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1978-2009

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We re-examine the link 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-one year period, 1978 through 2009. 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. This reinforces the conclusions reported in our previous analysis.

In contrast to our previous analysis, however, we do find – based on data which include the recent volatility in asset markets – that the effects of declines in housing wealth in reducing consumption are at least as large as the effects of increases in housing wealth in increasing the course of household consumption.

Keywords: consumption, nonfinancial wealth, housing market, real estate
JEL Codes: E2, G1

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I. 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 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 an 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 interpreted the coefficients of the wealth variables as indicating the strength of the association between these two kinds of household wealth and household consumption.

Our statistical results suggested that there were significant "wealth effects" upon 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 persisted for a variety of specifications for both panels of aggregate data.

These results received some notice in the popular media,[1] in some part, presumably, reflecting concurrent trends in the macro economy. In due course, the paper, "Comparing Wealth Effects: The Stock Market versus the Housing Market," was

[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).

published, in *Advances in Macroeconomics* in 2005. Contemporaneously, the data were made available online, and they were used by John Muellbauer (2008) in his well-known paper presented at the Federal Reserve Conference at Jackson Hole, Wyoming in 2007.

When our paper was originally presented, it relied upon the most recent data available. (The paper was first presented in January 2000, and it relied upon data through the second quarter of 1999). By the time the research was published, five years had elapsed, and by the time of the disastrous meltdown in mortgage markets, more than seven years had elapsed.

The purpose of this paper is to update the empirical analysis using data through 2009, and thus to incorporate the past decade of unusual volatility in housing wealth, stock market wealth, and personal consumption. As before, we present a variety of econometric models linking consumption to income, housing wealth, and stock market wealth. As in our previous analysis, we make no effort to "deduce" a structural model reflecting these relationships, preferring again to observe the robustness of these relationships to plausible specifications of the association.

In attempting to update our previous analysis, it was immediately apparent that comparable data from the panel of OECD countries previously analyzed could not be obtained. Hence, this analysis is confined to quarterly data on U.S. states, 1978:I-2009:II, extending our previous work which had analyzed these macro forces during 1982:I-1999:II.

The principal results and interpretations in our previous work are largely unchanged, but the estimated magnitudes are larger and more important statistically and also economically. 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, relative 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 to replication – certainly not as strongly as during the earlier period. Previously, we noted an asymmetry in the association between housing market wealth and consumption. When housing market wealth was increasing, household consumption was increasing. But when housing market wealth declined, household consumption declined only marginally. For the most part, this asymmetry is absent from the longer panel which now includes substantially more variation in asset prices, notably periods of declining house prices and declining stock market indices.

In Section II below we review the conceptual and measurement issues 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 III extends the empirical models relating consumption to housing wealth and stock market wealth. Section IV presents our conclusions briefly and reflects on their significance.

II. 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 relating changes in log consumption to changes in log stock market wealth, the estimated relationship is generally positive and statistically significant. Under a standard interpretation of these

results, from a suitably specified regression, the coefficient measures the "wealth effect" -- 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 quite analogous to those found for financial wealth. Yet until our work a decade ago, there was virtually no comparative research on this issue. As is evident from the events of the past half decade, the housing wealth effect may have become especially important, as institutional innovations (for example, 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, and 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 in his comments on Case (2000). The claim is essentially 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 made in a speech by Federal Reserve Chairman Alan Greenspan (November 2, 1999) in which he stated that "The permanent increase in spending out of housing wealth is somewhat

[2] Glaeser reminds us of the result from elementary price theory that if a rational individual has already purchased the desired housing (so that the endowment point equals the consumption point) then price changes in either direction are utility improving. (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.) But we cannot infer, when comparing general equilibria, 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).

higher, perhaps in the neighborhood of five percent." A decade ago, Glaeser found these remarks "inscrutable, unsupported and hard to accept."

But Glaeser's theory is belied by the public's widespread impression that increased home prices make them very much better off. Part of the reason may be psychological, due to the salience of the home price increases and the myopic failure to consider that there can't be such an advantage if most other homeowners have experienced the same price increases. Part of the reason they feel that way may have to do with a popular view that the collateral value of a home is of singular importance.

The second point has to do with this collateral value. Greenspan and Kennedy (2007), in an extensive data collection exercise, produced careful estimates of all the free cash and credit 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 maintained by the Federal Reserve. During the quarter century 1980-2005, the value of the housing stock owned by households increased by more than $19 trillion. Case (2006) estimates a virtually identical aggregate figure, but he then shows that roughly half of the increase came in the form of new capital (buildings and improvements) and half in the form of increases in the value of land, particularly land on the coasts. Over the course of five years, this would imply that the free cash and credit extracted with the home as collateral was roughly $3.5 trillion compared to a total of $5 trillion in total appreciation, net of improvement.

Table 1: Real Estate Assets Owned by Households and Market Value of Owner-Occupied Houses

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 Q1	16.477	14.119	1.17

Source: Federal Reserve Flow of Funds Data; Bureau of Economic Analysis.

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 build-up in home equity when and were it occurred did not encourage aggregate spending there and then. Nor that the bust in home prices did not discourage spending.

III. Housing Prices: 1978 – 2001

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 arises largely from differences in the elasticity of land supply, the performance of regional economies, and the changing demographics of states.

The expanded data set described below adds information on the years 1978-1981 and 2000-2009. These periods include the two most serious recessions since the Great Depression. The time period also spans the longest expansion in U.S. history, 1991-2001. In fact, as reported in Figure 1, between 1983 and 2000 there were only two quarters of negative growth, both in 1990.

The steady performance of the national economy contributed to a housing market that had almost never experienced price declines, at least not since 1975. The behavior of home prices since 1975 is chronicled in detail in Case (2008) and Case and Quigley (2008, 2010). Here 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 1990-91 while the FHFA index never declines at all between 1975 and 2007. Beginning 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 as the stock market was in decline. The recession of 2001 followed closely on the heels of 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 when 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, for example, Miami (+ 241 percent), Los Angeles (+240 percent), and San Diego and Washington D.C. (+197 percent).

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

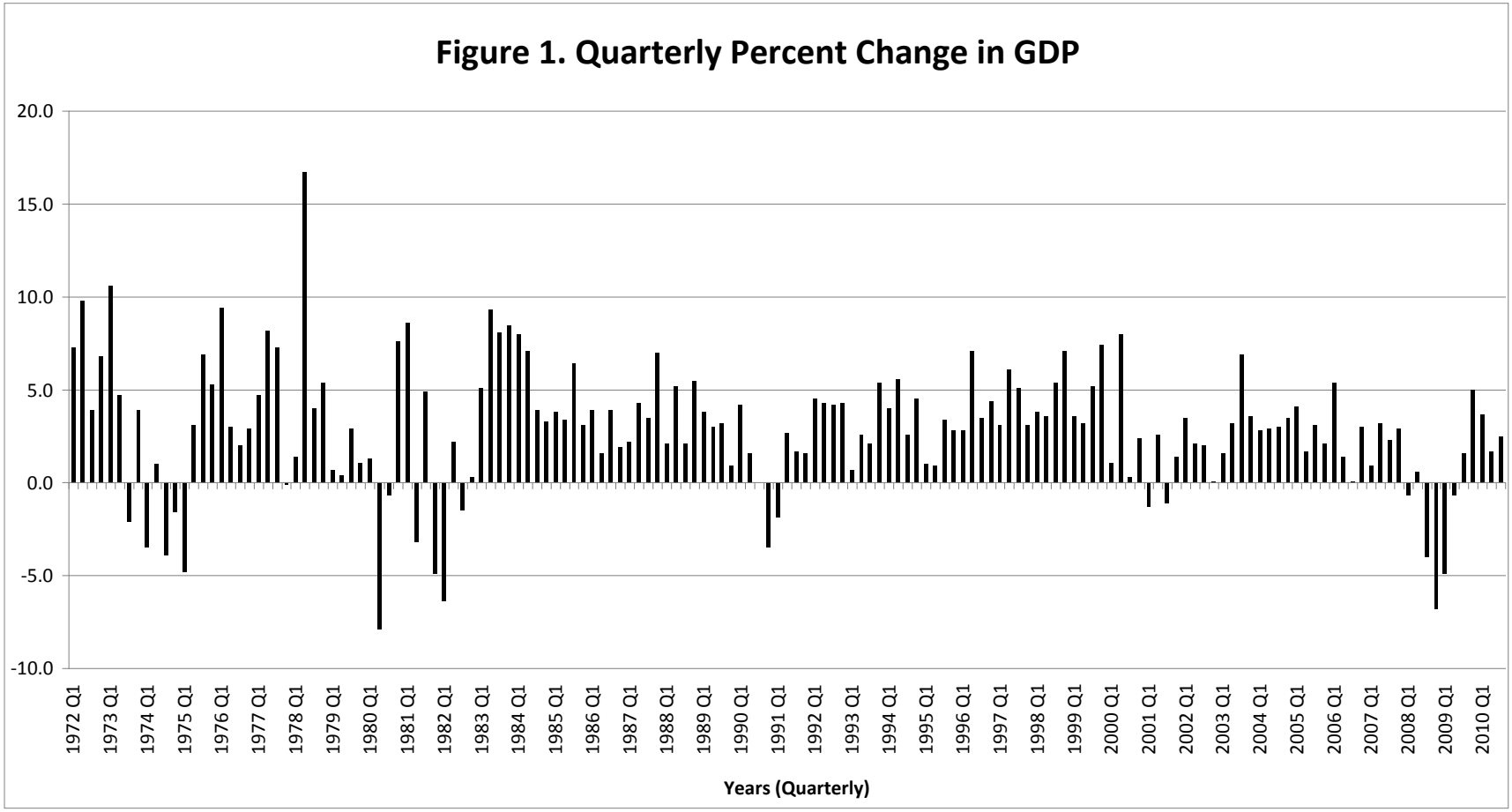
Figure 1. Quarterly Percent Change in GDP
20.0
15.0
10.0
5.0
0.0
-5.0
-10.0
1972 Q1
1973 Q1
1974 Q1
1975 Q1
1976 Q1
1977 Q1
1978 Q1
1979 Q1
1980 Q1
1981 Q1
1982 Q1
1983 Q1
1984 Q1
1985 Q1
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2003 Q1
2004 Q1
2005 Q1
2006 Q1
2007 Q1
2008 Q1
2009 Q1
2010 Q1
Years (Quarterly)

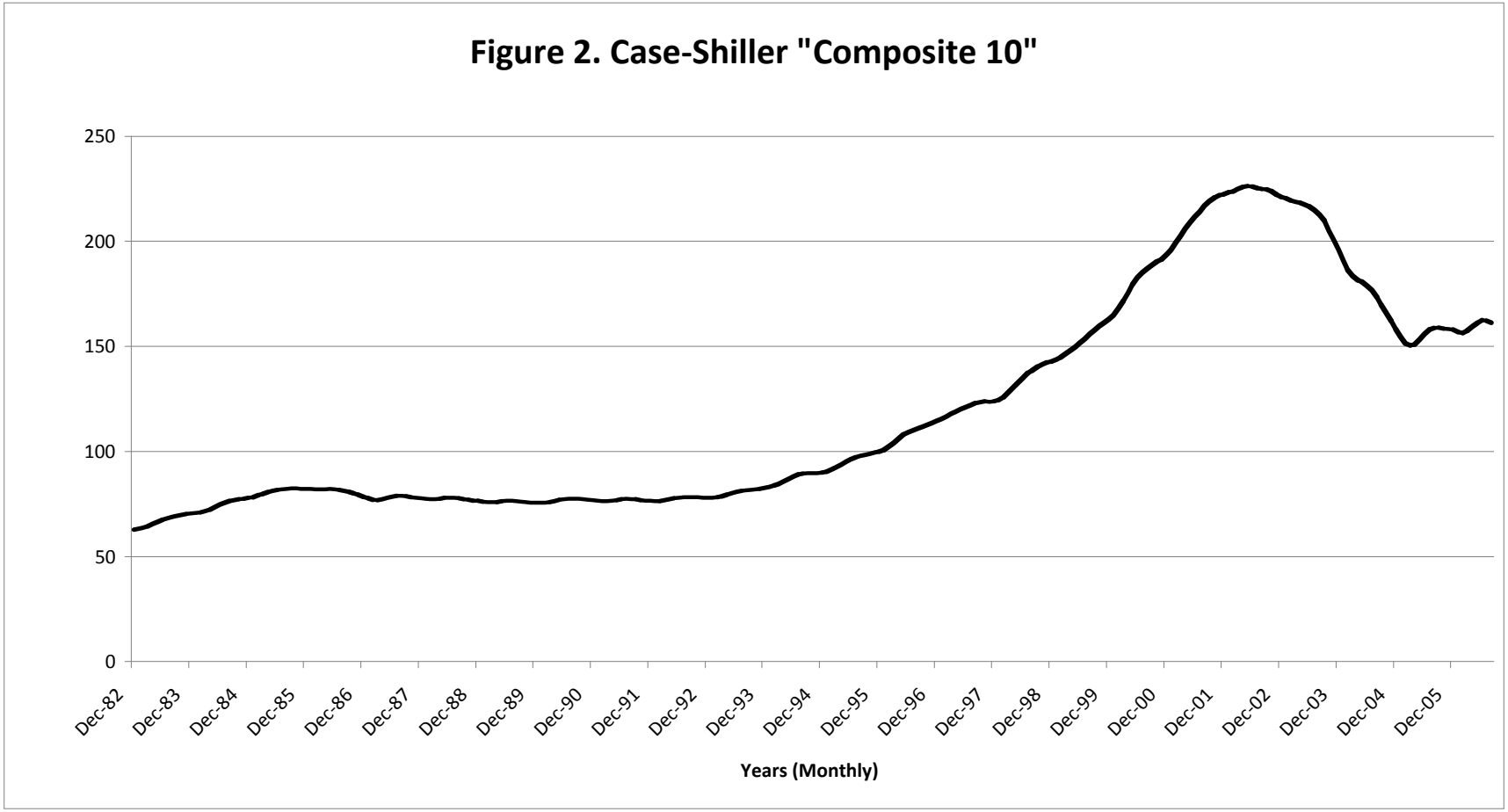


Figure 2. Case-Shiller "Composite 10"
250
200
150
100
50
0
Dec-82
Dec-83
Dec-84
Dec-85
Dec-86
Dec-87
Dec-88
Dec-89
Dec-90
Dec-91
Dec-92
Dec-93
Dec-94
Dec-95
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Years (Monthly)

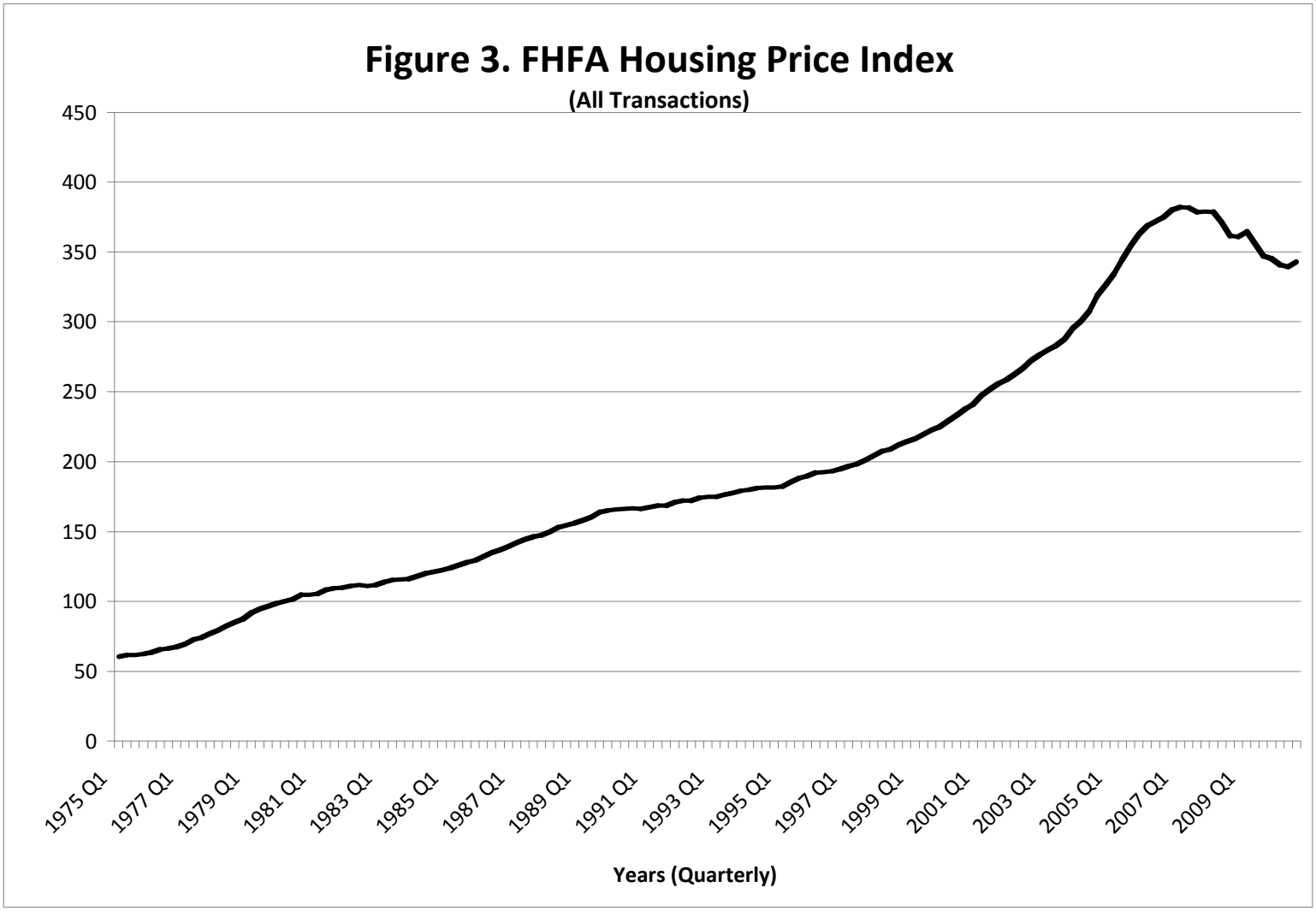


Figure 3. FHFA Housing Price Index
(All Transactions)
450
400
350
300
250
200
150
100
50
0
1975 Q1
1977 Q1
1979 Q1
1981 Q1
1983 Q1
1985 Q1
1987 Q1
1989 Q1
1991 Q1
1993 Q1
1995 Q1
1997 Q1
1999 Q1
2001 Q1
2003 Q1
2005 Q1
2007 Q1
2009 Q1
Years (Quarterly)

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 which had previously experienced the largest price increases and in cities where over-building had been most extreme (*e.g.*, Miami, Phoenix, Las Vegas). The California 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 had declining regional economies (*e.g.*, Detroit and Cleveland).

The changes in housing wealth and stock market wealth do not move closely 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, indexed over time with the Fiserv Case Shiller Index for the state, divided by per capita income in the state. Texas witnessed a steady decline in the ratio of house prices to income from 1975 to the late 1990s.

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 and Arizona are much like that in Texas, but with bubbles inflating and deflating since 2004. State housing markets were moving in complicated and asynchronous ways during the periods which we were able to add new data to the time series.

Table 2
S & P Case-Shiller Index Through September 2010*

Metropolitan Area	Peak Price	Change: Since Peak	Change: Last Year	Change: August - September 2010	Change: July - August 2010	Change: January 2000 - September 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

Note: * Released November 31st, 2010

Figure 4. House Price / Per Capita Income
Texas

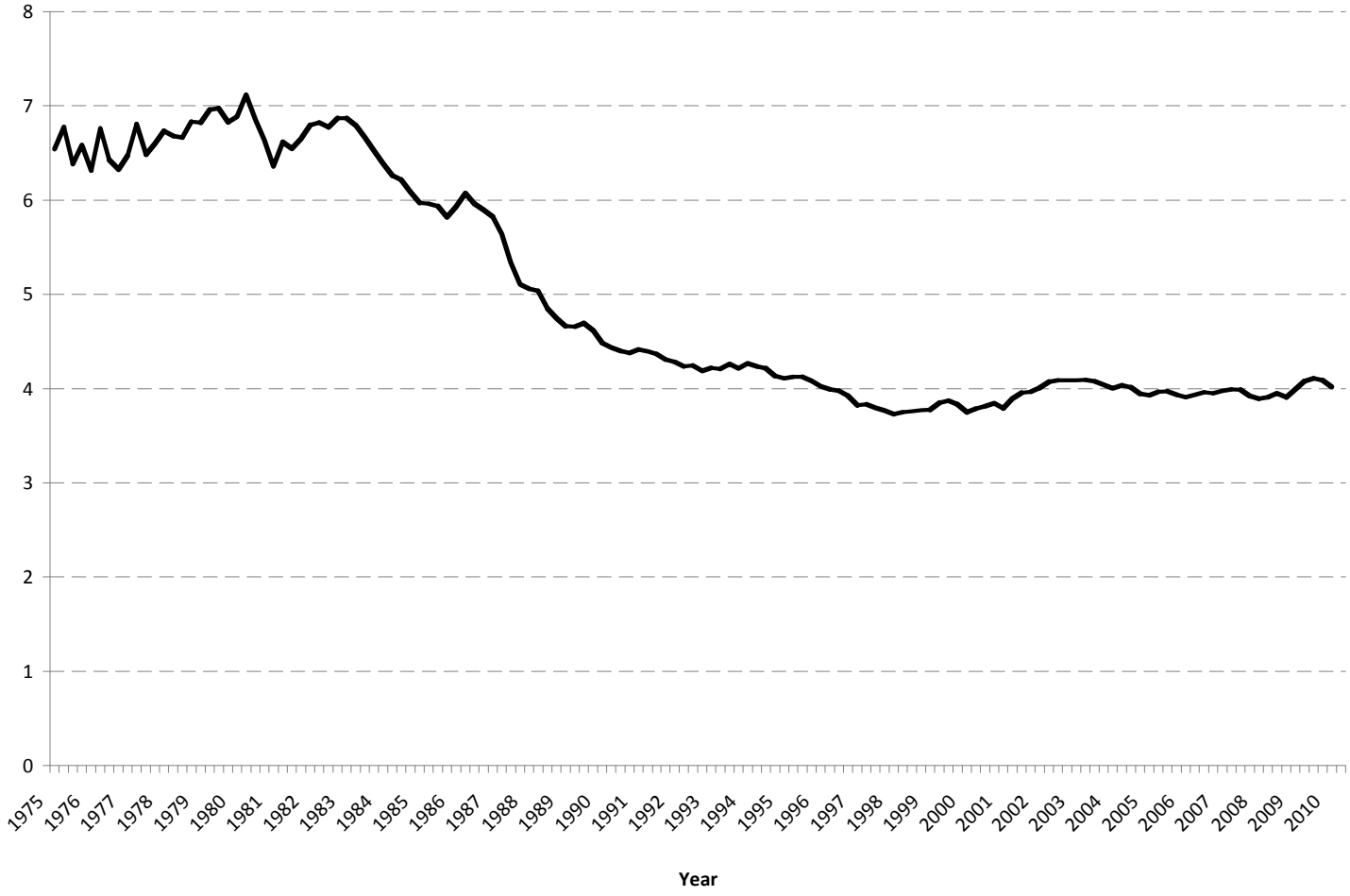


Figure 5. House Price / Per Capita Income
California

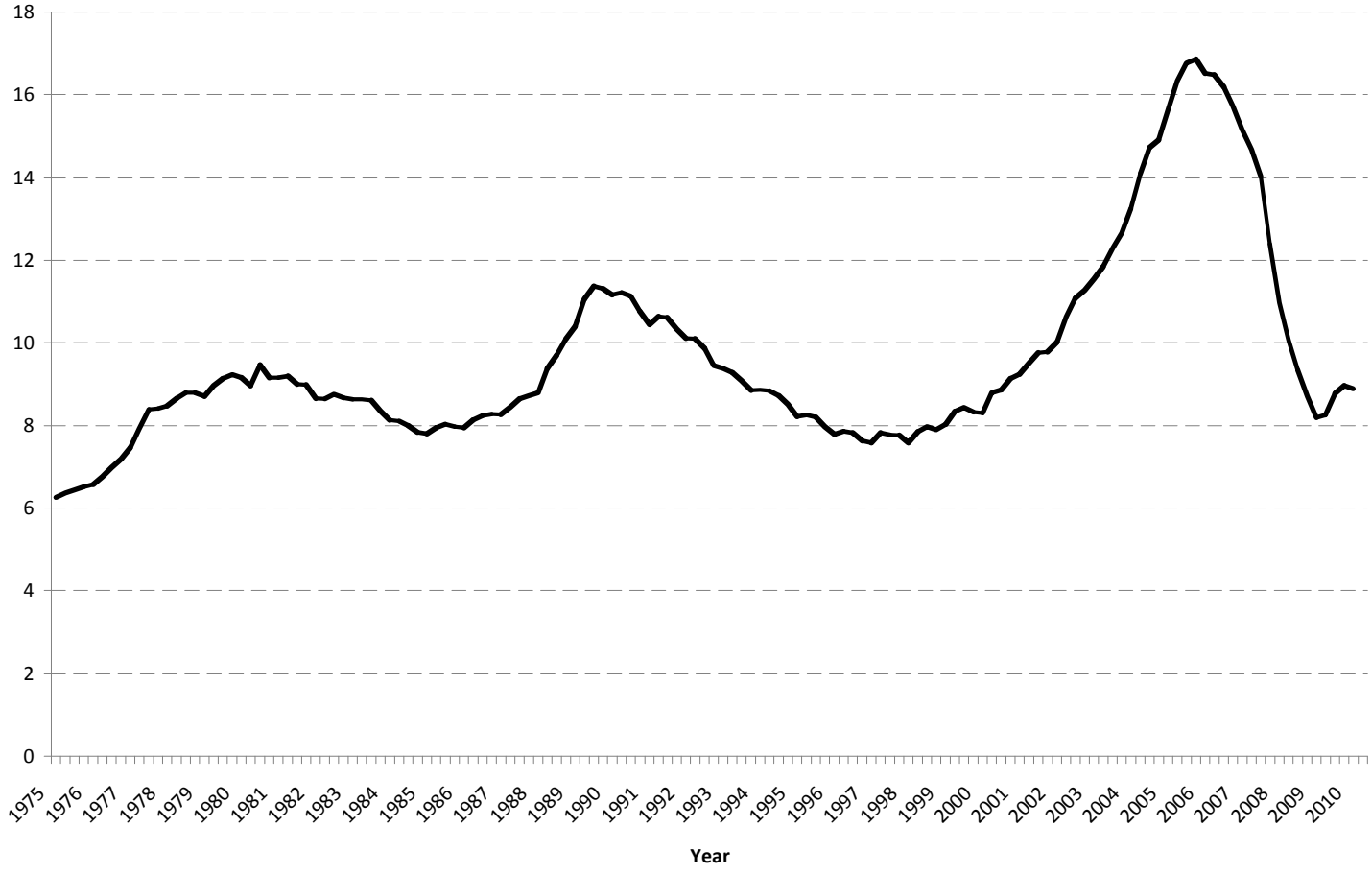


Figure 6. House Price / Per Capita Income
Florida

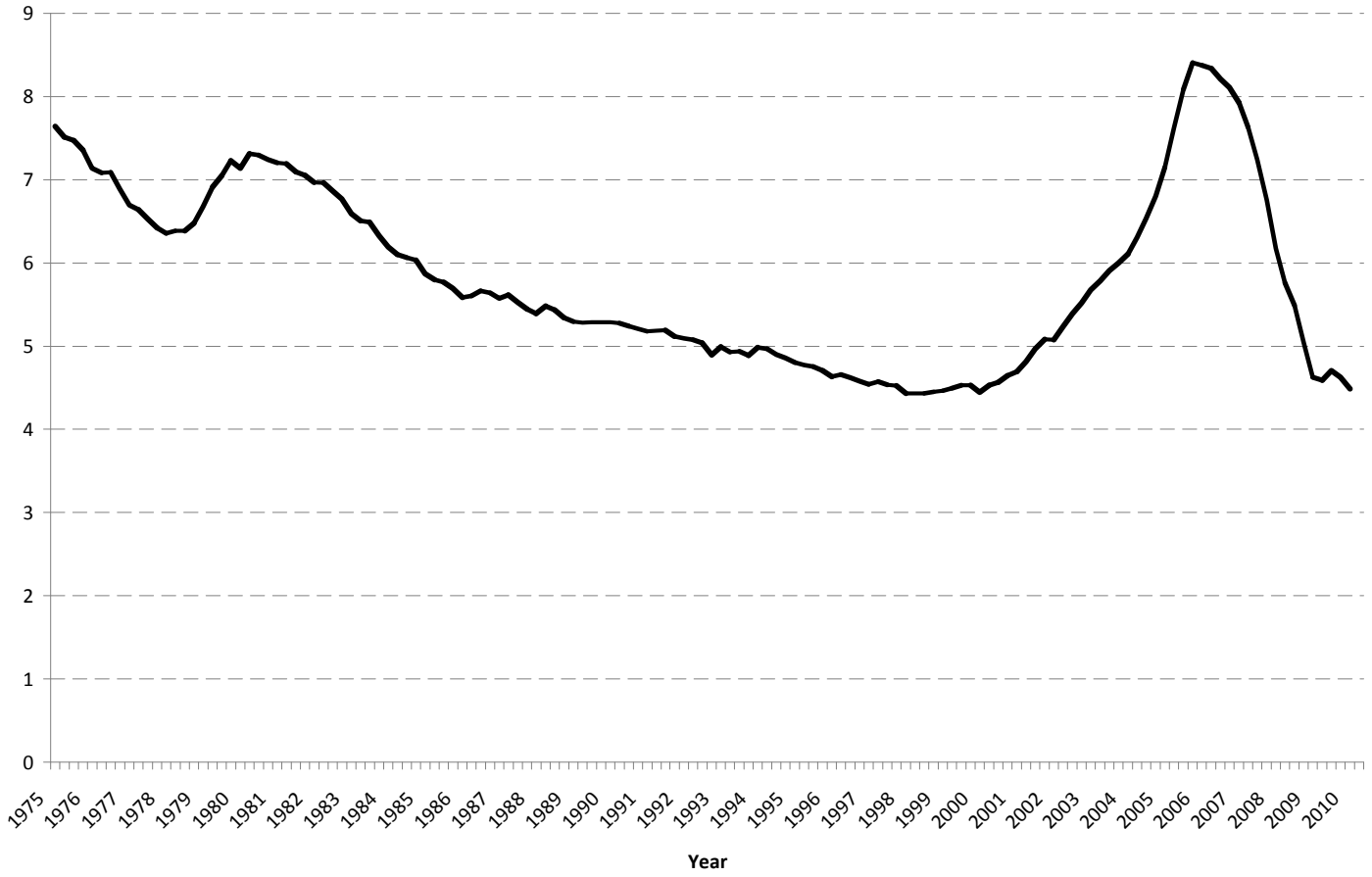
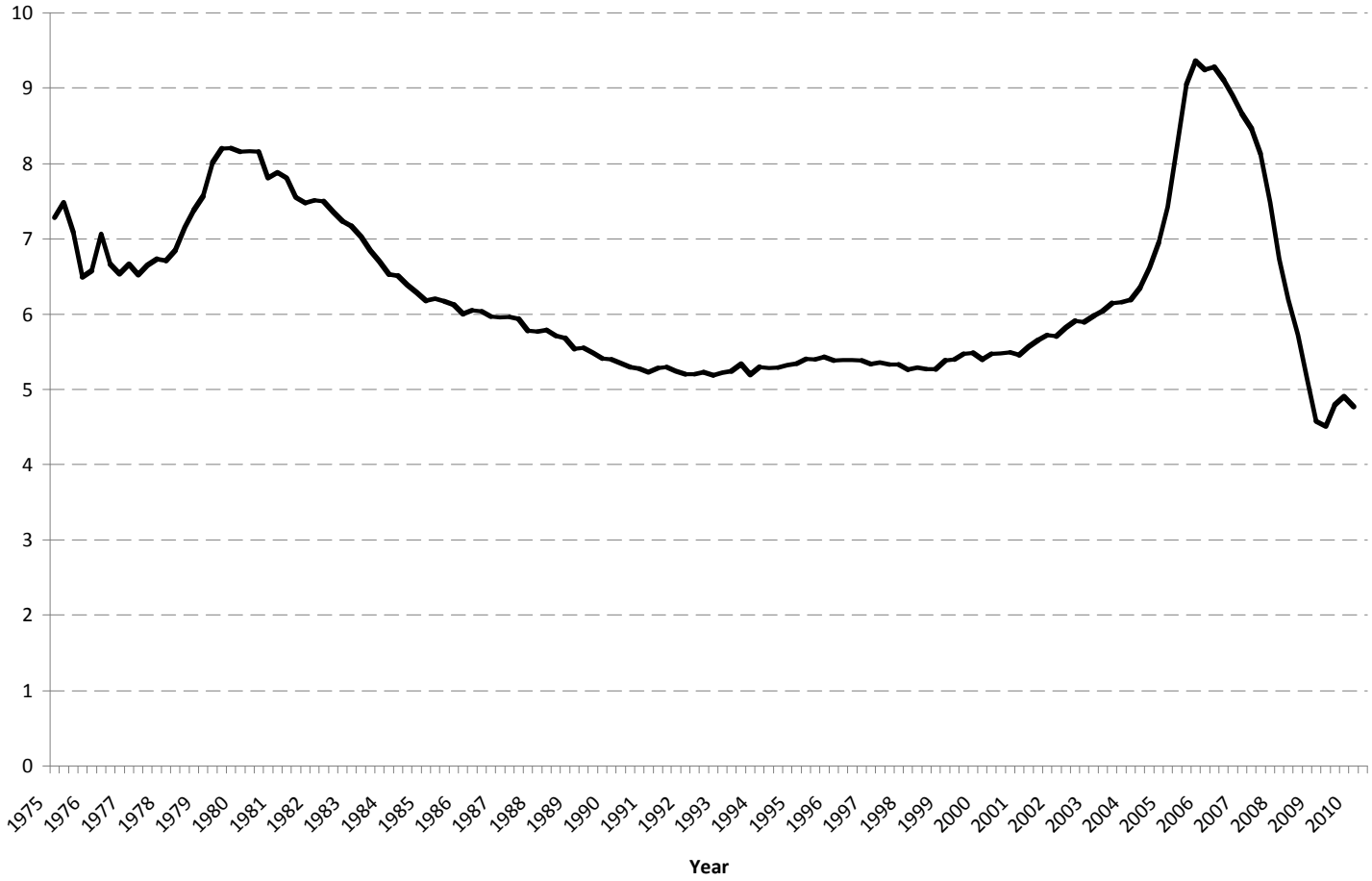


Figure 7. House Price / Per Capita Income
Arizona



IV. 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 reported here greatly increases the sample size for analysis, by seventy percent when compared to our previous analysis, from 3,700 observations on state-by-quarter-year to 6,300 observations.

A. Housing Wealth

Estimates of housing market wealth were constructed from repeat sales price indexes applied to the base values reported in the 2000 *Census of Population and Housing* 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 for all states.

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

(1) $V_{it} = R_{it} N_{it} I_{it} V_{io}$ 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),

V_{io} = mean home price for state i in the base year, 2000.

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

B. Retail Sales 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 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, 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 relating sales to employment were benchmarked to the *Census of Retail Trade*, available at five-year intervals. Estimates for all states were within five percent of the benchmarks.

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

To the extent that these systematic differences between retail sales and consumption are state-specific, they can be accounted for directly in multivariate

statistical analysis. Data on retail sales, house values, and stock market valuation, by state and quarter, were expressed per capita in real terms using the *Current Population Survey* and the GDP deflator.

C. Financial Wealth

Estimates of aggregate financial wealth were obtained quarterly from the Federal Reserve Flow of Funds (FOF) accounts. From the FOF accounts, we computed the sum of corporate equities, pension fund reserves, and mutual funds 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 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 added data on years 2008 and 2009. For the years from 1993 to 2009, we interpolated the share of holdings in each state, linearly, mapping the 1993 figures to the 2008 figures so that each summed to one. We assumed that for 1978 through 1986:IV, the distribution was the same as recorded in 1986.

We made considerable efforts to check these series against other data, as 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 at 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 available for 1986, 1987, 1989, 1991 and 1993, also aggregated to the nine census regions.

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

Figures 8 through 10 present the raw data for several states after conversion to 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.

V. Statistical Results

Tables 3 through 7 report various econometric specifications of the relationship between income, wealth, and consumption for U.S. states. All specifications include fixed effects (*i.e.*, 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 explore further the nature of estimated wealth effects and their robustness. Model II for each specification also includes state-specific time trends. Model III includes year-specific fixed effects as well as seasonal (i.e., quarterly) fixed effects.

Figure 8. Wealth and Consumption in Real Per Capita Dollars: California

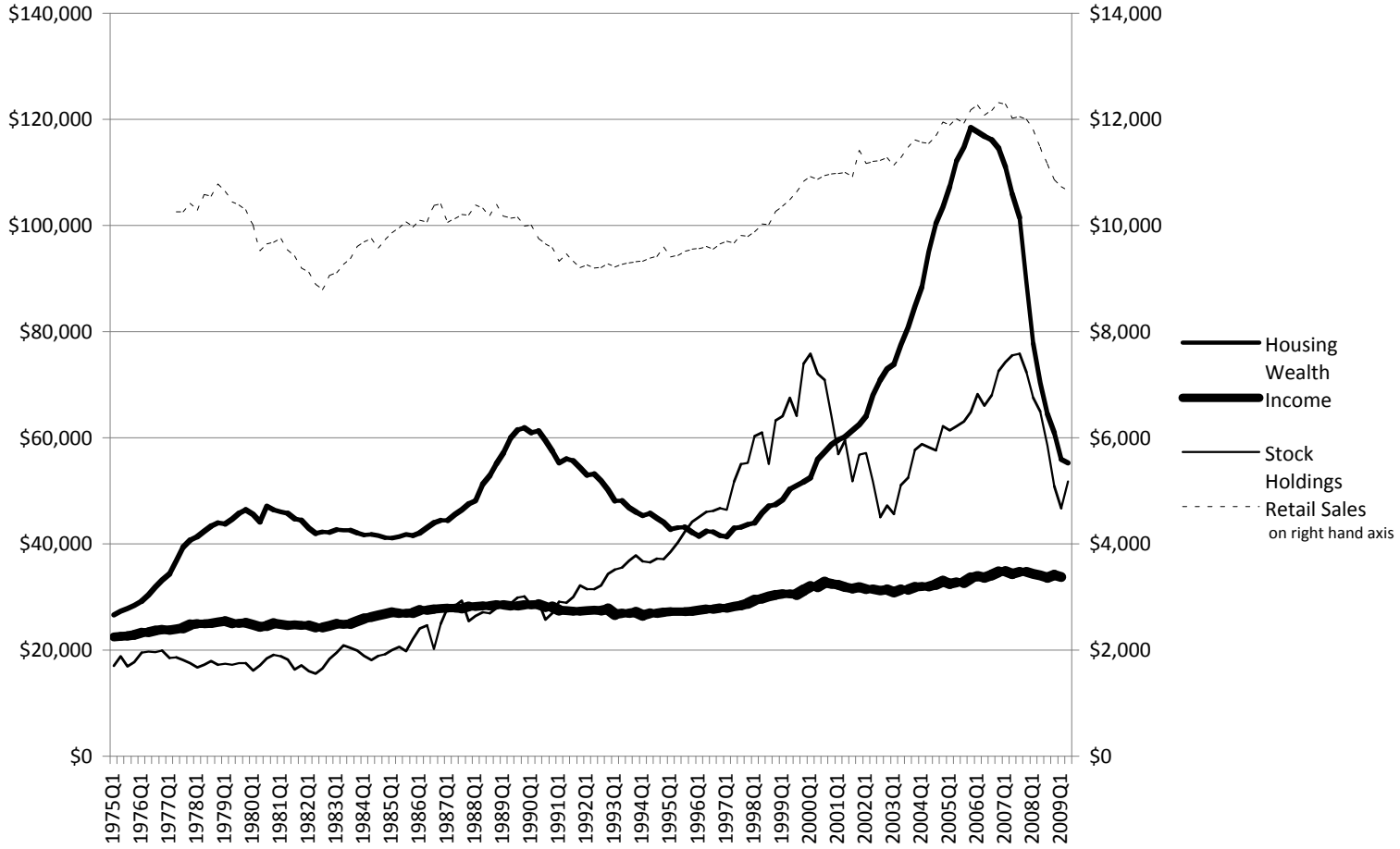


Figure 9. Wealth and Consumption in Real Per Capita Dollars: Arizona

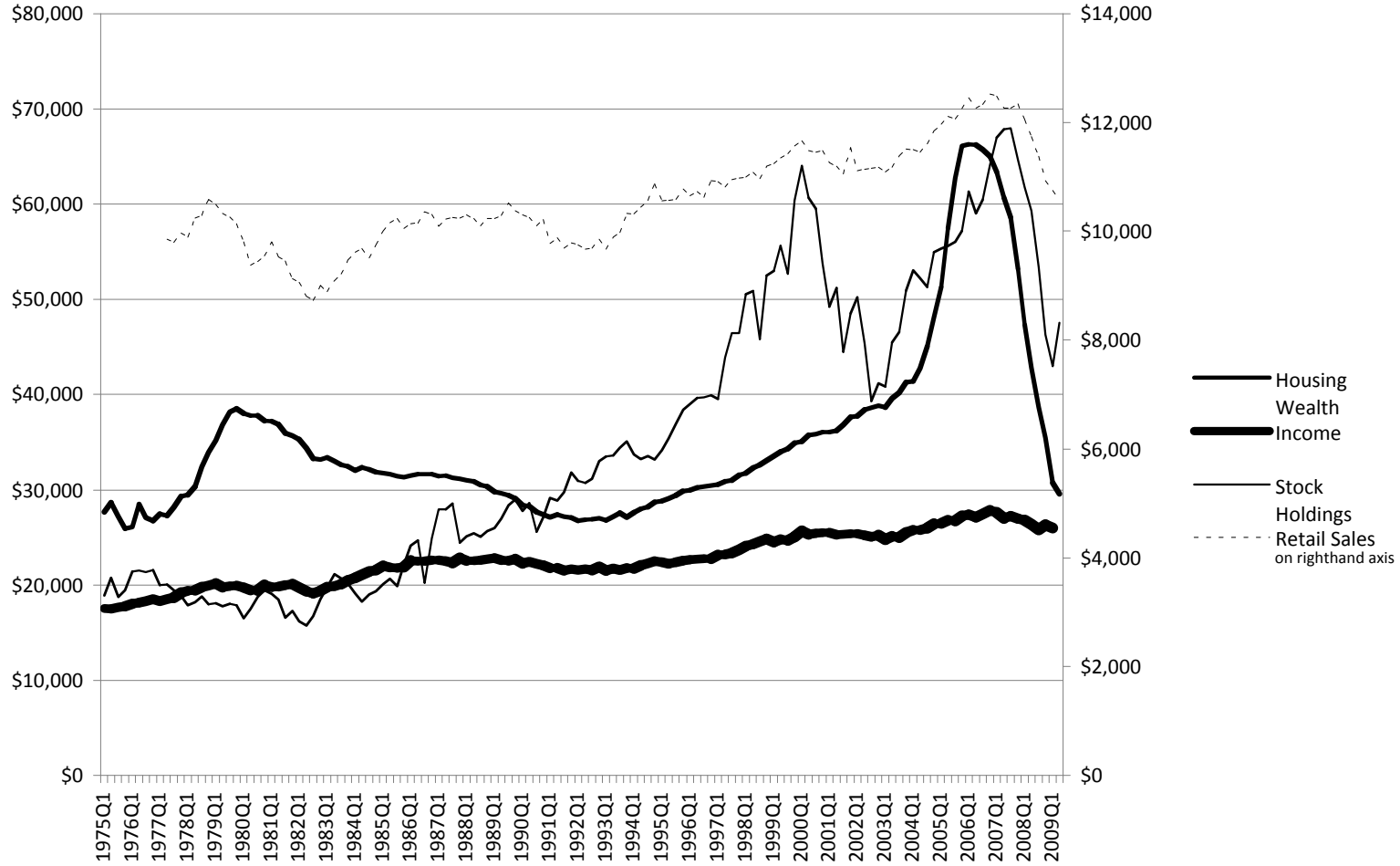
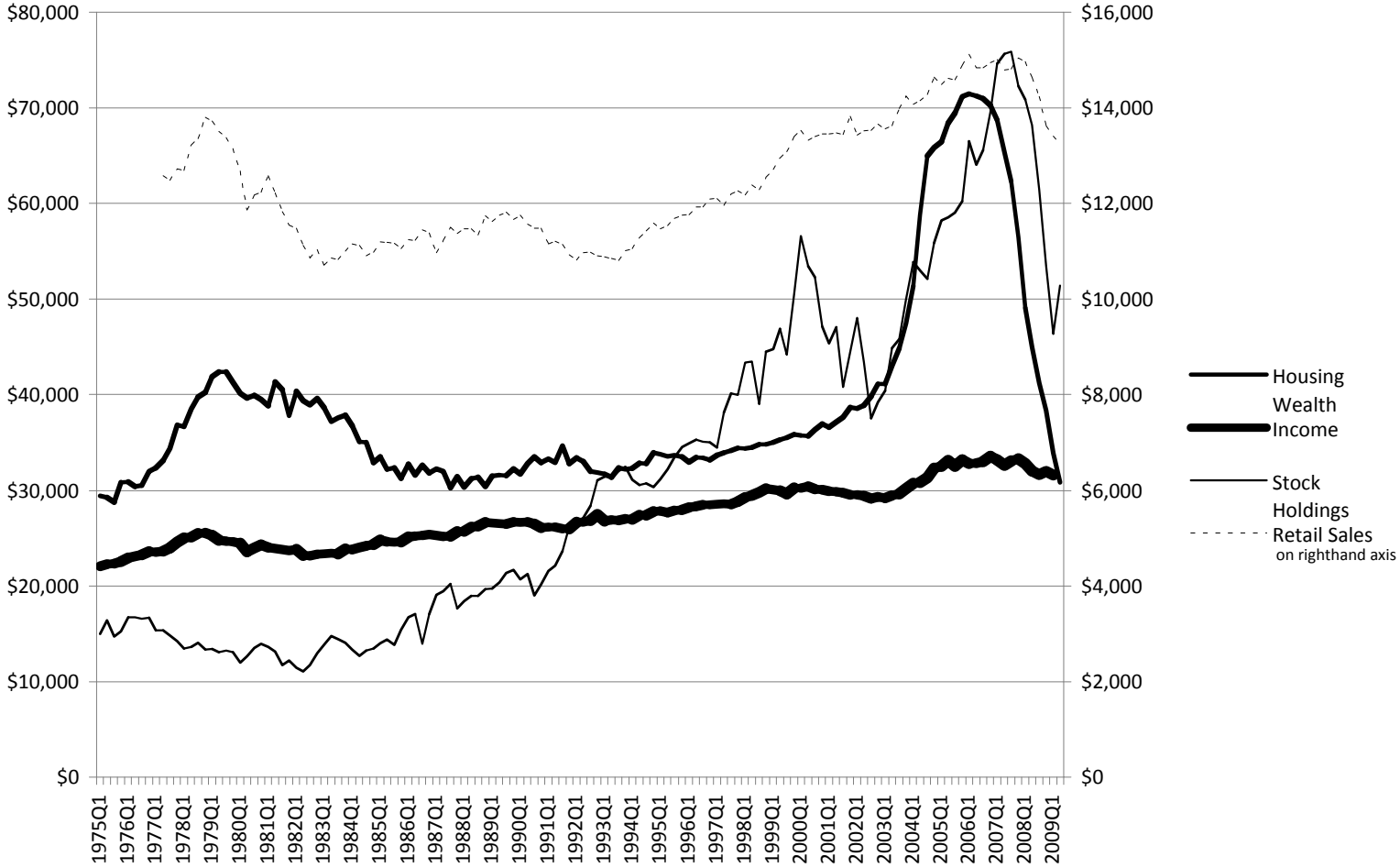


Figure 10. Wealth and Consumption in Real Per Capita Dollars: Nevada



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 estimated wealth coefficients reflect only 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 least squares regressions, the estimated elasticity is between 0.06 and 0.20. In contrast, the estimated effects of financial wealth upon consumption are a good bit smaller. In the simpler OLS model, the estimate ranges between 0.04 and 0.06. These magnitudes are much larger than the elasticities 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.[3] But the estimated elasticities for housing market wealth remain large - - 0.12 to 0.15.

The table also reports the t-ratio for the hypothesis 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 more important effect on consumption than does financial wealth. This is the

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

Table 3
Consumption Models: Quarterly Observations on States, 1978-2009*

Dependent variable: Consumption per capita

	Ordinary Least Squares			Serially Correlated Errors		
	I	II	III	IV	V	VI
Income	0.456	0.556	0.527	0.210	0.193	0.139
	(39.34)	(36.51)	(38.10)	(24.77)	(20.90)	(14.64)
Stock Market Wealth	0.053	0.061	0.037	0.036	0.030	0.028
	(25.05)	(24.33)	(14.55)	(18.14)	(13.72)	(12.76)
Housing Market Wealth	0.114	0.193	0.064	0.134	0.153	0.119
	(25.28)	(41.93)	(14.49)	(21.59)	(23.67)	(21.82)
Serial Correlation Coefficient	-	-	-	0.906	0.866	0.830
State Specific Time Trends	No	Yes	No	No	Yes	No
Year/Quarter Fixed Effects	No	No	Yes	No	No	Yes
R^2	0.9041	0.938	0.934	0.9959	0.9967	0.9973
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.

* 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.

same qualitative result 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 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 five or six times as large as the coefficient on financial wealth. Consumption changes are significantly dependent on changes in income and both forms of wealth, housing wealth and stock market wealth. Table 3 also presents the same first-difference equation when all three models are estimated using a simple instrumental-variables approach, relying upon lags in income and wealth as instruments for current income and wealth. In these regressions, the income elasticity is estimated to be a good bit larger, as is the elasticity of housing market wealth in two of the three specifications. Surprisingly, the estimated coefficient for stock market wealth has a negative sign.[4]

Table 5 presents the model in first differences including the lagged (log) ratio of consumption to income. This is the error-correction model (ECM) often employed in the presence of unit roots.[5] The model represents a co-integrated relation between consumption and income, where income includes that 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 income changes. Again, the results support the highly significant

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

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

Table 4
Consumption Models in First Differences:
Quarterly Observations on States, 1978-2009*

Dependent variable: Change in Consumption per capita	Ordinary Least Squares			Instrumental Variables**		
	I	II	III	IV	V	VI
Income	0.128	0.127	0.074	1.351	1.296	0.984
	(14.61)	(14.51)	(9.71)	(5.52)	(5.62)	(5.53)
Stock Market Wealth	0.015	0.015	0.005	-0.090	-0.092	-0.072
	(7.17)	(6.93)	(2.80)	(2.53)	(2.67)	(3.41)
Housing Market Wealth	0.090	0.090	0.038	0.198	0.239	-0.009
	(12.99)	(12.90)	(6.13)	(3.81)	(4.71)	(0.19)
State Specific Time Trends	No	Yes	No	No	Yes	No
Year/Quarter Fixed Effects	No	No	Yes	No	No	Yes
Regression R^2	0.0754	0.0795	0.35	-	-	-
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.

* See also note to Table 2.

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

immediate effect of housing market wealth upon consumption; the effect is especially large relative to that of financial wealth.

Table 5
Error Correction Consumption Models
Quarterly Observations on States, 1978-2009*

$$\Delta C_t = \alpha \Delta C_{t-1} + \beta_1 \Delta Inc_t + \beta_2 \Delta Stock_t + \beta_3 \Delta House_t + \gamma [C_{t-1} - Inc_{t-1}] + \text{Fixed Effects} + \varepsilon_t$$

Dependent variable:
Change in Consumption per capita

	I	II	III
Change in Income	0.142	0.152	0.084
	(16.46)	(17.59)	(10.87)
Change in Stock Market Wealth	0.016	0.015	0.006
	(7.48)	(7.17)	(3.07)
Change in Housing Market Wealth	0.085	0.088	0.045
	(12.23)	(12.71)	(7.20)
Lagged Change in Consumption	0.116	0.123	-0.090
	(9.52)	(10.07)	(7.23)
Lagged Ratio of Consumption to Income	-0.037	-0.064	-0.032
	(11.5)	(15.31)	(8.94)
State Specific Time Trends	No	Yes	No
Year/Quarter Fixed Effects	No	No	Yes
R^2	0.1071	0.1239	0.3624
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.

* See also note to Table 2.

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

financial wealth, and Buck and Pence (2008) report that a great many homeowners do not know the basic terms of their mortgages. Dynan and Maki (2001) have presented evidence using household data that the stock market wealth effect, to the extent that it is measurable, operates as lagged adjustment process. We amend our preferred specification to add a lagged term in the regressions. We do not include lags on household housing wealth, given the strong serial correlation of home price changes.[6] The results reported in Table 6, including the lagged change in the stock market wealth variable, are qualitatively similar to those reported in Table 5. The estimated effect of housing wealth is substantially stronger in Table 6, as is the estimated effect of income and stock market wealth. For Models I and II (which exclude year-specific fixed effects) the sum of the coefficients on stock market wealth is generally positive, but these effects are generally statistically insignificant.

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 at different phases of the life cycle. We relied upon estimates of the age distribution produced annually by the CPS since 1982. We computed the fraction of the population aged sixty or above by state and year and interpolated to quarters. We added interaction terms to the regressions 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, and regressions extending these non-results are omitted here.[7]

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

[7] The state data do not exhibit enough variation in age distribution, even over this longer sample period, to support estimates of the interaction of the wealth effect with age. However, it should be noted that *(continued at bottom of next page)*

Table 6
Error Correction Consumption Models with Lagged Stock Market Wealth Effects
Annual Observations on States, 1978-2008*

$$\Delta C_t = \alpha\Delta C_{t-1} + \beta_1\Delta Inc_t + \Delta\beta_2 Stock_t + \beta_3\Delta House_t + \gamma(C_{t-1} - Inc_{t-1}) + \beta_4\Delta Stock_{t-1} + \text{Fixed Effects} + \varepsilon_t$$

Dependent variable:
Change in Consumption per Capita

	I	II	III
Change in Income	0.445	0.465	0.186
	(16.54)	(18.14)	(9.09)
Change in Stock Market Wealth	0.036	0.033	0.002
During the past year, $DStock_t$	(8.96)	(8.45)	(0.58)
Change in Housing Market Wealth	0.168	0.178	0.053
	(14.81)	(16.54)	(6.11)
Lagged Change in Consumption	0.245	0.268	0.532
	(11.77)	(13.37)	(23.83)
Lagged Ratio of Consumption to Income	-0.182	-0.314	-0.105
	(16.36)	(23.06)	(12.52)
Change in Stock Market Wealth	0.012	0.012	0.006
During the past year compared to the previous year, $DStock_{t-1}$	(2.80)	(3.00)	(1.88)
State Specific Time Trends	No	Yes	No
Year Fixed Effects	No	No	Yes
R^2	0.5513	0.6204	0.8411
t-Ratio	10.594	12.245	5.614
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.

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

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) greatly advantaged the use of housing equity for consumption (by eliminating the tax deductibility of all other interest payments for consumer credit). Passage of the act greatly encouraged financial institutions to establish lines of credit secured by home equity, beginning in the fourth quarter of 1986. Even if homeowners did not plan to

Campbell and Cocco (2004), using data on individual households, did find evidence that the housing wealth effect is higher for older households.

access their home equity for consumption, their knowledge of the possibility may diminish the precautionary saving motive, a motive which has been shown to be an important determinant of consumption expenditures (Kennickell and Lusardi, 2004).

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 four of the six specifications, the estimated effects of housing market wealth upon consumption are substantially larger after the passage of TRA86. The point estimates are between two and ten times larger after the change in the tax law, and these differences are highly significant statistically. The comparisons are hardly definitive, and in two of the three specifications, they merely interpret a specific intercept shift. But they are quite suggestive.

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

Table 7: Pre vs Post 1986
Consumption Models in First Differences and Error Correction Models:
Quarterly Observations on States, 1978-2009*

Dependent variable: Change in Consumption per capita	Models in First Differences			Error Correction Models		
	I	II	III	IV	V	VI
Change in Income	0.125	0.124	0.075	0.140	0.150	0.085
	(14.31)	(14.19)	(9.80)	(16.18)	(17.33)	(10.98)
Change in Stock Market Wealth	0.015	0.014	0.005	0.015	0.014	0.006
	(6.98)	(6.72)	(2.79)	(7.31)	(6.93)	(3.06)
Pre 1986 Dummy	0.068	0.066	0.044	0.062	0.058	0.052
* Change in Housing Market Wealth	(7.73)	(7.48)	(5.83)	(7.08)	(6.69)	(6.89)
Post 1986 Dummy	0.126	0.129	0.026	0.122	0.137	0.295
* Change in Housing Market Wealth	(11.31)	(11.48)	(2.40)	(11.08)	(12.38)	(2.77)
Lagged Change in Consumption	-	-	-	0.114	0.120	-0.089
				(9.34)	(9.88)	(7.22)
Lagged Ratio of Consumption to Income	-	-	-	-0.038	-0.067	-0.032
				(11.67)	(15.82)	(8.97)
State Specific Time Trends	No	Yes	No	No	Yes	No
Year/Quarter Fixed Effects	No	No	Yes	No	No	Yes
R^2	0.0779	0.0824	0.3502	0.1098	0.1285	0.3627
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.

* See also note to Table 2.

Table 8: Housing Wealth Increases vs Decreases
Consumption Models in First Differences and Error Correction Models:
Quarterly Observations on States, 1978-2009*

Dependent variable: Change in Consumption per capita	Models in First Differences			Error Correction Models		
	I	II	III	IV	V	VI
Change in Income	0.126	0.125	0.074	0.139	0.149	0.083
	(14.42)	(14.34)	(9.68)	(16.21)	(17.36)	(10.84)
Change in Stock Market Wealth	0.015	0.014	0.005	0.015	0.014	0.006
	(6.95)	(6.53)	(2.78)	(7.31)	(6.86)	(3.06)
Dummy for Housing Wealth Decreases	0.154	0.170	0.051	0.138	0.153	0.056
* Change in Housing Market Wealth	(13.42)	(13.95)	(4.74)	(12.07)	(12.68)	(5.31)
Dummy for Housing Wealth Increases	0.024	0.011	0.026	0.030	0.024	0.033
* Change in Housing Market Wealth	(2.08)	(0.87)	(2.56)	(2.65)	(2.04)	(3.27)
Lagged Change in Consumption	-	-	-	0.109	0.115	-0.089
				(8.99)	(9.46)	(7.20)
Lagged Ratio of Consumption to Income	-	-	-	-0.036	-0.063	-0.032
				(11.06)	(14.98)	(8.96)
State Specific Time Trends	No	Yes	No	No	Yes	No
Year/Quarter Fixed Effects	No	No	Yes	No	No	Yes
R^2	0.0825	0.0888	0.3502	0.1120	0.1300	0.3626
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: H_0 is a test of the hypothesis that the coefficient on housing market wealth is the same for increases as it is for decreases.

* See also note to Table 2.

For each of the six regressions, the results indicate that increases in housing market wealth have had positive effects upon household consumption, but declines in housing market wealth have had negative and somewhat larger effects upon consumption. In four of the six comparisons, the increase in consumption associated with increases in housing market wealth is significantly less than the decrease in consumption associated with decreases in housing wealth.

These results were *not* found in our original analysis based on data through 1999. Presumably, this difference reflects the importance of the recent meltdown in the asset market for housing.

Appendix Table 1 compares the effects upon consumption of *both* increases and decreases in housing market and stock market wealth *simultaneously*. In each of the six models reported in the table, the effect of increases in housing market wealth upon consumption is positive and significant; the effect of decreases in housing market wealth upon consumption is negative and is also significantly larger.

In contrast, the statistical models report essentially no relationship between increases in stock market wealth and increases in consumption, but they do report a small and statistically significant 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 such as those 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 some third variable, such as general confidence in the economy. We believe even more strongly that these new results demonstrate that it is useful to think of consumption as determined in accordance with the models 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, changes that are likely to be correlated with consumption changes merely because housing services are a component of consumption. We have alluded elsewhere to others' evidence 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 compared to a model that postulates that general confidence determines both consumption and asset prices.

VI. 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.

There is some question about how much we can generalize for the future from the additional information provided by the recent meltdown. On the one hand, the meltdown is historically very unusual, and part of the consumption behavior may reflect factors special to that time. Regulators are now hard at work trying to correct some of these special factors. On the other hand, the meltdown provides us the first opportunity actually

to observe large price declines, and so this period ought to be indispensable to any analysis of housing wealth effects.

The numerical results vary somewhat with different econometric specifications, and so any numerical conclusion must be tentative. We find at best 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 upon 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 2005-2009 was roughly thirty percent (somewhat more in real terms). Estimates of the elasticity of consumer spending range from 0.03 to 0.18. The middle of the range is 0.08. That figure implies that a decline of thirty percent in housing wealth would lower consumer spending by 2.4 percent. Consumption is about $10 trillion, and that, in turn, implies a decline in consumption of about $240 billion annually. To put this figure 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 reduced spending on residential capital of about $255 billion. Either has 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 upon household consumption than do changes in stock market values.

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Appendix Table 1: Housing and Stock Market Wealth Increases vs Decreases Consumption Models in First Differences and Error Correction Models: Quarterly Observations on States, 1978-2009*

Dependent variable: Change in Consumption per capita	Models in First Differences			Error Correction Models		
	I	II	III	IV	V	VI
Change in Income	0.127	0.127	0.075	0.141	0.151	0.084
	(14.68)	(14.64)	(9.80)	(16.35)	(17.56)	(10.92)
Dummy for Stock Wealth Decreases	0.035	0.036	0.022	0.030	0.032	0.021
* Change in Stock Market Wealth	(9.37)	(9.59)	(6.47)	(8.26)	(8.58)	(6.23)
Dummy for Stock Wealth Increases	-0.002	-0.005	-0.009	0.003	-0.001	-0.007
* Change in Stock Market Wealth	(0.67)	(1.48)	(2.81)	(0.77)	(0.16)	(2.29)
Dummy for Housing Wealth Decreases	0.150	0.168	0.049	0.136	0.152	0.056
* Change in Housing Market Wealth	(13.09)	(13.81)	(4.68)	(11.86)	(12.63)	(5.26)
Dummy for Housing Wealth Increases	0.031	0.016	0.029	0.035	0.028	0.036
* Change in Housing Market Wealth	(2.62)	(1.33)	(2.81)	(3.04)	(2.39)	(3.51)
Lagged Change in Consumption	-	-	-	0.106	0.112	-0.094
				(8.70)	(9.13)	(7.51)
Lagged Ratio of Consumption to Income	-	-	-	-0.035	-0.062	-0.032
				(10.76)	(14.87)	(8.94)
State Specific Time Trends	No	Yes	No	No	Yes	No
Year/Quarter Fixed Effects	No	No	Yes	No	No	Yes
R^2	0.0880	0.0962	0.3538	0.1155	0.1346	0.3656
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.

* See also note to Table 2.