THE PECULIAR ECONOMICS OF HOUSING BUBBLES

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Home values increase rapidly during housing bubbles generating large capital gains. High loan-to-value (LTV) mortgages secured by expected future home values are one way to take advantage of these capital gains. In this article, we use a simple partial equilibrium consumer theory model to explore the implications of high LTV borrowing. We find that sufficiently large expected house price growth leads to an upward-sloping budget line when households can obtain high LTV mortgages. In this environment, the demand for housing fits neither the conventional theories of consumer goods nor that of investment goods. In fact, increases in the expected future price of housing may reduce current housing demand, whereas decreases in the effective (current) price may lead to households buying smaller homes. Moreover, high LTV loans reduce the effectiveness of monetary policy, but raise the volatility of aggregate demand. Tighter borrowing standards may help lower demand volatility at the expense of shrinking the economy. (*JEL* E21, R21, E52)

I. INTRODUCTION

Housing differs from other consumption goods in important ways. Houses are extremely durable, changing houses involves large transactions costs so that households do not move very often, and in most cases, houses are financed through borrowing. Furthermore, houses represent status and allow access to other benefits, such as parks, schools, or desirable neighborhoods. Automobiles share most of these attributes, although to a lesser extent, but housing and automobiles differ in one key feature. Automobiles, except maybe collectibles, tend to diminish in value over time. However, during several periods in recent history house prices have appreciated significantly, providing an investment motive for homeownership in addition to its consumption benefits.

Home values rise rapidly during housing bubbles, generating large capital gains. Households can take advantage of these capital gains in two ways: either by selling the house or borrowing against its increased value through home equity loans or new mortgages. If households are allowed to borrow against the current values of their homes, it is a small step to allow them to borrow against the expected future values of their homes, especially when both lenders and borrowers agree that house prices will keep rising. In fact, this has been happening. The Federal Reserve Act of 1913 limited the loan-to-value (LTV) ratio, that is, the fraction of the current price of a house one could borrow, to 50%. By 1970, that limit had grown to 90%, and in 1989 it rose to 100%. In 1997, the LTV limit increased to 125% allowing the mortgage loan to exceed the market value of the house, and these loans were aggressively marketed to consumers.[1] The purpose of this article is to explore the implications of these high LTV mortgage loans secured by expected future home values.

The evidence regarding high LTV loans paints a bleak picture. Haughwout, Peach, and Tracy (2008) report that 30% of subprime mortgages originated in 2006 had LTVs of at least 100%. These new subprime mortgages were

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1. High LTV borrowing often requires "piggybacking" second mortgages or home-equity loans on top of traditional mortgages, which have 80% LTV limitation.

ABBREVIATION

LTV: Loan-to-Value

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the primary contributors to the first increase in homeownership rates in three decades (Chambers, Garriga, and Schlagenhauf 2007). The high LTV originations led to high foreclosure rates during the recent housing bust. In 2007, 40% of the foreclosures in Massachusetts had origination LTVs of at least 100%. Fifteen years earlier, in contrast, fewer than 9% of foreclosures had such high origination LTVs (Foote et al. 2008). Haughwout and Okah (2009) note that roughly 10% of homes had negative equity in a December 2008 sample of 43 states that exclude boom and bust states. They report that the average origination LTV for the above-water homes was 83%, and that for below-water homes was 98%.

Our analysis presumes a particular type of market failure. If markets are efficient, expected future prices are tied to current prices through the interest rate. Specifically, if markets expect the price of an asset to be $600,000 in 10 years and the 10-year interest rate is 50% (i.e., 50% over 10 years and not 50% per year), then the present value of the asset is $400,000. Conversely, if the current value of the asset, say a house, is $400,000 and the 10-year interest rate is 50%, then the expected future price of the house is $600,000. But what would happen if markets forecast home prices to grow faster than the interest rate?[2] For example, what would occur if current house prices are $400,000 and are expected to rise to $700,000, but the corresponding long-term interest rate is only 50%? This scenario could materialize if the recent house price growth rate has exceeded the interest rate and both borrowers and lenders expect such recent price trends to persist, thereby expecting the housing bubble to continue, not burst.[3] How do these beliefs coupled with access to high LTV loans impact behavior today?

To answer this question, we use a simple, partial equilibrium, consumer theory framework.[4] Consumers derive utility from housing and consumption, and current house prices, expected future house prices, and the interest rate are all given. We analyze only one period, but consumers can borrow against the expected future value of any house they buy in that period. We find that when the house prices are predicted to rise faster than the interest rate, and when consumers are allowed to borrow against these expectedly high future prices, the budget line slopes upward. The logic is straightforward. A small house leads to appreciation the consumer can borrow against. A larger house leads to greater appreciation even if house prices grow at the same rate for small and large houses. Therefore, buying a larger house now generates more income that the consumer can spend now. Essentially, the consumer chooses a larger house so that she can afford to buy more of everything else as well.

Other researchers have looked at the interaction of housing and consumption. Dusansky and Wilson (1993) formulate a model in which rising current house prices lead to expectations of further house price increases, in which case households increase their demand for housing to take advantage of the anticipated capital gains. This leads to an upward-sloping demand curve for housing. Dusansky and Koc (2007) treat housing both as a consumption good and an investment vehicle, and then provide empirical evidence that the investment role dominates the consumption role using data from Florida.[5] Our theoretical model goes one step further than these studies, showing that not just an upward-sloping housing demand curve, but an upward-sloping household budget line results when the expected house price growth exceeds the interest rate and households obtain high LTV loans to take advantage of the anticipated house price appreciation.

When the budget line slopes upward and consumers have monotonic preferences, no optimum exists. To obtain a solution, we add a constraint that limits consumer borrowing to a multiple of earned income. Such borrowing constraints were common prior to the latest housing bubble, and one might expect them to return. For instance, before the recent housing bubble homebuyers could only borrow up to the point where their monthly mortgage payment equaled 28% of their monthly income and their total debt payments equaled 36% of their monthly income.[6] The constraint we add to identify a solution for the household optimization problem

2. Case and Shiller (2003) use survey evidence to document that home purchases in 2003 were driven in part by an investment motive fueled by expectations of large home price appreciation.

3. Dusansky and Wilson (1993) also explore a similar scenario.

4. This contrasts with the standard life cycle/permanent income approach to housing demand introduced by Artle and Varaiya (1978) and used more recently by Muellbauer (2008). In addition to simplifying the life cycle model into a single period, our article differs from these studies by explicitly allowing housing bubbles.

5. See also Henderson and Ioannides (1985).

6. Aron, Muellbauer, and Murphy (2008a), Aron et al. (2008b), and Williams (2008) show how financial deregulation leads to house price appreciation.

is a fixed relationship between the amount to be borrowed and income, with a single parameter governing this relationship.

Not surprisingly, the ability to borrow against overly optimistic future house prices leads to consumers purchasing larger houses. More surprisingly, however, it leads to greater consumption spending, too.[7] Furthermore, the model shows that housing demand fits neither the conventional theories of consumer goods nor that of investment goods. Particularly, increases in the expected future price of housing may lead to lower current housing demand, contrary to the typical pattern of an investment good for which rising expected future prices lead to higher current demand. Similarly, a decrease in the effective (current) price of housing may lead to households purchasing smaller homes, contrary to the usual pattern of a consumption good for which lower prices usually lead to higher quantity demanded.

We conclude our discussion by considering issues important to policymakers: the household response to changes in the interest rate and that to shocks in earned income. The former matters to central bankers for whom housing provides a transmission channel for monetary policy and the latter to those concerned with long-term economic growth. The model shows that the ability to borrow against high house price forecasts reduces the effectiveness of monetary policy but raises the volatility of aggregate demand.[8] Tightening borrowing standards can lower such volatility and increase the marginal propensity to save, although at the expense of shrinking the overall activity.

The plan of this article is as follows. Section II sets out the structure of the model describing the budget constraints and borrowing constraints. Section III examines the effect of rising house price forecasts. Section IV discusses the implications for policy investigating the effect of interest rate changes, income shocks, and lending restrictions. Section V discusses the recent developments in the housing market and macroeconomy in general in light of our model.

7. Jappelli and Pagano (1994) construct an alternative model showing how financial deregulation can lead to declining national savings and slower economic growth.

8. Edge, Kiley, and Laforte (2008) use a DSGE model of the U.S. economy to examine house price volatility and monetary policy effects. They find evidence that monetary policy has had little impact on recent residential investment trends, in line with our findings below. On a related note, Aron et al. (2008b) show that an easing in credit conditions has led to structural shifts in the consumption-to-income ratio, breaking the preexisting co-integration relationships.

II. BUDGET CONSTRAINTS AND BORROWING CONSTRAINTS

Our modeling approach is to construct a simple model in which households can borrow against the future values of their homes. To do this, we assume that households live for a single period, purchasing a home at the beginning of the period and selling it at the end. They have preferences over housing investment h and consumption spending c, with their utility function given by $u(h, c)$. Importantly, they do not value bequests or savings because they do not live past the first period, and therefore they have an incentive to spend all their resources and leave no equity in their homes.[9]

Earned income is given by y, realized at the beginning of the period. Households also earn the appreciation from the sale of their houses at the end of the period. At the beginning of the period, the price of a unit of housing is p_0 and the price of unit consumption is normalized to 1. These prices are both exogenous in the model, as is the forecast future price of housing, denoted by p_f. Both households and lenders agree on the value of p_f, so that if a household purchases a house of size h she can borrow against its expected future value, $p_f h$, at the exogenously given interest rate i.

Households make all their decisions simultaneously at the beginning of the period, choosing consumption, housing, and borrowing. They can finance current spending either through earned income or through borrowing against expected home equity. Current spending is $p_0 h + c$, and the most households can spend is

$$y + ap_f h/(1 + i)$$

where a is the fraction of the future home value that the household borrows. As households cannot borrow more than the expected future value of their homes, a is restricted to lie between 0 and 1.

This specification leads to immediate implications. Consider the budget constraint

$$p_0 h + c \leq y + ap_f h/(1 + i). \tag{1}$$

9. Together these assumptions make the model, in essence, static.

Rearranging yields

(2) $$[p_0 - ap_f/(1+i)]h + c \leq y.$$

The value

(3) $$r = p_0 - ap_f/(1+i)$$

is the *effective price of housing*, and it is clearly smaller than the current price p_0.

Although housing shares attributes with both consumption goods and investment goods, what makes housing most different from other consumption goods is the nature of the effective price r. At one extreme, if $a = 0$ so that the household does not borrow at all against expected future home values, the effective price r is exactly the same as the current price p_0, and housing is no different from any other consumption good. But if $a = 1$ so that households borrow fully against the future sales value of their houses and $p_f/(1+i) = p_0$ so that house prices are predicted to rise at the same rate as the interest rate, then the effective price of housing is zero and housing is free. If $p_f/(1+i) > p_0$ so that home prices are predicted to grow faster than the interest rate and households borrow the full amount of their expected home equity, then the effective price of housing becomes negative. We explore the implications of negative effective house prices in the next section.

Households may not be able to borrow the full expected future sales value of their homes, however, perhaps because lenders are subject to regulations that relate the loan size to earned income. To account for this, we impose the borrowing constraint

(4) $$ap_f h/(1+i) \leq by$$

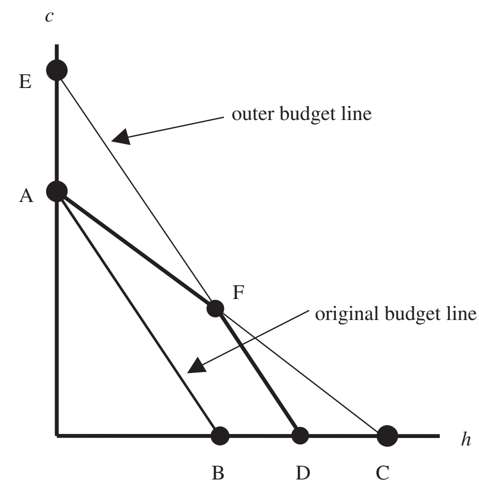
where b represents an upper limit on the fraction of earned income that a household can borrow. Substituting Equation (4) into Equation (1) yields another budget constraint

(5) $$p_0 h + c \leq (1+b)y.$$

This is the budget constraint that would hold if the household could acquire an unsecured loan of b times her income y. However, households cannot obtain unsecured loans and the ability to borrow by requires purchasing a house of sufficient expected future value to warrant the loan.

Figure 1 shows how the household's budget constraint works. Housing is measured on the horizontal axis and other consumption is measured on the vertical axis. The figure contains three lines. The line AB is the budget line that would hold if the household did not borrow at all against the future value of her home, that is, if $a = 0$. This is the budget line that is usually considered in consumer theory and its slope is $-p_0$. We will refer to it as the "original" budget line. The line AC is the budget line that is obtained when the household borrows fully against the future value of her home, so that $a = 1$. Borrowing reduces the effective price of housing, thereby making the budget line flatter with a slope $-[p_0 - p_f/(1+i)]$ instead of $-p_0$ as with budget line AB. Evidently, this allows the household to purchase more of both housing and consumption. The remaining line ED is the budget line that would hold if the household could obtain an unsecured loan of by and spend it in any way desired. This budget constraint corresponds to Equation (5) and is referred to as the "outer" budget line. Because both Equations (2) and (5) must hold, the actual budget constraint facing the household is the curve AFD.

FIGURE 1
Budget Constraints When Households Borrow against Future Home Values



It is worthwhile to see how the household moves along this curve from point A to point F, and then from F to D. Begin at point A. At this point, the household spends her entire income on consumption and has no housing to borrow against. So, she does not borrow. If she purchases some amount of housing, though, she gains the ability to borrow against its expected future value. For an effective price of housing r, the household moves along the budget line AC toward point F, purchasing larger houses and borrowing the full discounted expected future value of those houses. When the household reaches point F, however, she has hit the borrowing constraint for a total loan size of by, and no bank will lend her any more than that amount. This does not mean that the household cannot buy a larger house though; it only means that she cannot borrow more than by against that larger house. As the household cannot borrow against the future value of the additional housing units, the price of additional housing returns to the current price p_0 instead of the effective price r, and as the household purchases larger and larger houses she moves along the outer budget line from point F to point D.[10]

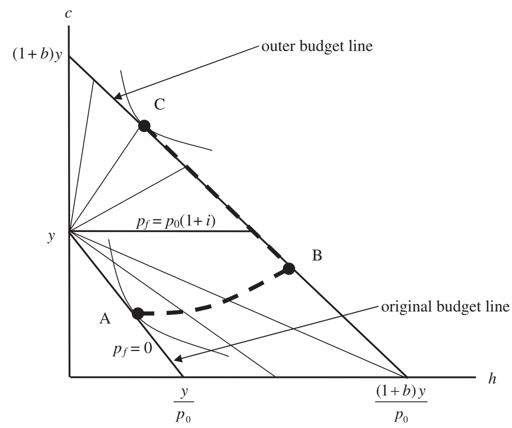
III. THE EFFECTS OF RISING HOUSE PRICE FORECASTS

A key feature of a housing bubble is that markets expect house prices to rise rapidly. If households have access to high LTV loans secured by this expected appreciation, house price forecasts affect the household's current choices of what homes to buy and how much to consume. Figure 2 illustrates these issues. First, suppose that $p_f = 0$, so that households cannot borrow because their homes will fully depreciate and have no value in the future. Accordingly, they are constrained to the original budget line. They solve the usual utility maximization problem and choose point A in the figure. Note that this is the budget constraint that would hold if housing were an ordinary consumption good.

Housing is not an ordinary consumption good, however, because home values do not fully depreciate during an individual's lifetime and homeowners can sell their houses at any time. Furthermore, homeowners may borrow against the forecast future value of their houses, especially when both borrowers and lenders agree on these forecasts. When the forecast future price of housing p_f rises, the budget line rotates outward because the effective price of housing r falls. Note that the intersection of the budget constraint with the vertical axis remains fixed at y, because when households spend all their income on consumption and none on housing they have nothing to borrow against.

As the forecast price of housing rises and the budget line rotates outward, the household's

FIGURE 2
Budget Lines with Rising Forecast Housing Prices



spending opportunities increase. When the forecast future price reaches the point where $p_f/(1 + i) = p_0$, so that expected growth in house prices matches the interest rate, housing becomes essentially free because the discounted expected future sales price equals the current purchase price. At this point, the budget line becomes horizontal, consistent with an effective price of zero. If house price forecasts rise even further, then the effective house price becomes negative and the budget line actually slopes upward, meaning that by purchasing larger homes households can purchase more of other consumption goods.[11]

The bold dashed curve in Figure 2 is the household's expansion path, showing the optimal housing–consumption pairs for different values of the forecast future price of housing. The expansion path begins at point A on the household's original budget line, which holds when the forecast price is zero and households are unable to borrow. As the forecast price rises and the budget line rotates outward, the household increases both the housing investment and consumption spending. Eventually, p_f rises to the level where the household's borrowing constraint becomes binding, which is point B in the figure. Further increases in the expected future price of housing mean that the household does not need as many housing units to secure the maximal loan size by

10. The point F, then, represents a situation in which the household borrows the maximum amount by that also corresponds to the full discounted expected future value of a house of the size $by(1 + i)/p_f$.

11. It is possible to modify the model to account for physical depreciation of houses, but that is ignored here in an effort to simplify the model.

according to its borrowing constraint, and so she begins downsizing. The downsizing continues until the household reaches point C, which is her utility-maximizing point along the outer budget line. At this point, the household no longer finds it worthwhile to give up housing in favor of increased consumption. Therefore, further increases in the forecast price of housing do not lead to a behavioral response.

Looked at differently, the expansion path shows how the economy behaves as the housing bubble, defined for our purposes as a sustained increase in house price forecasts, continues to grow. Initially, both consumption and housing demand increase as households purchase larger homes to finance their consumption expenditures. Eventually, households reach a point (shown by B in the figure) at which their borrowing is constrained by their income, and further forecast price increases lead to greater demand for consumption but lower demand for housing. At some point (C in the figure) this trend ends, and further increases in the forecast house prices have no economic impact.

Importantly, the analysis identifies three different regions on the expansion path for the effect of forecast prices on household behavior. In one region, corresponding to low forecast home prices, both consumption and housing demand increase with forecast prices. In this region, housing acts like an ordinary investment vehicle, with rising expected future prices leading to higher demand. In a second region, corresponding to a middle range of forecast home prices, consumption rises but housing demand falls with forecast prices. This contradicts the typical behavior of an investment vehicle for which demand rises when expected future prices increase. Housing also differs from an ordinary consumption good in this second region, because its demand falls even though the (current) effective price decreases. In the third region corresponding to high forecast home prices, further price increases have no effect on household spending.

IV. THE INTEREST RATE, SAVING RATES, AND VOLATILITY

The preceding section showed how the household's ability to take out high LTV mortgage loans secured by forecast home values leads to unusual purchasing patterns that fit neither investment nor consumption models. These patterns are only important, however, if they influence the way in which policy is formulated and carried out. This section explores the implications of the model for interest rate changes, household saving rates, economic volatility, and borrowing restrictions.

The effectiveness of monetary policy rests on its ability to promote changes in household spending. Within our model, monetary policy impacts the household through its effect on the interest rate. An examination of Equation (2) shows that interest rate changes work in exactly the same manner, but in the opposite direction, as changes in the expected future price of housing, and these changes were depicted in Figure 2. Both interest rate decreases and forecast future house price increases lead to counterclockwise movements along the expansion path. Unless the interest rate falls so low that households reach point C in Figure 2, monetary policy alters household behavior.

What matters for the economy, however, is not so much whether households modify their bundles of housing and consumption, but whether they change the total amount they spend on housing and consumption combined. In Figure 2, every bundle on the outer budget line, in particular between points B and C, costs exactly the same amount $(1 + b)y$. More importantly, this amount is completely independent of the interest rate and so is unaffected by monetary policy. When forecast future house prices are sufficiently high or the interest rate is sufficiently low that consumers borrow all the way up to their borrowing constraints, monetary policy influences the composition of household spending, but not the total amount. Particularly, a monetary loosening leads households to consume less housing and more consumption goods, and a monetary tightening does the opposite. The directions of changes are noteworthy though. Falling interest rates reduce the demand for housing, not raise it, contrary to the monetary transmission mechanism as it was previously understood.[12] Monetary tightening, perversely, leads to greater housing demand.

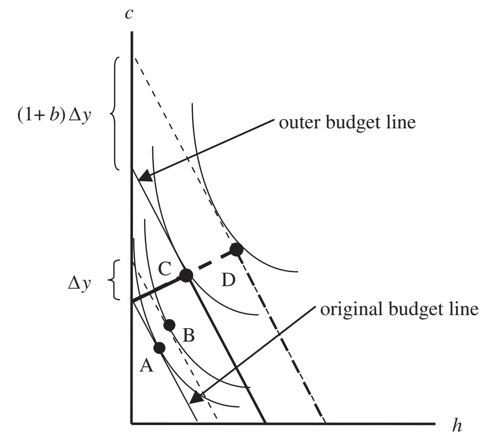
12. Traditionally, there are at least six transmission channels through which interest rate changes impact the residential investment, thus the overall economic activity. These channels include direct interest rate effects on the (1) user cost of capital, (2) expectations of future home values, and (3) housing supply, in addition to indirect (4) permanent (life-cycle) wealth effects, (5) temporary balance sheet/credit channel effects on consumer spending, and (6) temporary balance sheet/credit channel effects on housing demand. See Mishkin (2007) for an extensive discussion of the role of housing in the monetary transmission mechanism.

Much has been made about the downward trend in the U.S. personal saving rates over the past two decades.[13] In explaining this downward trend in household savings, an essential step is to have low household marginal saving propensities. In our model, when households borrow against high forecast home values, the marginal propensity to save can become negative. To see how, suppose that future house prices are predicted to be sufficiently large such that households reach their borrowing constraints and therefore consume between points B and C in Figure 2. Now, consider the impact of a positive income shock. An increase in earned income of Δy shifts outward both the original budget constraint and the outer budget constraint. The original budget constraint shifts upward by the amount Δy, whereas the outer budget constraint shifts upward more, by $(1 + b)\Delta y$. Accordingly, an income increase of the size Δy leads to a total increase in spending of $(1 + b)\Delta y$. The marginal propensity to spend, then, is $1 + b$, which is greater than 1, and the marginal propensity to save is $-b$ which is less than zero.

A final concern for policymakers is the volatility of economic activity. Figure 3 examines this issue through shocks to the household's earned income y, in two different scenarios. In the first scenario, households cannot borrow against future home values, and so must consume on their original budget constraint. The optimal point is A. An increase in earned income of Δy shifts this budget constraint upward by Δy and the new consumption point is B. The distance between points A and B can be thought of as a rough measure of the volatility in aggregate demand.

In the second scenario, households borrow against future home values and home price forecasts are sufficiently high to make the effective price of housing negative. Prior to the income shock, households choose to consume at the kink in the budget constraint, which is at point C. An earned income shock of the same size Δy shifts the outer budget line upward by $(1 + b)\Delta y$, which is a larger shift than in the first scenario. The new consumption point is D, at the kink of the outermost budget constraint. The distance between points C and D is greater than the distance between A and B, reflecting that aggregate demand would display increased variability if households were to engage in high LTV borrowing against forecast home values.

FIGURE 3
Income Shocks and Volatility



As the effect of any income shock Δy on total demand is magnified by a factor of $1 + b$, where b is the multiple of earned income households can borrow, regulating b represents a way to reduce demand variability. In particular, reductions in b lead to smaller adjustments in aggregate demand following an income shock, therefore a less volatile economy. Also, more restricted borrowing will help slow down the decline in household savings. The benefits associated with limitations on household borrowing come at a cost, however, because a smaller b also means lower levels of household spending. In particular, reductions in b move the outer budget line closer to the original budget line, leading in general to a contraction in overall activity.

V. CONCLUSION

This article examines the implications of high LTV mortgage borrowing for policy effectiveness and aggregate demand. We find that households that obtain high LTV loans secured by expectedly high future home values purchase larger homes in order to finance other consumption spending, and that housing demand does not fit traditional consumption or investment patterns. Rapidly rising home price forecasts can lead to interest rate policy having no impact on aggregate spending, but only causing changes in the mixture of housing and consumption.

13. For recent reviews of this literature, see Garner (2006) and Guidolin and La Jeunesse (2007).

Furthermore, high house price forecasts can generate negative marginal propensities to save and more volatile aggregate demand conditions. Restricting the household's ability to borrow can help reduce economic volatility and lead to higher marginal saving propensities at the expense of a smaller economy.

The proposed economic structure sheds light on the recent U.S. experience of a burst housing bubble and the resulting adverse macro consequences. In our model, rapidly falling home price forecasts increase the effective price of housing, moving the economy clockwise along the expansion path in Figure 2. In the upper part of the expansion path (i.e., above point B), falling price forecasts have no impact on the overall activity; households stay on the outer budget line and the aggregate household spending remains fixed at $(1 + b)y$. Below point B, however, further declines in expected home prices lead to households reducing the demand for housing. Because consumption is partly financed by purchasing large houses and borrowing against them, the decline in housing demand lowers consumption demand also. This is when the signs of recession appear with the aggregate household spending falling below $(1 + b)y$.

Furthermore, changes in the economic climate in a post-bubble world may lead financial institutions to curb lending.[14] More restricted borrowing, reflected by an inward shift of the outer budget line, puts another contractionary force on the economy leading to aggregate demand declining at a faster pace than otherwise. Although policymakers respond by cutting the interest rate to support the housing demand, monetary stimulus falls short of promoting full recovery. This is because falling interest rates fail to overcome the adverse effect of the steep decline in house price forecasts, as evident in Equation (3).

Our findings that house price forecasts affect macro outcomes in important ways ranging from increased aggregate demand volatility to policy ineffectiveness warrant a renewed interest in the optimal policy response to asset price bubbles. The traditional view that changes in asset prices, except their predictable impact on future inflation and output, should not be a concern for monetary policy needs to be justified in the light of recent developments.

14. The Federal Reserve Bank of Dallas has already called for lowering LTV limits (Gunther 2009).

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