumption, income, and wealth was estimated using standard multivariate techniques, and we assumed that the coefficients of the wealth variables indicate the strength of the association between these two kinds of household wealth and household consumption.

Our statistical results suggested that there are significant *wealth effects* on consumption associated with both types of wealth (housing wealth and financial wealth) but that the stimulatory effects of housing wealth substantially exceeded the effects of financial wealth. This result remained the same for a variety of specifications for both panels of aggregate data. These results were noticed by the popular media,[1] presumably reflecting concurrent trends in the macro economy. In due course, the paper "Comparing Wealth Effects: The Stock Market versus the Housing Market" was published, in *Advances in Macroeconomics* in 2005. At the same time, the data were made available online, and they were used by John Muellbauer (2008) in his well-known paper "Housing Credit and Consumer Expenditure" presented at the Federal Reserve Conference at Jackson Hole, Wyoming in 2007.

When our paper was originally presented, it relied on the most recent data that were available. The paper was first presented in January 2000, and it used data from 1982 through the second quarter of 1999. By the time the research was published, five years had passed, and by the time the disastrous meltdown in mortgage markets occurred, more than seven years had elapsed.

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[1] This work was the subject of the "Economics Focus" column in the *Economist* (November 8, 2001) and formed the basis for a subsequent cover story (March 30, 2002).

The purpose of this paper is to update the empirical analysis using data through 2012, and thus to incorporate the past decade of unusual volatility in housing wealth, stock market wealth, and personal consumption. The update more than doubles the number of quarter-street observations from under 3500 (68 quarters and 51 states including D.C.) to over 7600 (150 quarters and 51 states). As before, we present a variety of econometric models that link consumption to income, housing wealth, and stock market wealth. As in our previous analysis, we make no effort to deduce a structural model that reflects these relationships. We prefer to observe the robustness of these relationships to plausible specifications of the association. An earlier version of this paper updates the research to 2009 and was distributed as NBER Working Paper #16848 in March, 2011.

In an attempt to update our previous analysis, it was immediately apparent that comparable data from the panel of the Organisation for Economic Co-operation and Development (OECD) countries that were previously analyzed could not be obtained. This analysis is therefore confined to quarterly data on U.S. states, from 1975 to 2012.

The principal results and interpretations from our previous work are largely unchanged but the estimated magnitudes are larger, and in some cases statistically more important. When the more recent volatile period is included in the analysis, we find that the relationship between housing market wealth and consumption is a good bit stronger compared to the link between stock market wealth and consumption. This key finding is robust to a variety of reasonable specifications. One set of previous findings does *not* seem to hold up. In our earlier work, we have noted an asymmetry in the association between housing market wealth and consumption. When housing market wealth increased, household consumption increased. But when housing market wealth declined, household consumption declined only marginally. This asymmetry is absent or reversed in the longer panel. The data now include substantially more variation in asset prices, notably periods of declining house prices and declining stock-market indices, and show that declining house prices do lead to a lower level of consumer spending.

In Section 2, we review the conceptual and measurement issues that were addressed in the original research paper, and we discuss our efforts

to extend the time series for analysis. We also describe recent trends in housing wealth, stock-market wealth, and household consumption. Section 3 extends the econometric models that relate consumption to housing wealth and stock-market wealth. Section 4 presents our conclusions and reflects on their significance.

2 Wealth Effects and Consumption

It has been widely observed that changes in the values of financial assets are associated with changes in national consumption. In regression models that relate changes in log consumption to changes in log stock market wealth, the estimated relationship is generally positive and statistically significant. In a standard interpretation of these results, from a suitably specified regression, the coefficient measures the wealth effect, that is, the causal effect of exogenous changes in wealth upon consumption behavior.

There is every reason to expect that changes in housing wealth exert effects upon household behavior that are similar to those found for financial wealth. However, until our work from 2000–2001, there was virtually no comparative research on this issue. As is evident from the events of the past five years, the housing wealth effect may have become especially important as institutional innovations, such as, second mortgages in the form of secured lines of credit and option-ARM first-mortgage contracts, made it as simple to extract cash from housing equity as it was to sell shares or to borrow on margin.

Our previous paper summarizes the extensive theoretical and empirical rationale for wealth effects so we do not repeat this summary here. However, two arguments have recurred and should be acknowledged. The first, a general point, was made by Glaeser (2000) in his comments on Case (2000). He claimed that since a house is both an asset and a necessary part of outlays, when the value of a house increases there is little or no welfare gain.[2] Glaeser's comments were in part motivated by a comment that was made in a speech by Federal Reserve Chairman Alan Greenspan

[2] Glaeser reminds us of the result of elementary price theory that if a rational individual has already purchased the desired housing (so that the endowment point equals the consumption point) then

(November 2, 1999) in which he stated that "The permanent increase in spending out of housing wealth is somewhat higher, perhaps in the neighborhood of five percent." A decade ago, Glaeser found these remarks "inscrutable, unsupported and hard to accept."

Glaeser's theory is however contradicted by the public's widespread impression that increased home prices make them very much better off. Part of the reason may be psychological because of the salience of home price increases and the myopic failure to consider that there cannot be such an advantage if most other households have experienced the same price increases. This is exacerbated by the fact that homes are the collateral behind mortgage loans.

A second way to approach the topic of consumer spending out of home price appreciation is to simply look at the cash flows. Greenspan and Kennedy (2007), in an extensive data-collection exercise, produced careful estimates of all the free cash and credit that has been extracted from the housing stock since 1990. During the housing boom of 2001–2005, an average of just under $700 billion of equity was extracted *each year* by home equity loans, cash-out refinance, and second mortgages.

Table 1 reports the total value of the housing stock every five years since 1980 according to the Flow of Funds Accounts that is maintained by the Federal Reserve. Between 2001 and 2005, the value of real estate directly owned by the household sector increased by roughly $10 trillion. Half of this was appreciation of land and the other half was the value of new structures (see Case, 2006). On the way down, real estate holdings of households lost over $6 trillion. Given the magnitude of these flows, and the general failure at the time to recognize them as part of a credit bubble, it is hard to imagine that the buildup in home equity did not encourage aggregate spending when and where it occurred.

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price changes in either direction are improving utility. The household can always continue to consume the same bundle that it did before the change, but the price change has opened up new opportunities. We cannot however infer, when comparing general equilibriums, that any price change is unambiguously welfare improving — not without understanding the exogenous shocks that produced the change. A transcript of the debate can be found in the discussion following the paper by Karl Case (2000). A fuller discussion of the complex issues surrounding housing wealth effects can be found in our previous paper (2005).

Year	Household real estate (Trillions)	Nominal GDP (Trillions)	Real estate GDP ratio
1980	$2.943	$2.788	1.06
1985	4.658	4.217	1.1
1990	6.608	5.800	1.14
1995	7.631	7.414	1.03
2000	11.497	9.952	1.16
2005	22.026	12.638	1.74
2007	20.879	14.061	1.48
2009	17.154	13.974	1.23
2010	16.591	14.499	1.14
2011	16.134	15.076	1.07
2012 Q2	16.864	15.596	1.08

Source: Federal reserve flow of funds data; Bureau of economic analysis.

Table 1. Real estate assets owned by households and market value of owner-occupied houses.

3 Housing Prices: 1975–2012

We use regional (state-level) data to identify the wealth effect to exploit the fact that home prices have evolved very differently in different parts of the country. This largely arises from differences in the elasticity of land supply, the performance of regional economies, and the changing demographics of states. The expanded data set that is described below adds information on the years 1975–1981 and 2000–2012. These periods include the two most serious recessions since the Great Depression. The time period also spans the longest expansion in U.S. history, which was from 1991 to 2001. In fact, as reported in Figure 1, there were only two quarters of negative growth between 1983 and 2000, both in 1990.

The steady performance of the national economy has contributed to a national housing market that has almost never experienced price declines; at least not since 1975. The behavior of home prices since 1975 is chronicled

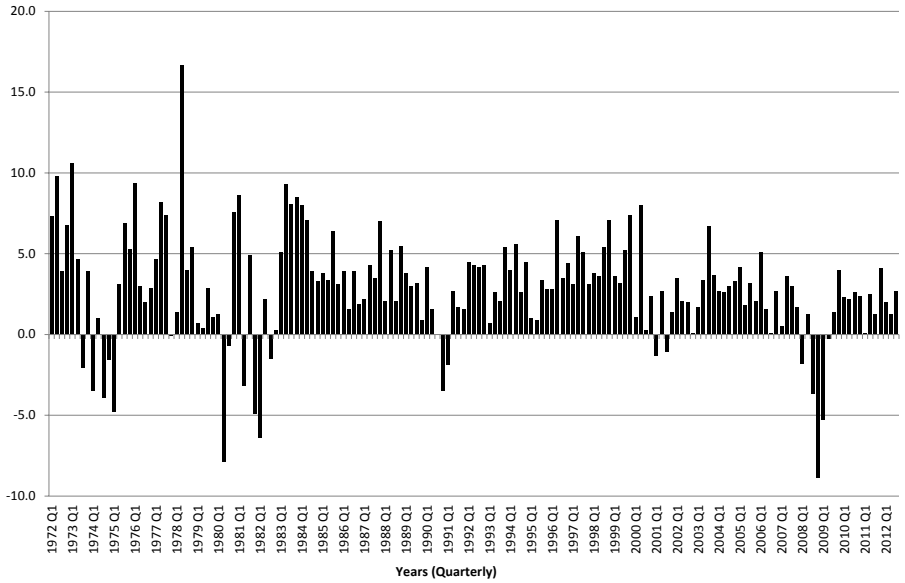

Figure 1. Quarterly percent change in GDP.

in detail in Case (2008) and Case and Quigley (2008, 2010). We review a few salient facts. Figures 2 and 3 report two national measures of house prices. The S&P Case Shiller composite-10 index shows only a minor drop during the recession of 1990–1991 while the Federal Housing Finance Agency (FHFA) index never declines at all between 1975 and 2007. In the late 1990s, prices begin to rise at an increasing rate. House-price increases, fed by inertia, easy money, and optimism, accelerated during the recession of 2001, even while the stock market was in decline. The recession of 2001 occurred closely after the DotCom stock-market crash, which began in the Spring of 2000. The NASDAQ peaked in March of 2000, and ultimately fell by 78 percent. This led to a period in which the stock market and the housing market were headed in opposite directions.

The most dramatic increases in home values and wealth occurred in regional booms and, more broadly, at the low end of the price distribution. A substantial expansion of credit to less-qualified buyers occurred between 2003 and 2007. In a number of cities, house prices tripled. Examples are Miami with +241 percent, Los Angeles with +240 percent, and San Diego and Washington D.C. with +197 percent.

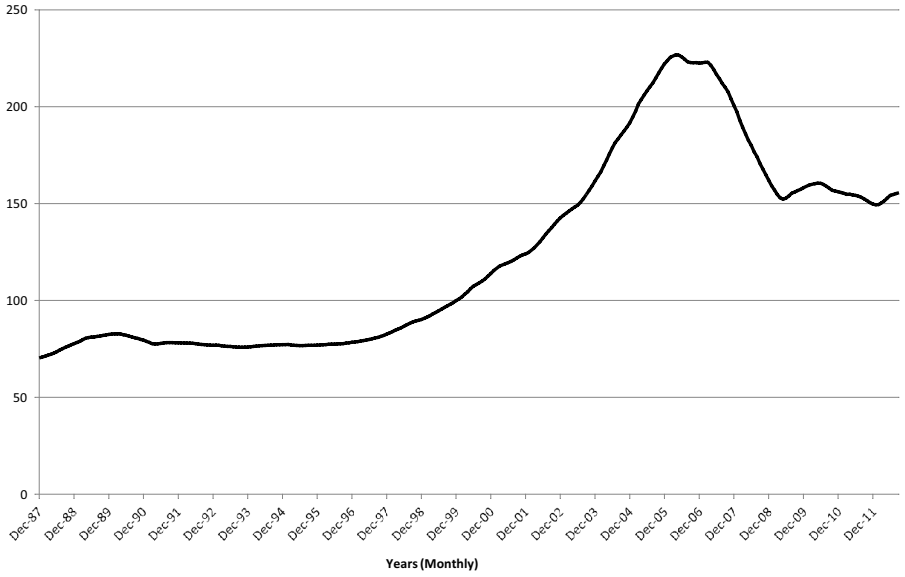

Figure 2. Case-Shiller "Composite 10".

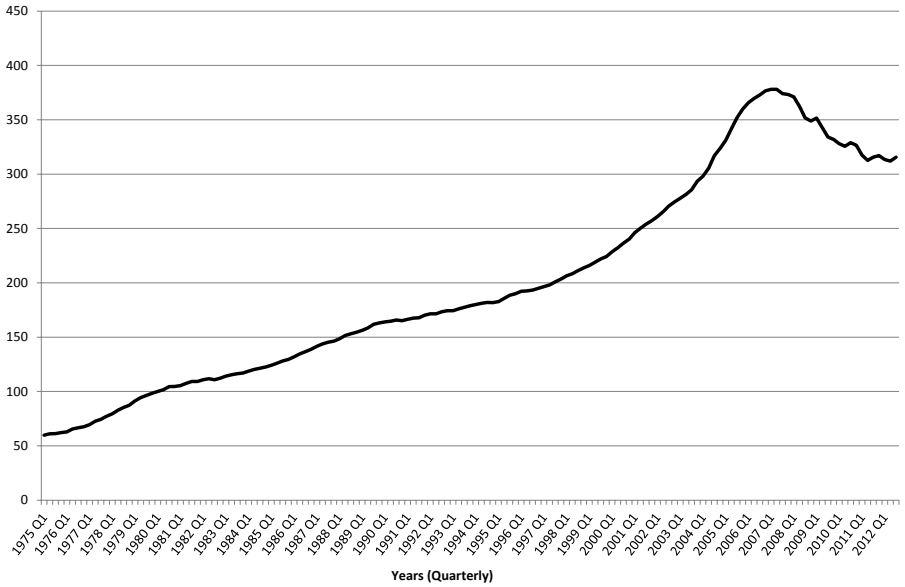

Figure 3. FHFA housing price index (all transactions).

In many regions of the country, there have been substantial periods of decline as well. Both the Northeast boom and the second California boom were followed by deep declines in housing prices. Nominal prices fell by thirteen percent in the Northeast, where a bottom was reached in fourteen quarters. In California nominal prices fell fourteen percent, and a bottom was not reached for twenty quarters. Some areas fared even worse; in San Diego prices fell seventeen percent and did not hit bottom for 24 quarters.

In September of 2005, prices began to fall in Boston, and by the summer of 2007 prices in every major metropolitan area of the U.S. were declining, some quite rapidly. Table 2 shows the extent of the decline and the differences in the pattern of decline over time. The largest declines occurred in the cities that had previously experienced the largest price increases and in cities where over-building had been most extreme (for example, Miami,

Metro area	Peak	% Δ Since Peak	% Δ Last Year	% Δ from July to August	% Δ from June to July	% Δ 2000 to August 2010
NV-Las Vegas	Aug 2006	−56.9%	−3.5%	0.1%	0.1%	1.2%
AZ-Phoenix	Jun 2006	−52.9%	−1.9%	−1.5%	−1.3%	7.2%
FL-Miami	Dec 2006	−48.1%	−2.7%	−1.2%	−0.3%	45.6%
MI-Detroit	Dec 2005	−44.4%	−3.2%	−1.3%	0.5%	−29.4%
FL-Tampa	Jul 2006	−42.7%	−4.3%	−0.8%	−0.5%	36.5%
CA-Los Angeles	Sep 2006	−36.0%	4.4%	−0.1%	−0.4%	75.4%
CA-San Francisco	May 2006	−35.2%	5.5%	−0.9%	−0.3%	41.5%
CA-San Diego	Nov 2005	−35.1%	5.0%	−1.0%	−0.6%	62.4%
DC-Washington	May 2006	−24.8%	4.6%	0.3%	0.3%	88.8%
MN-Minneapolis	Sep 2006	−27.7%	−1.0%	−2.2%	−0.3%	23.7%
WA-Seattle	Jul 2007	−24.6%	−2.6%	−0.6%	−0.8%	45.1%
IL-Chicago	Sep 2006	−26.0%	−5.6%	−1.5%	0.4%	24.8%
OR-Portland	Jul 2007	−22.6%	−3.6%	−1.9%	−0.9%	44.3%
NY-New York	Jun 2006	−19.1%	0.1%	−0.4%	0.2%	74.6%
GA-Atlanta	Jul 2007	−21.0%	−3.1%	−1.2%	−0.8%	7.8%
MA-Boston	Sep 2005	−14.3%	0.4%	−1.3%	−0.3%	56.3%
OH-Cleveland	Jul 2006	−16.0%	−1.9%	−3.0%	−0.3%	3.8%
NC-Charlotte	Aug 2007	−15.1%	−3.7%	−1.0%	−0.4%	15.4%
CO-Denver	Aug 2006	−9.2%	−1.6%	−1.0%	−0.1%	27.3%
TX-Dallas	Jun 2007	−7.1%	−2.6%	−1.6%	−1.1%	17.5%
Composite-10	Jun 2006	−28.7%	1.7%	−0.5%	−0.1%	61.3%
Composite-20	Jul 2006	−28.6%	0.7%	−0.7%	−0.2%	47.5%

Table 2. S & P Case-shiller index — through September 2010 released September 31st, 2010.

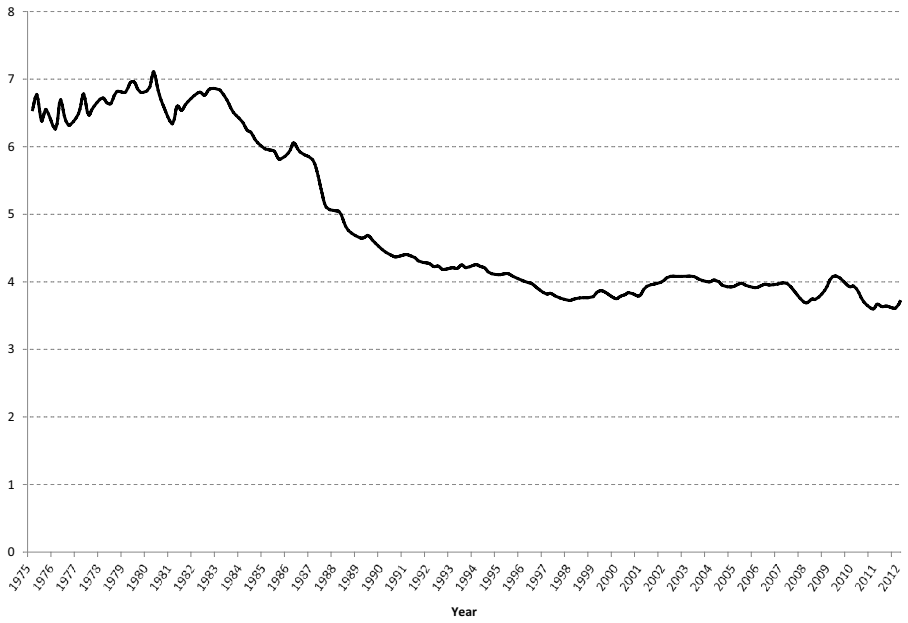

Figure 4. House price/per capita income Texas.

Phoenix, and Las Vegas). California's coastal cities had experienced very large increases in house values but due to supply restrictions, they never overbuilt. Finally, some cities did not experience any boom at all but still had declining regional economies (for example, Detroit and Cleveland).

The changes in housing wealth and stock market wealth do not move closely together with per capita income across states. Figures 4 through 7 report changes in the ratio of the price of a standard house to per capita income for four states. The charts are based on the value of the median house in the state in 2000. They are indexed over time with the Fiserv Case Shiller Index for the state, and divided by per capita income in the state. Figure 4 shows that Texas witnessed a steady decline in the ratio of house prices to income from 1975 to the late 1990s.

As can be seen in Figure 5, the most dramatic cyclical pattern is in California where the highest peak is simply out of line with the rest of the country. The patterns in Florida (Figure 6) and Arizona (Figure 7) are much like that of Texas but with inflating and deflating bubbles since 2004. State-housing markets were moving in complicated and asynchronous ways during the periods of which we were able to add new data to the time series.

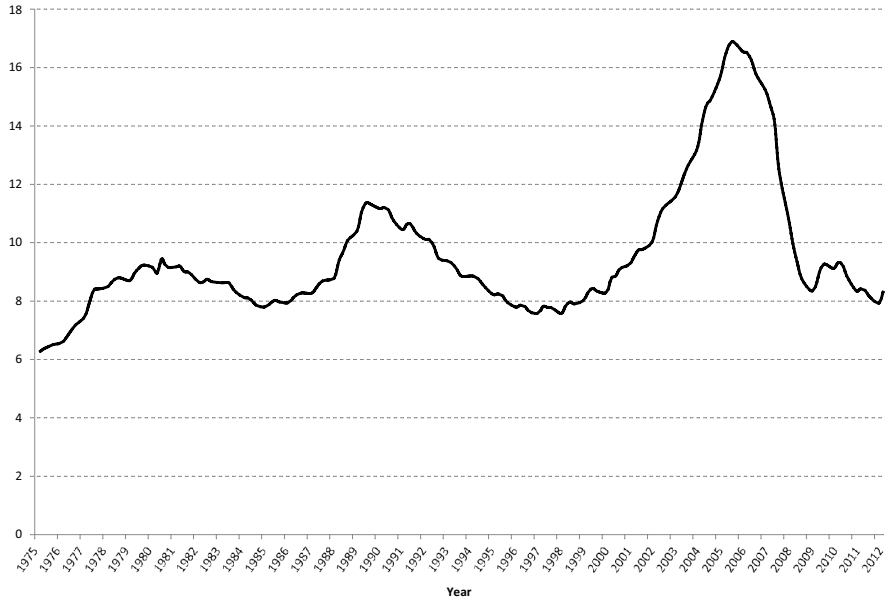

Figure 5. House price/per capita income California.

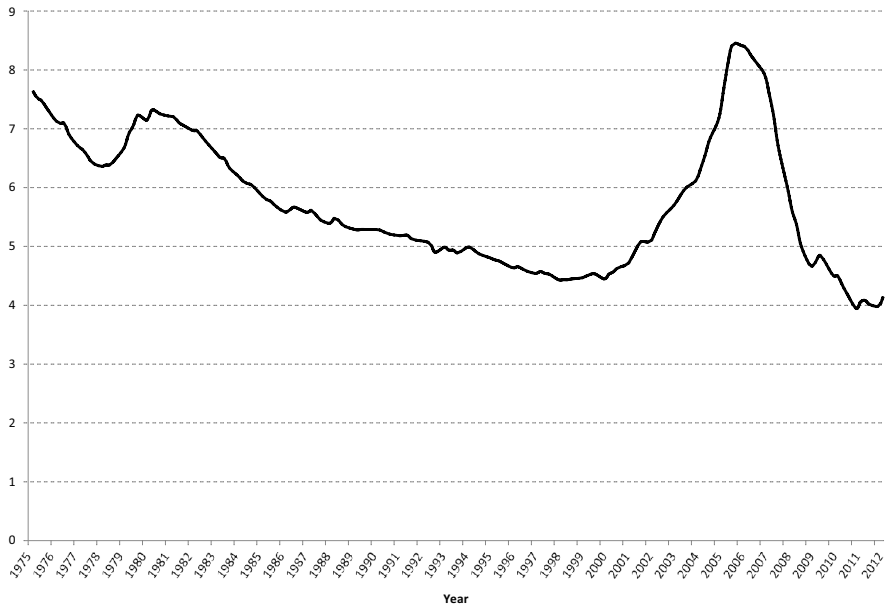

Figure 6. House price/per capita income Florida.

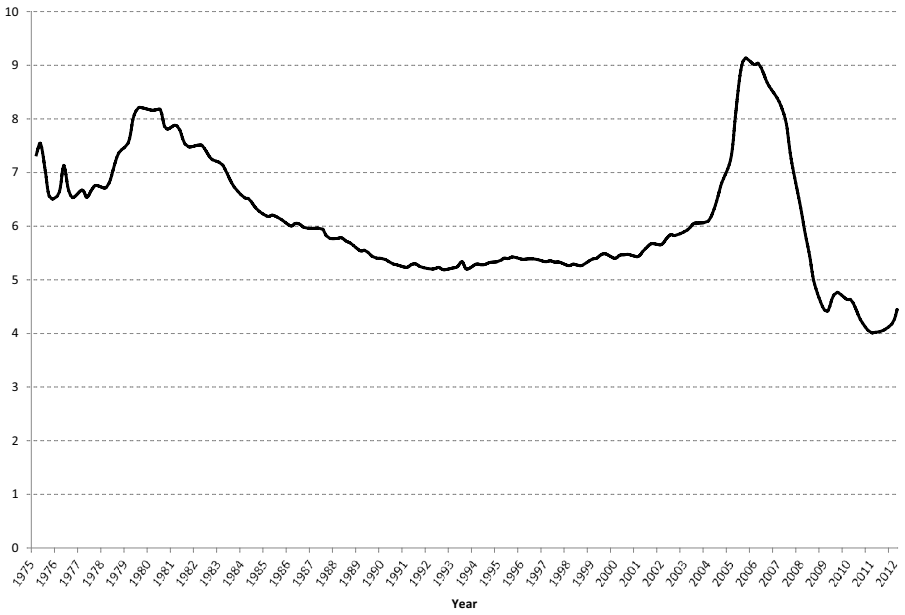

Figure 7. House price/per capita income Arizona.

4 Measurement Issues: The Data

The data set for U.S. states exploits the fact that the distribution of increases and decreases in housing values has been anything but uniform across regions in the U.S., and variations in stock-market wealth have been quite unequally distributed across households geographically. The panel offers the advantage that data definitions and institutions are uniform across geographical units. In addition, the extension that is reported here doubles the sample size for analysis from just under 3500 observations on state-by-quarter-year to over 7600 observations.

It should be noted that virtually all the data in the paper are new. We are aware of the fact that many of the time-series variables have been completely revised a number of times over the years. The four main time series — personal income, stock-market wealth, retail sales, and a proxy for housing wealth — are all constructed with the most recent updates available.

A. Housing Wealth. Estimates of housing-market wealth were constructed from repeat sales price indexes as applied to the base values that were reported in the *Census of Population and Housing* (2000) by state. Weighted repeat sales (WRS) indexes (see Case and Shiller, 1987, 1989), published by Fiserv Case Shiller Weiss, are now available for this entire period and for all states.

Equation (1) indicates the construction of the panel on aggregate housing wealth:

$$V_{it} = R_{it} N_{it} I_{it} V_{io} \tag{1}$$

where,
V_{it} = aggregate value of owner occupied housing in state i in quarter t,
R_{it} = homeownership rate in state i in quarter t,
N_{it} = number of households in state i in quarter t,
I_{it} = weighted repeat sales price index, for state i in quarter t ($I_{i1} = 1$, for 2000:I), and
V_{io} = mean home price for state i in the base year, 2000.

Our previous paper describes the construction of the aggregate housing market wealth variable in detail, using data from the *Current Population Survey and the 1990 and 2000 Census of Population and Housing*.

B. Retail as a Proxy for Consumption Spending. Unfortunately, there are no direct measures of consumption spending by households recorded at the state level. However, a consistent panel of retail sales has been constructed by Moody's Economy.com (Formerly Regional Financial Associates (RFA). See Zandi, 1997). Retail sales account for roughly half of the total consumer expenditures. The RFA estimates were constructed from county-level sales tax data, the *Census of Retail Trade*, published by the U.S. Census Bureau, and the Census Bureau's monthly national retail-sales estimates. For states with no retail-sales tax, or where data were insufficient to support imputations, the RFA based its estimates on the historical relationship between retail sales and retail employment. Data on retail employment by state are available from the Bureau of Labor Statistics. Regression estimates that relate sales to employment were benchmarked to the *Census of Retail Trade*, which is available at five-year intervals. Estimates for all states were within five percent of the benchmarks.

Retail sales can be expected to systematically differ from consumption spending for several reasons. A logical reason is that in states with relatively large tourist industries, recorded retail sales per resident are high. For example, Nevada, with 26 percent of its labor force employed in tourism, recorded the highest level of retail sales per capita through much of the period.

The extent to which that these systematic differences between retail sales and consumption are state-specific can be directly accounted for in multivariate statistical analysis. Data on retail sales, house values, and stock market valuation, by state and quarter were expressed in real terms per capita using the *Current Population Survey* and the gross domestic product (GDP) deflator.

C. Financial Wealth. Estimates of aggregate financial wealth were obtained from the Federal Reserve Flow of Funds (FOF) accounts every quarter. From the FOF accounts, we computed the sum of corporate equities, pension fund reserves, and mutual funds that are held by the household sector.

To distribute household financial assets geographically, we exploit the correlation between holdings of mutual funds and other financial assets. We have obtained mutual fund holdings by state from the Investment Company Institute (ICI). The ICI data are available for the years 1986, 1987, 1989, 1991 and 1993. In this paper, we have added data on 2008 and 2009. For the period from 1993 to 2009, we have interpolated the share of holdings in each state, linearly mapping the 1993 figures to the 2008 figures so that each is summed to one. We assumed that for 1978 through 1986, the distribution was the same as recorded in 1986, and that the weights for 2010, 2011, and 2012 were the same as they were in 2009.

We have made considerable efforts to check these series against other data because there are few alternative sources. The Survey of Consumer Finances (SCF) produces regular estimates of household wealth, including stock market wealth, from a stratified random sample of top wealth holders. Survey data are available for 1989, 1992, 1995, 1998, and 2001, and national aggregate data are published for those years. The staff of the Board of Governors of the Federal Reserve (Fed) maintain that this survey information is insufficient to estimate stock market wealth at the level of individual states. However, Andreas Lehnert of the Fed arranged for special tabulations to be

made available to us, aggregating micro data on stock-market wealth to the level of census region for each year of the SCF survey. These data can be compared to the ICI data that are available for 1986, 1987, 1989, 1991, and 1993, and which is also aggregated to the nine census regions.

In 1989, the one year that the two bodies of data have in common, the simple correlation between the two series is 0.934. The correlations are also quite high among the data for other years that do not match. The t-ratios that are associated with these correlations are large, but of course, the sample sizes are small (this is discussed in our previous paper).

D. Personal Income. To control for income, we have used the Bureau of Economic Analysis' Personal Income (as reported by Moodys.com). Figures 8 to 10 present the raw data for several states, after conversion, in per capita terms and deflation using the CPI. The left-hand scale is income, housing wealth, and financial wealth per capita in 1983 dollars. The right-hand scale measures retail sales in 1983 dollars.

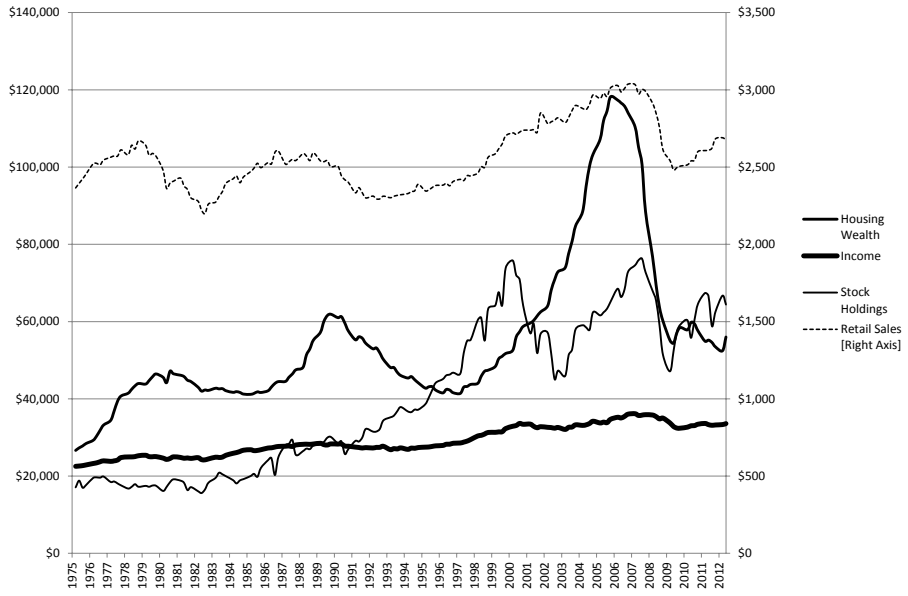

Figure 8. Wealth and consumption in real per capita dollars: California.

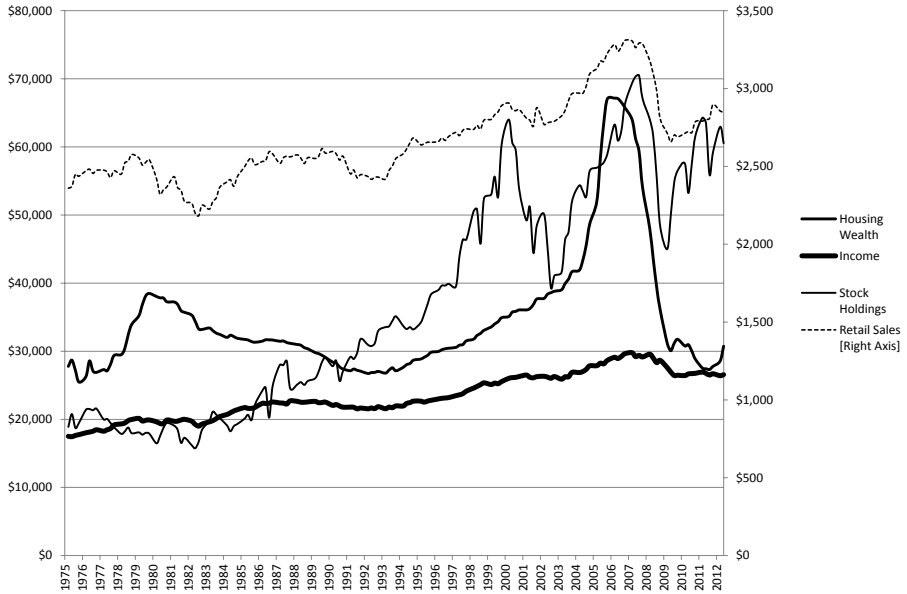

Figure 9. Wealth and consumption in real per capita dollars: Arizona.

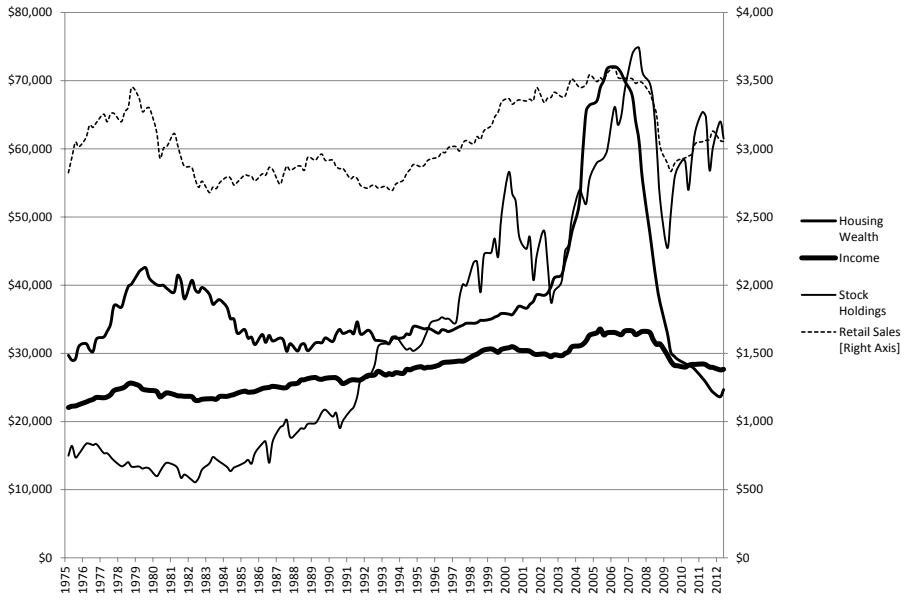

Figure 10. Wealth and consumption in real per capita dollars: Nevada.

5 Statistical Results

Tables 3 to 7 report various econometric specifications of the relationship between income, wealth, and consumption for U.S. states. All specifications include fixed effects (that is, a set of dummy variables for each state). These models formed the core of our original analysis. Model I is the basic specification representing the effects of both housing and stock-market wealth upon consumption. We also include two other specifications to further explore the nature of estimated wealth effects and their robustness. Model II includes state-specific time trends for each specification. Model III includes year-specific fixed effects as well as seasonal (that is, quarterly) fixed effects.

Note that, when interpreting the estimated coefficients for wealth in Model III, the effects of an overall change in stock-market wealth on consumption are controlled for in the regressions. Thus, in Model III, the

Dependent variable:	Ordinary least squares			Serially correlated errors		
Consumption per capita	I	II	III	IV	V	VI
Income	0.429	0.556	0.644	0.377	0.36	0.305
	(39.00)	(23.17)	(49.54)	(34.27)	(27.69)	(23.46)
Stock market wealth	0.035	0.075	0.028	0.029	0.028	0.029
	(17.50)	(15.00)	(14.00)	(14.50)	(14.00)	(14.50)
Housing market wealth	0.094	0.18	0.044	0.068	0.066	0.065
	(18.80)	(16.36)	(11.00)	(13.60)	(13.20)	(13.00)
Serial correlation coefficient	—	—	—	0.969	0.988	0.973
State specific time trends	No	Yes	No	No	Yes	No
Year/quarter fixed effects	No	No	Yes	No	No	Yes
R^2	0.960	0.804	0.974	0.987	0.967	0.987
t-Ratio/chi2	14.00	27.43	6.08	207.390	313.580	248.480
p-value for H_0	0.000	0.000	0.000	0.000	0.000	0.000
p-value for H_1	1.000	1.000	1.000	1.000	1.000	1.000

Note: H_0 is a test of the hypothesis that the coefficient on housing market wealth is equal to that of stock market wealth.
H_1 is a test of the hypothesis that the coefficient on housing market wealth exceeds that of stock market wealth.

Table 3. Consumption models: Quarterly observations on states, 1975–2012:2.[3]

[3] All variables are real (deflated by GDP deflator) measured per capita in logarithms, stock market and housing market variables are seasonally adjusted; all models include fixed effects by states. Absolute value of t ratios are in parentheses.

estimated wealth coefficients only reflect interregional differences in the growth of wealth.

Table 3 presents basic relationships between per-capita consumption, income, and the two measures of wealth. As the table indicates, in the simplest formulation, the estimated effect of housing-market wealth on consumption is significant and large. In the ordinary regressions with the least squares, the estimated elasticity is between 0.044 and 0.18. In contrast, the estimated effects of financial wealth on consumption are quite a bit smaller. In the simpler OLS model, the estimate ranges between 0.028 and 0.075. These magnitudes are similar to the elasticities we reported in our earlier paper. When the model is extended to allow for first-order serial correlation, the estimated elasticities for income and for stock market-wealth are generally smaller.[4] The estimated elasticities for housing-market wealth are between 0.065 and 0.068, this is larger than the same coefficient in our earlier work and much more statistically significant.

The table also reports the t-ratio for the hypothesis, showing that the difference between the coefficient estimates measuring housing- and financial-market effects is zero. A formal test of the hypothesis that the coefficient on housing-market wealth is equal to that of stock-market wealth against the alternative hypothesis that the two coefficients differ is presented, as well as a test of the hypothesis that the coefficient on housing-market wealth exceeds the coefficient on financial wealth. The evidence suggests that housing-market wealth has a bigger effect on consumption than financial wealth. This is the same qualitative result that was reported and discussed in our earlier work, but the statistical significance of the comparison is much larger with the richer panel of data on states.

Table 4 presents the results with all variables expressed as first differences. In the ordinary least-squares formulation, the coefficient on housing-market wealth is significant in all specifications, and is two to three times as large as the coefficient on financial wealth. Consumption changes are significantly dependent on changes in income and both housing-market wealth and stock-market wealth. Table 4 also presents the same first-difference equation when all three models are estimated using a simple instrumental-variables approach, and rely on lags in income and wealth as instruments for current income and wealth. In these regressions, the elasticity of

[4] These models rely on sequential estimation using the Prais-Winsten estimator with independent panels.

Dependent variable: Change in consumption per capita	Ordinary least squares			Instrumental variables*		
	I	II	III	IV	V	VI
Income	0.354	0.354	0.265	0.811	0.825	0.666
	(29.50)	(29.50)	(22.08)	(7.11)	(7.43)	(5.16)
Stock market wealth	0.027	0.027	0.014	0.094	0.091	−0.039
	(13.50)	(13.50)	(7.00)	(1.71)	(1.69)	−(1.39)
Housing market wealth	0.066	0.065	0.038	0.157	0.164	0.083
	(13.20)	(13.00)	(7.60)	(4.49)	(4.69)	(2.08)
State specific time trends	No	Yes	No	No	Yes	No
Year/quarter fixed effects	No	No	Yes	No	No	Yes
Regression R^2	0.149	0.149	0.347	—	—	—
t-Ratio	10.101	10.080	5.023	4.679	5.178	1.179
p-value for H_0	0.000	0.000	0.000	0.000	0.000	0.238
p-value for H_1	1.000	1.000	1.000	1.000	1.000	0.881

Note: H_0 is a test of the hypothesis that the coefficient on housing market wealth is equal to that of stock market wealth.

H_1 is a test of the hypothesis that the coefficient on housing market wealth exceeds that of stock market wealth.

*Using Lags 2 to 4 of Income, Stock market and Housing market variables as instruments for Income, Stock market and Housing market wealth.

Table 4. Consumption models in first differences: Quarterly observations on states, 1975–2012:2.[5]

spending to changes in housing wealth is estimated to be quite large (0.16). Surprisingly the coefficient of stock-market wealth has a negative sign.[6]

Table 5 presents the model's variables as first differences, including the lagged (log) ratio of consumption to income. This is the error-correction model (ECM) that is often employed in the presence of unit roots.[7] The model represents a co-integrated relation between consumption and income, including income that is derived from the stock market and housing. Note that the lagged ratio of consumption to income has a coefficient that is negative and significant in all regressions. Thus, transitory shocks, arising from changes in other variables in the model or the error term in the regression, will have an immediate effect on consumption but will eventually be offset, unless the shocks are ultimately confirmed by

[5] See also note to Table 2.

[6] This result persists when alternative lags are used as the instruments in the regression.

[7] Note that our previous paper investigated a variety of tests for unit roots, but no evidence of unit roots was uncovered.

$$\Delta C_t = \alpha \Delta C_{t-1} + \beta_1 \Delta \text{Inc}_t + \beta_2 \Delta \text{Stock}_t + \beta_3 \Delta \text{House}_t + \gamma\,[C_{t-1} - \text{Inc}_{t-1}] + \text{Fixed Effects} + \varepsilon_t$$

Dependent variable: Change in consumption per capita	I	II	III
Change in income	0.355	0.347	0.278
	(27.31)	(26.69)	(23.17)
Change in stock market wealth	0.025	0.025	0.014
	(12.50)	(12.50)	(7.00)
Change in housing market wealth	0.07	0.066	0.042
	(11.67)	(11.00)	(8.40)
Lagged change in consumption	0.064	0.058	−0.077
	(5.82)	(5.27)	(−7.00)
Lagged ratio of consumption to income	−0.016	−0.005	−0.026
	(−8.00)	(−5.00)	(−8.67)
State specific time trends	No	Yes	No
Year/quarter fixed effects	No	No	Yes
R^2	0.157	0.152	0.356
t-Ratio	9.393	9.929	5.969
p-value for H_0	0.000	0.000	0.000
p-value for H_1	1.000	1.000	1.000

Note: H_0 is a test of the hypothesis that the coefficient on housing market wealth is equal to that of stock market wealth.
H_1 is a test of the hypothesis that the coefficient on housing market wealth exceeds that of stock market wealth.

Table 5. Error correction consumption models quarterly observations on states, 1975–2012.[8]

income changes. Again, the results support the highly significant immediate effect of housing-market wealth on consumption; which is especially large compared to the effect of financial wealth.

In Table 6, we introduce a lagged stock-market response within the ECM framework. There are certainly reasons to expect some time lags, such as household inattention, evaluation of household finances only at periodic intervals (for example, annual tax reporting times), adjustment costs to

[8] See also note to Table 2.

changing consumption, and habit formation. Some of these reasons are confirmed by survey data on individual consumers' decisions. Kennickell and Starr-McCluer (1997) found that households have imperfect knowledge of their own financial wealth, and Buck and Pence (2008) report that many homeowners do not know the basic terms of their mortgages. Using household data, Dynan and Maki (2001) have presented evidence that the stock-market-wealth effect, to the extent that it is measurable, operates as a lagged adjustment process. We amend our preferred specification by adding a lagged term in the regressions. We do not include lags on household housing wealth, given the strong serial correlation of home-price changes.[9] The results that are reported in Table 6, including the lagged change in the stock-market-wealth variable, are qualitatively similar to those that are reported in Table 5. The estimated effect of housing wealth is also quite similar (0.069).

In our earlier paper, we also investigated the importance of simple demographics (the age distribution of the state populations) since theory implies that the wealth effect should be different in different phases of the life cycle. We have relied on estimates of the age distribution that were produced annually by the CPS since 1982. We have computed the fraction of the population aged sixty or above by state and year, and interpolated to quarters. We have added interaction terms to the regressions that are reported in Table 6, in an effort to estimate how the wealth effect is affected by age. The estimated age-interaction-effect variables were not statistically significant so regressions extending these non-results are omitted here.[10]

Due to changes in savings and tax institutions, we anticipate that the importance of the housing-wealth effect may have changed over time. The Tax Reform Act of 1986 (TRA86) was a great advantage to the use of housing equity for consumption because it eliminated the tax deductibility of all other interest payments for consumer credit. Beginning in the fourth quarter of 1986, the passage of the act greatly encouraged financial institutions to establish lines of credit that were secured by home equity. Even if

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[9] This is the same specification that is reported in Table 5 of our original paper.

[10] Even over this longer sample period, the state data do not exhibit enough variation in age distribution to support estimates of the interaction of the wealth effect with age. However, it should be noted that Campbell and Cocco (2004), who use data on individual households, did find evidence that the housing wealth effect is higher for older households.

$$\Delta C_t = \alpha \Delta C_{t-1} + \beta_1 \Delta \text{Inc}_t + \Delta \beta_2 \text{Stock}_t + \beta_3 \Delta \text{House}_t + \gamma (C_{t-1} - \text{Inc}_{t-1}) + \beta_4 \Delta \text{Stock}_{t-1} + \text{Fixed Effects} + \varepsilon_t$$

Dependent variable: Change in consumption per capita	I	II	III
Change in income	0.355	0.347	0.27
	(29.58)	(28.92)	(22.50)
Change in stock market wealth during the past year, DStock_t	0.026	0.026	0.016
	(13.00)	(13.00)	(8.00)
Change in housing market wealth	0.069	0.065	0.042
	(13.80)	(13.00)	(8.40)
Lagged change in consumption	0.049	0.043	−0.087
	(4.45)	(3.91)	(−7.91)
Lagged ratio of consumption to income	−0.016	−0.005	−0.026
	(−8.00)	(−5.00)	(−8.67)
Change in stock market wealth during the past year compared to the previous year, DStock_{t-1}	0.020	0.020	0.021
	(10.00)	(10.00)	(10.50)
State specific time trends	No	Yes	No
Year fixed effects	No	No	Yes
R^2	0.166	0.161	0.365
t-Ratio	10.594	12.245	5.614
			0.000
p-value for H_1	1.000	1.000	1.000

Note: H_0 is a test of the hypothesis that the coefficient on housing market wealth is equal to that of stock market wealth. H_1 is a test of the hypothesis that the coefficient on housing market wealth exceeds that of stock market wealth.

Table 6. Error correction consumption models with lagged stock market wealth effects annual observations on states, 1975–2012.[11]

homeowners did not plan to access their home equity for consumption, their knowledge of the possibility may diminish the precautionary-saving motive, which has been shown to be an important determinant of consumption expenditures (Kennickell and Lusardi, 2004).

[11] Extends only until 2008, because 2009 information is only reported through Q2. See also note to Table 2.

Dependent variable: Change in consumption per capita	Models in first differences			Error correction models		
	I	II	III	IV	V	VI
Change in income	0.348	0.348	0.26	0.349	0.342	0.273
	(29.00)	(29.00)	(21.67)	(26.85)	(26.31)	(22.75)
Change in stock market wealth	0.027	0.027	0.014	0.025	0.025	0.014
	(13.50)	(13.50)	(7.00)	(12.50)	(12.50)	(7.00)
Pre 1986 dummy	0.04	0.04	0.024	0.042	0.039	0.026
*Change in housing market wealth	(6.67)	(6.67)	(4.00)	(6.00)	(5.57)	(4.33)
Post 1986 dummy	0.118	0.118	0.077	0.122	0.118	0.082
*Change in housing market wealth	(13.11)	(13.11)	(8.56)	(13.56)	(13.11)	(9.11)
Lagged change in consumption	—	—	—	0.064	0.058	0.078
				(5.82)	(5.27)	(7.09)
Lagged ratio of consumption to income	—	—	—	−0.017	−0.005	−0.026
				(−8.50)	(−5.00)	(−8.67)
State specific time trends	No	Yes	No	No	Yes	No
Year/quarter fixed effects	No	No	Yes	No	No	Yes
R^2	0.154	0.154	0.349	0.163	0.158	0.359
t-Ratio	4.110	4.416	1.386	4.353	5.677	1.726
p-value for H_0	0.000	0.000	0.166	0.000	0.000	0.084

Note: H_0 is a test of the hypothesis that the coefficient on housing market wealth is the same before and after 1986.

Table 7. Pre vs Post 1986 consumption models in first differences and error correction models: Quarterly observations on states, 1975–2012:2.[12]

Table 7 presents variants of our preferred statistical models, the first differences and the ECM models, for the panel of U.S. states. In these regressions, we distinguish between the potential effects of housing wealth on consumption before and after the last quarter of 1986. In each of the six specifications, the estimated effects of housing market wealth on consumption are substantially larger after the passage of TRA86. The point estimates are substantially larger (with elasticity of 0.118) after the change in the tax law, and these differences are highly statistically significant.

Lastly, evidence suggests that housing consumers may react differently to perceived increases in housing values compared to perceived declines in asset values. As suggested by Kahneman and Tversky's prospect theory, Genesove and Mayer (2001) have shown that home sellers behave differently in reaction to declines in home prices than they do in reaction to increases. Apparently, the painful regret from the loss of home value has different psychological consequences than the pleasant elation that

[12] See also note to Table 2.

Dependent variable: Change in consumption per capita	Models in first differences			Error correction models		
	I	II	III	IV	V	VI
Change in income	0.354	0.353	0.265	0.355	0.347	0.279
	(29.50)	(29.42)	(22.08)	(27.31)	(26.69)	(23.25)
Change in stock market wealth	0.027	0.027	0.014	0.025	0.025	0.014
	(13.50)	(13.50)	(7.00)	(12.50)	(12.50)	(7.00)
Dummy for housing wealth decreases	0.103	0.1	0.06	0.104	0.1	0.07
*Change in housing market wealth	(11.44)	(11.11)	(7.50)	(11.56)	(11.11)	(8.75)
Dummy for housing wealth increases	0.031	0.032	0.019	0.034	0.031	0.014
*Change in housing market wealth	(3.44)	(4.00)	(2.38)	(3.78)	(3.44)	(1.75)
Lagged change in consumption	—	—	—	0.059	0.053	0.079
				(5.36)	(4.82)	(7.18)
Lagged ratio of consumption to income	—	—	—	−0.016	−0.004	−0.027
				(−8.00)	(−4.00)	(−9.00)
State specific time trends	No	Yes	No	No	Yes	No
Year/quarter fixed effects	No	No	Yes	No	No	Yes
R^2	0.152	0.152	0.348	0.160	0.155	0.358
t-Ratio	6.977	7.983	1.435	5.864	6.584	1.371
p-value for H_0	0.000	0.000	0.151	0.000	0.000	0.170

Note: Ho is a test of the hypothesis that the coefficient on housing market wealth is the same for increases as it is for decreases.

Table 8. Housing wealth increases vs decreases consumption models in first differences and error correction models: quarterly observations on states, 1975–2012:2.[13]

people experience because of an increase in home value, which frees up new opportunities to consume home equity. Table 8 provides additional evidence, using the same preferred models (this is the specification we reported in Appendix Table 3 of the original paper).

For each of the six regressions, the results indicate that increases in housing-market wealth have positive effects on household consumption while declines in housing-market wealth have negative and somewhat larger effects upon consumption. These results were *not* found in our original analysis based on data up to 2000. The housing-wealth elasticity in a falling market is estimated to be about 0.10, and about 0.032 in a rising market.

Appendix Table A1 compares the effects of both increases *and* decreases in housing-market and stock-market wealth on consumption. In each of the six models that are reported in the table, the effect of increases in housing-market wealth on consumption is positive and significant; the effect of

[13] See also note to Table 2.

Dependent variable: Change in consumption per capita	Models in first differences			Error correction models		
	I	II	III	IV	V	VI
Change in income	0.356	0.355	0.265	0.359	0.35	0.279
	(29.67)	(29.58)	(22.08)	(27.62)	(26.92)	(23.25)
Dummy for stock wealth decreases	0.101	0.099	0.06	0.103	0.099	0.07
*Change in stock market wealth	(11.22)	(11.00)	(7.50)	(11.44)	(11.00)	(8.75)
Dummy for stock wealth increases	0.031	0.032	0.019	0.034	0.032	0.014
*Change in stock market wealth	(3.88)	(4.00)	(2.38)	(3.78)	(3.56)	(1.75)
Dummy for housing wealth decreases	0.043	0.043	0.028	0.043	0.042	0.029
*Change in housing market wealth	(10.75)	(10.75)	(7.00)	(10.75)	(10.50)	(9.67)
Dummy for housing wealth increases	0.011	0.011	0	0.007	0.009	−0.002
*Change in housing market wealth	(2.75)	(2.75)	(0.00)	(1.75)	(2.25)	(−0.67)
Lagged change in consumption	—	—	—-	0.055	0.049	0.083
				(5.00)	(4.45)	(7.55)
Lagged ratio of consumption to income	—	—	—	−0.017	−0.004	−0.027
				(−8.50)	(−4.00)	(−9.00)
State specific time trends	No	Yes	No	No	Yes	No
Year/quarter fixed effects	No	No	Yes	No	No	Yes
R^2	0.155	0.155	0.350	0.164	0.158	0.361
t-Ratio	6.794	7.592	4.313	5.457	6.173	3.975
p-value for H_0	0.000	0.000	0.000	0.000	0.000	0.000

Note: H_0 is a joint test of the hypothesis that the coefficient on housing market wealth and stock market wealth are the same for increases as for decreases.

Table A1. Housing and stock market wealth increases vs decreases consumption models in first differences and error correction models: Quarterly observations on states, 1975–2012.[14]

decreases in housing-market wealth on consumption is negative, and is also significantly larger.

The statistical models also report a relationship between increases in stock-market wealth and increases in consumption, and a larger relationship between decreases in stock-market wealth and decreases in consumption.

As emphasized in our original paper, there is always room for skepticism about the estimation and interpretation of simple macroeconomic structural relations like the ones presented here (see, for example, Cooley and Leroy, 1981, or Leamer, 1983). Underlying our analysis is an assumption that it is useful to think of causality as running from wealth components to consumption, and not that, for example, the two are determined by a third

[14] See also note to Table 2.

variable, such as general confidence in the economy. We believe even more strongly that these new results demonstrate that it is useful to think that consumption is determined in accordance with the models that we have presented. In consulting this evidence, recall that our measure of housing wealth excludes wealth changes due to changes in the size or quality of homes, even though these changes are likely to be correlated with consumption changes merely because housing services are a component of consumption. We have alluded elsewhere to evidence from other studies, using data on individuals, that the reaction of consumption to stock-market increases is stronger for stockholders than for non-stockholders (Mankiw and Zeldes, 1991), and that the reaction of consumption to housing-price increases is stronger for homeowners than for renters. This lends additional credibility to our structural models when we compare them to a model that postulates that general confidence determines both consumption and asset prices.

6 Conclusion

The importance of housing-market wealth and financial wealth in affecting consumption is an empirical matter. We have examined this wealth effect with a reasonably long panel of cross-sectional time-series data, one that is more comprehensive than any applied before, and with a number of different econometric specifications. The numerical results vary somewhat because of different econometric specifications, and therefore any numerical conclusion must be tentative. At best, we find weak evidence of a link between stock-market wealth and consumption. In contrast, we do find strong evidence that variations in housing-market wealth have important effects on consumption. This evidence arises consistently using thirty-one year panels of U.S. states, and this finding is robust to differences in model specification.

As for the magnitude of the effects, consider a few of the most recent changes in housing wealth. The decline in housing wealth from 2005 to 2009 was roughly thirty percent (somewhat more in real terms). Estimates of the elasticity of consumer spending range from 0.03 to 0.18, but those that are estimated with separate coefficients for up markets and down markets are consistently about 0.10 in down markets. This implies that a decline of 35 percent in housing wealth would lower consumer spending by 3.5 percent. Consumption is about $10 trillion, and that, in turn, implies an annual

decline in consumption of about $350 billion. To put those figures into context, consider the effects of the decline in housing production from 2.3 million units to 600 thousand, at $150,000 each. This implies a reduction in spending on residential capital of about $255 billion. Individually, these have a large impact on the economy; together they have a very large impact.

These calculations should not imply a false precision in the interpretation of our econometric models. Nevertheless, they do reinforce our conclusion that changes in housing values continue to exert a larger and more important impact on household consumption than changes in stock market values do.

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