Housing Bubbles: A Survey

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Abstract

The past 25 years have represented two periods of extreme movements in U.S. and global house prices that appear to be much larger than can be easily explained by changes in fundamentals. These episodes spurred research on housing bubbles that focused attention on the role of outsized expectations in excessive house price appreciation. By contrast, some economists pointed to alternative explanations for excess volatility, including liquidity constraints, lending cycles, search externalities, and zoning delays. Empirical work supports the role of these factors in explaining at least some of the cyclical variation of house prices and inventories of homes for sale. Existing research does not yet provide a crisp definition of a housing bubble nor does it allow researchers to predict where or when bubbles can occur.

1. INTRODUCTION

We are now slowly emerging from the worst financial and housing crisis since the Great Depression. More than one in four homeowners with a mortgage owe more on their mortgage than their house is worth, with some families having lost nearly their entire nest egg for retirement. Millions of Americans face the possible loss of their homes as they can no longer afford their mortgage payments, and some are choosing not to pay their mortgages given the bleakness of their housing and financial situations. Taxpayers and depositors have already spent hundreds of billions of dollars covering the housing-related losses from Fannie Mae and Freddie Mac, as well as the many failed banks, with more to come. Housing markets are at the center of the crisis.

Below I consider facts and previous academic research on the cyclical movement of house prices. The housing boom and bust of the previous decade serve as a natural laboratory to consider what drives housing cycles. Two facts are especially relevant. (These facts are drawn out in much more detail in Hubbard & Mayer 2009.) First, the house price run-up in the United States was not unique; house prices in many other global markets increased to a similar extent over the same time period. Second, the house price cycle varied enormously across American markets. House prices in coastal markets and some inland locations such as Las Vegas and Phoenix boomed and then crashed, while house prices in many Southern and Midwestern markets remained much less volatile. I consider a number of alternative explanations that might explain this episode, including declining real interest rates, the rapid rise in subprime lending in the United States, and speculation.

Of course, housing cycles are not limited to this past decade. Observers have long puzzled about the exaggerated cyclical behavior of house prices relative to fundamentals. Economists have proposed a number of measures of fundamentals with which to compare house prices and determine whether a housing bubble exists. Some compare house prices to the present value of rents, often computed using the user cost of capital. Others compare the price of a house to its construction cost. A third group examines the relationship between house prices and economic fundamentals such as income, population, and employment.

In evaluating whether a housing bubble exists, I consider two alternative definitions of a housing bubble. First, a bubble can result when house prices are excessively volatile over the cycle, rising more than fundamentals would suggest in a boom and falling faster than the decline in fundamentals in a bust. By this definition, the literature suggests that housing bubbles are common. A second definition states that bubbles represent extreme movements of house prices, during which housing prices rise rapidly, growing 20%, 30%, or even 40% per year for two or three years, and then falling just as rapidly in the following three years. Although less common than the first definition of a bubble, such episodes have occurred in markets such as Las Vegas, Phoenix, and Miami in this decade and in Vancouver, Canada, in the late 1980s and Japan in the mid-1980s.

Next I examine alternative explanations for excess volatility in housing markets that do not rely on excessive expected appreciation. Many economists have focused on market imperfections or frictions that might lead house prices to overshoot fundamentals. The most commonly cited frictions are borrowing constraints, search market externalities, and zoning rules that delay construction. Borrowing constraints are hypothesized to lead to momentum on the way up, as capital gains relax borrowing constraints as prices

rise, and as prices fall, borrowing constraints make it impossible for many homeowners to move and purchase a new home. Increasing numbers of houses coming on the market with rising prices lead to a greater choice for buyers in a search market, and thus better matches and potentially even higher prices. Zoning rules limit the ability of housing supply to adjust to demand shocks. Such limits lead prices to spike in a boom and to fall faster in a bust.

Economists have also pointed to psychological models in explaining excess volatility. When prices start rising, irrational exuberance leads buyers and sellers to become carried away, causing house prices to spike in booms. As prices fall, models such as loss aversion can explain why sellers are reluctant to sell as house prices fall. Owners may lose confidence in the value of their homes as well.

The review concludes by considering an agenda of possible future research on housing bubbles. House prices appear excessively volatile in supply-constrained markets, but supply constraints alone seemingly cannot explain such exaggerated cycles. Extreme cycles (bubbles) have appeared more rarely but are not limited to supply-constrained markets. Existing research does not explain why housing bubbles appear in some markets and at some times, but not in others. Researchers might link data on housing bubbles with evidence about the prevalence of bubbles in other investment markets, such as Internet stocks or tulip bulbs. Future research on bubbles should consider what types of policies governments and businesses might pursue to fight them as well.

The next section discusses evidence from the recent crisis. Section 3 explores the question of how to define a housing bubble. In Section 4, I consider various measures of fundamentals that can be used to assess the extent to which housing prices are excessively volatile. Next the review considers market imperfections that might lead to excess volatility, including search frictions, down-payment constraints, and loss aversion. I conclude with a summary and an agenda for future research.

2. LESSONS FROM THE RUN-UP AND SUBSEQUENT DECLINE OF U.S. AND GLOBAL HOUSE PRICES IN THE 2000s

The recent crisis has taught us hard and painful lessons about how bad things can get in the housing market. Yet the recent housing bubble occurred in many countries around the world, not just in the United States. As early as June 16th, 2005, *The Economist* claimed that "The worldwide rise in house prices is the biggest bubble in history... never before have real house prices risen so fast, for so long, in so many countries."

Figure 1 (see color insert) plots the changes in house prices for the United States and selected European countries. In this graph, the United States experience is relatively unremarkable when compared with several European countries. House prices in the U.S. boom rose less than those in the United Kingdom and Spain, but rose slightly more than those in Ireland and France. What is striking for the United States is how sharply house prices collapsed compared with most other countries when the boom ended. Similarly, house prices showed appreciable increases in developing countries such as Brazil, Argentina, China, Hong Kong, and India over the same time period.

Although house prices boomed globally, there was appreciable variation in the extent of house price appreciation across different U.S. metropolitan statistical areas (MSAs). **Figure 2** (see color insert) plots house prices for 16 U.S. MSAs. The first six cities in **Figure 2*a*** are historically cyclical markets. These are coastal locations where land is scarce,

demand is strong, and real house prices have risen consistently over time.[1] Housing cycles are not new in these markets; cycles predate subprime mortgages and the excesses associated with the recent crisis. **Figure 2*b*** shows that house prices in a second group of markets are much more steady over time. These Midwestern and Southern markets either have relatively unrestricted new construction or little growth in demand to live in these MSAs. Housing cycles are much more muted, although these markets surely had access to subprime loans. The third group of MSAs, shown in **Figure 2*c***, exhibits the most striking pattern of price appreciation. Until the recent crisis, real house prices were amazingly stable, although population in markets such as Las Vegas, Miami, and Phoenix grew at 3–10 times the national average from 1970 to 2000.[2] Yet, seemingly out of the blue in 2003, house prices seemed to explode for the next four years. And when the bubble burst, house prices in these markets returned to their preboom level, or in some cases even lower than where their house prices started.

2.1. House Prices and Mortgage Rates

Hubbard & Mayer (2009) point to declining global interest rates as the common factor across countries with booming house prices. The authors present regressions showing that house prices across U.S. cities adjust by up to 85% of the change in the after-tax cost of owning a home, which itself is predominantly driven by changes in interest rates. For example, a decline in mortgage rates from 6% to 5% could reduce the cost of owning a home by up to 16%, leading to an increase in house prices of 13.6%. Up to 2005, declining interest rates could explain an appreciable portion of the run-up in house prices in many American cities. Mayer & Sinai (2009) show that user costs explain a much greater proportion of the variation in price/rent ratios in the 2000s boom than in the 1980s boom two decades earlier.[3] Taylor (2009) also argues that low interest rates led to higher housing demand and contributed to the subsequent crisis. Even across cities, Himmelberg et al. (2005) point out that in a low–interest rate environment, falling interest rates lead to bigger percentage increases in house prices in land-constrained markets (e.g., the Northeast and California) with above-average rates of expected future house price appreciation.[4]

In contrast, Favilukis et al. (2010) suggest that declining interest rates play a smaller role in the U.S. house price boom, instead pointing to financial market liberalization (e.g., relaxed credit constraints and lower housing transaction costs) and its subsequent reversal. The authors develop a two-sector general equilibrium model in which households have limited opportunities to insure housing risk and present simulations to support their conclusions.

[1]Gyourko et al. (2006) refer to these and similar MSAs as "superstar cities," making the observation that house prices in cities that are in high demand and with limited growth in construction have seen very high price growth just like the wages of superstars in sports, media, or industry. Himmelberg et al. (2005) point out that house prices are predictably more volatile in fast-growing locations where house prices are especially sensitive to changes in interest rates or growth rates.

[2]Population in Las Vegas, Miami, and Phoenix grew by 405%, 123%, and 212%, respectively, between 1970 and 2000, compared to the U.S. population growth rate of 38% over the same time period.

[3]Glaeser et al. (2010) also find that house prices are more highly correlated with interest rates in the most recent boom.

[4]Gyourko et al. (2006) show that high-demand coastal markets with supply constraints have had higher growth rates of house prices than locations in the Midwest and South, which have slower growing demand or a relatively elastic supply of land.

Additionally, Glaeser et al. (2010) suggest that simple calculations of the user cost of housing using the current mortgage rate ignore important dynamic considerations, including the fact that long-term interest rates are mean reverting.[5] In their model, consumers reduce the amount they would otherwise pay for a home when mortgage rates are low, recognizing that they may need to sell their home and move at a time period when rates are higher. The authors present empirical work showing that a 1% decrease in real mortgage rates is associated with up to an 8-percentage-point increase in real house prices, lower than the elasticity found in Hubbard & Mayer (2009), suggesting that declines in real interest rates can explain relatively little of the 2000s boom in U.S. house prices. However, unlike the theory, the authors' empirical work reflects a reduced-form specification using aggregate data that misses the structural interpretation of the user cost model.[6] Even so, Glaeser et al. conclude the falling real rates can explain up to 45% of the national run-up in house prices from 2000 to 2005, but explain little of the subsequent decline from 2006 to 2008, and explain only about 20% of the increase in real house prices from 1996 to 2006.

2.2. The Role of Easy Credit and Subprime Mortgages

Although subprime lending was quite prevalent in the United States up to 2006, these risky mortgages were not widely available in other countries. Thus subprime lending cannot explain the pronounced rise in house prices outside the United States during the early part of the decade, although it surely could have contributed to the house price run-up in many U.S. cities, especially after 2005 when house prices rose even as mortgage rates were also increasing but subprime loans were flowing freely.

Many authors have linked easy credit and subprime lending with the U.S. housing bubble. Khandani et al. (2009) argue that the confluence of rising home prices, declining interest rates, and near-frictionless refinancing opportunities led to coordinated increases in leverage during the boom and rapidly rising defaults during the bust. Similarly, Favilukis et al. (2010) suggest that much of the recent housing boom can be explained by a combination of relaxed credit constraints and lower housing transaction costs. Finally, Mayer & Sinai (2009) examine the rise in price-rent ratios between 2000 and 2005 and show that the growth in subprime lending was largest in housing markets with the biggest growth in price-rent ratios.

By contrast, Glaeser et al. (2010) argue that easy credit was not a strong contributor to rising U.S. house prices. The authors find little correlation between rising house prices and higher loan-to-value ratios and lower loan rejection rates using national U.S. housing data.[7]

Of course, causality is difficult to prove. Did house prices rise because buyers relied on unsustainable lending practices to buy a home, or did subprime lending take off because house prices were rising and buyers needed to rely on subprime loans to afford a home?

[5]Shiller (2007a) also notes that declines in mortgage rates make a tempting explanation for the subsequent run-up in global house prices. However, he argues that the exact timing of falling interest rates does not correspond to rising house prices.

[6]For example, in the standard user cost model, as pointed out by Himmelberg et al. (2005), house prices are more sensitive to mortgage rates in metropolitan areas with faster appreciating house prices.Glaeser et al. (2010) instead run regressions at the aggregate national level, or average across a large number of cities, whereas the user cost model is highly nonlinear.

[7]The authors note that endogeneity may limit the conclusions from their analysis.

Although not conclusive, data seem to suggest that unsustainable lending contributed to the housing bubble in some locations.

Mayer & Pence (2009) show that subprime loans were most prevalent in markets with excessive valuations (high price-rent ratios), not just markets with high house prices. Bubble markets such as Las Vegas, Miami, and Phoenix had a very high percentage of subprime loans (8%, 9%, and 12% of all housing units in 2005, respectively), whereas housing markets with high price-income ratios such as San Francisco, Boston, and New York relied much less on subprime lending over the same period (3%, 4%, and 4% of all housing units in 2005, respectively). This suggests that subprime lending was not used just to improve housing affordability.

The data also show a marked decline in origination standards for subprime loans between 2005 and 2007, precisely the time period when most authors agree that housing prices deviated the most from fundamentals. Mayer & Pence (2009) document that the median loan-to-value ratio for a purchase loan was an astounding 100% for subprime mortgages originated in 2005, 2006, and the first half of 2007.[8] In previous years, the median down payment by a subprime borrower was 10% of the purchase price.

Once house prices had peaked, poor underwriting standards during the boom seem to have contributed to the subsequent collapse in house prices. Gerardi et al. (2009) run simulations showing that, had underwriting standards remained at the 2002 levels, but with house prices following their post-2005 pattern, foreclosures would have been half of what they turned out to be.

Rising foreclosures may have spread and led house prices to spiral downward. Campbell et al. (2011) show that foreclosures in turn led to declines in house prices, with 28% discounts for foreclosed houses and smaller discounts for houses near a property with a forced sale.

2.3. Investors, Speculation, and Fraud

Although the previous subsection focuses on the role of lenders, it takes two to tango. Purchasers also appear to have gotten carried away in this crisis. One of the most striking facts in the housing bubble is the strong correlation between investor ownership of property and excess appreciation across MSAs. Wheaton & Nechayev (2008) show that forecast errors in an equation forecasting house price appreciation between 1998 and 2005 are positively correlated with the percentage of home sales attributed to investors or second-home buyers at the end of the period in 2005.

Once again, it is challenging to determine causality between investor purchases and excess house price appreciation. Investors might have purchased in high-appreciation-rate markets because they anticipated that booming house prices would present profitable opportunities. Alternatively, the presence of speculators might have driven prices up higher than would have happened had only owner-occupants participated in the market.

Shiller has long argued that investors and consumers in housing and other financial markets are subject to irrational exuberance and unrealistic expectations of future price appreciation (e.g., see Shiller 2005, 2009; Ackerloff & Shiller 2009). Shiller (2007a) points to speculative feedback and social contagions as key factors in the recent global rise in

[8]In fact, many mortgages even started with a loan-to-value ratio above 100% because borrowers were able to roll closing costs into the balance of their mortgage.

house prices. One problem in examining the theory of irrational exuberance/social contagion is that it does not help predict where and when bubbles occur. For example, why did bubbles seem to occur in some markets in the United States but not in others? Why were housing bubbles so widespread in many parts of Europe (e.g., United Kingdom, Ireland, Spain) but not in Germany?

Some authors examine contemporary written evidence to understand expectations of house price appreciation. Gerardi et al. (2009) document reports by investment banks exhibiting confidence that house prices would continue to rise, which is consistent with Shiller's (2007b) argument that irrational expectations of future price appreciation were a large factor in explaining the recent housing bubble. Case & Shiller (2003) point to a large rise in the use of the terms housing boom and housing bubble in 2002 and 2003 as further evidence that home buyers and sellers were aware that home price rises might be unsustainable.

Fraud is another common feature of overheated investment markets, and this boom was no exception. Ben-David (2009) shows that up to 16% of highly leveraged transactions in Cook County, Illinois, were inflated as buyers and sellers included items in the sales price that could not be collateralized (e.g., paying buyers' closing costs or giving cash back). These inflated transactions had the effect of overstating any down payment by the purchaser, leading to higher observed house prices and mortgages that were larger than would be justified by the quality of houses alone. Similarly, the *Miami Herald Tribune* published an investigative report on property flipping in Miami during the boom years, documenting $10 billion in suspicious deals in Florida (Braga et al. 2009), which would represent about 10% of all property transactions in the Miami MSA in 2005 and 2006 (C. Mayer, calculations from deeds records of sales in those years).

3. DEFINING A HOUSING BUBBLE

When looking at the recent housing market crisis or previous episodes of housing bubbles, the question naturally arises as to how to measure fundamentals so as to compare current prices with what prices should be if they fully reflected fundamentals. Before beginning the analysis of fundamentals, however, I consider the issue of what constitutes market inefficiency and what constitutes a bubble.

Although the word bubble is used liberally today when describing the behavior of house prices, this was not always the case. In 1989, Case and Shiller published what has become the seminal article on housing market inefficiency, "The Efficiency of the Market for Single Family Homes." The article examines the behavior of house prices in four cities, noting that house prices exhibited statistically significant short-run momentum and did not fully incorporate information about changes in interest rates. The authors make a compelling case that house prices do not follow fully rational patterns and spurred more than two decades of research on housing cycles. Yet, in the entire article, the authors never use the word bubble even once. In a subsequent article in a *Journal of Economic Perspectives* symposium on bubbles, Shiller (1990) uses the word bubble just once, in the conclusion.

Later work by Case & Shiller (2003) examines the question of housing bubbles with the title "Is There a Bubble in the Housing Market?" The paper explicitly takes on the question of how a researcher might determine whether a housing bubble exists. Among other exercises, the article reports the results of a Lexis-Nexis search for the term housing bubble in the popular press, noting that prior to 2002 the phrase was almost never used, even in

the late 1980s, a time that many economists now point to as having a number of local housing bubbles.

Academic researchers examining housing market inefficiency started to explicitly consider the possibility of housing bubbles soon after the publication of the symposium on bubbles in 1990. For example, Meese & Wallace (1994) examine the present value relation using data on house prices, rents, and the cost of capital from 1970 to 1988. The article concludes that although long-run results are consistent with the present value relation, short-run prices deviate appreciably from fundamentals. The authors note that their preferred explanation for these results is high transaction costs but that they cannot rule out "asset market bubbles or nonrational explanations."

In summarizing the *Journal of Economic Perspectives* bubble symposium, Stiglitz (1990, p. 13) notes that a bubble occurs "if the reason that the price is high today is *only* because investors believe that the selling price is high tomorrow—when 'fundamental' factors do not seem to justify such a price—then a bubble exists. At least in the short run, the high price of the asset is merited, because it yields a return (capital gain plus dividend) equal to that on alternative assets." Case & Shiller (2003) use a similar definition for housing. To address this question empirically, the authors have conducted surveys of recent homebuyers as far back as 1988 to examine how expectations differ in boom, postboom, and bust markets (Case & Shiller 1988, 2003).

Of course, it is quite possible to be skeptical of survey results as responses often seem quite unrealistic. For example, recent buyers in Los Angeles and San Francisco from the 1988 and 2003 surveys conducted by Case and Shiller report that they expect house prices to rise at a rate between 13.1% and 15.7% per year for the next 10 years, resulting in a 240%–320% rise in house prices over a single decade. Even in Milwaukee, buyers reported an expected annual price appreciation of 7.3% in 1988 and 11.7% in 2003. These reported expectations appear unrealistically high.

Instead, most authors attempt to determine whether a bubble exists by comparing actual house prices with what house prices should be based on a model of fundamentals. In doing so, researchers sometimes attribute large increases in actual house prices relative to fundamental house prices as representing periods in which a bubble exists. The presumption is that when house prices do not fully reflect fundamentals, a bubble is present. I discuss the challenges of this interpretation in the sections that follow.

4. BUBBLES AND HOUSE PRICE FUNDAMENTALS

In this section, I summarize research on whether fundamentals can fully explain changes in house prices. This exercise is hampered by the challenge of determining the reasonable expectations of changes in fundamentals such as population, income, interest rates, and rents, and even more so in figuring out what a scarcity premium might be for land in locations where construction is constrained and how that scarcity premium might change over time. Previous authors have considered three alternative approaches to examining fundamentals: finance-based models that compare the price of a home with the present discounted value of rents, often using the price-rent ratio as a proxy for overpricing; a construction-cost methodology of comparing house prices to the cost of constructing a new home; and affordability metrics that examine the ability of potential owners to purchase housing. Below I summarize each approach, considering their strengths and weaknesses.

4.1. Present Discounted Value of Rents and the User Cost of Housing

For almost three decades, authors have examined the cost of owning a home relative to renting using the same model that economists apply to examining corporate investment decisions: the user cost of capital.

Poterba (1984) applies a variant of the user cost of capital model to housing markets to examine the capitalization of tax subsidies to home ownership. Using a dynamic version of the user cost model with construction lags, Poterba shows that house prices might overshoot their fundamental level and recover, even in a model with fully rational agents.

In Poterba (1984), the user cost model helps define the equilibrium relationship between the housing rents and prices. Case & Shiller (1989) note the importance of this relationship, stating "there is little hope of proving definitively whether the housing market is not efficient. We see no way of obtaining an accurate historical time series on implicit rents of owner-occupied homes." Meese & Wallace (1994) collect data on housing rents, prices, and the cost of capital to determine whether the present value relation holds for housing.

Subsequently, many authors have used the rent-price ratio as a measure of the extent to which prices exceed their equilibrium level. In its simplest form, the user cost model states that the rent-price ratio is equal to the user cost of housing, which is defined as

$$\frac{R_{it}}{P_{it}} = \left((1-\tau_{it})r_t + m - E[\%\Delta P]_{it}\right), \quad (1)$$

where R_{it} is the owner equivalent rent for a representative home for one year in city i at time t, P_{it} is the corresponding purchase price for that same home, $(1-\tau_{it})r_t$ is the after-tax, equivalent-risk opportunity cost of capital (that is, what an investor would earn for an investment of equivalent risk), m is the maintenance cost as a percent of the purchase price, and $E[\%\Delta P]_{it}$ is the expectation of future house price appreciation in city i at time t.

Authors have augmented the user cost equation in several ways. Some models separate the real estate risk premium from the risk-free rate when computing the risk-adjusted rate of return (r_t). Others compute the expected rate of future house price appreciation as the sum of expected inflation and expected real house price appreciation (see Himmelberg et al. 2005 for a more detailed summary of the user cost equation and the underlying variables; Poterba 1992 is an example of a paper that adds an explicit risk premium to the user cost model).

The static version of the user cost model has been examined in a number of contexts. For example, user costs present a convenient framework to consider the impact of the tax deductibility of interest on house prices. Consistent with the user cost model, Poterba (1991) shows that higher expected inflation benefits more expensive houses relative to cheaper houses. Gyourko & Sinai (2003) and Poterba & Sinai (2008) use user costs to examine the potential geographic and cross-sectional impacts of eliminating the tax deductibility of mortgage interest, owner imputed rent, and property taxes.

Other authors have used the model to examine potential mispricing in housing markets. Himmelberg et al. (2005) compute the user cost over time and across cities to examine whether current house prices are relatively expensive compared with the previous two decades. Meese & Wallace (1994) examine the present value of rents relative to prices, concluding that the present value relationship fails to hold in the short run using data from

[9]The user cost model is just a slightly expanded version of the Gordon growth model $\left(Price = \frac{dividend}{interest\ rate - expected\ growth\ rate}\right)$ applied to housing.

San Francisco. Mayer & Sinai (2009) examine pricing deviations between the actual price-rent ratio and the ratio predicted by the user cost model. The authors show that simple behavioral variables such as lagged house price growth do not explain pricing discrepancies, whereas credit variables such as the concentration of subprime lending are correlated with pricing deviations. Poterba (1991) considers how possible deviations from the user cost model might be related to homeowner expectations of house price changes.

Authors also have identified a number of potentially serious concerns about the user cost model and the comparison of house prices with the present discounted value of rent. Glaeser & Gyourko (2007) argue that such comparisons are inaccurate because of appreciable differences between owners and renters and the types of residences in which they live.

As Glaeser & Gyourko point out and Case & Shiller (1989) noted more than two decades ago, it is challenging, if not impossible, to measure rents in the types of homes that are typically occupied by owners over a long time series and across various markets. Most commonly, authors have used different price and rent indexes under the assumption that the rent index is a good proxy for the rent that might be paid to an equivalent owner-occupied property. Smith & Smith (2006) attempt to correct for this problem by finding a sample of owner-occupied houses that are also available for rent to examine whether price-rent ratios are too high, concluding that there was little evidence of a housing bubble in the mid-2000s. Other authors show that rents appear to be highly correlated with prices in the long run, although the two series show appreciable deviations in the short run. For example, Gallin (2006) shows that prices and rents are cointegrated but also that the price-rent ratio predicts future changes in both prices and rents over a four-year horizon. Hubbard & Mayer (2009) show that a simple regression of a log-linearized version of the user cost model (e.g., a regression of log price on log rent and log user cost) generates a coefficient on log rents near unity and a coefficient on log user cost of −0.75, both very close to what is predicted by the static user cost model.

Another appreciable problem with estimating the user cost model is that the model is inherently static, but a number of variables in the model likely change over time. Although the price-rent ratio can often serve as a shorthand measure of valuation (as does the price-earnings ratio for stocks), a serious analysis of overvaluation should incorporate factors such as time-varying expected growth rates in prices and rents and also dynamic risk premia.

First consider the risk premium for owner-occupied housing. There is much debate on the extent to which owners should apply a large risk premium to housing. Favilukis et al. (2010) incorporate dynamic considerations in a two-sector general equilibrium model in which heterogeneous households have limited opportunities to insure against aggregate and idiosyncratic risks. The model highlights a number of reasons that real estate risk premia can change over the business cycle. By contrast, Sinai & Souleles (2005) argue that the risk premium for owner-occupied housing should be relatively low because owning a home serves as a hedge against future rent increases. In the authors' framework, computing a single-market risk premium can be complicated because of differences in housing consumption for heterogeneous households.

Computing the expected rate of house price appreciation is also enormously challenging. Authors have used a variety of approaches. Some have used long-term historical appreciation as a proxy for future appreciation under the assumption that housing is a long-term investment and that long-run rates of house price appreciation are persistent

within metropolitan areas (Gyourko et al. 2006). Others have used a weighted average of recent rates of house price appreciation following survey evidence from Case & Shiller (1988) that households appear to have a backward-looking component to their future expectations of house price growth.

Of course, any assumption about house price appreciation rates is problematic when trying to determine whether there is a bubble in house prices. After all, there is almost always some path of house price appreciation that can justify current price-rent ratios, even if that path might appear extremely unlikely to some observers (especially in retrospect). The question of whether a bubble exists is equivalent to asking whether such expectations have a reasonable basis in reality.

4.2. House Prices and Construction Costs

A second approach to comparing house prices to fundamentals relies on the construction cost of a standard house as a benchmark for valuation. Authors cite theory that suggests that land has limited value above its agricultural use in many cities around the country, either because of few regulations limiting construction in high-demand markets or because housing is readily available in markets in which demand growth is low.[10] Shiller (2009) argues that, despite regulatory barriers to converting farmland to urban land, "these barriers tend to be thwarted in the long run if economic incentives to work around them become sufficiently powerful." Thus he concludes that in the long run, house prices should grow with inflation.

Whether looking at Germany and Japan, or Detroit and Cleveland, slow demand growth may explain why house prices were stagnant in some markets while house prices boomed in other locations. Glaeser & Gyourko (2005) point out that the supply curve for housing is kinked, with housing inelastically supplied when demand falls below the existing stock of housing, but upward sloping when demand exceeds the existing stock at current prices. Thus house prices in slow or negative demand growth markets are capped by construction costs. In markets in which there are few zoning requirements, Glaeser & Gyourko show that house prices are determined by construction costs, even when growth in demand is high. In some fast-growing Southern markets such as Houston, Atlanta, or Charlotte, the easy availability of land explains how population can grow yet house prices can remain flat. When demand rises, builders acquire land and build new houses. Construction costs determine the price of housing in those markets (Gyourko & Saiz 2004).

Glaeser et al. (2008) extend this intuition further, linking housing supply to housing bubbles. The authors develop a simple model in which locations with elastic supply have fewer and shorter bubbles. The authors point out that excessive house price run-ups in the 1980s occurred almost exclusively in locations where land is inelastically supplied. Similarly, Mayer & Somerville (2000) demonstrate that supply responds about 20% more slowly to demand shocks in highly regulated markets, thus suggesting that prices may be more volatile in these highly regulated markets. However, one puzzle to emerge from the recent crisis is why cities such as Las Vegas and Phoenix with plenty of available land suddenly faced an enormous housing bubble, despite having behaved like other steady markets in earlier decades.

[10]Gyourko (2009) provides a summary of the literature on housing supply and land prices, pointing out that in most markets around the country, house prices are similar to estimated construction costs.

Of course, it is important to note that there is no conflict between finance-based estimates of house prices being determined by the present discounted value of rents and the fact that land may have little value in most parts of the country and thus house prices in these markets may be determined by construction costs as well. After all, construction will take place as long as it is profitable for homeowners or investors to purchase a home. If demand is strong enough to drive rents up such that the present discounted value of rents exceeds house prices, builders will construct more houses, which will drive down rents such that prices once again equal the present value of rents. As Poterba (1984) demonstrates, in the short-run when demand rises, house prices may overshoot fundamental prices due to construction lags, but long-run house prices will equal the cost of constructing a new home.

4.3. House Prices and Local Economic Variables

Several recent papers have taken a third approach to determining equilibrium house prices, comparing house prices to household income and population. The intuition behind this approach is that long-run house prices should be determined by affordability and the size of the population (interacted with the elasticity of housing supply). These papers follow a long urban tradition first developed by Alonso (1964) of solving for a spatial equilibrium in which house prices reflect a differential willingness to pay for various locations. Rosen (1979) and Roback (1982) extend this model to consider the relationship between wages and rents to measure market-based differences in the quality of life across cities.

Gyourko et al. (2006) examine long-term trends of increasing skewness in house price appreciation across metropolitan areas, attributing this skewness to a combination of inelastic supply of land in some attractive locations and an increasing number of high-income households who desire to live in those locations. The paper uses data on supply constraints and income growth of recent movers to support their predictions. Van Nieuwerburg & Weill (2007) develop a general equilibrium model with similar predictions, showing that an increase in the cross-sectional dispersion of wages combined with limited land supply in productive cities can generate strong flows of workers desiring to move to these productive cities and thus increased dispersion metropolitan area house prices.

Glaeser & Gyourko (2006) create a dynamic model in the spirit of Rosen (1979) and Roback (1982) in an attempt to replicate a number of key stylized facts, including short-run momentum and long-term mean reversion in house prices, persistence in construction, and highly volatile short-term construction and house price changes. The model uses fundamentals such as local income, population, and interest rates and allows for differences in supply elasticity and construction costs across metropolitan areas. It can explain mean reversion of prices, positive serial correlation of construction, and the volatility of both prices and quantities in many markets. However, the model cannot explain low-frequency price changes in volatile coastal markets and the short-term price momentum.

5. ALTERNATIVE EXPLANATIONS FOR EXCESS VOLATILITY OF HOUSE PRICES

Regardless of the type of model, almost all the empirical research cited above suggests that actual house prices are more volatile over the cycle than would be predicted by a model of

fundamentals. Below I consider a number of models that explain why house prices appear to deviate from fundamentals.

In examining this question, it is important to consider that a single model is unlikely to be able to explain the variety of house price experiences in markets across the United States and around the world. For example, Favilukis et al. (2010) point to time-varying risk, down-payment constraints, and mortgage rates to help explain the recent boom/bust cycle, but as **Figure 2** demonstrates, house price changes varied enormously across markets within the United States, a fact that would be hard to explain with their model alone. Global house prices also exhibited cyclical variation, even in markets in which down-payment constraints did not appear to move appreciably in the past decade (e.g., Spain). Finally, explanations for the extreme boom/bust cycles in markets without previous cycles (e.g., Las Vegas and Phoenix as in **Figure 2*c***) are likely to be different than explanations for markets in which exaggerated cycles have been more common (e.g., coastal markets as in **Figure 2*a***).

5.1. Cyclical Variation in Search

Early research on housing markets noted that cyclical variation in sales volume is strongly positively correlated with house price changes. Markets with growing house prices also have increases in sales volume and vice versa (see Case 2008 for a summary of facts and recent papers). This cyclical variation in sales volume and prices, which has also been documented in stock markets, does not appear to be related solely to differences in buyers' and sellers' desire to trade in booms versus busts.

This procyclical behavior of housing sales and prices is similar to the pattern for employment and wages (see also Arnott 1989 and Lazaer 2010 as other examples of search models applied to housing that generate cyclical behavior of inventories and prices). Wheaton (1990) develops an early example of a housing-specific search model. In his model, owners move according to a stochastic process in which they become dissatisfied with their current home. Households must purchase a new home before moving from their existing home in order to have somewhere to live. Sellers accept an offer if it is sufficiently far above their reservation price, which is determined by individual preferences for a house and the expected net surplus received from continued search. In this model, vacancy rates are inversely correlated with prices.

It is possible to develop greater cycles in prices and trading volume through more variable shocks to search costs or mobility rates. As with most search models, a positive externality exists with the higher mobility rates or lower search costs. With higher mobility, there are more buyers and sellers, which allows better matches to take place and thus more transactions with a given search cost. Lower search costs generate greater entry by buyers and sellers, with a similar outcome.

5.2. Cyclical Variation in Sellers' Reservation Prices

Time on the market and the number of houses remaining on the market unsold grow rapidly in housing busts, suggesting that many sellers would prefer to sell at some price but are unable or unwilling to sell at current market prices. Although stickiness associated with search behavior might be part of the explanation, it is hard to understand why search costs vary so much over the cycle. One might also expect that shocks encouraging mobility

might be higher during an economic downturn, leading to exactly the opposite pattern that we normally see in which transactions rise in booms, not busts. Thus researchers have focused on possible reasons that sellers' reservation prices might adjust in a positively correlated way with house prices for reasons beyond search externalities.

Housing economists have long pointed to down-payment constraints as being a major factor in helping to explain the cyclical behavior of house prices. For example, Stein (1995) incorporates down payments into a simple model of trade in housing. In his model, some households who would otherwise prefer to sell choose not to do so in a bust because if they sell at a low price, they would not have enough money left over for a reasonable down payment on a new house of their desired size. With search, these discouraged sellers might choose to fish for a higher price, even recognizing that a probability of sale is relatively low if gains from moving are high enough. Stein shows that multiple equilibria are possible in which there are high prices and many housing transactions or low prices and few sales. Ortalo-Magne & Rady (1999, 2006) develop a life-cycle model, extending Stein's results to incorporate a more complex setting with additional implications, including the prediction that house prices should be more volatile for trade-up homes than starter homes.

Empirical evidence appears to strongly support the importance of down-payment constraints in contributing to the procyclical behavior of inventories and house prices. Genesove & Mayer (1997) obtain detailed data on property listings in the Boston condominium market, including list prices, time on the market, property attributes, and mortgage and previous purchase prices for all properties available for sale and selling prices for properties that sold. The authors show that sellers increase asking prices and have a longer time to sale when they have low or negative equity, but they also sell their houses for a higher price. The latter result is consistent with the fishing hypothesis in Stein's model and with the premise of most search models in which there is not a single market price for a house, but in which the selling price depends in part on the seller's reservation price.

Other authors posit that sellers may raise asking prices in a downturn not because they cannot afford to sell due to a high mortgage, but because sellers are averse to selling their houses at a nominal loss. Using the same data described above on Boston condominiums, Genesove & Mayer (2001) examine the impact of a high previous purchase price on selling behavior. Much like sellers with a high mortgage, the authors demonstrate that sellers facing a possible nominal loss set a higher asking price and have a longer expected time to sale. However, conditional on selling, owners facing a nominal loss receive a higher transaction price. When comparing the two effects, Genesove & Mayer (2001) show that loss aversion can explain much more of the cyclical variation in sales volume and time on the market than liquidity constraints. In more recent work, Engelhardt (2003) finds similar results for the empirical importance of loss aversion on mobility using a much broader data set from the National Longitudinal Survey of Youth, although he finds little impact of low housing equity on mobility.

Nonetheless, although such search behavior is likely an important factor in explaining the procyclical behavior of house prices and sales volume, it cannot explain the excess volatility of house prices over the cycle. In fact, the results in Genesove & Mayer (1997, 2001) suggest that sellers raise their reservation prices in a downturn when house prices are low, leading observed house prices to be higher than they otherwise would be if sellers were price takers. Goetzmann & Peng (2006) demonstrate this bias using repeat

sales data from Los Angeles. Thus countercyclical reservation prices lead to reduced volatility of prices over the cycle.

Other empirical research, however, supports the link between leverage and house price volatility. For example, Lamont & Stein (1999) show that cities with higher loan-to-value ratios exhibit a greater sensitivity of house price changes in response to income shocks. Mayer (1993) shows that high-priced homes are more volatile than low-priced properties. These findings are consistent with the importance of down-payment constraints demonstrated by Ortalo-Magne & Rady (1999), who show that the demand of trade-up buyers is more sensitive to house price shocks than the demand of first-time buyers because of the dependence of the down payment for a trade-up buyer on the sale price of her existing home. So when house prices rise, demand from trade-up buyers rises disproportionately, but willingness to pay falls rapidly when house prices decline.

6. CONCLUSION: LESSONS LEARNED AND TOPICS FOR FUTURE RESEARCH

The past 25 years have represented two periods of extreme movements in U.S. house prices. During the early and mid-1980s, house prices rose in many parts of the country. Starting in 1986, house prices plummeted first in Texas, next in New England in the late 1980s, and finally in California in the early 1990s. This episode spurred an initial body of research on housing bubbles that focused attention on the role of outsized expectations in excessive house price appreciation, with a resulting crash when the economy turned. By contrast, some economists pointed to alternative explanations for excess volatility, including liquidity constraints, search externalities, and zoning delays. Empirical work supports the role of all three factors in explaining at least some of the cyclical variation of house prices and inventories of homes for sale.

The more recent boom/bust housing cycle in the 2000s was much more stark, with catastrophic results for the U.S. economy and its financial system. Once again, coastal markets exhibited a strong cyclical pattern that was much stronger than most other parts of the country. However, there were also key differences between the recent boom/bust and its predecessor in the 1980s. The booms and busts in the 2000s occurred at the same time in many cities, rather than being spread out over a nearly seven-year period in the previous cycle. The correlated nature of the boom led some commentators to point to macro factors such as declining real interest rates and reduced lending standards as causes of the cycle. However, the incredible price increases and subsequent crashes in a few so-called sand markets such as Las Vegas, Phoenix, and Miami were truly unprecedented, defying decades of relatively stable house prices and unrestricted construction. Macro factors alone would have a hard time explaining the extremely variable pattern of house price appreciation across U.S. markets, although declining real interest rates can more easily explain the global increase in house prices from 2000 to 2005.

Despite the rich data and experience from these episodes, there is not a firm consensus about what caused the crisis, nor is there a methodology for diagnosing bubbles or a strategy on how to prevent them. For example, Gerardi et al. (2010) point out that few economists predicted the crash before it occurred. Almost surely multiple factors played a role. Although subprime lending cannot explain the global pattern of the crisis, it likely added fuel to the U.S. boom at the top of the cycle and surely contributed to the ferocity of the bust. Relaxed underwriting that led to low (nonexistent?) required down

payments surely allowed more buyers into the market than could responsibly purchase homes.

Even less progress has been made in determining the role of speculators in the crisis. Many critics in the popular press point to investors as fueling the bubble. However, data from subprime and alt-a loans suggest that investors represented a small proportion of total transactions (Mayer et al. 2009). Yet price determination in search models can be highly nonlinear, so even a small positive shock to demand can sometimes lead to a large price increase. Future research can examine where speculators might have purchased homes and, if investors truly fueled the boom, why speculators purchased homes in some markets much more so than others. Others have argued that a wider cross section of buyers and sellers got caught up in the crisis and that outsized expectations of house price appreciation led to the unprecedented boom. Fear of being left out might have added extra urgency for some buyers to purchase a home before prices rose even further. Once again, there is limited evidence on this view one way or another.

Without firm evidence about what causes bubbles, it is hard to develop policy to prevent future housing bubbles. Some have argued that the Federal Reserve should tighten monetary policy when national housing bubbles begin to appear (although such prescriptions would not address the rolling regional cycles of the 1980s). Others suggest that the government should tighten bank lending standards or even apply minimum down-payment constraints for all housing transactions. Even ignoring the challenges in enforcing a firm loan-to-value limit, global evidence suggests that such policies still face some limitations. Spanish banks never really loosened lending standards during their boom, yet prices still appeared to rise faster than fundamentals. Recent evidence from China shows that even tightening down-payment requirements does not necessarily halt house price appreciation. Looking outside housing, leverage likely did not play a key role in the Internet bubble.

With many unanswered questions, there is much room for future research. Maybe one day we will find a way to help diagnose housing bubbles before they take off and to protect the economy and the financial system from the costs of excessive risk and high leverage.

DISCLOSURE STATEMENT

The author is not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review.

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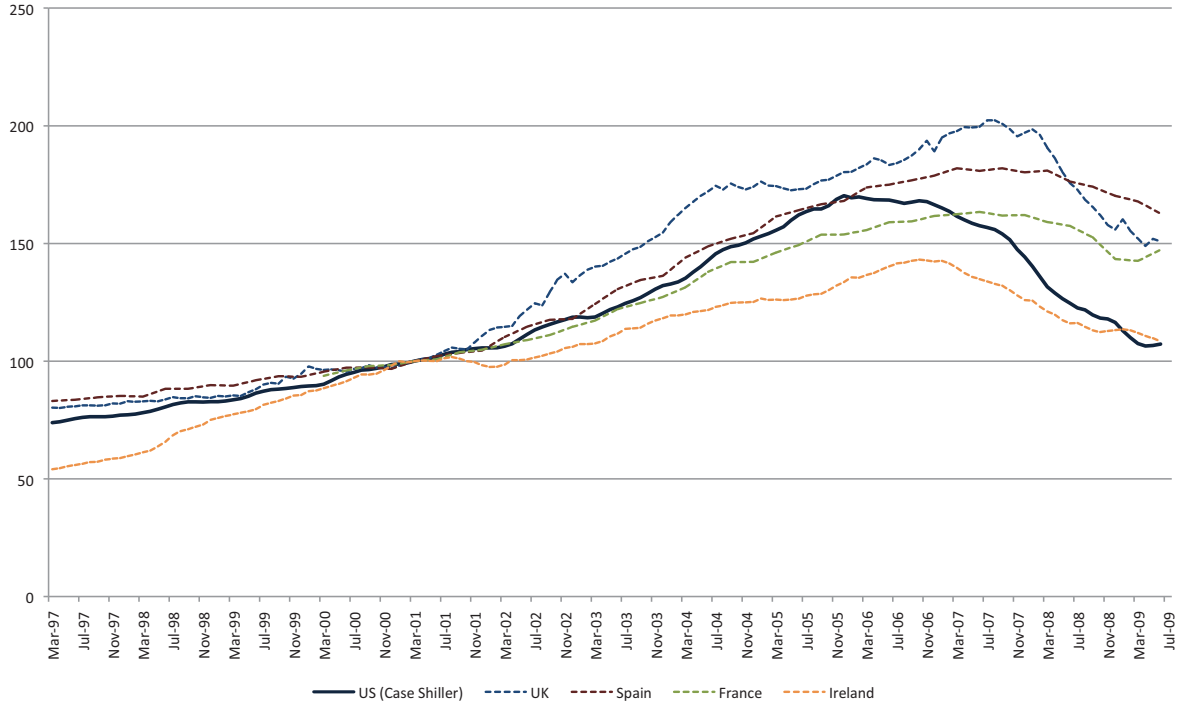
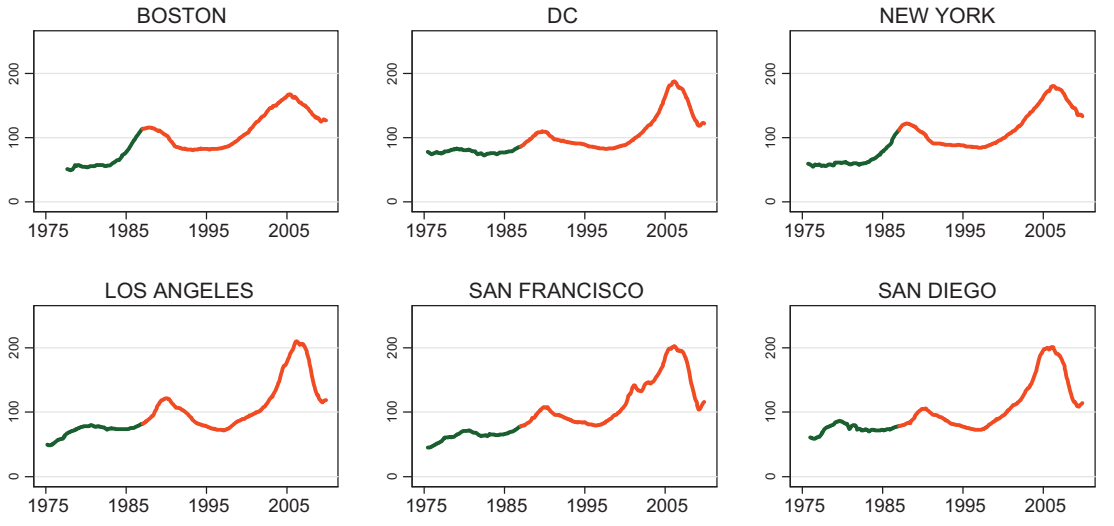


Figure 1

Real house prices in the United States and selected European countries.

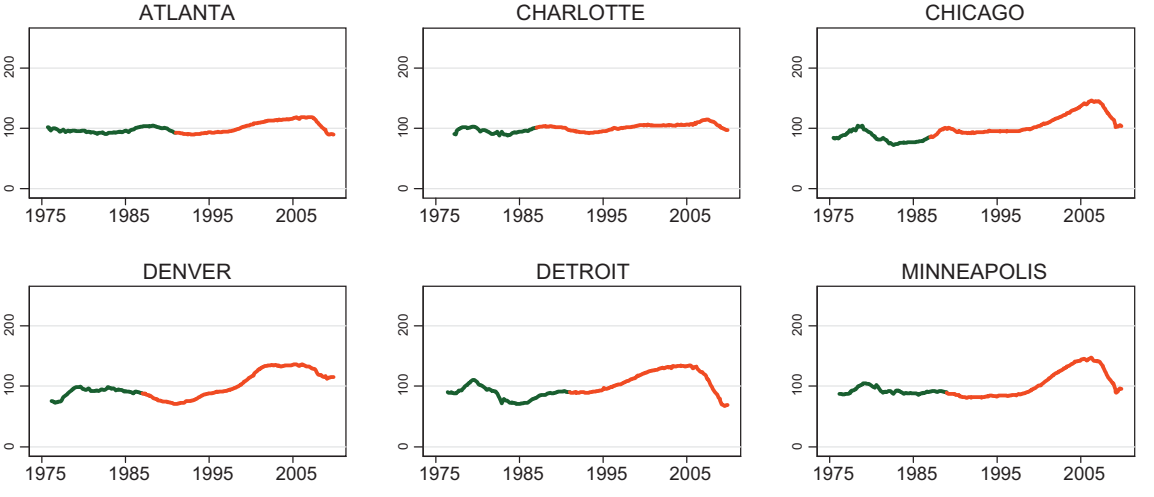
a

House prices in cyclical markets



b

House prices in steady markets



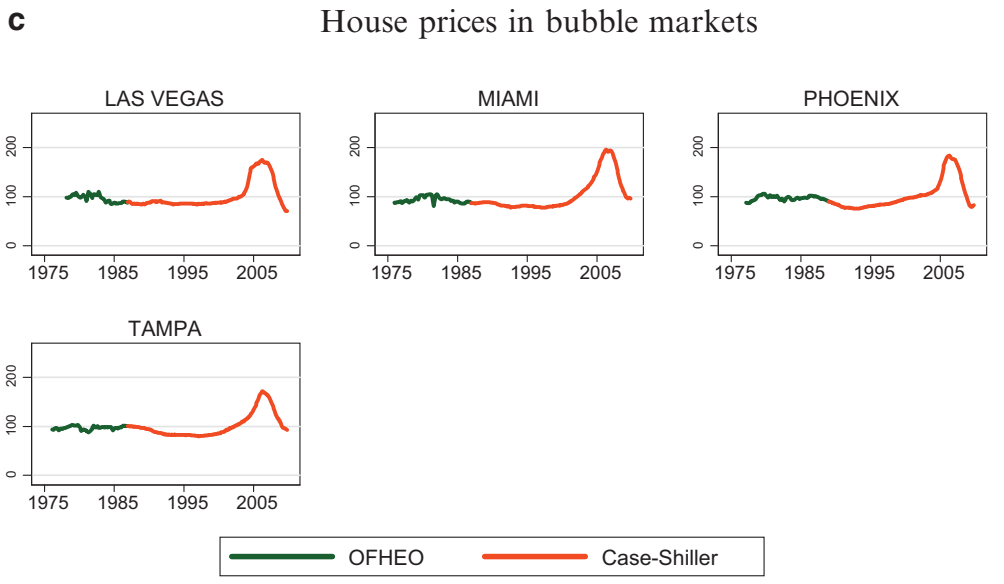


Figure 2

(*a*) House prices in cyclical markets, (b) in steady markets, and (c) in bubble markets. Data taken from OFHEO, Case-Shiller Index, and BLS. OFHEO Index current as of quarter 3 2009. Case-Shiller Index current as of November 2009 Real Home Price Index.

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