Do Housing Bubbles Affect Consumption?

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Abstract

Standard optimzing models of consumption postulate that consumption is a function of wealth and implicitly assume that wealth is comprised of assets whose market price coincides with the fundamental price, defined as the expected present value of future dividends. We use a simple theoretical framework to show that when the market price deviates from the fundamental price, consumption behavior will depend on whether households use the market or the fundamental price to evaluate wealth. If households respond to the market price, then in an otherwise standard PIH/LCH model, the deviations from the fundamental price– what we refer to as bubbles– will affect consumption. We then empirically investigate whether housing price bubbles affect consumption expenditures using both aggregate data on durables and non-durables and the corresponding retail sales data for four regions of the U.S. The data suggest that the market price of single family homes has deviated from its fundamental price by as much as 20%-30%. In tests like those of Hall (1978), we find that housing price bubbles have predictive power for future consumption. At the aggregate level and in some regions (especially the Northeast), the impulse response function of both durables and non-durables suggests that bubble innovations can have a significant effect on consumption. The housing bubble is also found to account for over 20 percent of variations in expenditure on durables in every region considered.

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1 Introduction

Suppose that asset prices are not always equal to their fundamental values. Is there any reason that macroeconomists should care? The answer depends on whether deviations from fundamental price affect real behavior. Asset prices have been noted to bear interesting relationships with historical and more recent economic fluctuations. Temin (1976), for example, suggests that there was an "inexplicable fall in autonomous spending" shortly after the October 1929 stock market crash. Romer (1990) finds evidence that the crash contributed to a fall in consumption expenditures.

More recently, the late 1980's witnessed a sharp rise in house prices concurrent with strong real economic activity in North American cities such as New York, Boston and Toronto; these areas were also particularly hard hit by the recession of the early nineties when house prices collapsed. In Japan, housing prices rose throughout the 1980's, and consumer spending in Japan has been strong during this period. As reported in the [Economist (November 7, 1992, p. 97)], "the surge in asset prices made households feel wealthier, so they saved less and borrowed even more to keep acquiring . . . the value of property and equities rose even faster than personal debt, so households' balance sheets continued to look healthy. The price of urban residential land tripled in the ten years to 1990, lifting net household wealth (assets minus debts) from five times disposable income in 1985 to 8 1/2 times in 1990." However, housing prices in Japan peaked in 1990 and have since dropped by as much as 70 percent. As also noted in the Economist (August 1, 1992, p. 61). "the bursting of Japan's bubble includes what Noboru Kawai, Morgan Stanley's Japanese economist, describes as the sharpest slowdown in consumer spending for more than 30 years."

In their analyses of the 1990-91 recession in the U.S., both Blanchard (1993) and Hall (1993) identify a sharp drop in consumption as the precipitating factor.[1] Blanchard (1993) finds that the recovery of the economy after a consumption shock is much slower than after other types of shocks. A similar view seems to have influenced others: "One much-used explanation for this lackluster performance [of the U.K. economy in the early 1990's] is that falling house prices have constrained consumer spending. Having seen the value of their homes plunge, people have responded to lower interest rates by rebuilding their wealth - by extra saving or reducing debts - rather than by borrowing and spending more, and so boosting recovery. The British Treasury has been so struck by this "wealth effect" that it

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[1] Hall (1993) considers and rejects a long list of potential explanations (other than the collapse of an asset price bubble) for the fall in consumption.

now regards changes in house prices as one of the main indicators by which it steers interest rates." [Economist, January 16, 1993, p. 77]

The relationship (if any) between possible asset price bubbles and consumption has never been explored at either the empirical or the theoretical level. The objective of our research is to investigate whether deviations from fundamentals in asset prices – specifically, housing prices – affect consumption.[2] We define the fundamental price as the expected present value of future dividends. We will use the term "bubble" to describe deviations from fundamentals in a generic way. In other words, we do not restrict ourselves to "rational bubbles".[3] We use a simple consumption model to examine the possible effects of asset price bubbles on consumption. One of our main conclusions is that asset price bubbles may or may not affect consumption depending on whether households form their own expectations of the present value of future dividends or simply look at the market price. If households base their decisions on the market price of the asset, then asset price bubbles can affect consumption.

In our empirical work, we consider both aggregate U.S. data and data from four regions of the U.S.. The regional data turn out to be quite interesting because of the differences in housing price dynamics across the four U.S. regions. We then examine whether housing price bubbles affect expenditures on non-durable and durable consumption for the aggregate U.S. economy and the four regions. We focus on housing price because housing wealth constitutes about one-third of total personal wealth in most industrialized countries, and there are generally more homeowners than stockholders.

The plan of the paper is as follows. Section 2 considers the consumer's problem when there is a risky asset whose market price may not correspond to the expected present value of future dividends (i.e. an asset which may contain a bubble). The relationship between the time series properties of the deviations from fundamentals and consumption is discussed. Section 3 describes how we measure housing price bubbles. We then examine the time series properties of bubbles, specifically whether they look more like fads or rational bubbles. Section 4 examines the predictive power of bubbles for future consumption growth. Section 5 examines the response of both non-durable and durable consumption to innovations in the housing price bubble. Section 6 uses a forecast error decomposition to examine the effects of bubble innovations for consumption and compare the importance of these effects relative to innovations in variables such as income and interest rates. Section 7 provides a brief

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[2] The purpose of this paper is not to investigate whether the housing market is "efficient". We take it as given that housing price bubbles may exist and focus on whether they affect consumption.

[3] In fact, different types of bubbles have different implications for consumption. As we discuss in the paper, "fads" will tend to affect consumption growth while rational bubbles will tend not to.

summary and conclusion.

2 The Consumer's Problem

We assume that labour income is diversifiable and that there are two assets, a riskless asset whose return r can vary over time but is known, and a risky asset which pays a stochastic dividend D to the agent at the beginning of the period before consumption decision is made.[4] In addition, the price of the risky asset fluctuates. Specifically, if the price of the risky asset is one at the beginning of period $t-1$, it is $(1+z_{t-1})$ at the beginning of period t. If the agent allocates a fraction w_{t-1} of her portfolio to the riskless asset in period $t-1$, then at the beginning of period t she has

$$A_t = (A_{t-1} + D_{t-1} - C_{t-1})[(1+r_{t-1})w_{t-1} + (1+z_{t-1})(1-w_{t-1})]$$

where A_{t-1} is the total value of assets in period $t-1$ and C_{t-1} is consumption in period $t-1$. All variables dated $t-1$ except z_{t-1} are in Ω_{t-1}, the agent's information set at time $t-1$. In addition, we assume that $\{r_{t-1}, r_t, r_{t+1}, \ldots\} \in \Omega_{t-1}$, which is consistent with the idea that r is the return on the riskless asset.

The consumer's problem is

$$\begin{aligned} \overset{Max}{\{C_t, w_t\}} \qquad & E_0 \sum_{t=0}^{\infty} (1+\theta)^{-t} U(C_t) \\ s.t.\ A_{t+1} \quad = \quad & (A_t + D_t - C_t)[(1+r_t)w_t + (1+z_t)(1-w_t)] \\ \equiv \quad & R_t(A_t + D_t - C_t), \end{aligned}$$

where θ is the rate of time preference. The first order conditions for C_t and w_t are:

$$\begin{aligned} C_t: \qquad & U'(C_t) = (1+\theta)^{-1} E_t[V'_{t+1}[(1+r_t)w_t + (1+z_t)(1-w_t)]], \\ w_t: \qquad & E_t[V'_{t+1}(A_{t+1})(A_t + D_t - C_t)(r_t - z_t)] = 0. \end{aligned}$$

Using the envelope theorem (which implies that $V'_t(A_{t+1}) = U'(C_{t+1})$) and the fact that $A_t \in \Omega_t$, $D_t \in \Omega_t$, and $C_t \in \Omega_t$, the first order conditions can be written as:

$$U'(C_t) = (1+\theta)^{-1} E_t[U'(C_{t+1})[(1+r_t)w_t + (1+z_t)(1-w_t)]], \tag{1}$$

$$E_t[(r_t - z_t)U'(C_{t+1})] = 0. \tag{2}$$

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[4] Explicitly including labour income would not alter the key results. It would simply add another term (human capital) to the expression for W_0 in the equation for C_0 below. It would be straightforward to generalize the analysis for the case of multiple risky assets.

The first order conditions can be used to obtain the following familiar expression for the consumption Euler equation:

$$U'(C_t) = \frac{(1+r_t)}{(1+\theta)} E_t[U'(C_{t+1})].$$

Solving the budget constraint forward and taking expectations at time 0, we obtain the intertemporal budget constraint:

$$E_0\left[\sum_{j=0}^{\infty}\prod_{i=0}^{j-1} R_i^{-1} C_j\right] = E_0\left[\sum_{j=0}^{\infty}\prod_{i=0}^{j-1} R_i^{-1} D_j + A_0\right]. \tag{3}$$

We assume that the utility function is quadratic,[5] specifically of the form:

$$U(C_t) = aC_t - \frac{b}{2}C_t^2. \tag{4}$$

Using the first order conditions and the law of iterated expectations, we obtain an expression for expected future consumption:

$$E_0[C_j] = \left(\prod_{i=0}^{j-1}\frac{1+\theta}{1+r_i}\right) C_0 + \frac{a}{b}\sum_{k=0}^{j-1}\left(\prod_{i=k+1}^{j-1}\frac{1+\theta}{1+r_i}\frac{r_k-\theta}{1+r_k}\right). \tag{5}$$

Substituting this expression into the intertemporal budget constraint and rearranging, we obtain the following consumption function:

$$\begin{aligned}
C_0 &= \frac{-\gamma_0}{\gamma_1} + \frac{1}{\gamma_1}\left(E_0\left[\sum_{j=0}^{\infty}\left(\prod_{i=0}^{j-1}\frac{1}{1+r_i}\right) D_j\right] + A_0\right), \\
&\equiv \frac{-\gamma_0}{\gamma_1} + \frac{W_0}{\gamma_1}, \\
\text{where} \qquad & \gamma_0 \equiv \sum_{j=0}^{\infty}\left(\prod_{i=0}^{j-1}\frac{1}{1+r_i}\right)\sum_{k=0}^{j-1}\left(\prod_{l=k+1}^{j-1}\frac{1+\theta}{1+r_l}\frac{r_k-\theta}{1+r_k}\right), \\
& \gamma_1 \equiv \sum_{j=0}^{\infty}\prod_{i=0}^{j-1}\frac{1+\theta}{(1+r_i)^2}.
\end{aligned}$$

In other words, consumption is a linear function of wealth.

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[5] We discuss the generalization to other utility functions, which do not imply certainty equivalence, below.

2.1 When Might Bubbles Affect Consumption?

Define the fundamental value of the risky asset as the expected present value of future dividends:

$$P_0^* = E_0 \left[\sum_{j=0}^{\infty} \left(\prod_{i=0}^{j-1} \frac{1}{1+r_i} \right) D_j \right]. \tag{6}$$

We can thus rewrite the consumption function as

$$C_0 = \frac{-\gamma_0}{\gamma_1} + \frac{1}{\gamma_1} P_0^* + \frac{1}{\gamma_1} A_0. \tag{7}$$

Now suppose that asset pricing works in such a way that the market price of an asset is always equal to its fundamental value (i.e. $P = P^*$). Then a consumer can use two equivalent approaches to determine her optimal consumption. Either she can base her consumption on her expectation of the value of the future dividend stream on the risky asset or she can simply look at the market price of the risky asset and base her consumption on the market value. As long as the market price equals the fundamental price, the two approaches will yield the same consumption decision.

If the market price diverges from the fundamental price, the situation is more complex. A literal interpretation of the consumption function above suggests that the consumer should base her consumption on the fundamental price (the expected present value of future dividends), regardless of the market price. But practical consideration suggests that consumers might be inclined to use market prices. Trying to calculate the present value of uncertain future dividends is difficult; using market prices might have considerable advantages in terms of information-gathering and computation. Thus the standard PIH/LCH framework leaves some room for ambiguity about how consumers might respond to bubbles.

More precisely, let us define a bubble as the market price of an asset minus the fundamental price:

$$B_t = P_t - P_t^*. \tag{8}$$

Then, if consumers base their consumption decisions on market prices, we will have

$$\begin{aligned} C_0 &= \frac{-\gamma_0}{\gamma_1} + \frac{1}{\gamma_1} P_0 + \frac{1}{\gamma_1} A_0 \\ &= \frac{-\gamma_0}{\gamma_1} + \frac{1}{\gamma_1} (P_0^* + B_0) + \frac{1}{\gamma_1} A_0. \end{aligned}$$

In other words, if consumers base their consumption decisions on market prices, bubbles will affect consumption. More generally, it is possible that consumers may put some weight on both the market price and some weight on their own expectations of future dividends. A simple way to represent this is to let a bubble have a different (possibly smaller) effect on consumption than the present value of future dividends. This suggests:

$$C_0 = \frac{-\gamma_0}{\gamma_1} + \frac{1}{\gamma_1}\left(\psi_{p*}P_0^* + \psi_B B_0\right) + \frac{1}{\gamma_1}A_0. \tag{9}$$

This equation embeds two possible cases. First, if the consumer uses her own information to forecast future dividends (and not market price), then $\psi_B = 0$ and bubbles will have no effect on consumption. Second, if the consumer puts some weight on both her own expectations of future dividends and on market prices, then $\psi_{p*} > 0$ and $\psi_B > 0$. In this case, bubbles will affect consumption.

Even for consumers who ignore market prices, there is another potential channel through which bubbles might affect consumption. Consider the case of a consumer for whom $\psi_B = 0$ but who happens to sell the risky asset at a time when $B_0 > 0$. Since her consumption decisions were based on valuing the risking asset at P^* but $P_0 = P_0^* + B_0$, she realizes an unexpected capital gain of B_0. Her consumption will (temporarily) rise by B_0/γ_1.

The quadratic utility function used in the above derivations is very convenient because it yields a simple analytical solution to the consumer's problem (thus helping to build our intuition). Carroll and Kimball (1996) show that quadratic utility is a special case in which the coefficient of relative prudence equals zero. As a result, consumption is linear in wealth. They show that for a wide class of alternative utility functions, consumption will still be a function of wealth. Since the present value of future dividends on a risky asset is part of the consumer's wealth, the essential features of our earlier analysis will carry over. In particular, the consumer will still be faced with the question of whether or not to be guided by market prices. The difference in the more general cases considered by Carroll and Kimball (1996) is that consumption will no longer be a linear function of wealth.

The analysis leading to (9) has assumed perfect capital markets while much empirical work on consumption has suggested the possibility of liquidity constraints. The Euler equation derived by Zeldes (1989) for a consumer under liquidity constraints suggests that the change in consumption is a function of the shadow cost of liquidity constraints. As analyzed in Garcia, Lusardi and Ng (1997), among others, this shadow cost is a function of household characteristics, amongst which is home ownership. Like the ownership of durables such as cars, a home provides collateral which allows the consumer to borrow from financial institutions. How does a housing price bubble affect the situation? The answer depends on the attitude of the lender. If the lender evaluates collateral using the fundamental value of the house, then a housing price bubble will not change the consumer's collateral. However, if the lender evaluates collateral using market price (as frequently seems to be the case), then a bubble will increase the consumers' collateral, loosen the liquidity constraint, and thus increase consumption.

2.2 The Importance of the Time Series Properties of Bubbles

The previous subsection shows that if agents value their wealth according to the market price of their assets, and the market price deviates from the fundamental price, consumption will be a function of the asset price bubble. The foregoing, however, is a necessary but not a sufficient condition for asset price bubbles to affect consumption. In this subsection, we will show that the link between consumption and bubbles also depends on the time series properties of the bubble. To illustrate this, we consider two simple but striking cases – a deterministic rational bubble and a deterministic fad.

We now show that a deterministic rational bubble has no effect on the consumption Euler equation. Define a deterministic rational bubble as:

$$B_{t+1}^{DRB} = (1 + z_t^*) B_t^{DRB}, \quad z_t^* > 0,$$

where z^* is the fundamental return on the risky asset. That is,

$$(1 + z_t^*) = \frac{P_{t+1}^*}{P_t^*}.$$

Note that because $z_t^* > 0$, a deterministic rational bubble is an explosive process. Then the actual return $(1 + z_t)$ is

$$\begin{aligned} 1 + z_t &= \frac{P_{t+1}}{P_t} = \frac{P_{t+1}^* + B_{t+1}}{P_t} \\ &= (1 + z_t^*) \frac{P_t^*}{P_t} + \frac{B_{t+1}}{P_t}. \end{aligned}$$

Substituting in the definition of the deterministic rational bubble, we have

$$\begin{aligned} 1 + z_t &= (1 + z_t^*) \frac{P_t^*}{P_t} + (1 + z_t^*) \frac{B_t^{DRB}}{P_t} \\ &= (1 + z_t^*) \frac{P_t^* + B_t^{DRB}}{P_t} \\ &\equiv 1 + z_t^*. \end{aligned}$$

Thus, in the case of a deterministic rational bubble, the existence of the bubble has no effect on the Euler equation since $1 + z = 1 + z^*$ implies that

$$E_t[(1 + z_t)U'(C_{t+1})] = E_t[(1 + z_t^*)U'(C_{t+1})].$$

In contrast, a deterministic fad will now be shown to affect the consumption Euler equation. Define a deterministic fad as:

$$B_{t+1}^{DF} = (1 + \tilde{z}_t)B_t^{DF}, \qquad \tilde{z}_t < 0.$$

Note that because $\tilde{z}_t < 0$, a deterministic fad is a mean-reverting process.[6] Using the definition of $(1 + z_t)$, we have

$$\begin{aligned} 1 + z_t &= (1 + z_t^*)\frac{P_t^*}{P_t} + (1 + \tilde{z}_t)\frac{B_t^{DF}}{P_t} \\ &= (1 + z_t^*)\frac{(P_t^* + B_t^{DF})}{P_t} + (\tilde{z}_t - z_t^*)\frac{B_t^{DF}}{P_t} \\ &= (1 + z_t^*) + (\tilde{z}_t - z_t^*)\frac{B_t^{DF}}{P_t}. \end{aligned}$$

Since z_t^* will typically be a small positive fraction (e.g., 0.05 per annum) and $\tilde{z}_t < 0$, $\tilde{z}_t - z_t^*$ will be non-zero. Unless $B_t^{DF}/P_t = 0$, that is, unless the market price does not contain a fad component, a fad will affect consumption if consumers base their decisions on market prices.

Although these two examples are simple, they suggest that it would be useful to know something about the time series properties of housing price bubbles. In particular, it would be useful to know whether they are more like rational bubbles, which are explosive because $z_t^* > 0$, or fads, which are mean-reverting because $\tilde{z}_t < 0$. We provide evidence on this issue later in the paper.

3 The Time Series Properties of Bubbles

3.1 Measuring the Housing Price Bubble

To test whether or not consumption is affected by deviations of asset prices from their fundamentals, we need to construct the fundamental price of an asset. Consistent with (6) we define P_t^* as:

$$P_t^* = E_t \sum_{j=0}^{\infty} \prod_{i=0}^{j-1} (\frac{1}{1 + r_{t+i}}) D_{t+j}. \tag{10}$$

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[6] This corresponds to the process u_t in Equation (5) of Summers (1986) with v_t, the stochastic component, set equal to zero.

Although the fundamental price of the asset is an unobserved variable, it can be constructed from the present value formula given assumptions on the process for dividends and the discount rate. The simplest method assumes that r is constant and that that $d_t \equiv log(D_t)$ is a random walk with drift satisfying $d_t = \alpha + d_{t-1} + \epsilon_t$, $\epsilon \sim N(0, \sigma^2)$. Then $P_t^* = \rho D_t$, where $\rho = \tilde{\rho}/(1-\tilde{\rho})$, $\tilde{\rho} = [exp(\alpha + \sigma^2/2)](1+r)^{-1}$. Using the sample mean of the price dividend ratio to calculate ρ, we can define:[7]

$$P_t^* = \rho D_t, \tag{11}$$

$$b_t = \frac{P_t - P_t^*}{P_t} = 1 - \frac{\rho D_t}{P_t}, \tag{12}$$

where b_t is the deviation of actual price from the fundamental price expressed as a percentage of actual price[8]. We also used a VAR to forecast dividend growth and/or allow r to vary. The time series properties of b_t are rather similar and we only report results for the simplest formulation.

All of the empirical work is based on quarterly data for the period 1978:1-1994:1. Detailed data sources for each variable are described in footnotes. Figure A1 plots the bubble at the aggregate level and Figure B1 plots the bubble, b_t, for each of the regions. The Northeast is the most interesting region; there is deviation of 20% to 30% away from fundamentals. The strongest evidence for a housing price bubbles occurs in the late 1980's, which accords with anecdotal evidence. The West also shows substantial, though smaller variation away from fundamentals (about 15% to 20%). In the West, the peak housing prices (relative to fundamentals) occurred in the late 1970s and late 1980s. As in the Northeast, this corresponds to the widespread perception that housing prices were relatively high during these periods. In the South, there is a run-up of housing prices (relative to fundamentals) in the late 1970s, but little variation relative to fundamentals since then. In the Central region, the variation is only about five percent above and below the fundamental price.

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[7] If there are no bubbles, then $P_t = P_t^*$ and $\hat{\rho} \equiv T^{-1} \sum_{t=1}^{T} P_t/D_t \to \rho$. If there are bubbles but B_t/D_t is mean zero over the sample period, then $P_t = P_t^* + B_t$ and $\hat{\rho} \equiv T^{-1} \sum_{t=1}^{T} (P_t^*/D_t) = \rho$. If there are bubbles and B_t/D_t is positive (negative) on average over the sample, then $\hat{\rho}$ will be an overestimate (underestimate) of ρ and the mean bubble from (11) will be below (above) the true mean of the bubble.

[8] In the aggregate data, D_t is residential rent (PZR211 from Citibase) and P_t is the median price of single family homes (HNMP from Citibase). In the regional data, P_t is the average price of existing single family homes collected by the Census Bureau (and obtained from the Federal Reserve Database, where the series are AVGEXTNE, AVGEXTNC, AVGEXTSO, and AVGEXTWT, noting that the last two letters refer to Northeast, Northcentral, South, and West respectively. In the regional data, D_t is the residential rent component of the CPI from the Bureau of Labor Statistics (BLS)– CPIRENTNE, CPIRENTNC, CPIRENTSO, and CPIRENTWT

3.2 Fads or Rational Bubbles?

As noted above, fads have different time series properties than rational bubbles. Fads lead to mean reversion in prices while rational bubbles introduce an explosive component in expected future prices. As Summers (1986) originally pointed out, if the mean reversion is slow, standard univariate tests, such as unit root tests, may have difficulty distinguishing slowly mean-reverting prices from non-stationary prices. Here we therefore try a different approach which borrows from the empirical macroeconomic literature.

We estimate a small VAR (which includes four lags of log consumption, log income, the interest rate, and housing price bubbles) and plot the response of b_t to an innovation in b_t[9]. If b_t represents a rational bubble, the impulse response function should show a permanent effect on the level of b_t. In fact, the response path should be explosive. On the other hand, if b_t is a fad, the effect of an innovation should be transitory. Figure A2 plots the aggregate impulse response function. The dashed lines represent the two standard error confidence band based on Monte-carlo simulations. The results is quite clear: an innovation in b_t has a transitory effect. Thus, aggregate housing price bubbles look more like fads than rational bubbles.

We also estimate similar VARs for each of the four regions[10]. The resulting impulse response functions are plotted in Figure B2. In all regions, an innovation in b_t has a transitory effect. Another interesting feature of the regional impulse response functions is the contrast between the Northeast and West on the one hand, and the Central and Southern regions on the other. Recall that earlier we saw little evidence of substantial housing price bubbles in the Central and Southern regions. There is a similar breakdown among regions in persistence. In the Northeast and the West, an innovation in b_t has a larger and far more persistent effect than in the other two regions. In these two regions, the initial impact of an innovation in b_t is about twice as large. This suggests that if we want to understand the effect of bubbles on consumption, we should focus particularly on the Northeast and West where there is

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[9] Per capita consumption is real consumption of non-durables and services (series GCDSQ+GCDNQ from Citibase) divided by population (GPOP from Citibase). Real per capital income is GYDQ from Citibase. The nominal interest rate is FYGL from Citibase. The real interest rate is the nominal interest minus the lagged annualized inflation rate of the CPI. Housing price bubbles are described in "Measuring the Housing Price Bubble" above.

[10] In the regional data, consumption is monthly retail sales of non-durable goods (purchased from the U.S. Department of Commerce) averaged over three months and seasonally adjusted using EVIEWS. Nominal income data are reported by the Census Bureau (which we obtained from the FRB database where they are labelled PINCNE, PINCNC, PINCSO, and PINCWT). Nominal consumption and income are divided by the regional CPI (obtained from the BLS) to calculate real consumption and income.

evidence of substantial and persistent price bubbles.

4 The Predictive Power of Bubbles for Consumption

Our first approach is very simple. Since Hall (1978) it has been recognized that non-durables consumption is close to a martingale. A natural question is whether bubbles have any predictive power for consumption growth. We begin by estimating the following equation on quarterly aggregate data:

$$\Delta c_t = a_0 + A(L)\Delta b_{t-1} + e_{1t}, \tag{13}$$

where c_t is the logarithm of non-durables consumption and $A(L) = A_1 + A_2L + A_3L^2 + A_4L^3$. The results are reported in the first row of Table 1. The t-statistics are reported in parentheses below the coefficient estimates. The last column lists the χ^2 statistic for the null hypothesis that the coefficients on housing price bubbles are jointly zero, with the p-value in square brackets. As the results indicate, the null hypothesis that the coefficients on the lagged bubble terms are zeros is strongly rejected. Thus, it appears that housing price bubbles have some predictive power for consumption growth.

Table 1: The Predictive Power of Bubbles for Consumption Growth.

	A_1	A_2	A_3	A_4	χ^2
Base Case	.066	0.106	-.024	-0.058	12.52
	(1.88)	(2.97)	(-.68)	(-1.67)	[.014]
Controlling	.022	.098	-.019	-0.038	16.66
for r_{t-1}	(-.85)	(3.66)	(-.77)	(-1.47)	[.002]
Controlling	0.054	.095	-0.043	-.066	12.72
for y_{t-1}	(1.51)	(2.64)	(-1.21)	(-1.86)	[.013]

The PIH and LCH both suggest that interest rates might have some effect on consumption growth. Moreover, it could be argued that housing price bubbles might proxy for changes in interest rates. To control for this, we add lags of the interest rate to the base case specification. This does not alter the main result: The data continue to reject the null hypothesis that the coefficients on the bubble terms are zero.

As noted above, considerable attention has been paid to the possibility that consumption is affected by liquidity constraints. As Hall and Mishkin (1982), Hayashi (1985) and Zeldes (1989), among others, have noted, lagged income will tend to have predictive power for consumption growth if consumers face liquidity constraints. To control for this possibility, we add lagged income to the basic specification. Again the result is the same: the null hypothesis of zero coefficients on the bubble terms is rejected.

5 The Response of Consumption to Bubbles

To study the effect of an innovation in b_t on consumption, we again use a VAR with log consumption, log income, the real interest rate and housing price bubbles. A nice feature of the VAR approach is that it controls for several types of shocks (especially interest rate and income shocks) which might affect consumption. For example, if we did not control for interest rates, a fall in the interest rate could arguably show up as an increase in the measured housing price bubble and we could mistakenly attribute any apparent effect of b_t on consumption to bubbles rather than to changes in the interest rate. Since we are estimating nonstructural VARs, it is worth noting that our results do not appear to be particularly sensitive to the ordering of the variables in the VAR.

5.1 The Response of Non-Durables to Bubbles

Figure A3 shows the aggregate impulse response function of non-durable consumption to an innovation in b_t. The impulse response function suggests that an innovation in b_t boosts consumption. The effect of an innovation in b_t on consumption peaks in the third quarter and trails off to zero after two years. Near the peak of the effect of an innovation in b_t on consumption, the effect is significantly different from zero.

Figure B3 plots the impulse response function for the four regions. We will focus on the Northeast, the region in which there is the strongest evidence of substantial and persistent housing price bubbles[11]. As in the aggregate data, an innovation in b_t boosts consumption. The effect peaks at about six quarters but is highly persistent, still having a substantial effect after four years. The greater persistence in the effect of an innovation in b_t on consumption in the Northeast (compared to the aggregate effect) seems to correspond to the greater persistence in the effect of an innovation in b_t on b_t itself. To see this, compare Figure A3 with Figure B3. The maximum effect of a one standard deviation innovation in b_t on consumption is about twice as large as in the aggregate data, boosting consumption by

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[11] In the regional data, expenditure on durables and non-durables is based on monthly retail sales of durable goods (obtained from the U.S. Department of Commerce). The monthly data are averaged over three months, seasonally adjusted, and divided by the appropriate regional CPI.

about 0.5 percent for about eight quarters. The standard error bands show that the effect is significantly different from zero for about two years after the initial shock.

5.2 The Response of Durables to Bubbles

Durable consumption is of special interest because it is relatively volatile and may play an important role in business cycle movements in general and the transmission of monetary policy in particular. (See, for example, Bernanke and Gertler (1995) who showed that consumer durables drop dramatically about one or two quarters after a negative monetary policy shock.)

Figure A4 presents evidence on the effect of aggregate housing price bubbles on aggregate durable consumption. The results are based on a VAR similar to the one in Figure A3, except that durable consumption is replaced by expenditure on non-durable consumption[12]. The impulse response function shows that an innovation in b_t increases aggregate durable consumption. The effect of a one standard deviation innovation in b_t on durables is about five times larger than the effect on non-durables. The effect on durables is significantly different from zero for several quarters after the initial shock.

Figure B4 shows the impulse response function for durables for the four regions. We begin by discussing the Northeast. As in the aggregate data, an innovation in b_t boosts durable consumption. The effect peaks at about four quarters and is highly persistent. A one standard deviation innovation in b_t raises expenditure on durables about 2% for six to eight quarters. Since a one standard deviation innovation in b_t initially boosts b_t by about 2%, the percentage increase in durable expenditure is about the same as the initial percentage increase in b_t. The effect of b_t on durables is significantly different from zero for about eight quarters.

The impulse response functions for the Central and West regions are also of some interest. As in the Northeast, an innovation in b_t boosts durable consumption. The effect peaks at about four quarters and tails off more rapidly than in the Northeast, perhaps because housing price bubbles in these two regions were less persistent than in the Northeast over our sample period. The effect of an innovation in b_t on consumption is significant for several quarters in the Central region and is borderline significant during the first year in the West. Not surprisingly, given the small magnitude and short duration of bubbles in the south, we see little significant evidence of an effect of bubbles on durable consumption in that region.

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[12] Real per capital expenditure on durables is durable expenditure (Citibank series GCDQ) divided by population and the CPI.

6 How Important are Bubbles?

The previous three sections provide evidence that bubbles have a statistically significant effect on both non-durable consumption and on durables expenditures, but they give little sense of the relative importance of the bubble innovations, as compared to standard determinants of consumption such as income and interest rates. To assess the contribution of innovations in housing price bubbles and other shocks, we present forecast error variance decompositions based on the VARs described in the previous sections.

We begin by looking at durables expenditure. Not surprisingly, durables shocks account for a large percent of the variation of durables expenditure as shown in Table 2.[13] Perhaps more surprisingly, at their peaks, bubble innovations also account for a substantial share of the variance. For example, at the aggregate level, bubble shocks account for about one-quarter of the variance, about the same share as income shocks and much more than interest rate shocks. This seems to be a general pattern. In every region, bubble innovations contribute more to the variance than interest rate shocks and, in most regions, they contribute about the same or more than income shocks.[14]

Table 2 (Maximum) Percent variance of durables accounted for by shocks to:

region/shock	Durables	Income	Interest Rate	Bubble
Aggregate	46.8	25.0	2.9	25.2
Northeast	33.8	4.3	21.2	40.7
Central	54.3	13.9	5.5	26.3
South	67.8	14.4	5.6	12.3
West	21.7	56.0	7.8	14.5

Table 3 provides information on the contributions of various shocks to other variables, namely, bubbles, non-durable consumption, and output, in the Northeast. All entries are for the eight quarter horizon. The important contribution of bubble innovations to durables expenditure clearly carries over to non-durables in the Northeast. Specifically, 41% of the

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[13] Table 2 presents the variance decomposition at the horizon at which bubbles have their peak impact, which is typically about four to eight quarters after a bubble shock.

[14] The ordering of variances can make a difference to the variance decomposition, but the effect is not necessarily drastic. For example, in the Northeast, if bubbles were ordered last, the contribution of bubble shocks drops from 41% to 32%, and this remains larger than the contribution of shocks to the interest rate, income, or durables.

variance is accounted for by innovations to the bubble, compared to 7% for the interest rate and 7% for output.

The forecast error variance for housing price bubbles is overwhelmingly accounted for by innovations to the bubble, and little of the variance is accounted for by shocks to the interest rate or output. Although the origin of bubbles is not the focus of this paper, this result suggests that bubbles may be more like sunspot or "animal spirits" phenomena, as opposed to being primarily a result of monetary policy, for example. Much attention has recently been devoted by macroeconomists to discovering the shocks that drive business cycles.[15] Since technology shocks and monetary policy shocks would affect interest rates and output, the first row of Table 3 provides a shred of evidence that bubbles may be linked to a distinctive set of shocks. Although the results in Table 3 are for the Northeast, the aggregate results are similar; 89% of the forecast error variance for housing price bubbles at the eight quarter horizon is accounted for by innovations in bubbles.

Perhaps the most interesting result in Table 3 is the variance decomposition for output. Not surprisingly, a substantial share of the forecast error variance (about one-third) is accounted for by shocks to output. However, an even larger share (about two-fifths) is accounted for by innovations to the housing price bubble. This suggests that, at least in some circumstances, bubbles may play an important role in output fluctuations.

Another way of looking at the importance of housing price bubbles is to plot the impulse response function of output to a bubble innovation, as shown in Figure B5. In the Northeast, bubble innovations clearly boost output, with the effect peaking about four to eight quarters after the initial shock. The effect is quite persistent and significantly different from zero for about two years.

Table 3: Variance Decomposition of Consumption, Bubbles and Output for the Northeast

Accounted for by shocks to:

% variance of	Bubble	Non-Durables	Durables	Interest Rate	Output
Non-Durables	41.1	44.6	-	7.1	7.3
Bubble	84.9	-	7.1	6.6	1.4
Output	38.3	-	1.8	25.7	34.2

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[15] See, for example, Cochrane (1994b).

7 Conclusion

There is little (if any) economic research on the potential effect of asset price bubbles on consumption. In this paper, we make a start at closing this gap. We first use the standard PIH/LCH model to examine whether asset price bubbles will affect consumption. Our analysis leads to two main conclusions. First, asset price bubbles may affect consumption if households use market prices to form their assessments of the expected present value of the future dividends from an asset. Second, the time series properties of an asset price bubble help to determine whether the bubble will affect consumption. For example, a deterministic rational bubble (which adds an explosive component to the asset price) will not affect consumption, but a fad (which adds a mean-reverting component) may affect consumption. At both the aggregate level and for all of the regions, housing price bubbles seem to be transitory and thus look more like fads than rational bubbles.

Using "excessive sensitivity" tests of the type pioneered by Hall (1978), we find that housing price bubbles have predictive power for future consumption. This result continues to hold even when we control for interest rates and income. To obtain a better picture of how housing price bubbles might affect consumption, we estimate VARs and plot the impulse response function of consumption to bubble innovations. At the aggregate level and in some of the regions (especially the Northeast), there is evidence that housing price bubbles significantly boost consumption. This is true for both non-durables and durables.

Housing price bubbles seem to account for a substantial portion of the variation in consumer durables expenditure. At the aggregate level and for each of the regions, bubble innovations account for at least one-fifth of the forecast error variance of consumer durables. In most cases, bubble innovations account for as much or more of the variance than either interest rate or income innovations.

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