

Synopses of Selected Research on Housing, Mortgages, and Foreclosures
Homeownership and Mortgage Initiatives, Research Subcommittee¹
September 1, 2008

Statement of Purpose

The contributions in this document are synopses of key findings from research and Federal Reserve System policy analysis on selected topics relating to housing, mortgage loan performance, and foreclosures. This document was prepared as part of the Federal Reserve System's Homeownership and Mortgage Initiatives.² A goal of the project is to leverage the knowledge, expertise, and national reach of the Federal Reserve System to develop responses to the sharp rise of mortgage delinquencies and foreclosures. More specifically, the non-technical summaries of selected research and analysis in this document have been prepared to support the Federal Reserve System's efforts to raise awareness and understanding of the problems in mortgage and housing markets.

Organization of Document

One set of contributions in this document provides overviews of issues related to housing. These include an analysis of the historical dynamics of the behavior of house prices; an assessment of the behavior of house prices during the recent boom and slump; an examination of the rise in the homeownership rate; and a review of the evidence regarding the effects of housing wealth on consumer spending. Other contributions in this document deal with the performance of the subprime mortgage market. In this set, one contribution provides evidence showing that there was a steady deterioration in credit quality of mortgage loans in recent years; another gives us insights into the profiles of markets with concentrations of subprime lending; and a third discusses the evidence regarding the drivers of mortgage delinquencies and foreclosures before and during the recent meltdown in the subprime mortgage market. Finally, two contributions focus on issues related to foreclosures. One piece reviews the options for loan workouts and reviews the evidence on the efficacy of efforts to reduce preventable foreclosures. A second contribution assesses the evidence relating to the spillover effects from foreclosures.

¹ Chair: Ned Prescott (Federal Reserve Bank of Richmond). Members: Kelly Edmiston (Federal Reserve Bank of Kansas City), Fred Furlong (Federal Reserve Bank of San Francisco), Erica Groshen (Federal Reserve Bank of New York), and Nellie Liang (Board of Governors of the Federal Reserve System).

² The project was authorized by the Conference of Presidents of the Federal Reserve System.

Table of content
Synopses of Selected Research on Housing, Mortgages, and Foreclosures

House Price Dynamics	Pages 3-15
Research Findings on House Price Fundamentals	Pages 16-32
Recent Changes in the Homeownership Rate	Pages 33-41
Housing Wealth and Consumption	Pages 42-52
Changes in Mortgage Underwriting Standards	Pages 53-57
Neighborhood Profiles of Subprime Mortgage Originations	Pages 58-60
Drivers of Mortgage Delinquencies and Foreclosures	Pages 61-71
The Efficacy of Mortgage Loan Workouts	Pages 72-83
The Spillover Effects of Foreclosures	Pages 84-90

Homeownership and Mortgage Initiatives
March 28, 2008
James A. Wilcox
University of California, Berkeley
Visiting Scholar, Federal Reserve Bank of San Francisco

House Price Dynamics

Introduction

Over recent decades, house prices in the U.S. (and in many other countries) have exhibited periods in which inflation-adjusted (or, real) house prices rose for several consecutive years, followed then by several years of declining real house prices. For 17 industrialized countries, Tsatsaronis and Zhu (2004) showed that, between 1970 and 2003, real house prices went through nearly two full cycles of long sequences of price rises followed by sequences of price declines.¹

Empirical studies of house price dynamics attribute these cycles to momentum and reversion. Momentum refers to the tendency for house prices to rise further once they start to rise and to fall once they have started falling. Momentum of this sort may operate independently of or simultaneously with price changes that are driven by changes in the longer-term, more fundamental determinants of house prices. Reversion refers to the tendency of momentum-driven, shorter-term deviations of house prices to eventually “correct” in that they revert toward their longer-term trend or fundamentals-based values.

House Price Data

Empirical studies of house price dynamics often use panel data, which consists of house prices for different jurisdictions (cities, metropolitan statistical areas, states, or countries) over some common period of time. Different studies attempt to explain (and sometimes attempt to forecast) different measures of house prices: market (or nominal) or real house prices, percentage changes in nominal or real house prices, house price-to-income ratios, and so on. The overall perspectives that emerge from these studies depend little on which house price measure was used.

¹ Tsatsaronis, Kostas and Haibin Zhu. 2004. “What Drives Housing Price Dynamics: Cross-country Evidence.” *BIS Quarterly Review* March 65-78.

Figure 1 plots annual data for 1950-2007 for the national average of “constant-quality” sales (or nominal) prices of houses. As they do for any price index, the agencies that produce indexes of house prices try to “compare apples with apples.” The agencies in various ways attempt to measure what happens to the prices of a “constant quality” house, by adjusting sales prices for the number of bedrooms, square footage, presence of a swimming pool, and so on. Figure 1 shows that house prices rose by about the same amount that the CPI rose until the late 1990s. Then, they rose much faster.

Figure 2 shows the same nominal house prices after dividing by the values of the CPI to produce data for the “real” price of houses. Figure 2 also shows of course that real house prices fluctuated somewhat until the late 1990s, but rose by unprecedented amounts to unprecedented levels by the middle of the 2000s. Those who felt that there was a “bubble” in house prices pointed to data like that shown in Figure 2.

Figure 3 plots the percentage changes in the nominal and real house prices from Figures 1 and 2. Figure 3 shows why many people, up until recently, might have thought that nominal house prices (at least their national averages) do not fall: The dotted line virtually never dipped below zero percent. But, Figure 3 also shows that real house prices often fell and fell by sizeable percentages. We see negative growth of real house prices around the recessions of the middle of the 1970s, the early 1980s, and the early 1990s. Real house prices also fell in 2007.

One reason that nominal house prices didn’t fall in earlier years was higher inflation. When inflation was higher, as it was from the middle of the 1960s through the middle of the 1990s, the decline in real prices that was warranted by economic conditions did not require an actual decline in (nominal or sales) prices. Instead, for example, the sales prices of houses increased by small percentages in the early 1990s, when the economy was weak. Given that general price inflation was then about 3 percent, the real price of house then declined for several years in a row. In the current circumstance, hypothetically, if conditions warrant real house prices falling by 15 percent and if the inflation rate were, say, 2 percent, then the sales prices of houses would fall by 13 percent. A reading of -13 percent for the dotted line for the percentage change in nominal house prices in Figure 3 would also be unprecedented—but perhaps no more

unprecedented than the record percentage price increases during the middle of the 2000s that we see in Figure 3.

Figure 3 also shows the momentum in real and nominal house prices. When the percentage change in real house prices rose to about 5 percent in the middle of the 1970s, for example, it continued around that rate of increase for about 4 years. The large percentage changes in real house prices in the 2000s lasted for more than a half dozen years. Similarly, around the recessions of the early 1980s, real house prices declined for several years in a row. Below we will provide some estimates of how large the momentum-like effects in house prices have been historically.

Fundamentals

To explain house prices over time, typically studies have examined a number of variables to serve as sensible proxies for the “fundamental” supply and demand forces that might contribute to longer-term trends and shorter-term fluctuations in house prices. In various studies, a wide range of variables have been found to be useful in explaining house prices: Interest rates, real income per capita or its growth rate, GDP growth, demographic measures (such as the age composition or growth rate of total population), job growth, the unemployment rate, the growth rate of inflation-adjusted bank credit, consumer price inflation, construction costs, zoning restrictions, and housing starts.² A number of different measures of interest rates have been used: Nominal and real, short- and long-term, overall and mortgage rates.

² Case, Karl E. 1986. “The Market for Single-Family Homes in the Boston Area.” *New England Economic Review* May/June: 38-48.

Case, Karl E. and Robert J. Shiller. 1990. “Forecasting Prices and Excess Returns in the Housing Market.” *American Real Estate and Urban Economics Association Journal* 18(3): 253-73.

Case and Shiller. 2003. “Is There a Bubble in the Housing Market?” *Brookings Papers on Economic Activity* 2: 299-342.

Englund, Peter and Yannis M. Ioannides. 1997. “House Price Dynamics: An International Empirical Perspective.” *Journal of Housing Economics* 6(2): 119-136.

Glaeser, Edward L., and Joseph Gyourko. 2002. “The Impact of Zoning on Housing Affordability.” Working Paper 8835. Cambridge, Mass.: National Bureau of Economic Research (March).

Malpezzi, Stephen. 1999. “A Simple Error Correction Model of House Prices.” *Journal of Housing Economics* 8(1): 27-82.

Evidence of Momentum

At the same time, however, studies also often reported that fundamentals alone are rather poor predictors of shorter-term house price movements.³ For instance, Case (1986) found, based on ten years of data for ten, large cities, that fundamentals predicted a 15 percent house price increase for Boston, when prices actually climbed by 140 percent.

Instead, shorter-term house prices are often better predicted by recent, past movements than they are by fundamentals or deviation from fundamentals. In a well-known paper, Case and Shiller (1989) showed that a change in real home prices tended to be followed by a further house price change in the same direction and that the further change was about $\frac{1}{4}$ - $\frac{1}{2}$ as large as the preceding change.⁴

This pattern has been validated repeatedly. In a study of real house prices in 15 OECD countries, Englund and Ioannides (1997) found a similar follow-on effect, as measured by the first-order autocorrelation coefficient, of about 0.45.

Tables 1 and 2 in effect show estimates of extent of momentum in real and nominal house prices nationally (for samples beginning either in 1915 or in 2007), for 4 selected states, and for 4 selected cities. Table 1 shows that, based on OFHEO's, national-average, real house prices for 1977-2007, the effect of the current year's house price growth was to raise the next year's house price growth by 0.61. Table 2 shows that, based on nominal house price growth, an additional percentage point of house price growth in the current year was to raise the next year's house price growth by 0.68. Thus, for every extra percent that real house prices rose nationally, these results suggest that the percentage increase the following year would be 0.61 percent and thus that prices would rise another 0.61 percent.

Columns 8-10 show the actual 2007 value for the percentage change in real house prices and the forecasts based on the estimates in Tables 1 and 2 for each jurisdiction. For example, the 10 percent real house price decline for California in 2007, based on the

³ Kodrzycki, Yolanda and Nelson Gerew. 2006. "Using State and Metropolitan Area House Price Cycles to Interpret the U.S. Housing Market." Federal Reserve Bank of Boston *Public Policy Briefs* 06-1.

⁴ Case and Shiller. 1989. "The Efficiency of the Market for Single-Family Homes." *American Economic Review* 79(1): 125-37.

estimated momentum pattern given in columns 2 and 3, suggests that real house prices would fall 6 percent further this year and fall another 4 percent in 2009.

Reasons for Momentum and Reversion

Two broad explanations are most commonly given for why price changes in the current year, for example, might partially add on to price changes in the next year. One is supply-based and the other is information-based (Capozza et al. 2002).⁵ Tsatsaronis and Zhu (2004) contend that various factors may affect the long-term supply, demand, quantities, and prices in housing markets: Levels and growth of income and population, whether the tax system favors home ownership over other forms of wealth accumulation, long-term averages of interest rates, the availability and cost of land, and the cost of construction and improving the existing housing stock. In the shorter-term, however, the growth of the housing stock might be constrained, for example, by the length of planning and construction phases of homebuilding, inertia in land planning schemes, and other factors. In addition, shorter-term shifts in housing demand can be affected by the availability, cost, and flexibility of debt financing and by returns available to households on their other assets.

Krainer (2003) notes that “real estate markets do not clear immediately after a shock to the economy.⁶ It takes time for buyers and sellers of existing houses to search for each other. And, it takes time for developers to bring new houses to market after an increase in demand and to work off inventories when demand weakens.” As a consequence, in the shorter term, house prices can adjust gradually to changes in fundamentals (such as interest rates, population growth, job growth, and so on). Given the practical constraints on the stock of houses to adjust quickly, house prices also may tend to even “over-adjust,” or overshoot, somewhat and then retreat as increased construction catches up with the prior increases in demand.

Case and Shiller (1989, 2003) offer an information-based explanation for momentum and reversion of house prices. They argue that home buyers notice the shorter-term persistence of house price changes and, based on that persistence, form their

⁵ Capozza, Dennis R., Patric H. Hendershott, Charlotte Mack, and Christopher J. Mayer. 2002. “Determinants of Real House Dynamics.” NBER Working Paper No. 9262.

⁶ Krainer, John. 2003. “House Price Bubbles.” *FRBSF Economic Letter* 203-6.

expectations of future changes in house prices. Witnessing sustained price increases, homebuyers may come to believe that “a home that they would normally consider too expensive for them is now an acceptable purchase because they will be compensated by significant further price increases.” These processes, then, can temporarily become self-sustaining, as the extra demand further drives house prices up.

Over the longer term, the fundamental determinants of demand and supply tend to re-assert themselves. Those even higher house prices, however, spur additional construction of new houses. The additional supply responds not only to the gap between the existing supply of houses and the originally desired number of houses, but to the even larger gap produced by the momentum-based extra demand.

Another reason that momentum is reversed, and prices revert, is that momentum can price first-time buyers out of the market. In addition, high house prices dissuade businesses from locating in those areas. As they re-locate, so, too, do their employees. Families with children and retirees may also move. In Case and Shiller’s description “prices cannot go up rapidly forever, and when people perceive that prices have stopped going up, this support for their acceptance of high home prices could break down. Prices could then fall.” (Case and Shiller 2003). Thus, house prices may have momentum for several years, followed by reversion.

Evidence of Reversion

Simple plots of real house price data over several years often suggest such reversion. In addition, several studies found statistical validation for reversion in real house prices. Cho (1996) observed regarding momentum and reversion: “The consensus in this literature is that both house prices and excess returns exhibit systematic short-run and long-run behavior: a positive serial correlation in the short run a negative serial correlation, or mean reversion, in the long run.”⁷ Moreover, in a study of 15 OECD countries Englund and Ioannides (1997) report house prices reverted over longer horizons, for example of about five years. Similarly, Kodrzycki and Gerew (2006) concluded that house prices reverted, in that “house sales volumes, new home

⁷ Cho, Man. 1996. “House Price Dynamics: A Survey of Theoretical and Empirical Issues.” *Journal of Housing Research* 7(2): 145-172.

construction, and mortgage delinquencies have provided leading indicators when a statewide house price boom was nearing an end.” They also examine “the empirical relationship between metropolitan-area house prices and measures of their deviation from justifiable values... (they find that) the probability of a house price decline in metropolitan areas has depended on both the extent to which housing was overvalued two to three years earlier and on changes in market fundamentals.”

In a more technical vein, Malpezzi (1999) found, based on a data sample that covered a number of metropolitan areas for a number years, that house prices, though sometimes straying quite a way, tended to revert back toward levels justified by metro-area incomes, i.e., house prices tended to revert. Thus, his results suggest that, over long-enough periods of time, house prices are indeed tethered to economic fundamentals, such as income and interest rates.

In contrast, Gallin (2003) found that house prices and income are not cointegrated nationally or for metro areas.⁸ He argues that the gap between house prices and income has not been a useful predictor of future house price changes. However, Gallin, unavoidably in 2003, used data that did include much of the recent (and unprecedented) upswing in U.S. house prices, but did not include the current downswing.

Probabilities

The Kodrzycki and Gerew (2006) article is also noteworthy in that it provides a way to forecast the probabilities of house price declines for individual cities. The mortgage insurance company PMI has long posted on its website the estimated probabilities of nominal house prices declines over the next eight quarters for each of many dozens of metropolitan areas. Among the factors that PMI includes in its forecasts are recent past house price increases and “affordability.” Presumably the role of recent past increases is to allow for momentum; presumably reduced affordability (due to higher house prices or interest rates relative to incomes) signals that prices are more likely to decline, thereby incorporating a role for reversion in the PMI forecasts.

⁸ Gallin, Joshua. 2003. “The Long-run Relationship between House Prices and Income: Evidence from Local Housing Markets.” Federal Reserve System *Finance and Economics Discussion Series* 2003-17.

Local Effects on House Prices

Perhaps not surprisingly, house price dynamics differ somewhat across local markets. Capozza et al. (2002) conclude that both momentum (or positive serial correlation) and reversion vary by city. They “explore the dynamics of real house prices by estimating serial correlation and mean reversion coefficients from a panel data set of 62 metro areas from 1979-1995... Serial correlation is higher in metro areas with higher real income, population growth, and real construction costs. Mean reversion is greater in large metro areas and faster-growing cities with lower construction costs. Empirically, substantial overshooting of prices can occur in high real construction costs areas, which have high serial correlation and low mean reversion, such as the coastal cities of Boston, New York, San Francisco, Los Angeles, and San Diego.” Similarly, McCarthy and Peach (2004) concluded that “in states along the east and west coast – an inelastic supply of housing has made home prices particularly sensitive to changes in demand.”⁹

Case and Shiller (2003) found that, during their sample period, in the vast majority of U.S. states, income alone explains almost all price changes. However, in about 8 other states, it did not. In those states, (California, Massachusetts, etc.) the ratio of house prices to income displayed momentum, with long inertial upswings followed by long inertial downswings, with swings typically lasting several years. In addition, Kodrzycki and Gerew (2006) note that “lead-lag relationships have varied considerably across states and time periods, indicating that turning points in house prices are difficult to predict precisely.”

Bubbles and Caveats

Academics and laypeople often have rather different ideas about what constitutes a bubble. For academics, house prices changes, regardless of how persistent, that reflect changes in fundamentals or gradual adjustments of supply or demand do not connote bubbles. For example, declines in interest rates or increases in incomes might raise real house prices for several years consecutively, and by large amounts, without there being a

⁹ McCarthy, Jonathan and Richard W. Peach. 2004. “Are Home Prices the Next ‘Bubble.’” *FRBNY Economic Policy Review* December 1-17.

bubble in house prices. Thus, McCarthy and Peach (2004) and Himmelberg et al. (2005) argued that, at the time of their writing, higher house prices could be explained by higher incomes and lower interest rates and thus were not evidence of a house price bubble in the U.S.¹⁰ Nor would subsequent declines in house prices necessarily indicate that there had been a bubble. By contrast, laypeople might well regard persistent house price changes as suggesting a bubble, regardless of whether they were driven by fundamentals.

Beginning in 2007, it may be that house price bubbles are deflating in several important metropolitan housing markets. Though such a deflation may be a, or even the, major factor driving house prices during 2008 and 2009, the data used in prior studies, and for Tables 1 and 2 below, may contain no bubble of the magnitude hinted at by Figure 2. And, if so, then nor did any of the studies, or results in Tables 1 and 2, reflect how house prices typically behave during the popping of a bubble of that magnitude.

¹⁰ Himmelberg, Charles, Christopher Mayer, and Todd Sinai. 2005. "Assessing High House Prices: Bubbles, Fundamentals, and Misperceptions." *Federal Reserve Bank of New York Staff Reports* No. 218.

Figure 1
 U.S. nominal house prices and consumer price index (CPI)
 Annual data, both rebased 1950 = 100
 Nominal house prices: Case-Shiller 1950-74, OFHEO 1975-2007

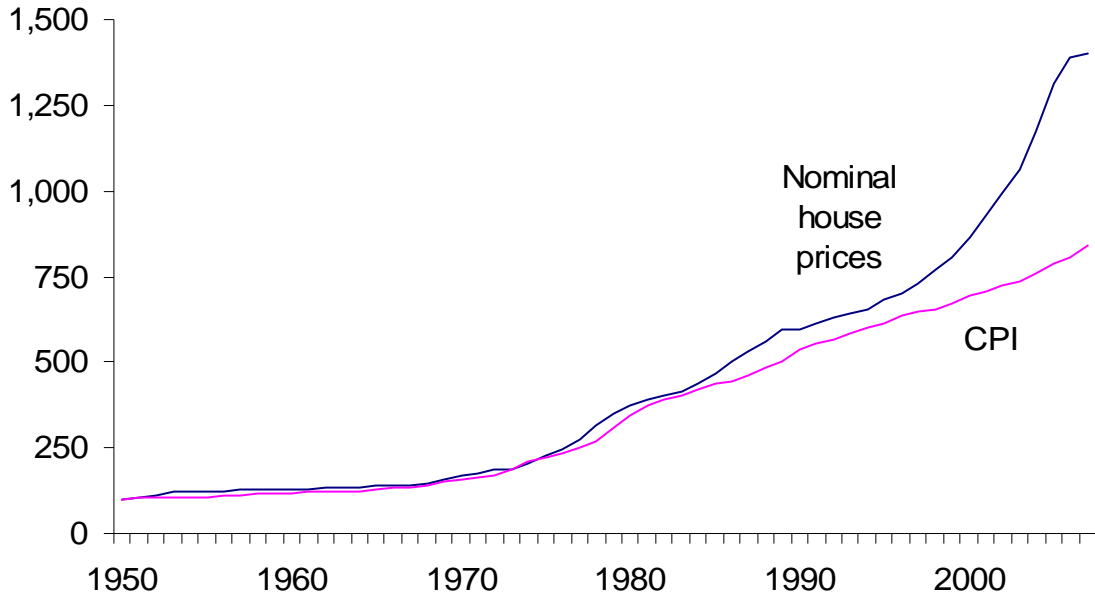


Figure 2
 U.S. real house prices, deflated using the CPI
 Annual data, rebased 1995 = 100
 Nominal house prices: Case-Shiller 1950-74, OFHEO 1975-2007

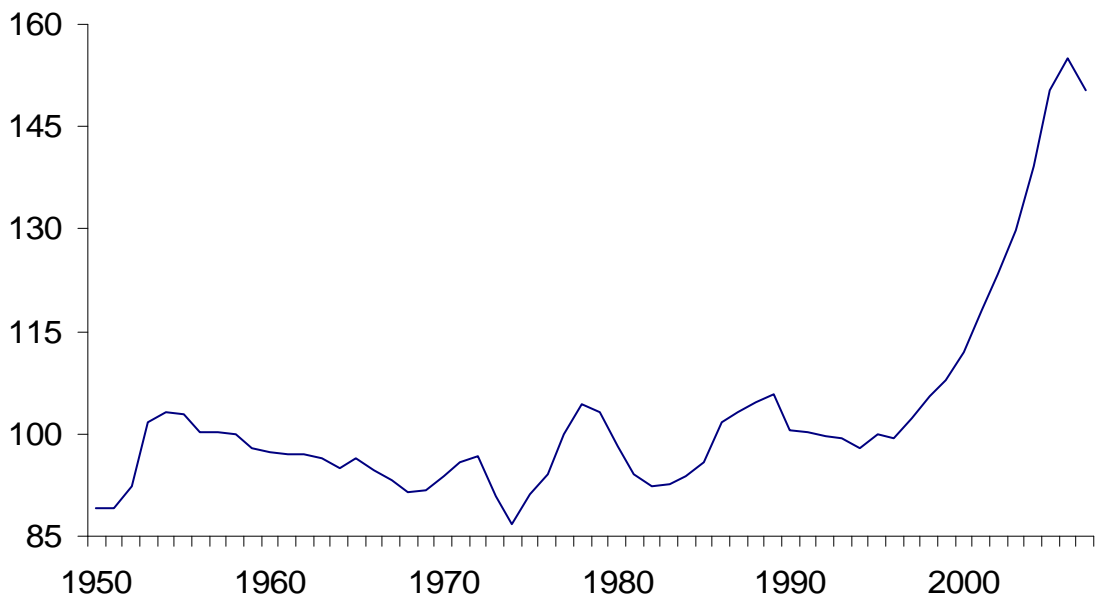


Figure 3
Percent change in nominal and real U.S. house prices
Annual data
Nominal house prices: Case-Shiller 1950-74, OFHEO 1975-2007

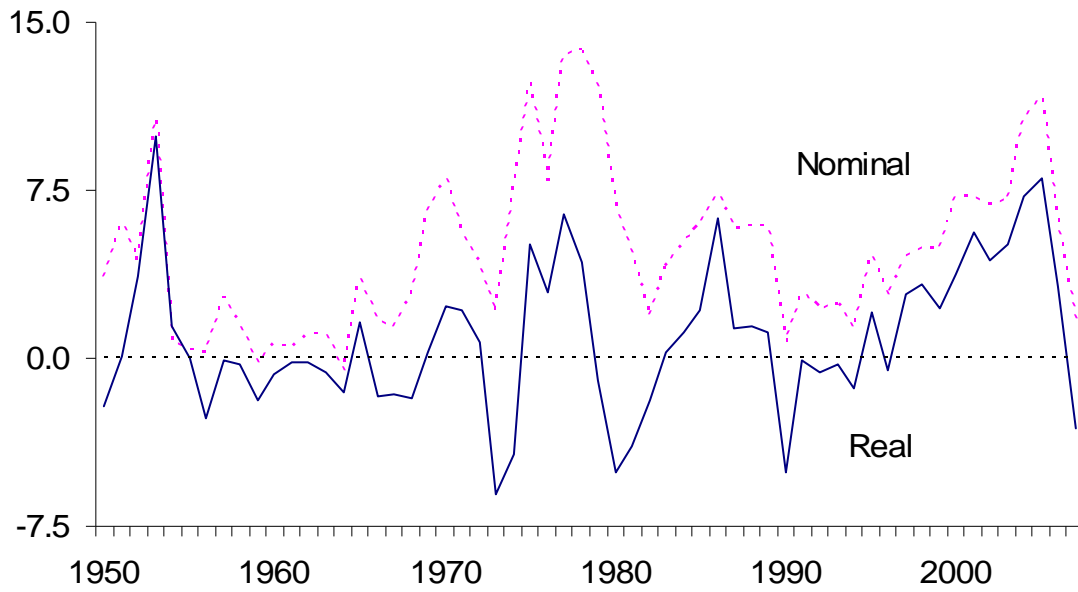


Table 1
Real House Prices

First order autoregressions for percent annual growth rate (Q4 to Q4) real house prices for selected sample periods and jurisdictions. In column 3, we present the coefficient for the first-order term and, in parenthesis, its t-statistic. House prices are from Case-Shiller 1915-1974 and OFHEO 1975-2007. Columns 6 – 10 include recent values and forecasts.

	Years (1)	Con- stant (2)	Mo- men- tum (3)	R ² (4)	F (5)	Most recent growth peak		Value in 2007 (8)	Forecast	
						Date (6)	Value (7)		2008 (9)	2009 (10)
U.S.	1915-2007	0.37	0.45 (4.75)	0.20	22.5	2005	8	-3	-1	0
	1977-2007	0.48	0.61 (4.05)	0.35	16.4				-1	0
Selected states										
California	1977-2007	0.63	0.69 (4.94)	0.46	24.4	2004	21	-10	-6	-4
Florida	1977-2007	0.70	0.63 (4.03)	0.36	16.3	2005	23	-8	-5	-2
Iowa	1977-2007	-0.05	0.36 2.13)	0.14	4.6	2005	2	-1	-1	0
N. Carolina	1977-2007	0.52	0.50 (3.13)	0.25	9.8	2006	5	+1	+1	+1
Selected cities										
Atlanta	1978-2007	0.86	0.25 (1.46)	0.07	2.1	2005	2	-1	0	+1
Los Angeles	1977-2007	0.74	0.71 (5.39)	0.50	29.1	2004	23	-7	-4	-2
New York	1978-2007	1.15	0.73 (5.56)	0.52	30.9	2005	12	-3	-1	0
St. Louis	1977-2007	0.28	0.60 (4.09)	0.37	16.8	2003	4	-2	-1	0

Table 2
Nominal House Prices

First order autoregressions for percent annual growth rate (Q4 to Q4) nominal house prices for selected sample periods and jurisdictions. In column 3, we present the coefficient for the first-order term and, in parenthesis, its t-statistic. House prices are from Case-Shiller 1915-1974 and OFHEO 1975-2007. Columns 6 – 10 include recent values and forecasts.

	Years (1)	C coeff. (2)	Mo- men- tum (3)	R ² (4)	F (5)	Most recent growth peak		Value in 2007 (8)	Forecast	
						Date (6)	Value (7)		2008 (9)	2009 (10)
U.S.	1915-2007	1.70	0.58 (6.79)	0.34	46.1	2005	12	+1	+2	+3
	1977-2007	1.63	0.68 (5.29)	0.48	28.0				+2	+3
Selected states										
California	1977-2007	1.70	0.72 (5.36)	0.50	28.7	2004	25	-7	-3	-1
Florida	1977-2007	2.11	0.65 (4.30)	0.39	18.5	2005	28	-5	-1	+1
Iowa	1977-2007	3.07	0.27 (1.50)	0.07	2.3	2005	6	+3	+4	+4
N. Carolina	1977-2007	2.64	0.50 (3.12)	0.25	9.7	2006	8	+5	+5	+5
Selected cities										
Atlanta	1978-2007	3.13	0.41 (2.46)	0.18	6.1	2005	5	+2	+4	+5
Los Angeles	1977-2007	1.70	0.74 (5.89)	0.55	34.7	2004	27	-3	-1	+1
New York	1978-2007	2.32	0.72 (5.38)	0.51	28.9	2005	16	+1	+3	+4
St. Louis	1977-2007	1.70	0.65 (4.70)	0.43	22.1	2005	8	+3	+3	+4

Research Findings on House Prices and Fundamentals

Introduction

The housing boom is over. The purchase-only index from the Office of Federal Housing Enterprise Oversight (OFHEO) indicates that nominal house prices increased at an average rate of 6½ percent per year from the middle of 1997 to the middle of 2007, but fell at an annual rate of 3¼ percent since then (upper panel of exhibit 1). A similar measure published by S&P (commonly known as the Case-Shiller index) indicates that the level of nominal prices peaked in the middle of 2006 and, by the end of 2007, had fallen a cumulative 10 percent. Although the boom-and-bust cycle for house prices has been evident in many parts of the country, its extent has varied considerably from place to place. Cities such as Phoenix and Las Vegas experienced the most dizzying gains in home prices and have already seen wrenching losses (for those who bought near the peak) while other cities are in the midst of more mild cycles (exhibits 2a and 2b). The recent weakness in house prices and construction has been accompanied by a sharp pull-back in homebuilding and mortgage and construction lending.

For much of the past decade, analysts debated the existence of a “bubble” in housing markets. Semantic disagreements aside, the debate is over: Most now agree that housing became overvalued in a wide range of markets and that a correction is underway. However, that does not mean that economists fully understand what drove the rapid run-up in house prices or can predict with much confidence how much further prices may fall. The purpose of this note is to provide a brief description of the different ways many economists think about “fundamental” determinants of house prices, and to provide a few thoughts on the links between the credit and housing booms.

Fundamental Determinants of House Prices

Most housing-market analysts would agree that a list of fundamental determinants of house prices would include demand-side factors such as population, per-capita income, and household size and supply-side factors such as construction costs and zoning and other building restrictions. Indeed, limited supply of land (where people want to live)

and building restrictions are crucial reasons why demand matters so much (Davis and Heathcote, 2007; Davis and Palumbo, 2007; Glaeser, Gyourko, and Saks, forthcoming). For example, population would not be an important determinant of house prices if land were unlimited and metro areas could expand easily. In addition, one might add to the list of demand factors credit-market developments that reduce costs and expand access to mortgage loans (see below). Accurately measuring these factors and translating them into an estimate of “fundamental” house prices is difficult.

House Prices and Income

A common way to make the translation is to assert a stable long-run relationship between house prices and demand factors such as income, population, and interest rates, and then use regression analysis to estimate the fundamental price level. Deviations of actual prices from this fundamental level could then provide a measure of over or undervaluation at different points in time or in different housing markets. Some researchers then ask how quickly such “misvaluations” tend to be eliminated (Abraham and Hendershott 1996; Malpezzi 1999; Capozza *et al.* 2002; Meen 2002). This approach assumes that house prices and fundamentals are linked by a stable long-run relationship; they may drift apart temporarily, but their tendency is to return to their long-run equilibrium. Global Insight used this approach in its widely quoted report *House Prices in America* to argue that housing was overvalued in 21 metro areas at the end of last year, down from 58 metros in 2006. The argument in less technical terms is often given as “house prices cannot outpace incomes forever.”

As appealing as this statement may initially appear, there is no theoretical reason why it should be true, and the empirical evidence suggests that the econometric approach is indeed flawed. In particular, there is no law of nature that states that the *level* of house prices must be tied immutably to the *level* of, say, income. To provide one counterexample, Ortalo-Magne and Rady (2006) provide a theoretical model in which house prices may “overreact” to income because of credit constraints that most likely would change over time. Gallin (2006) used standard statistical techniques to show that

there is little empirical evidence for a long-run relationship among house prices and fundamentals such as income, population, and interest rates at the national level. In addition, he showed that more sophisticated and powerful tests for a panel of 95 U.S. cities also do not provide evidence that such a relationship holds.

These results do not mean that fundamentals do not affect house prices. But the results do suggest that this statistical approach likely provides a poor guide as to the “fundamental” level of house prices and the likely future path of actual prices. In other words, the idea that house prices will likely fall until they are better aligned with income may be misleading.

House Prices and Rents

An alternative approach for thinking about valuation in housing markets is to examine the relationship between house prices, interest rates, and rents. In this approach, the housing market is analyzed using ideas and methods that were developed to study the stock market: The ratio of prices to rents in the housing market is like the ratio of prices to dividends in the stock market. The analogy is not perfect. For instance, stocks provide a stream of dividends, which can be observed when they are paid, while houses provide a stream of housing services, which are never observed. Economists often argue that housing rents should provide a reasonable estimate of the value of housing services (controlling for differences in owner-occupied and rental homes). Campbell and Shiller (2001) showed that when stock prices have been high relative to dividends, future returns (essentially price changes) of stocks have been subdued. Seen this way, high house prices could be justified if current or expected future rents are high or if carrying costs (which include mortgage interest payments, net taxes, and depreciation) are low. But if prices appear unusually high relative to these factors, one might conclude that housing is overvalued.

Only a handful of papers deal directly with the question of how much the rent-price ratio helps predict future price changes in the housing market. Mankiw and Weil (1989) and

Case and Shiller (1990) looked at the forecasting value of the rent-price ratio in a time-series setting, but the available data were limited, and the results inconclusive. More recently, Himmelberg, Mayer, and Sinai (2005) used the rent-price ratio as a way of assessing if house prices appeared inexplicably high relative to a historical benchmark. Smith and Smith (2006) used the rent-price ratio to examine what kind of assumptions about future changes in rents were necessary to justify house prices in 2005. McCarthy and Peach (2004) examined the rent-price ratio for housing, but focused only on newly built homes. These studies argued that housing did not appear overvalued in 2004 and 2005.

Gallin (forthcoming) explicitly examined the time-series relationship among house prices, rents, and interest rates. He used both short-term regression techniques (standard error-correction models) and long-horizon regression models to examine how well the rent-price ratio predicts future changes in real rents and prices. Gallin's short-term results were too imprecise to make useful predictive statements about how "overvaluation" affected house price changes at a quarterly frequency. However, Gallin found that over four-year horizons, periods in which house prices are high relative to rents appear to be followed by periods in which real house-price growth is slower than usual. Gallin also found that the level of interest rates has historically had a surprisingly small effect on the level of house prices. Campbell *et al.* (2007) examined the behavior of the rent-price ratio in more detail. They showed how the rent-price ratio at each date can be split into three components: expectations of future rent growth, future interest rates, and future returns to housing in excess of the 10-year U.S. Treasury bond. This third component, which they called the housing premium, is simply the part of housing valuations that cannot be explained by "fundamentals." Campbell *et al.* showed that, as is the case for the stock and bond markets, a significant part of the volatility in the rent-price ratio can be explained in terms of volatility of the premium.

Because a low rent-price ratio has been a harbinger of sluggish price growth, one might be tempted to cite the low level of the rent-price ratio in 2005 and 2006 as a sign of an

“overvaluation” in the housing market (lower panel of exhibit 1). However, several important caveats argue against such a strong conclusion.

First, the data used by all researchers are imperfect. The greatest concern is that neither the rent data nor the house-price data accurately measure relevant rent and price changes; Crone, Nakamura, and Voith (2006), Davis, Lehnert, and Martin (forthcoming), Gallin (2006, forthcoming), and Rappaport (2007) all discuss the shortcomings of the available data. Second, all studies make simplifying assumptions that affect the results. For example, Campbell *et al.* (2007) ignore the role of transactions costs and assume that people’s forecasts about the future can be captured by a simple statistical model. Third, and perhaps most important, the rent-price ratio has not been a *precise* indicator of if, when, and by how much house prices will change direction. Indeed, the rent-price ratio was quite low in 2005, yet housing continued to appreciate. Just as the dividend-price ratio is an imperfect tool for forecasting stock prices, the rent-price ratio should be considered only a rough guide to future movements in house prices.

Explaining the Recent Run-up in House Prices

Economists cannot well explain the recent run-up in prices using basic macroeconomic data and models (Campbell *et al.*, 2007; Gallin, forthcoming; Shiller, 2007; Wheaton and Nechayev, 2007). However, many economists have been using new approaches to try to explain the recent boom. For example, Brunnermeier and Julliard (2006) argue that very low inflation rates can fuel house-price booms if low nominal interest rates fool people into believing that housing is cheaper than it actually is. Others have argued that “behavioral” or “social-psychological” explanations have played an important role in the recent boom; Shiller (2007) is a strong advocate of this view, Mayer and Sinai (2007) less so. For example, Shiller argues that a “boom psychology” can induce over-optimistic beliefs about house-prices that can be self-perpetuating, for a time.

In a related line of research, economists have begun to look at how financial innovations and the resultant expansion of mortgage credit may have affected house prices.

Dell’Ariccia, Igan, and Laeven (2008), Keys, Mukherjee, Seru, and Vig (2008), and Mian and Sufi (2007) all argue that increased securitization of mortgage loans has been associated with decreases in lending standards and a resultant expansion of mortgage credit. Indeed, lending to non-prime borrowers surged in recent years and some of the borrowers were not required to make significant down payments or document their incomes. In addition, Mian and Sufi found that the expansion of mortgage credit from 2001 to 2005 was linked to sharp increases in home prices in zip codes which had previously had high denial rates for mortgages. An obvious implication is that the recent sharp pullback in mortgage lending could well add to the bust in house prices.

News stories about increased mortgage securitization, the boom in sub-prime and “alt-A” mortgage lending, and other financial innovations are commonplace. An implication (stated or otherwise) is that the credit boom drove the housing boom. The early results from the relevant research do point to a causal link from mortgage credit to house prices. Furthermore, the peak in mortgage lending to prime borrowers occurred more than year before the peak in home sales, and mortgage lending to subprime and “alt-A” borrowers seems to have played a key role in boosting sales in 2005 (exhibit 3).

That said, economists are only just beginning to disentangle cause and effect in the housing and credit markets. Although easy lending likely fueled housing, rising house prices also fueled easy credit, and we probably cannot pin the entire housing boom or ongoing bust on the mortgage market. What is certain is that economists will be debating these key issues for a long time to come.

References

- Abraham, J. and Hendershott, P. 1996. "Bubbles in Metropolitan Housing Markets." *Journal of Housing Research*. 7: 191-207.
- Brunnermeier, M. and Julliard, C. 2006. "Money Illusion and Housing Frenzies." CEPR Discussion Papers: 6183
- Campbell, John Y. and Shiller, Robert J. 2001. "Valuation Ratios and the Long-Run Stock Market Outlook: An Update." NBER Working Paper W8221.
- Campbell, Sean D.; Davis, Morris A.; Gallin, Joshua; Martin, Robert F. 2006. "A Trend and Variance Decomposition of the Rent-Price Ratio in Housing Markets." Board of Governors of the Federal Reserve System (U.S.), Finance and Economics Discussion Series: 2006-29.
- Capozza, Dennis R.; Hendershott, Patric H.; Mack, Charlotte; and Mayer, Christopher J. 2002. "Determinants of Real House Price Dynamics." NBER Working Paper 9262.
- Case, Karl E. and Shiller, Robert J. 1990. "Forecasting Prices and Excess Returns in the Housing Market." *AREUEA Journal*. 18(3):252-273.
- Crone, Theodore M.; Nakamura, Leonard I.; and Voith, Richard P. 2004. "Hedonic estimates of the cost of housing services: rental and owner-occupied units." Federal Reserve Bank of Philadelphia, Working Papers: 04-22.
- Crone, Theodore M.; Nakamura, Leonard I.; and Voith, Richard P. 2006. "The CPI for rents: a case of understated inflation." Federal Reserve Bank of Philadelphia, Working Papers: 06-7.
- Morris A. and Heathcote, Jonathan. 2005. "Housing and the Business Cycle Davis." *International Economic Review*. v. 46, iss. 3, pp. 751-84.
- Davis, Morris A. and Palumbo, Michael G. 2008. "The Price of Residential Land in Large U.S. Cities." *Journal of Urban Economics* (63), p. 352-384.
- Davis, Morris A.; Lehnert, Andreas; and Robert F. Martin. 2008. "The Rent-Price Ratio for the Aggregate Stock of Owner-Occupied Housing." *Review of Income and Wealth*, forthcoming.
- Dell'Araccia, Giovanni; Igan, Deniz; and Laeven, Luc. 2008. "Credit Booms and Lending Standards: Evidence from the Subprime Mortgage Market." Working paper.

- Gallin, Joshua. 2006. "The Long-Run Relationship between House Prices and Income: Evidence from Local Housing Markets Gallin." *Real Estate Economics*. Fall 2006, v. 34, iss. 3, pp. 417-38.
- Gallin. Forthcoming. "The long-run relationship between house prices and rents." *Real Estate Economics*.
- Glaeser, Edward L.; Gyourko, Joseph; and Saks, Raven E.. 2005. "Why Have Housing Prices Gone Up?" *American Economic Review*. v. 95, iss. 2, pp. 329-33.
- GlobalInsight. *House Prices in America*. 2007:4.
<http://www.globalinsight.com/Highlight/HighlightDetail2350.htm>
- Himmelberg, Charles ; Mayer, Christopher; and Sinai Todd. 2005. "Assessing high house prices: bubbles, fundamentals and misperceptions." *Journal of Economic Perspectives*. 19:67-92.
- Keys, Benjamin J.; Mukherjee, Tanmoy; Seru, Amit; and Vig, Vikrant. 2008. "Securitization and Screening: Evidence from Subprime Mortgage Backed Securities." Working paper.
- Malpezzi, S. 1999. "A Simple Error Correction Model of House Prices." *Journal of Housing Economics*. 8: 27-62.
- Mankiw, N. Gregory and David N. Weil. 1989. "The baby boom, the baby bust, and the housing market." *Regional Science and Urban Economics*. 19, 235-258.
- Mayer, Christopher and Sinai, Todd. 2007. "Housing and Behavioral Finance." Working paper.
- McCarthy, Jonathan and Peach, Richard W. 2004. "Are Home Prices the Next 'Bubble'?" Federal Reserve Bank of New York Economic Policy Review, December 2004, v. 10, iss. 3, pp. 1-17.
- Meen, G. 2002. "The Time-Series Behavior of House Prices: A Transatlantic Divide?" *Journal of Housing Economics*. 11: 1-23.
- Mian, Atif and Sufi, Amir. 2007. "The Consequences of Mortgage Credit Expansion: Evidence from the 2007 Mortgage Default Crisis." Working paper.
- Ortalo-Magne, Francois and Rady, Sven. 2006. "Housing Market Dynamics: On the Contribution of Income Shocks and Credit Constraints." *Review of Economic Studies*. v. 73, iss. 2, pp. 459-85.

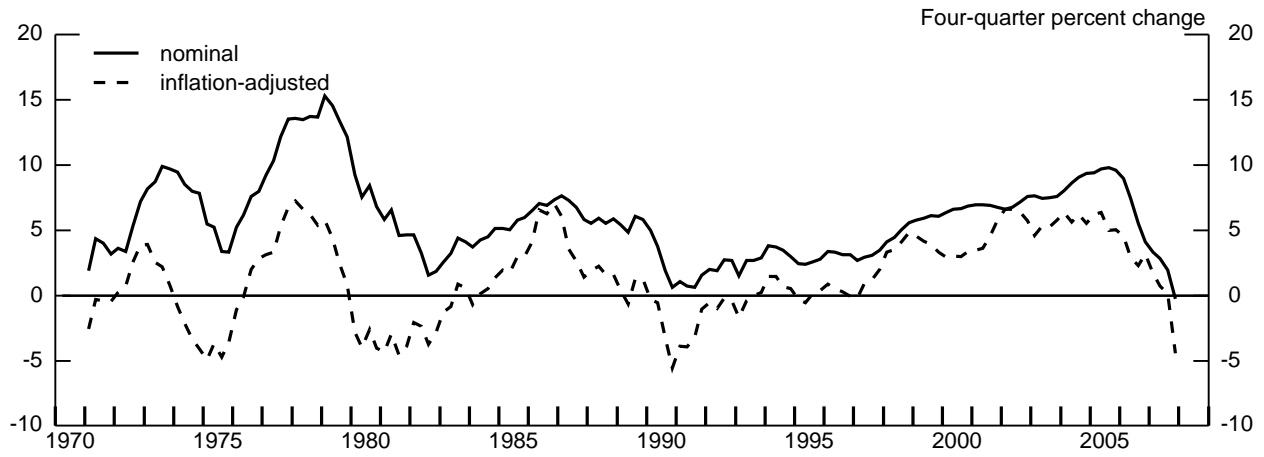
Rappaport, Jordan. 2007. "Comparing Aggregate Housing Price Measures." *Business Economics*. v. 42, iss. 4, pp. 55-65.

Shiller. 2007. "Understanding Recent Trends in House Prices and Home Ownership." National Bureau of Economic Research, Inc, NBER Working Papers: 13553.

Smith, Margaret Hwang and Smith, Gary. 2006. "Bubble, Bubble, Where's the Housing Bubble?" *Brookings Papers on Economic Activity*, 2006, iss. 1, pp. 1-50.

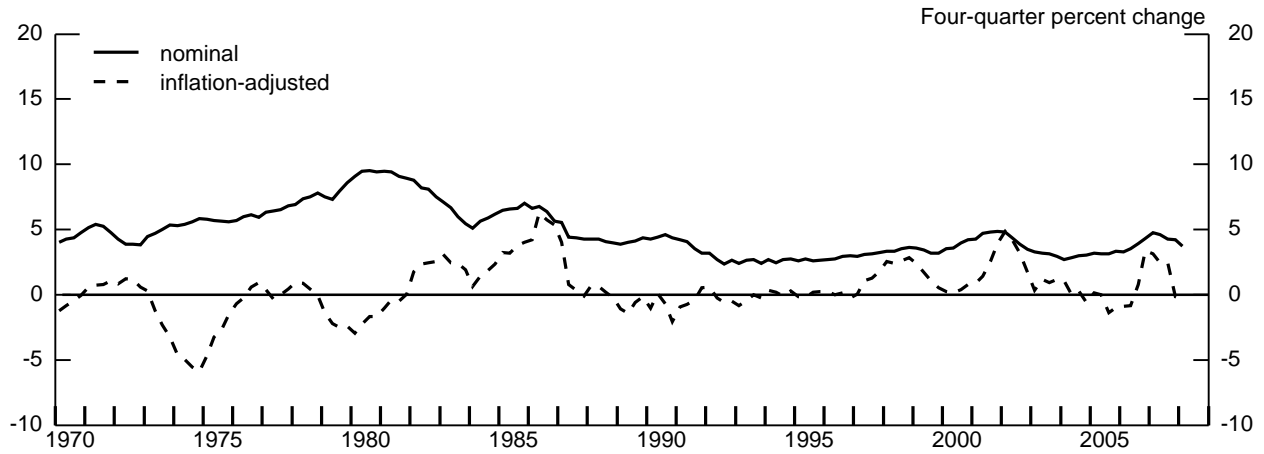
House prices and rents

Changes in house prices



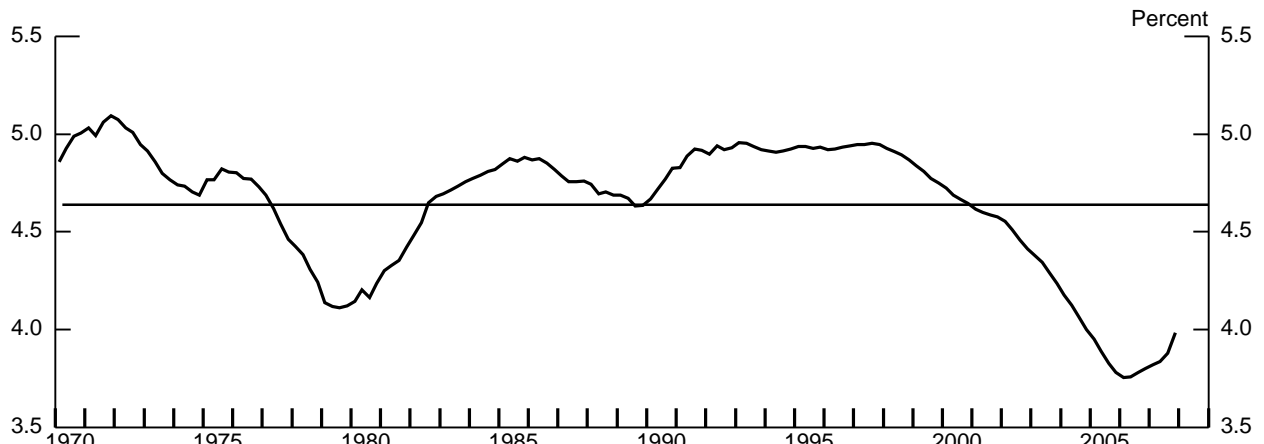
Sources: OFHEO, Freddie Mac, and BLS.

Changes in housing rents



Source: BLS. Data are adjusted as in Gallin (forthcoming)

Rent-price ratio



Sources: Same. Data are adjusted as in Gallin (forthcoming) and benchmarked to Davis, Martin, and Lehnert (2007).

Exhibit 2a Changes in House Prices by Reserve Bank District

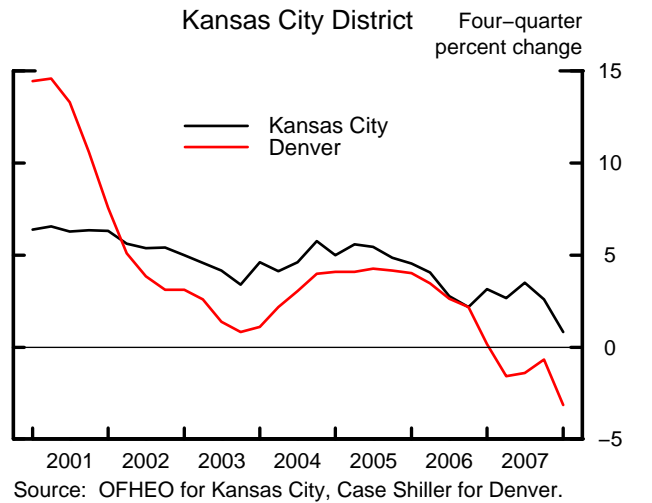
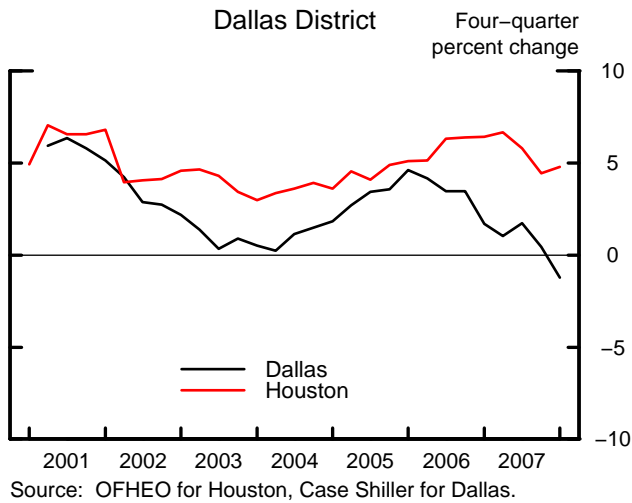
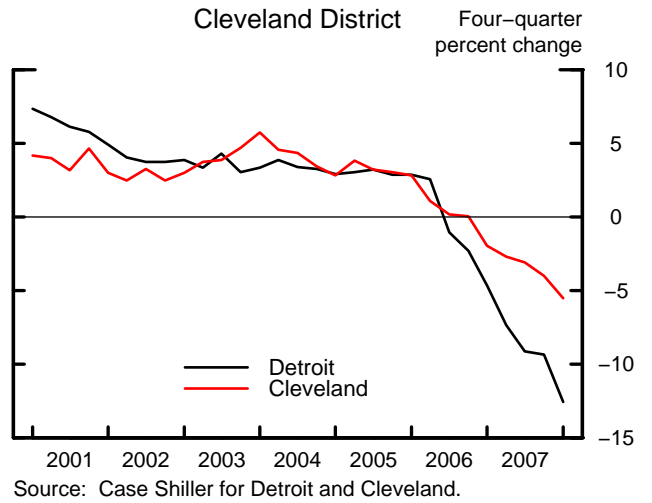
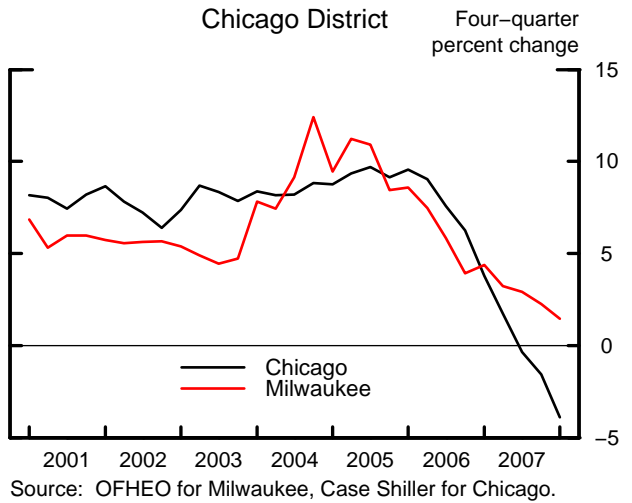
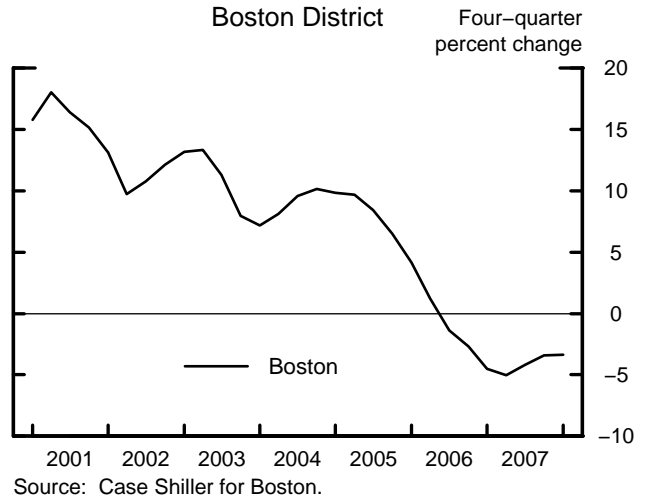
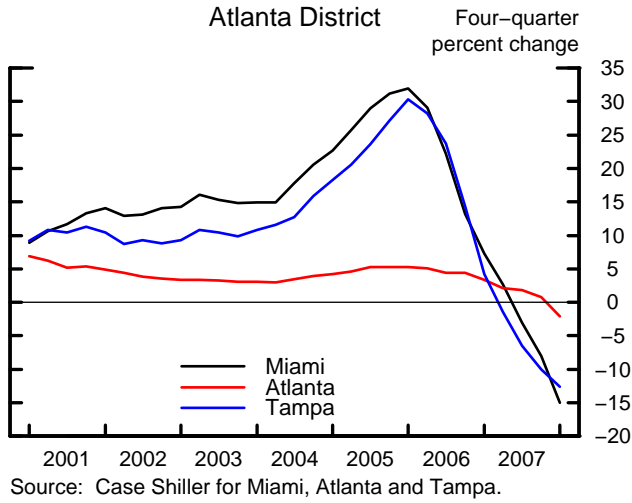


Exhibit 2b Changes in House Prices by Reserve Bank District

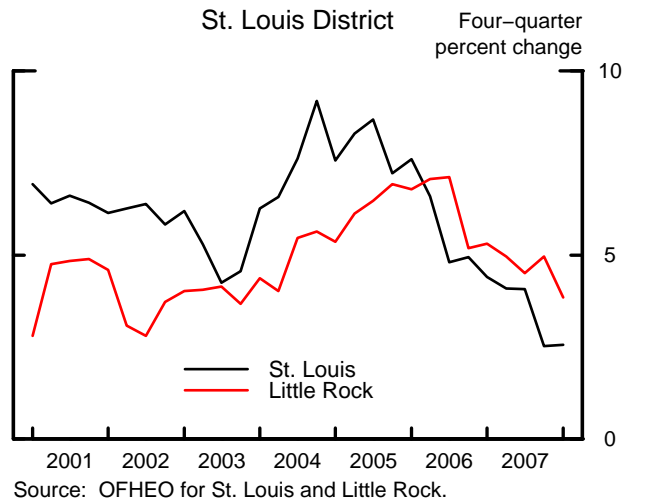
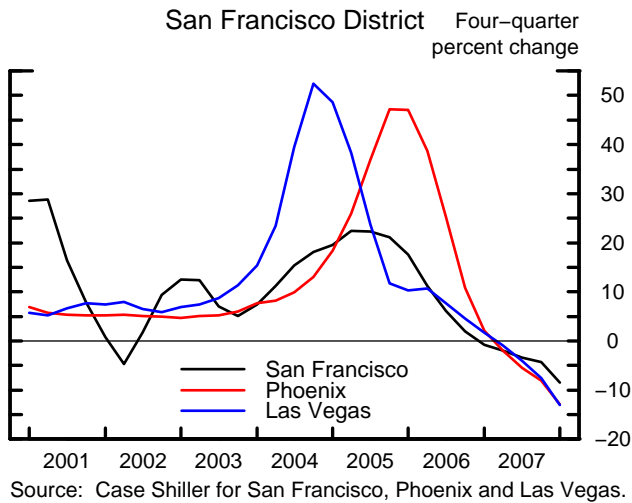
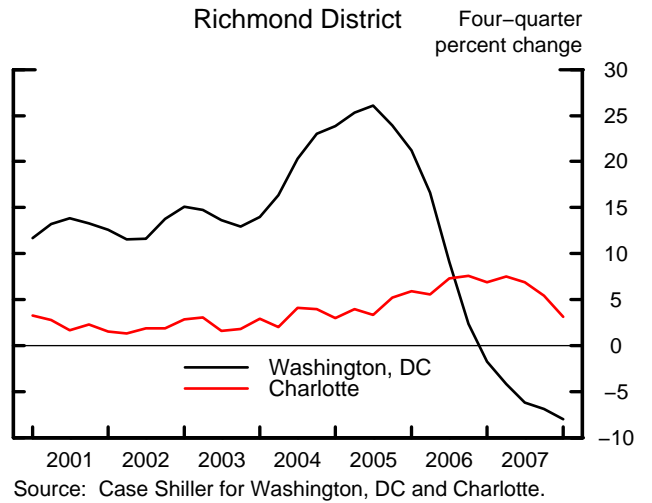
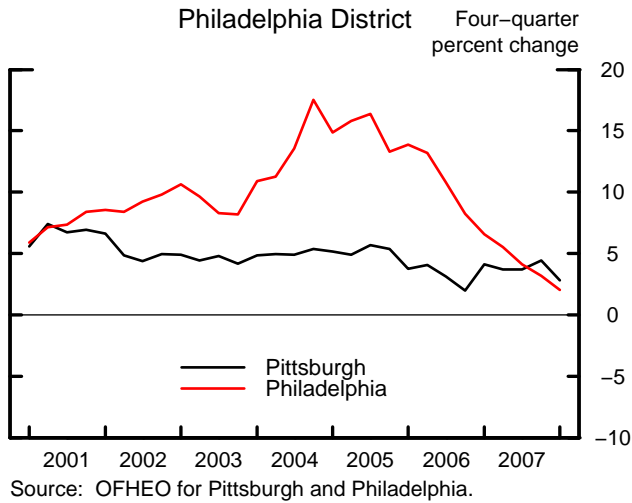
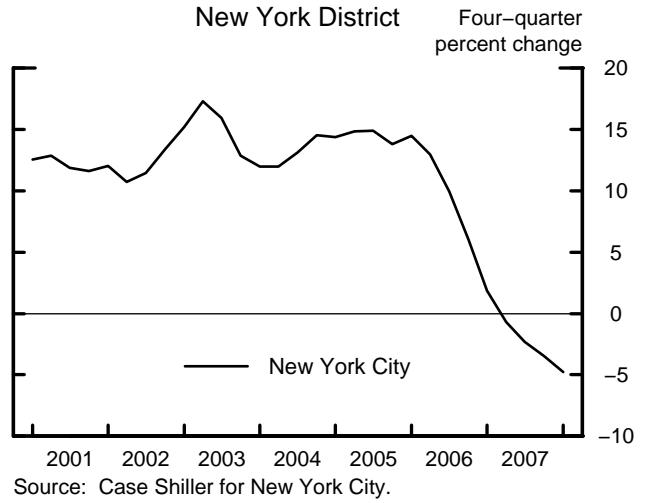
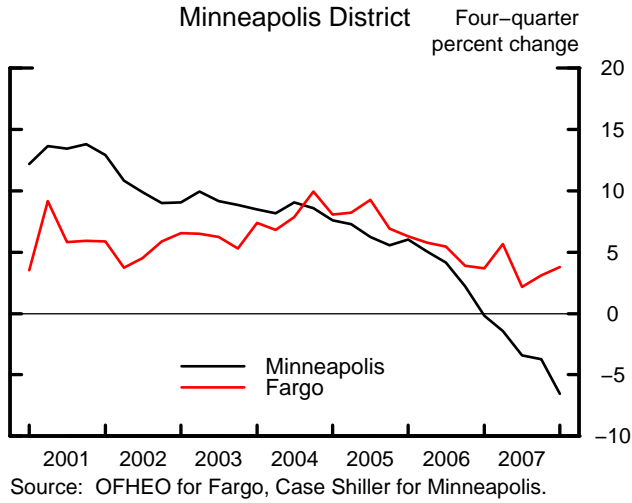
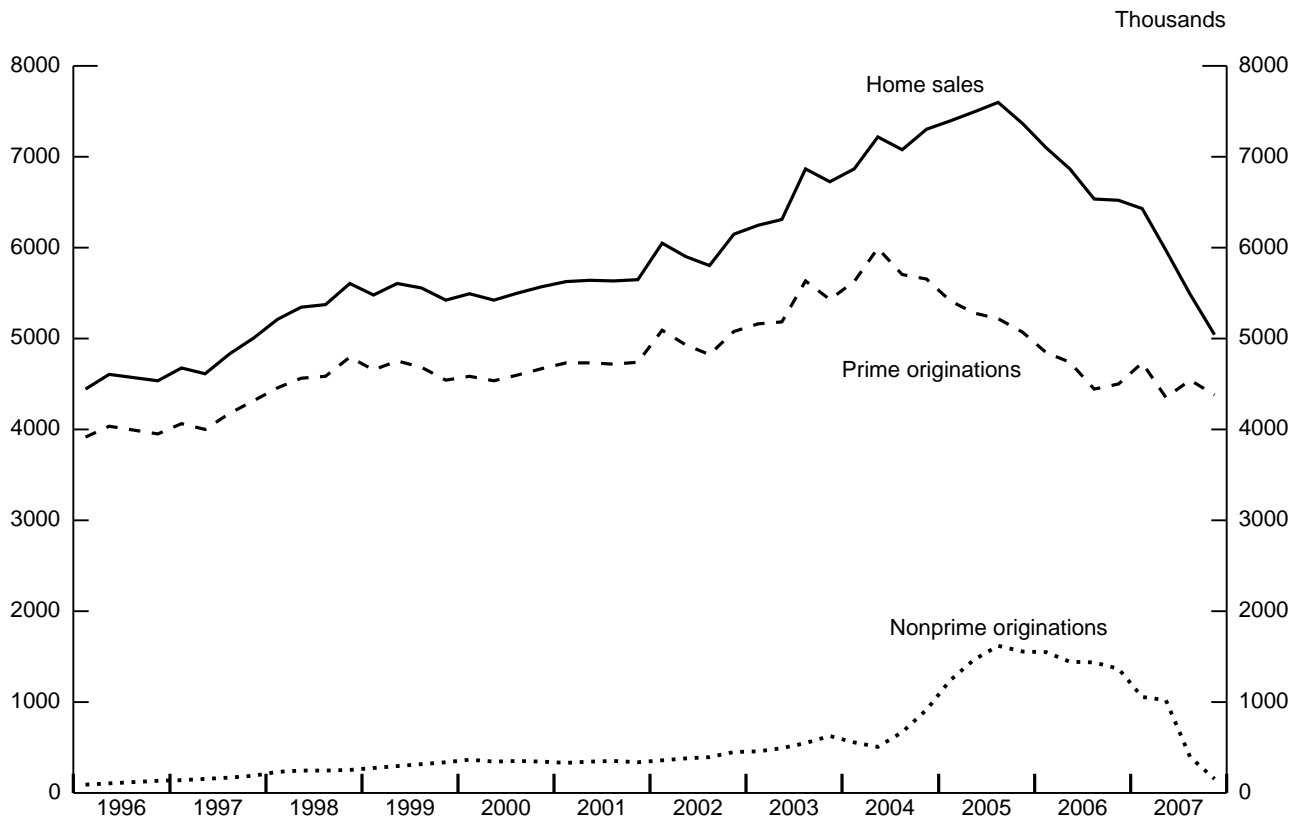


Exhibit 3
Home sales and mortgage originations



Sources: Census, NAR, HMDA, LoanPerformance, Inside Mortgage Finance

Exhibit 4a Changes in House Prices by Reserve Bank District

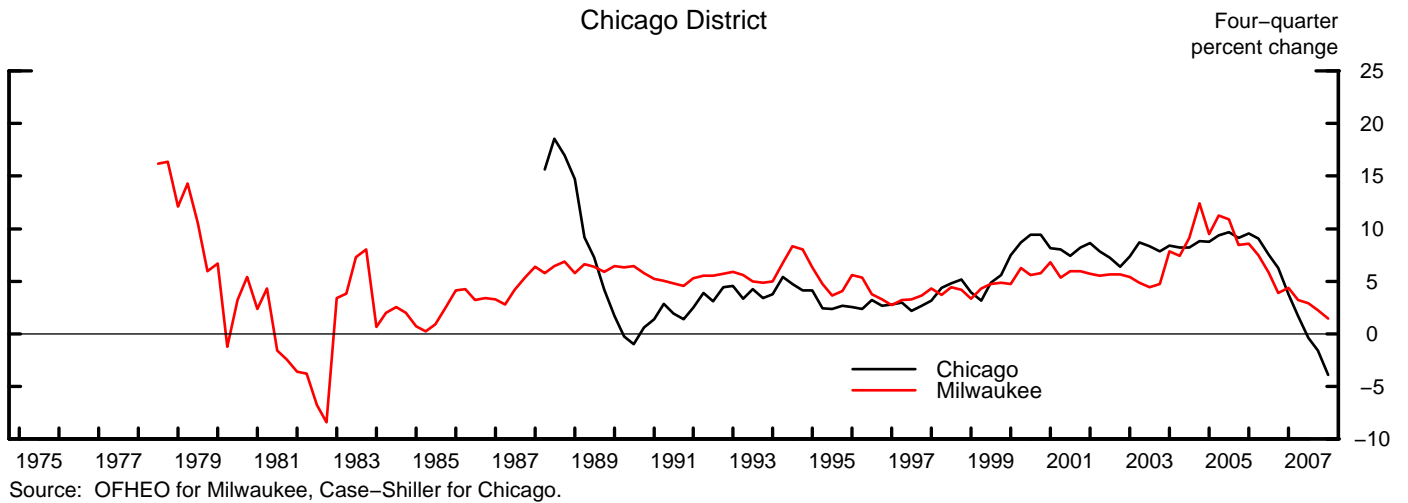
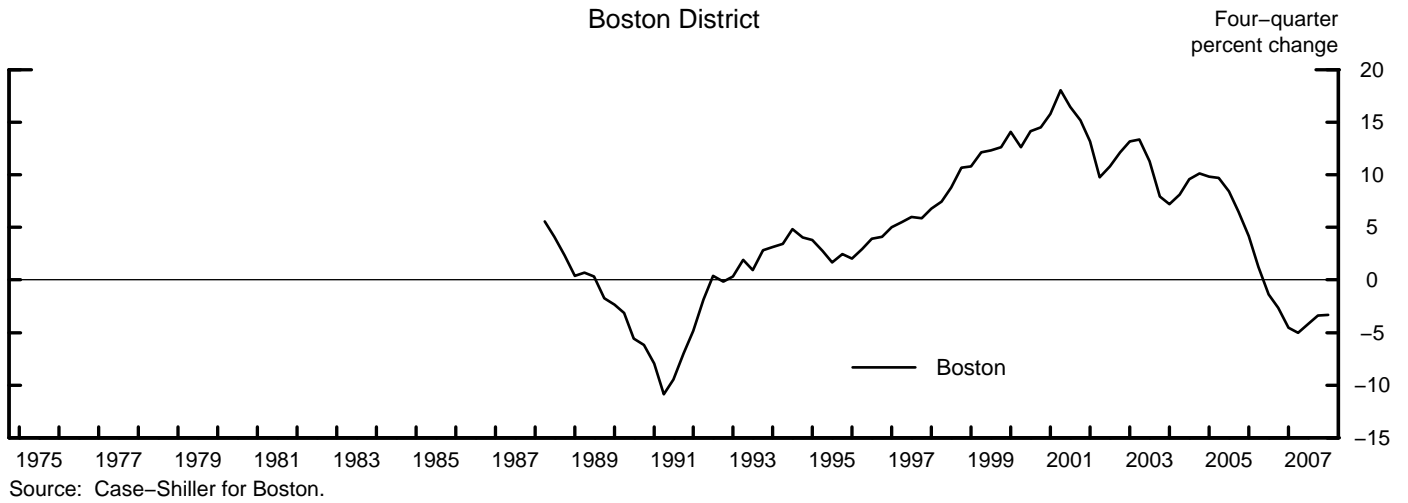
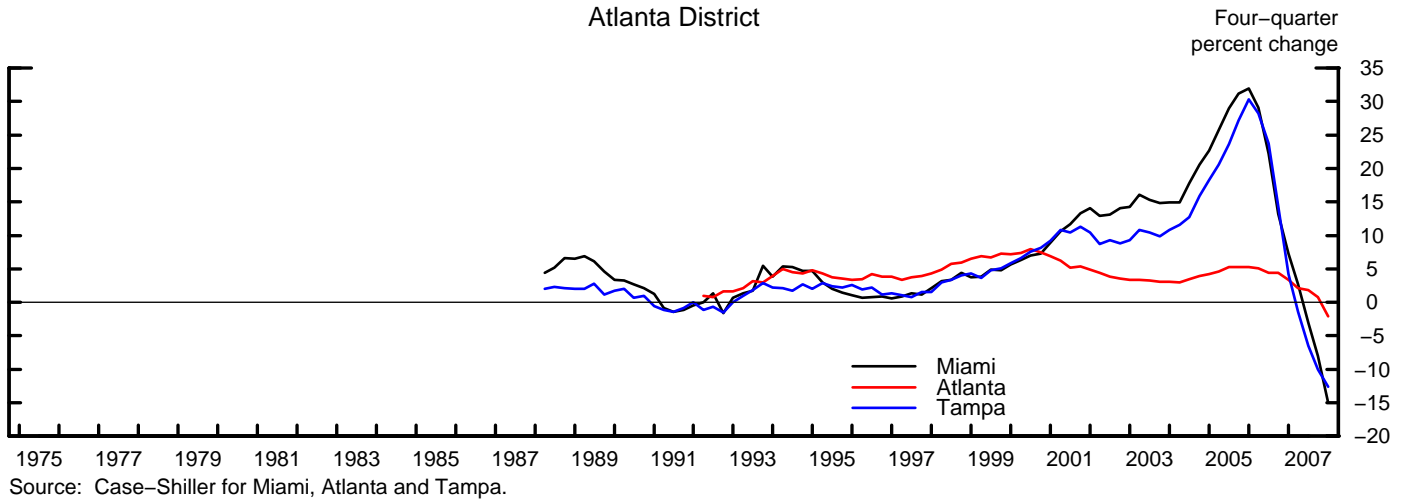


Exhibit 4b Changes in House Prices by Reserve Bank District

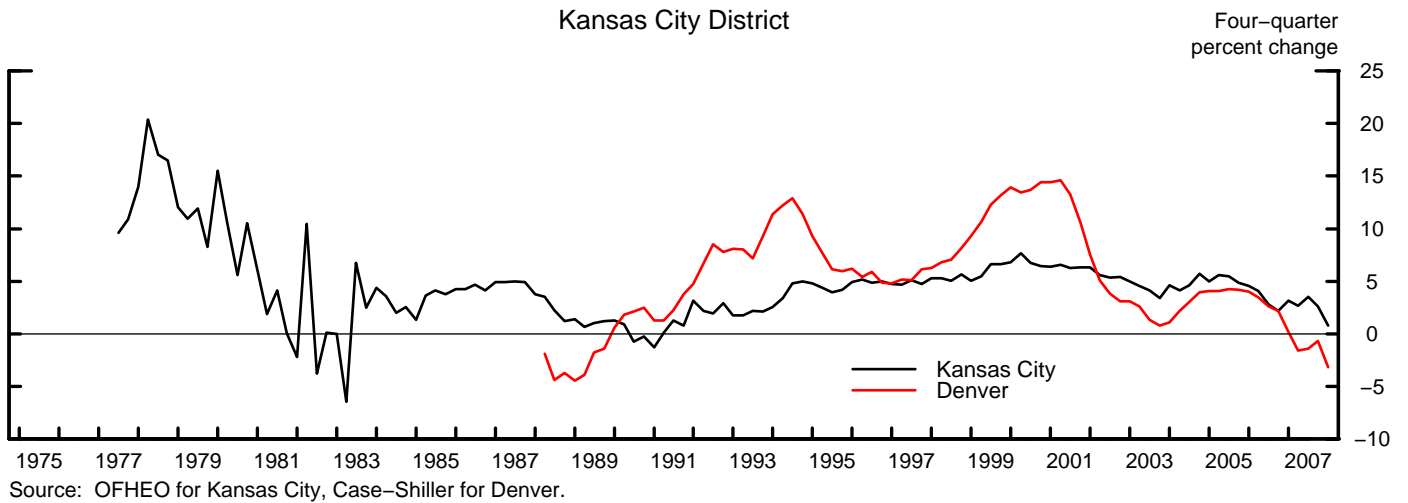
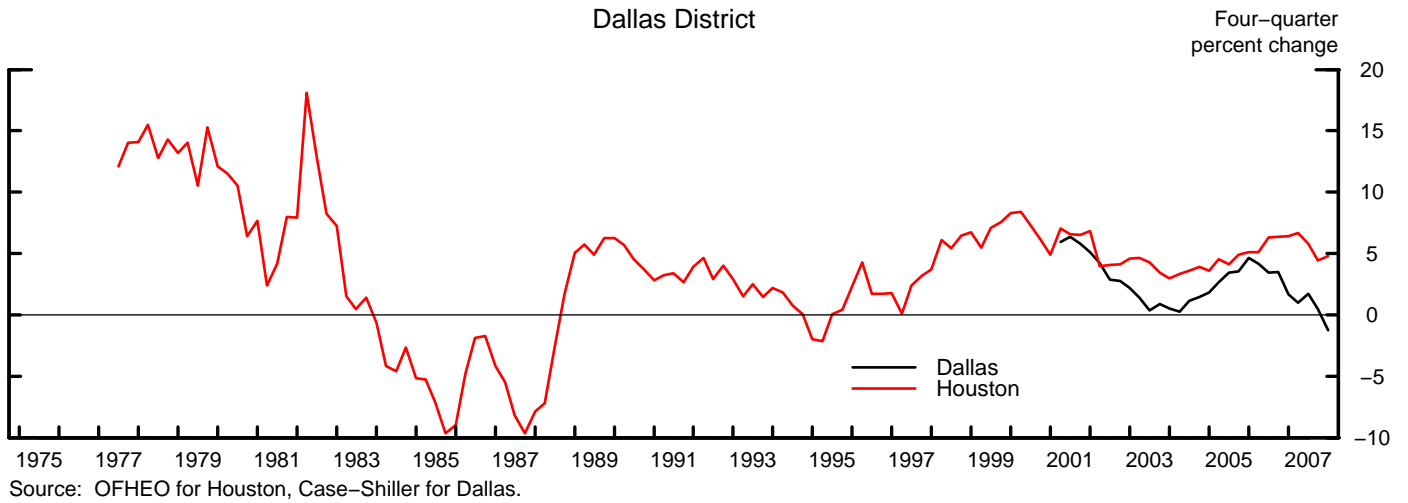
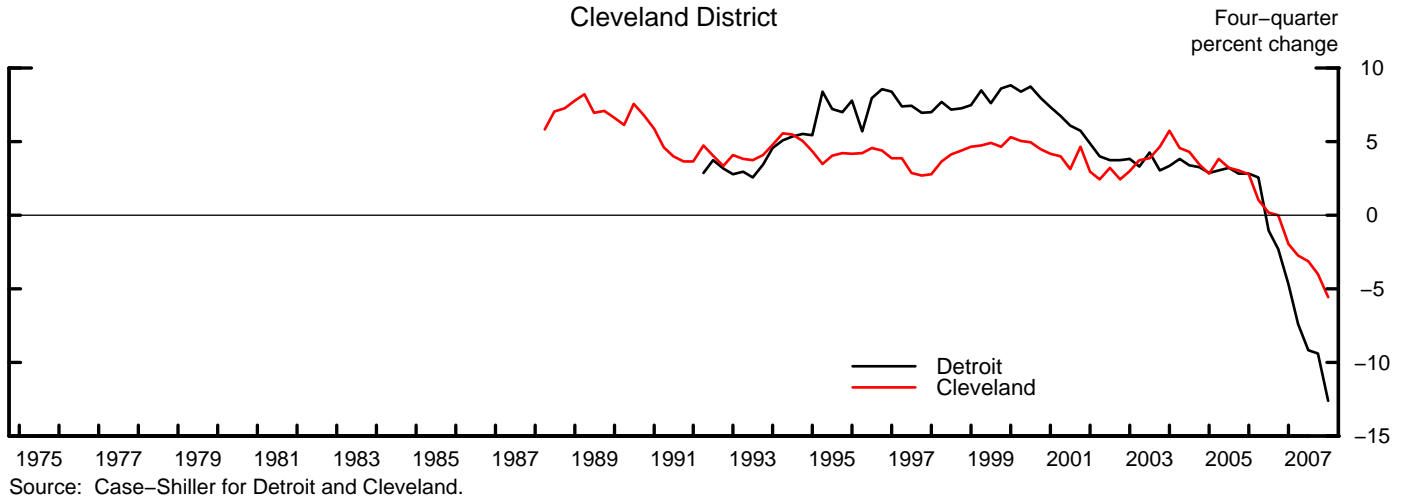


Exhibit 4c Changes in House Prices by Reserve Bank District

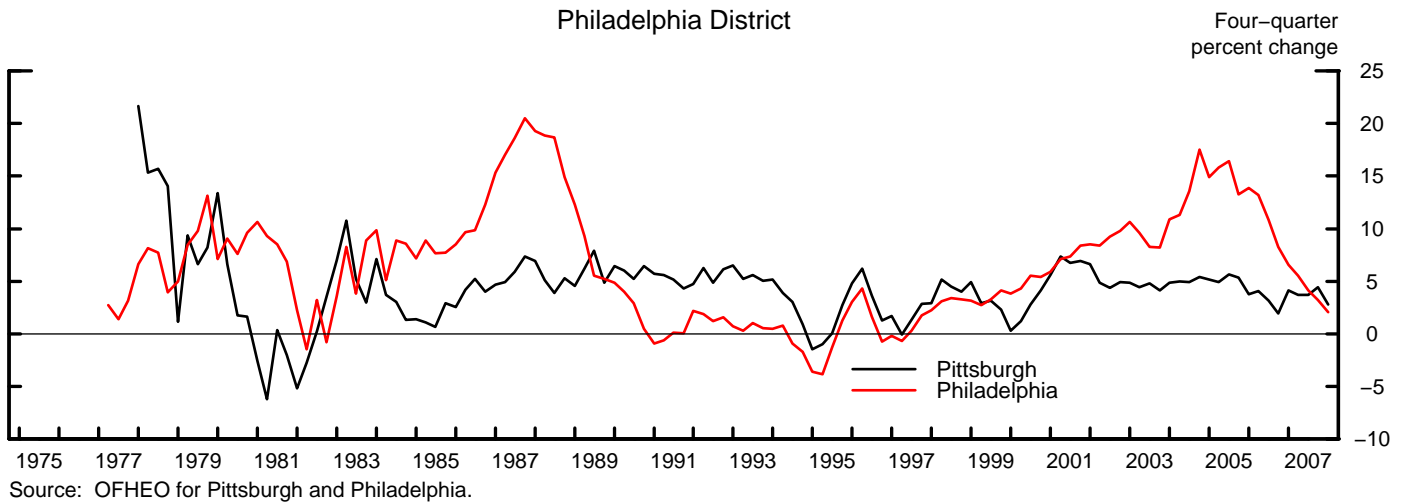
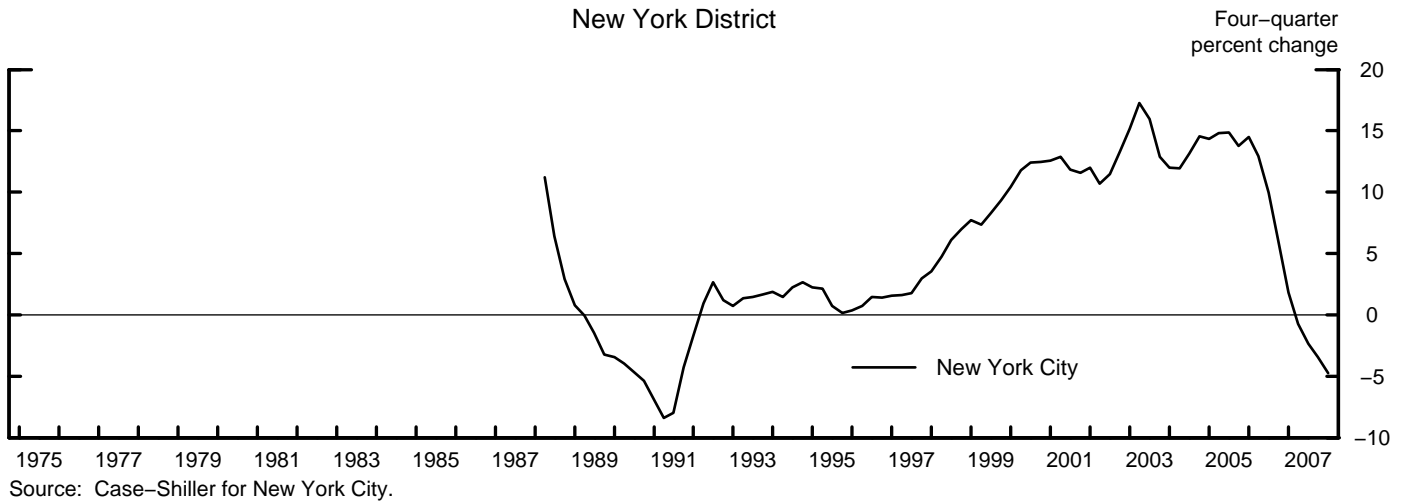
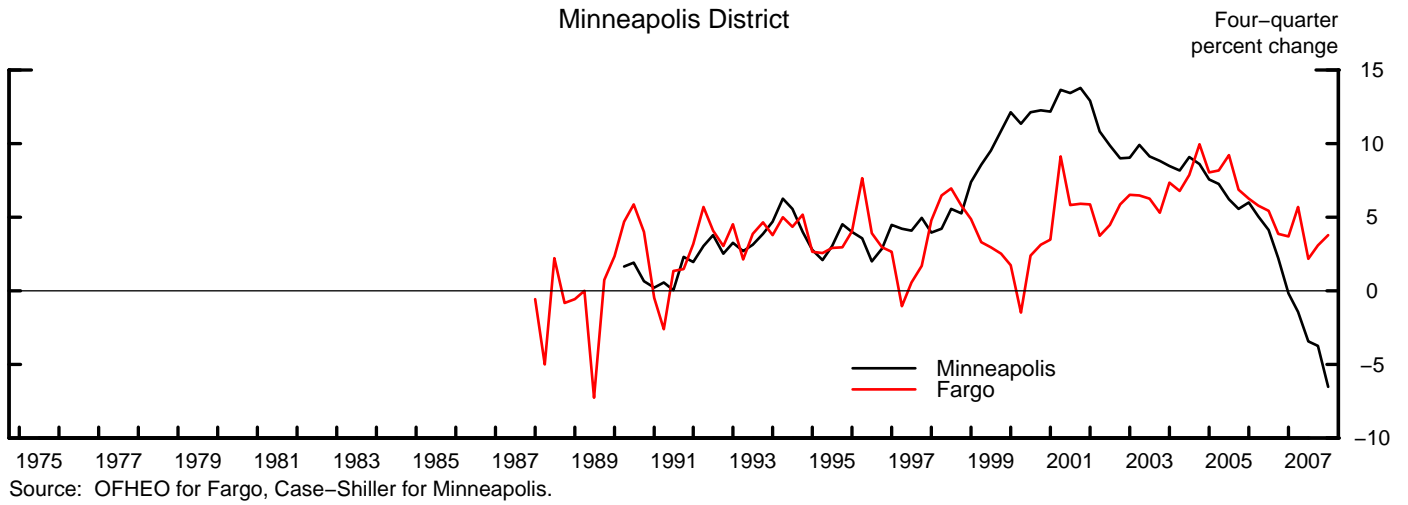
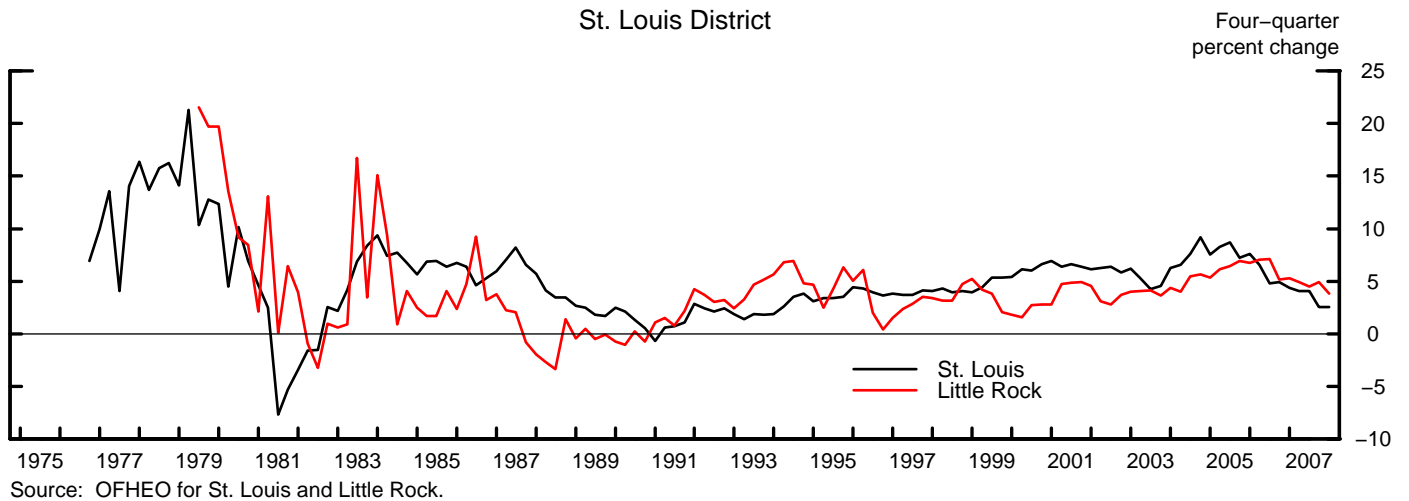
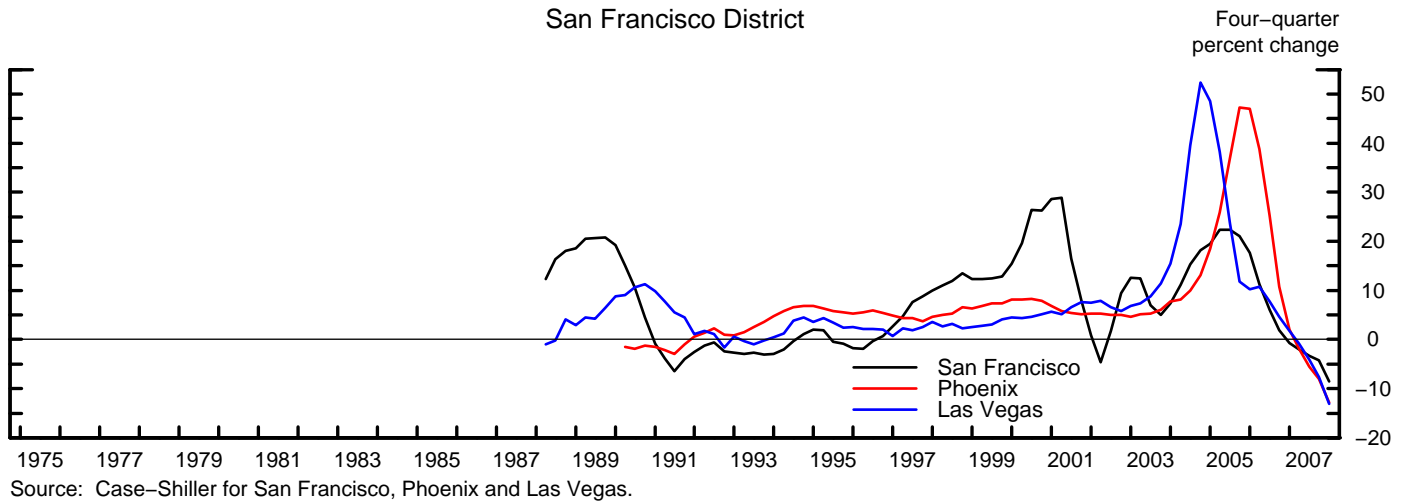
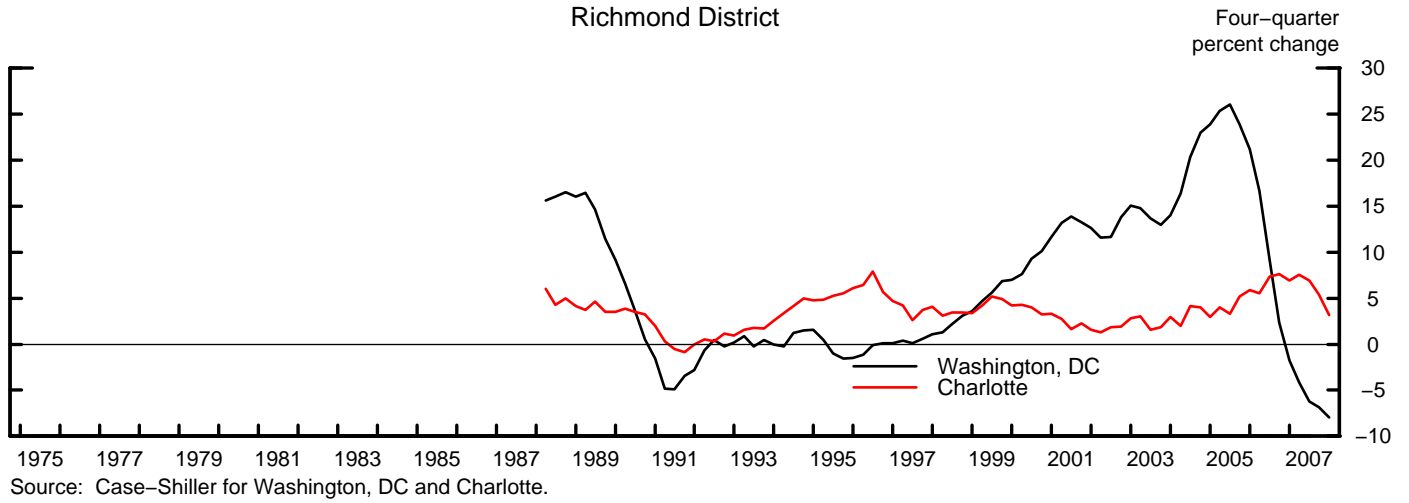


Exhibit 4d Changes in House Prices by Reserve Bank District



Recent Changes in the Homeownership Rate

Introduction

The second half of the 1990s and the early years of the current decade were boom years for housing markets. Despite rising house prices and declining affordability, the homeownership rate, which was basically stable at 64 percent for the past thirty years, shot up a full 5 percentage points between 1994 and 2004. The national homeownership rate has never been higher than it was at this time. This note summarizes some existing research detailing the recent changes in the homeownership rate, with attention paid to the various explanations for why these changes took place.

The Empirical evidence shows gains in ownership rates among all regions, income, and age groupings. Most research to date places an important emphasis on changes in the access to credit when accounting for changes in the homeownership rate. This is consistent with the research suggesting that young households and, particularly, young educated households enjoyed the largest gains in homeownership since the mid-1990s. This group, with higher expected income relative to current income, likely would benefit the most from easing of liquidity constraints associated with innovations in the financing of residential real estate.

The historical behavior of the homeownership rate

The homeownership rate is calculated as the share of occupied housing units that are owner-occupied. The homeownership rate is reported by the Census Bureau, which gathers the relevant data through the Current Population Survey.

The time-series behavior of the homeownership rate can be viewed in Figure 1.¹ This behavior can be described by focusing in on three historical episodes. In the first episode, homeownership rates increased steadily over a twenty-year period, rising from

¹ This series was constructed using the homeownership rate estimates for 1965 to the present from the Current Population Survey, and splicing on estimates of the homeownership rate from 1930-1970 from the decennial census.

about 45 percent at the end of the WWII to about 64 percent by 1965. This change in the homeownership rate dwarfs the change over the period discussed in the present day. Some of the underlying forces behind that episode were unique to the period, such as the pent-up demand for housing released following the end of the Great Depression and the conclusion of the war. However, some interesting parallels exist between this episode and the most recent rise in the homeownership. In particular, the mortgage market underwent a large transformation with the activities of the precursors to the government-sponsored agencies that aided the flow of capital to the housing market.

Following this period of growth, the homeownership rate leveled off. In this second phase, roughly between 1965 and 1994, the homeownership rate leveled off and fluctuated within a narrow band. This period is notable, if only because of because of the relative stability of the overall homeownership rate in the face of considerable changes in the economic environment over that time period.

Finally, in the third episode, the rate climbed by about five percentage points starting in about 1995. A fair amount of research has been dedicated to more precisely identifying the “winners” from the most recent episode of homeownership increases.² These gains appear to be very broad-based across geographic regions (see Figure 2). Some states with large gains in homeownership rates, such as Arizona (+8.2%) and Hawaii (+9.6%), had relatively low homeownership rates to begin with (62.9% and 50.2%, respectively). States with relatively small gains in the homeownership rate tended to have high rates to begin with, like Kentucky (up 0.4% to 71.2%) and North Carolina (up 0.8% to 70.1%).

While the regional patterns in the recent homeownership gains are not particularly stark, the real winners appear to have been determined along demographic lines. The following table taken from Doms and Krainer (2007) gives the basic information. Virtually all types of households considered here experienced gains. Young households experienced the largest gains over this period.³ Households headed by individuals aged 18-29 gained nearly seven percentage points, increasing from 26.6% to 33.2%. Perhaps more remarkable was the increase in the ownership rate for households with heads aged

² For example, see Chambers, Garriga, and Schlagenhauf (2006), Doms and Krainer (2007), and Li (2005).

³ It is also true that young households experienced declines in their homeownership rates between 1985-1994.

30-39. This group also gained 6 percentage points over the time period, from 55.8% to 61.8%. Among the young, there were sharp differences in outcomes according to education of the household. In the fast-growing 30-39 group, households where the head had 13 years or more years of schooling enjoyed a nearly 8-percentage point increase in homeownership (60.4% to 67.9%), while households with 12 years or less experienced increases in the homeownership rate of just 2 percent (50.2% to 52.0%). Insofar as income, the largest gains accrued to households in the middle two income quartiles, which grew by 5.2% and 5.6%, respectively. Interestingly, given the current attention to the subprime market, the lowest income quartile actually experienced mild gains in homeownership over this time period, growing 3.5% from 41.2% to 44.7%.

Why did the homeownership rate increase?

At the simplest level, models of housing tenure choice (homeownership) predict that an individual will own if the expected net benefits of owning are higher than from renting. With this framework in mind, some of the variables that have been used in theoretical models and empirical studies include:

- User cost of housing measures: including interest rates, marginal tax rates which determine the tax advantage to homeownership, and expected house price appreciation rates.
- Income variability measures.
- Demographics.
- Measures of access to credit markets.

Of these candidate variables, recent research has focused almost exclusively on the last item: credit market access. Before turning to this topic, however, it is useful to consider why some of the other variables thought to be important determinants of the tenure choice decision are not helpful in explaining the rise in the homeownership rate. Indeed, several of measures listed above changed in ways that would lead us to expect

declines in the homeownership rate. Marginal tax rates decreased rather than increased over this time, which would tend to reduce the subsidy and discourage homeownership. Individual household income variability has generally trended up—not down—over the past several decades, which would tend to make individual households more risk averse about their home purchase, *ceteris paribus*.⁴

Turning to more plausible explanations for the rise in the homeownership rate, it is well-known that house price appreciation was extremely strong over this period. For most homebuyers who bought during this time, housing has turned out to be an excellent investment. But did the anticipation of house price appreciation *cause* the homeownership to rise?⁵ One piece of evidence somewhat at odds with this interpretation is the fact that regional house price appreciation has varied considerably over this the last decade, and seemingly out of proportion to the changes in regional homeownership and in other measures of housing demand. We can see this in a bivariate setting in figure 3; at the state level, changes in the ownership rate are uncorrelated with changes in house prices over the time period in question. Doms and Krainer (2007) found that changes in housing expenditures increased over this period as well, and with little relation to actual house price appreciation in the local market.

Another plausible explanation that nevertheless fails to account for the sharp rise in the homeownership rate is demographic change. Demographics have long been associated as a key component of aggregate demand for housing. Closer inspection, however, suggests that the rise in the homeownership rate was simply too rapid to be accounted for by changes in the age composition of the population (i.e., the aging of the baby boomers).

Nominal mortgage interest rates fell about 2 percentage points to about 5.8 percent between 1995 and 2005, reaching their lowest levels since the 1960s.⁶ Taken in isolation, however, there are doubts about whether declines in interest rates alone had an appreciable affect on the homeownership rate, mainly because much larger changes in

⁴ Dynan, Elmendorf, and Sichel (2006). Although, this increase in household level volatility might actually raise the demand for housing as home equity extraction can be used to smooth out income shocks.

⁵ Mian and Sufi (2007) make the opposite argument, suggesting that changes in lending standards caused house prices to rise.

⁶ Source: Freddie Mac.

homeownership rates in the past have not accompanied variation in the homeownership rate.⁷

As noted above, average mortgage rates fell considerably over this period. It is also true that mortgage rates fell even more for nonprime borrowers. This leads to the most popular explanation for the rise in the homeownership rate: that changes in the access to credit markets relaxed financial constraints and paved the way for a higher homeownership rate. To date, researchers have looked at two different ways in which access to credit markets has improved: lower lending standards and financial innovation.

All mortgage interest rates contain a risk premium that compensates the lender for the risk that the borrower may default. But given the informational problems in lending, borrowers considered too risky are not given loans at all. With lower risk premia, borrowers who were previously shut out of the mortgage market were allowed to enter, and consequently the homeownership rate increased. This is the story of Mian and Sufi (2007), who note that during the subprime boom, originations of loans for home purchase were particularly high in zip codes characterized by high mortgage rejection rates earlier in the 1990s.⁸ From this perspective, changes in the homeownership rate are viewed as the outcome of a shock to the supply of credit.

The other way in which access to credit improved is through financial innovation. There is long list of innovations that took place over this time. To name a few, lenders embraced the use of credit scoring and other risk management tools during this period. Secondary markets were developed for the securitization and trading of nonconforming mortgage debt. Finally, lenders developed (and priced attractively) the so-called alternative mortgages, that allow for more flexible mortgage repayment schedules for otherwise constrained borrowers.

Innovation is thought to be important because so many of the innovations listed above would seem to have made borrowing easier for precisely the types of households that experienced the largest increases in the homeownership rate. As an example, young households typically have low income relative to permanent income, and also tend to be constrained with respect to a downpayment. Alternative mortgages that lower the

⁷ See Painter and Redfearn (2002).

⁸ Mian and Sufi's analysis is done at the zip code level, so it is not possible to verify whether homeownership rates actually increased in conjunction with the increase in lending.

downpayment and shift the repayment of principle to the future seem to be tailor-made for helping young household into homeownership at an earlier stage than in the past. Girardi, Rosen, and Willen (2005) in fact show that the size of the first-time housing purchase is now a better predictor of future income than thirty years ago. Doms and Krainer (2007) show that changes in homeownership rates and in overall housing expenditures were greatest for young households and young educated households. In other words, the changes were greatest for those households with the largest deviations between current and permanent income. Chambers, Garriga, and Schlagenhauf (2006) show in a quantitative exercise that innovations resulting in a lowering of the downpayment requirement on housing can account for the rise in the homeownership rate.

Conclusion

The homeownership rate rose by about 5 percentage points between 1995 and 2005. Research suggests that young households and, particularly, young educated households enjoyed the largest gains in homeownership over this time. Most research to date places an important emphasis on changes in the access to credit when accounting for changes in the homeownership rate.

With this emphasis on developments in the mortgage market, it is inevitable to wonder what the current problems in the financial markets imply for the homeownership rate in the future. Abstracting from the path of house prices and other economic variables, an increase in the risk premium on mortgage loans and tighter underwriting standards must result in a tightening of financial constraints on households. Thus, we would expect the homeownership rate to fall back from the high point observed in 2004. Indeed, this already appears to be happening. For the longer term outlook, however, the key would seem to be the extent to which the mortgage market innovations discussed here depend on lender and investor risk aversion. Innovations like the increased use of credit scoring, risk-based pricing, and the improved design of alternative mortgage products would seem to lead to more consumer choice, regardless of the risk premium embedded in the pricing of the mortgages. If so, then we might expect this lending to resume (if not at the same scale) once the turmoil in financial markets passes. One

reason to be optimistic on this front is that the homeownership rate started rising steadily well before the period of compressed risk premia.

References

Chambers, C., Garriga, C., and Schlagenhaut, D., 2006. "Recent Trends in Homeownership." Federal Reserve Bank of St. Louis *Review*.

Doms, M., and Krainer, J., 2007. "Innovations in Mortgage Markets and Increased Spending on Housing." Federal Reserve Bank of San Francisco working paper.

Dynan, K., Elmendorf, D., and Sichel, D., 2007. "The Evolution of Household Income Volatility." Finance and Economics Discussion Series 2007-61. Washington: Board of Governors of the Federal Reserve System.

Girardi, K., Rosen, H., and Willen, P., 2006. "Do Households Benefit from Financial Deregulation and Innovation? The Case of the Mortgage Market." FRB Boston Public Policy Discussion Papers Series, paper no. 06-6 (2006).

Li, W., 2005. "Moving Up: Trends in Homeownership and Mortgage Indebtedness." Federal Reserve Bank of Philadelphia *Business Review*.

Mian, A., and Sufi, A., 2007. "The Consequences of Mortgage Credit Expansion: Evidence from the 2007 Mortgage Default Crisis."

Painter, G., and Redfearn, C., 2002. "The Role of Interest Rates in Influencing Long-Run Homeownership Rates." *Journal of Real Estate Finance and Economics*. 25: 2/3, 243-267.

Fig. 1 Homeownership Rate: 1930-2005

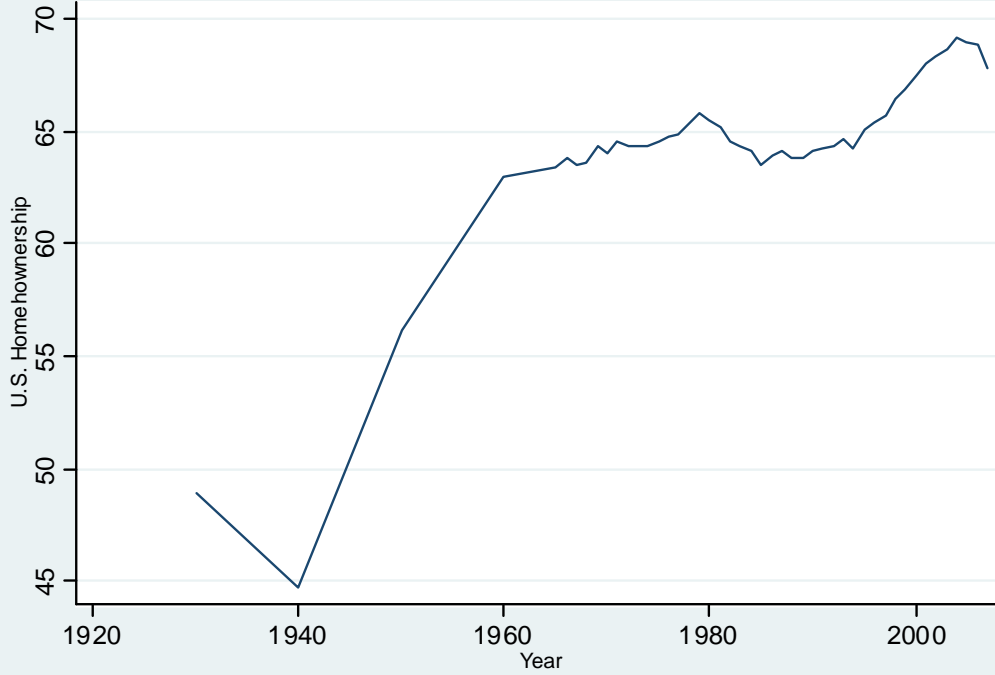


Fig. 2 Homeownership Rate Patterns

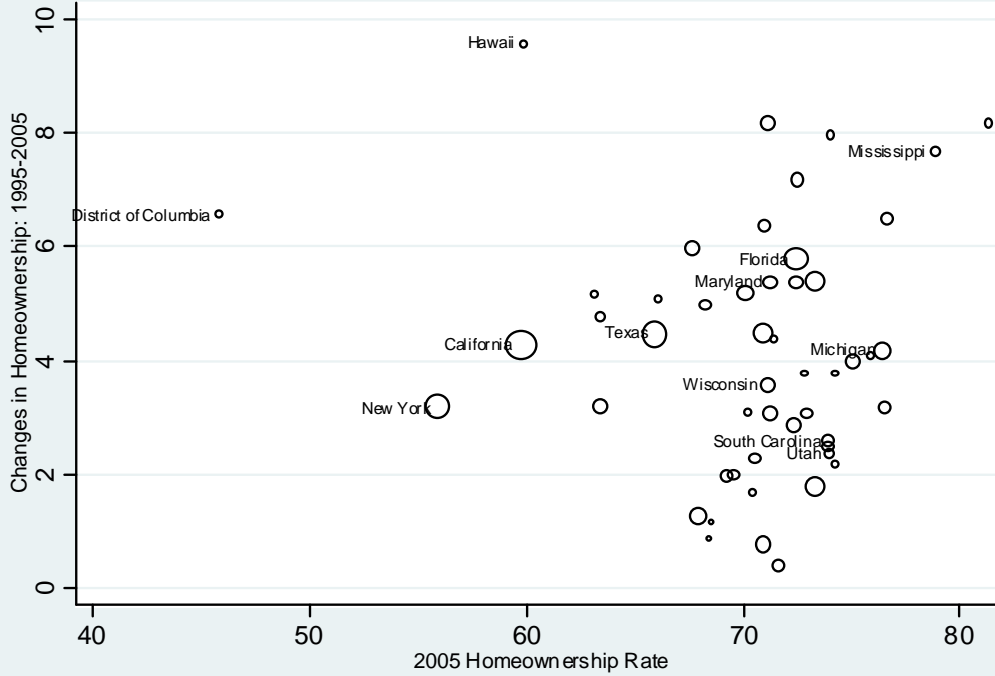


Fig. 3 Changes in Homeownership Rates and House Prices

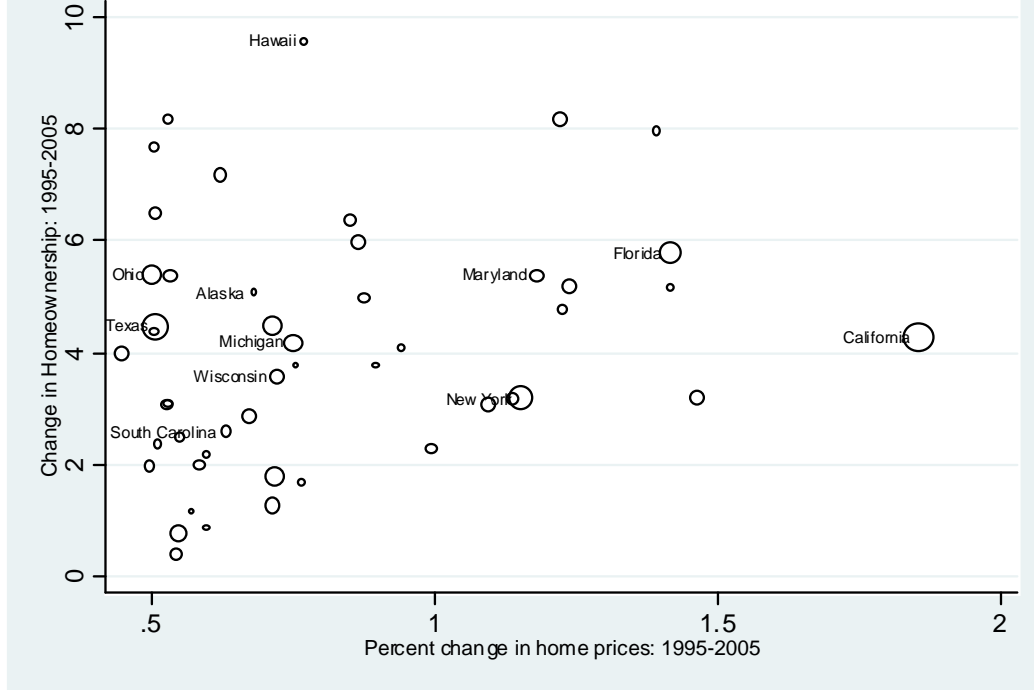


Table 1: Homeownership Rates by Demographic Groups, 1994 to 2004

Age of head of household	Rates by year		Change	
	1994	2004	2004-1994	
18-29	26.6	33.2	6.6	
30-39	55.8	61.8	6.0	
40-49	70.5	74.1	3.6	
50-59	77.8	79.6	1.8	
60+	77.9	81.4	3.5	
Education (in years of schooling) of head of household				
12 years or less	61.3	64.1	2.8	
13 or more	66.6	72.9	6.3	
Age and education of head of household				
18-29	12 years or less	25.4	30.0	4.6
	13 or more	27.7	35.6	7.9
30-39	12 years or less	50.2	52.0	1.8
	13 or more	60.4	67.9	7.5
40-49	12 years or less	63.6	66.1	2.5
	13 or more	75.8	79.6	3.8
50-59	12 years or less	73.4	73.2	-0.2
	13 or more	82.5	83.7	1.2
60+	12 years or less	75.3	78.2	2.9
	13 or more	83.4	86.0	2.6
Income quartile of family income				
1st quartile	41.2	44.7	3.5	
2nd quartile	58.6	63.8	5.2	
3rd quartile	72.9	78.5	5.6	
4th quartile	87.1	91.1	4.0	

Source: Current Population Survey and authors' calculations

Homeownership and Mortgage Initiatives
March 12, 2008
Yelena Takhtamanova
Federal Reserve Bank of San Francisco

Housing Wealth and Consumption

Introduction

Historically, real estate in the U.S. has been the dominant asset on the household balance sheet. The early 1960s and the late 1990s were exceptions to this rule; though during this decade, with the combination of the stock market decline at the start of this decade and the continuation of the housing boom, the U.S. housing wealth has moved back above financial wealth in terms of the share of assets.¹

Most recently, however, the slump in housing in the U.S. and the decline in house price in many markets has reduced the value of housing equity for many consumers. Moreover, futures markets and many analysts are forecasting further drops in home prices and thus homeowner equity.

While, during the housing boom it appeared that gains in home equity supported growth in consumer spending, the concern now is that the declining house prices are reducing homeowners' total wealth and damping spending. This note reviews the theory and empirical evidence regarding the links between the value of equity (housing wealth) and consumer spending.

Regarding theory, there are reasons to expect housing wealth to affect spending over the near to intermediate term, though the long-run effects are uncertain. With regard to the empirical evidence, on balance, the research suggests that the final effects of changes in housing wealth to consumption is somewhere in the range of 3 to 10 cents on the dollar. The empirical evidence also suggests that the effect increases gradually, with the immediate impact being relatively small (about 2 cents on the dollar), and the final effect taking several years to play out. While much of empirical evidence for the U.S. suggests

¹ It also is the case that the bulk of household wealth is held in real estate in other developed countries (see, for example, Sierminska et. al 2006).

that housing wealth has a stronger effect on consumption than financial wealth, the statistical significance of this difference is not especially strong.

The Link Between Housing Wealth and Consumption

It is not clear to what extent changes in housing prices have *long-term* effects on aggregate spending. House price changes produce winners and losers. The increase in the consumption of the winners should be offset by the decline in spending by the losers. For instance, when relative home prices rise and current homeowners are made better off, future homeowners (current renters or future households) are made worse off. While consumer spending by current homeowners might increase, consumer spending by others might decline. Little or no net long-run effect on spending would be expected if the changes in house prices merely reflected changes in taste, and not, say, a change in the effect of housing to the efficiency in production of other goods and services.

Yet, the above argument does not rule out the possibility of short- and medium-run effects of changes in house prices on consumption. One way to see this is to realize that the winners and losers from the change in house prices may not change their behavior at exactly the same time. For example, when home prices increase, homeowners who benefited from this increase might increase their spending immediately, while the decline in the spending of renters (and future households) might come with a delay.

Changes in housing wealth can alter short-term spending by changing the ability of a household to refinance and extract equity. In the past, rising home prices allowed households who had borrowed close to their mortgage maximum to refinance. Refinancing can be done for a variety of reasons: lower interest rate, increase or reduce a payment period or extract cash. As a digression, according to the 2001 Residential Finance Survey, for both prime and sub-prime loans, the two major reasons for refinancing were to lower their interest rate and to receive cash (Pennington-Cross and Chomsisengphet 2007). Within prime-loans, the most common reason to refinance was to lower interest rates, while receiving cash dominated the list of reasons to refinance within sub-prime

loans (ibid.).² When additional funds received via refinancing are spent on consumption of non-housing goods, aggregate consumption increases. It is important to note, though, that many cash-outs are taken to improve property, in which case residential investment, rather than consumption would receive a boost.³

Possible Reasons for Differences in Financial and Housing Wealth Effects

Although standard theories used to analyze the link between consumption and wealth (the permanent income hypothesis of Friedman (1957), and the Ando and Modigliani (1963) life-cycle model) do not distinguish between different types of wealth, recent research has emphasized that there are several reasons for expecting a difference in the effects of changes in housing wealth and financial wealth on consumption.

To begin with, housing is both an asset and a consumption item. Increases in house prices may indeed lead to an increase in one's wealth, but they also lead to a higher cost of housing services. Thus, an increase in relative house price does not necessarily lead to an increase in a household's overall ability to consume more of non-housing goods and services. This argument would lead a researcher to expect a lower MPC from housing wealth than from financial wealth. On the other hand, households can access some of the equity to support consumption by assuming greater debt backed by the wealth of their house. In recent years, we have seen an increased availability and lower costs of home equity loans. However, the turmoil in the financial market that began in August of 2007 may have reduced the availability of credit, while increasing the costs.

Housing wealth and financial wealth also differ with respect to distribution. Housing wealth is more broadly distributed across households, while financial wealth tends to be concentrated among wealthier households. Empirical evidence suggests that MPC out of wealth is lower for richer households (Carroll 2004). This suggests that housing wealth effect might exceed financial wealth effect.

The literature suggests that agents' awareness of changes in the two types of wealth may differ (Dvornak and Kohler 2003, Case et al. 2005). There is no consensus

² For prime loans, 66% of refinances were for a rate reduction, and about 26% were to extract equity (Pennington-Cross and Chomsisengphet 2007). For sub-prime loans, about 40% of refinances were to lower interest rate, and 49% were to extract equity (ibid.).

³ According to 2001 Residential Finance Survey, 85.4 % of cash outs were used to improve property.

among authors about which type of wealth is more “trackable” (that is, easier to measure accurately). Some argue that it may be easier to find information on current financial wealth than on current real estate wealth, as houses are less homogenous and are less frequently traded than shares (Dvornak and Kohler 2003). Thus, an increase in financial wealth may lead to a larger increase in consumption than an equivalent increase in housing wealth. In contrast, it has been suggested that from 1989 to 1995 in the U.S. there seemed to be a trend away from direct ownership of corporate stock and toward ownership through financial intermediaries (Poterba and Samwick 1995). Those who own stock indirectly might be less aware of the current value of their portfolio than direct stock owners. Additionally, an estimate of the value of one’s current housing wealth could be derived by using information on sale prices of comparable houses in one’s neighborhood. Yet, in recent years, with information on both values of stock portfolios and housing prices being increasingly available and accessible, the differences in households’ awareness of the two types of wealth might have narrowed.

Households may view changes in housing wealth as more permanent than changes in financial wealth (Pichette and Tremblay 2003, Carroll 2004).⁴ In that case, one would expect households to be more willing to increase their consumption following an increase in housing wealth than an increase in financial wealth.

Finally, households may put different types of wealth into different “mental accounts” and, therefore, view changes in the value of some assets as more appropriate to use for current consumption than others (Shefrin and Thaler 1988). We would expect to see a higher MPC out of financial wealth if households perceive changes in housing wealth to be more appropriate for long-term savings.

In the end, economic theory does not provide an unambiguous answer to the question regarding the relative size of financial and housing wealth effect. As a result, one must turn to empirical evidence.

⁴ Possibly, this view can change over time (i.e. as relative volatility of house prices and prices of other assets changes). Also, it may differ by country (as relative volatility of prices of houses and other assets might vary by country).

Macroeconomic Evidence

Empirical models built to quantify the relationship between aggregate consumption, income and wealth are based on the life cycle framework. According to the life cycle framework, predictable changes in household wealth should not lead to direct changes in planned consumer spending, because such changes in wealth would have already been incorporated into consumer's spending decision. On the other hand, surprise changes in household wealth do invoke a response in household spending, as consumers optimally respond to them only after the fact. This effect on *unexpected* changes in housing wealth to consumption is referred to in the literature as the wealth effect.

However, not all consumers are likely to behave in a way that is consistent with the standard life cycle hypothesis. Increase in house prices can also relax borrowing constraints faced by some households. Looking at predictable house prices changes might allow a researcher to separate pure wealth effect from the effect of borrowing constraints.

In the past decade, several studies used macroeconomic data to assess the effect of housing and financial wealth on consumption (Table 1 gives results from select recent studies of the link between wealth and consumption). Some of those studies do suggest that consumption reacts differently to changes in the two types of wealth. The results on relative sizes of consumption sensitivity to changes in the two types of wealth are mixed. For the U.S. and Canada, the estimated wealth effect out of housing wealth exceeds that out of financial wealth (Davis and Palumbo 2001, Carroll 2004, Carroll et al 2006, Pichette and Tremblay 2003). However, there is no consensus on the statistical significance of these differences. In the Davis and Palumbo (2001) study, the difference between the wealth effects is marginally significant.

Carroll (2004) pointed out that the results obtained by Davis and Palumbo may be biased due to the implicit assumption of a constant saving rate and real interest rate over time. Carroll, Otsuka and Slacalek (2006) propose a new approach to estimating wealth effect (which differs from the currently popular co-integration methodology, which is utilized by Davis and Palumbo 2001 and Pichette and Tremblay 2003 among others). They find a higher wealth effect out of housing wealth (MPC out of housing wealth is

0.02 in the next quarter, and 0.09 in the long run, while MPC out of financial wealth is half the size in both short- and long-run), although the difference between MPCs out of the two types of wealth is not statistically significant.

The lack of variation in aggregate house prices makes it difficult to estimate the wealth effect from housing wealth precisely and to determine whether the difference between housing and financial wealth effect is significant. Some empirical investigations circumvent this issue by using international or regional data. For example, Case et al. (2005), use U.S. state-level data. They find a highly statistically significant MPC out of housing market wealth in 0.03 – 0.04 range and a small and statistically insignificant from zero MPC out of stock market wealth. In this study, the difference between consumption responsiveness to stock market wealth and housing market wealth is statistically significant. They also find a significantly higher housing wealth effect for a panel of 16 OECD countries.

On the other hand, Ludwig and Slok (2004) use a panel of 14 OECD countries and find a larger financial wealth effect. In Australia, Dvornak and Kohler (2003) use state-level data and also find the financial wealth effect to be stronger than the housing wealth effect.

Using aggregate data or even regional data for studying the wealth effect can also be problematic, because movements in aggregate wealth are likely to be endogenous (Carroll 2004, Dolmas 2003) since movements in asset prices can be affected by many factors that also affect consumption decisions (“most notably, overall macroeconomic prospects,” states Carroll 2004).

Microeconomic Evidence

There have been few studies using microdata to address the link between housing wealth and consumption. For a sample of the U.S. homeowners, Bostic et al. (2005) find that sensitivity of consumption spending with respect to financial wealth is smaller than with respect to housing wealth (elasticities are 0.02 and 0.06 financial and housing wealth, respectively). Juster et al. (2005) find the effect of capital gains in stocks on saving is larger than the effect of capital gains in housing or other assets in the United States. Lehnert (2004) uses PSID and finds MPC out of housing wealth to be between

0.02 and 0.03 for a sample of “stable households” (i.e. he excludes households that experiences severe distress and that have moved).⁵

Disney et al. (2007) find that for the U.K. a 1% housing price shock reduces active savings by approximately 0.1%, and a 1% rise in the value of financial assets reduces its active savings by 0.3 %. Grant and Peltonen (2005) use Italian household data and find that, for all households in the sample, consumption elasticity with respect to housing wealth is 0.8 percent but statistically insignificant, and consumption elasticity with respect to equity wealth is around 0.5 percent and significant. Sierminska and Takhtamanova (2007) examine wealth effects out of financial and housing wealth for Finland, Italy, and Canada, and find larger wealth effect out of housing wealth for all three countries (estimates of the elasticity of consumption with respect to housing wealth range between 0.1 and 0.14, while estimates of elasticity of consumption with respect to financial wealth are in the 0-0.04 range).

Some more Details: Differential Wealth Effects across Demographic Groups

In the life cycle framework, consumption responsiveness to changes in wealth (MPC) depends on many factors. Among them are life expectancies, real interest rates, borrowing constraints, and risk aversion. Some micro studies focus on age differences in wealth effects.

Lehnert (2004) uses household-level PSID data to investigate the wealth effect by age. He separates his sample into age quintiles (25-34, 35-42, 43-51, 52-62, and 63-95) and finds the largest marginal propensities to consume for the youngest (25-34) and next-to-oldest (52-62) groups (0.04 and 0.08 respectively). The fact that the youngest households have a high MPC might be somewhat puzzling: their life expectancy is the longest out of the group, which would imply the lowest MPC. On the other hand, they are likely to be liquidity constrained, and liquidity constrained households ought to have higher MPCs (as they are limited in their ability to smooth consumption by borrowing against future income). Households in the 52-62 age group are the ones who are most likely to retire and move into smaller, less valuable quarters.

⁵ Lehnert (2004) excludes households that are likely to have realized their housing gains and are expected to consume a large portion of these gains.

There is also some international evidence on the subject. Campbell and Cocco (2007) use microdata for the U.K., and examine the effect of house prices on consumption. They find the largest effect for older homeowners and the smallest for younger renters. This result is challenged by Disney et. al (2007), who find little evidence of heterogeneity in responses of young and old households, but it must be noted that in their paper older households are defined as those 45 years and older. Bover (2005) examines the patterns of wealth effects on consumption in Spain and finds a stronger effect of housing for prime-age adults and an insignificant financial effect. Sierminska and Takhtamanova (2007) find that the housing wealth effect is significantly lower for younger households and is strongest for those aged 55-64 in Finland and Italy and those aged 75 and over in Canada. In Canada the effect consistently increases from age 55 onwards, and in Finland and Italy the effect increases up to the group aged 55-64 and then is lower in the two oldest age groups.

Summary: The Strength and Speed of Housing Wealth Effect

On balance, existing empirical evidence suggests that the final long-run effects of changes in housing wealth to consumption is somewhere in the range of 3 to 10 cents on the dollar. The empirical evidence also suggests that the effect is gradual, with the immediate impact being relatively small (about 2 cents on the dollar), and the final effect taking several years to play out. While much of empirical evidence for the U.S. suggests that housing wealth has a stronger effect on consumption than financial wealth, the statistical significance of this difference is uncertain.

Empirical evidence suggests that the strength of the wealth effect might vary by age. The consumption of those on the verge of retirement might be more responsive to housing wealth changes (as these households are likely to realize capital gains by “downsizing” their house). This finding is important in light of the aging of population that is taking place across industrial countries – as older homeowners take up a larger share of population, aggregate consumption sensitivity to house prices might increase. It is also possible that consumption of younger (and may be credit constrained) households is highly sensitive to housing wealth changes.

References

Ando, A. and F. Modigliani. 1963. "The Life-Cycle Hypothesis of Saving: Aggregate Implications and Tests." *American Economic Review*, 53(1), p. 55-84.

Bernanke, Ben. 2008. Semiannual Monetary Policy Report to the Congress Before the Committee on Financial Services, U.S. House of Representatives. <http://www.federalreserve.gov/newsevents/testimony/bernanke20080227a.htm>

Bover, O. 2005. "Wealth Effects on Consumption: Microeconometric Estimates from the Spanish Survey of Household Finances," *Documentos de Trabajo*, No. 0522, Banco de Espana, Spain.

Campbell, J. Y. and J. F. Cocco. 2007. "How do House Prices Affect Consumption? Evidence from Micro data." *Journal of Monetary Economics* 54 (2007), pp. 591-621..

Carroll, C. 2004. "Housing Wealth and Consumption Expenditure." *Unpublished manuscript, Johns Hopkins University*.
<http://econ.jhu.edu/people/ccarroll/papers/FedHouseWealthv2.pdf>

Carroll, C., M. Otsuka and J. Slacalec. 2006. "How Large Is the Housing Wealth Effect? A New Approach." *Unpublished manuscript, Johns Hopkins University*.
<http://econ.jhu.edu/people/ccarroll/papers/COS-WealthEffects.pdf>

Case, K., J. Quigley, R. Shiller. 2005. "Comparing Wealth Effects: The Stock Market versus the Housing Market." *Advances in Macroeconomics: Vol. 15: no. 1, article 1*.

Davis, M., and M. Palumbo. 2001. "A Primer on the Economics and Time Series Econometrics of Wealth Effects." *Federal Reserve Board. Finance and Economics Discussion Paper No. 2001-09*.

Disney, R., J. Gatherhood, and A. Henley. 2007. "House Price Shocks, Negative Equity and Household Consumption in the U.K." unpublished manuscript.

Dolmas, J. 2003. "A Note on the Potential Pitfalls in Estimating a 'Wealth Effect' on Consumption from Aggregate Data." *Economic Letters*, 78(3), p. 437-44.

Dvornak, N., and M. Kohler. 2003. "Housing Wealth, Stock Market Wealth and Consumption: A Panel Analysis for Australia." *Reserve Bank of Australia, Research Discussion Paper 2003-07*.

Friedman, Milton. 1957. "A Theory of the Consumption Function." Princeton University Press, Princeton.

Grant, C. and T. Peltonen 2005. "Housing and Equity Wealth Effects of Italian Households." DNB Working Paper No. 43.

Juster, T.F., J.P. Lupton, J.P. Smith and F. Stafford. 2005. "The Decline in Household Saving and the Wealth Effect." *The Review of Economics and Statistics* 87(4): 20-27.

Lehnert, A. 2004. "Housing, Consumption, and Credit Constraints." Federal Reserve Board Working Paper No. 2004-63.

Ludwig, A. and T. Slok. 2004. "The Relationship Between Stock Prices, House Prices, and Consumption in OECD Countries." *Topics in Macroeconomics*, 4(1): 1114-1114.

Pennington-Cross, A. & S. Chomsisengphet. 2007. "Subprime Refinancing: Equity Extraction and Mortgage Termination," *Real Estate Economics, American Real Estate and Urban Economics Association*, vol. 35(2), pages 233-263, 06.

Pichette, L., and D. Tremblay. 2003. "Are Wealth Effects Important for Canada." Bank of Canada Working Paper 2003-30.

Poterba J., and A. Samwick. 1995. "Stock Ownership Patterns, Stock Market Fluctuations and Consumption." *Brookings Papers on Economic Activity*, 2: 295-372.

Shefrin, H. and R. Thaler. 1988. "The behavioral life-cycle hypothesis." *Economic Inquiry*, 26: 609-643.

Sierminska, E., Brandolini, A. and T. Smeeding. 2006. "Comparing Wealth Distribution across Rich Countries: First Results from the Luxembourg Wealth Study" Luxembourg Wealth Study Working Paper 1.

Sierminska, E., and Y. Takhtamanova. 2007. "Wealth Effect out of Financial and Housing Wealth: Cross-Country and Age Group Comparisons." FRBSF Working Paper 2007-01.

Table 1

STUDY	HOUSING WEALTH	FINANCIAL WEALTH	COUNTRY
Macroeconomic Evidence			
Davis & Palumbo (2001) Pichette & Tremblay (2003)	Long-run MPC 0.08 MPC 0.057	Long-run MPC 0.06 MPC \approx 0	U.S. Canada
Carroll (2004)	Immediate (next quarter) MPC 0.015 Long-run MPC 0.09	Immediate (next quarter) MPC 0.01 Long-run MPC 0.04	U.S.
Carroll, Otsuka & Slacalec (2006)	Immediate (next quarter) MPC 2 cents Long-run effect 9 cents	Immediate (next quarter) MPC 0.01 Long-run MPC 0.04	U.S.
Panel Data (Provides More Variation in House Prices)			
Dvornak & Kohler (2003)	L.R. MPC 0.03	L.R. 0.06-0.09	Australia
Ludwig & Slok (2004)	0	Elasticity \approx 0.02 - 0.05	panel of 16 OECD countries
Case, Quigley & Schiller (2005)	Elasticity 0.11-0.17	0	panel of 14 developed countries
	MPC 0.03-0.03	MPC \approx 0	panel of U.S. state data
Macroeconomic Evidence			
Disney, Gatherhood, and Henley	MPC 0.01		U.K.
Lehnert (2004)	MPC between 0.02 and 0.03	-	U.S.
Bostic, Gabriel & Painter (2006)	Elasticity 0.06	Elasticity 0.02	U.S.
Bover (2005)	MPC 0.015	-	Spain
Sierminska and Takhtamanova (2007)	Elasticity 0.1-0.14	Elasticity 0 - 0.04	Canada, Finland & Italy

Note: MPC is estimated elasticity multiplied by the average ration of consumption to wealth

Homeownership and Mortgage Initiatives
March 25, 2008
Yuliya Demyanyk
Federal Reserve Bank of St. Louis

Changes in Mortgage Underwriting Standards¹

Overview

The explosive growth in subprime lending in recent years was accompanied by an increase in the riskiness of subprime mortgages, reflecting easing in credit market conditions. Utilizing loan-level data, Demyanyk and Van Hemert (2008) analyze the quality of subprime loans by adjusting their performance for differences in borrower characteristics, loan characteristics, and house price appreciation since origination. In this research paper we show that quality of loans deteriorated for six consecutive years before the crisis. The accumulating problems in the subprime market were not visible with a naked eye, as they were masked by the high house price appreciation; however, they could have been detected with a simple statistical exercise long before the crisis.

The degeneration of the loan quality was monotonic but not equally spread among different type of borrowers. Over time, high-LTV borrowers became increasingly risky (their adjusted performance worsened more) compared to low-LTV borrowers. Securitizers seem to have been aware of this particular pattern in the relative riskiness of borrowers: we show that over time mortgage interest rates were more sensitive to the LTV ratio of borrowers.

In principal, the subprime-prime mortgage rate spread (subprime mark-up) should account for the default risk on subprime loans. As the overall riskiness of subprime loans rose between 2001 and 2006, for a market to experience a sustainable growth the subprime mark-up should have risen as well. Our research shows that this was not the case: both the price of risk and the price-per-unit-of-risk (subprime mark-up adjusted for differences in borrower and loan characteristics) declined over time.

¹ See, Yuliya Demyanyk and Otto Van Hemert, "Understanding the Subprime Mortgage Crisis." 2008 Available at the SSRN: <http://ssrn.com/abstract=1020396>

An explosive growth of subprime mortgage market, accompanied by the declining quality of loans, easier financing, and a decline in subprime mark-up (price of risk) constitutes a classic lending boom-bust scenario, in which unsustainable growth leads to a collapse of the market.

Data

We derived our data from a loan level database containing information on about half of all US subprime mortgages originated between 2001 and 2006. The data source is First American LoanPerformance. For purposes of our investigation, we focused on first-lien loans over the 2001 to 2007 period.

Delinquency rates

Our findings on delinquent loans revealed noteworthy information. We defined a loan to be delinquent if payments on the loan were 60 or more days late or the loan was in foreclosure. The loans originated in 2006 stood out in terms of high delinquencies and foreclosures; 2001 was a fairly bad vintage year as well, ranking second, both in terms of the delinquency and the foreclosure rates. The bad performance of vintage 2006 was not confined to a particular segment of the subprime market, but rather reflected a market-wide phenomenon.

We also computed the delinquency and foreclosure rates for all outstanding mortgages (all vintages pooled together). Based on this calculation, the fraction of FRMs that are delinquent or in foreclosure remained fairly constant at about five percent from 2005 on. These rates are consistent with those used in an August 2007 speech by the Chairman of the Federal Reserve System (Bernanke (2007)), who said "For subprime mortgages with fixed rather than variable rates, for example, serious delinquencies have been fairly stable at about 5-1/2 percent." It is important, though, to realize that this result is driven by an aging effect of the FRM pool, caused by a recent decrease in the popularity of FRMs. In other words, FRMs originated in 2006 in fact performed unusually poorly, but if one analyses the delinquency rate of outstanding FRMs over time, the weaker performance of vintage 2006 loans is masked by the aging of the overall FRM pool.

Change in underwriting standards

We found that underwriting criteria—such as FICO, LTV, DTI—are very important determinants of mortgage performance. However, for mortgages originated in 2006, those factors were not

significantly different compared to previous origination years. Therefore, changes in underwriting criteria cannot explain the crisis of 2007.

Loan Quality

We analyze the quality of loans based on their performance, adjusted for differences in observed loan characteristics, borrower characteristics, and subsequent house price appreciation. Using a simple statistical technique, we adjust the delinquency and foreclosure rates for these factors. The results indicate that the quality of loans has been deteriorating every year since 2001, with no particularly large jump from 2005 to 2006. In other words, the crisis was on the way for several years before it occurred. It did not show visible signs, like a virus during the incubation period, in terms of high delinquencies and foreclosures. High house price appreciation masked the true riskiness of subprime mortgages.

Loan-to-Value and loan delinquencies

Our analysis shows that high CLTV ratios have been increasingly associated with higher delinquency rates.

We also find that the combined loan-to-value (CLTV) is a determinant of delinquencies and foreclosures. However, the first-lien loan-to-value (LTV) is an even more important determinant of the mortgage rate, possibly because the loss-given-default on the first lien loan is more related to the first lien LTV than the CLTV.

Among the interesting results from our analysis was the impact of the CLTV ratio on mortgage interest rates over time. Considering all first-lien loans, about 30 percent have a CLTV smaller than 80 percent; about 20 percent have a CLTV of exactly 80 percent; and about 50 percent have a CLTV greater than 80 percent. The average CLTV increased slightly from 80 percent in 2001 to 84 percent five years later. Also, the distribution shifted slightly over time: in 2001 the percentage of loans in these three CLTV categories was 35 percent, 20 percent, and 45 percent, respectively; in 2006, it was 28 percent, 14 percent, and 58 percent.

Pricing risk

We also looked at whether the pricing of subprime mortgages was sensitive to differences in risk. Specifically regarding LTV, using a series of regressions, we tested whether the sensitivity of the lender's interest rate to the first lien LTV ratio changed over time. We found that lenders were to some degree aware of the association between high LTV ratios and risky borrowers: we demonstrated that over time they made the mortgage interest rate more sensitive to the LTV ratio of borrowers. Specifically, in 2001, a borrower was hardly charged a higher interest rate for the higher LTV ratio. In contrast, in 2006, a borrower with a one standard deviation above-average LTV ratio was charged an interest rate higher by 30 basis points.

In another exercise, we explored the behavior of the subprime-prime rate spread. In general, the interest rate on subprime mortgages is higher than on prime mortgages in order to compensate the lender for the additional default risk associated with subprime mortgages. As the overall riskiness of subprime loans rose between 2001 and 2006, for a market to experience a sustainable growth, the subprime markup should have risen as well. We showed that this was not the case: Both the price of risk and the price per unit of risk (the subprime markup adjusted for differences in borrower and loan characteristics) declined over time.

To explore the rate spread pattern, we focused on FRMs.² We used data on subprime rates from the LoanPerformance database; for the prime rate, we used the contract rate on FRMs reported by the Federal Housing Finance Board in its Monthly Interest Rate Survey. We found that the subprime-prime rate spread declined over time, both with and without adjustment for changes in loan and borrower characteristics. At the same time, the riskiness of loans has increased, implying that, on a per-unit basis, the subprime-prime spread declined even more.

Risk Layering

In our analysis we investigated whether a combination of several risk-factors—so-called risk layering plays an important role in explaining the crisis. The data suggests that, even though there have been increases in number of originated mortgages with several high-risk factors present at the same time (like, e.g., low FICO and high LTV), this a) does not change the result of

² We focused on the FRMs and not hybrid mortgages because the price of hybrids is determined by both the initial rate and the margin over the index rate, which complicates the comparison of subprime and prime rates.

monotonic worsening in loan quality for six consecutive years before the crisis and b) does not 'explain' why there is a crisis.

Were changes in loan quality steady or sudden?

We find that adjusting for loan and borrower characteristics and economic circumstances, riskiness of subprime loans had risen steadily for six years since 2001, and the marked deterioration of the loan quality was already apparent by the end of 2005.

Neighborhood Profiles of Subprime Mortgage Originations¹

We document that subprime mortgage originations are more prevalent in two types of neighborhoods: (1) neighborhoods with large shares of residents who are minority or lower-income, or have compromised credit and (2) neighborhoods with substantial new construction and higher house price appreciation. Minority areas have a disproportionate share of subprime both within a given city and across cities.

These neighborhood-incidence results hold across three different definitions of subprime: mortgages in subprime securitized pools as reported by First American LoanPerformance; mortgages with an APR more than three percentage points above comparable Treasury securities as reported in the Home Mortgage Disclosure Act (HMDA) data; and mortgages in the HMDA data originated by a lender on the U.S. Housing and Urban Development's Subprime Lender list.

We also examine which states experienced the most subprime lending. Subprime mortgage originations are a larger share of *housing units* in states with more house price appreciation and new construction, such as Nevada, Arizona, and Florida (Table 1), but a larger share of *mortgages* in economically depressed states such as Michigan and Ohio (Table 2), although Nevada and Florida head this list as well. In states with lively housing markets, both prime and subprime borrowers may take out mortgages to purchase newly constructed homes, invest in properties, or cash out equity. In states with depressed housing markets, investment and cash out activity among prime borrowers may be subdued, and the remaining borrowers may have difficulty qualifying for prime credit because of job losses and other manifestations of the local economy.

¹ See "Subprime Mortgages: What, Where, and to Whom?" by Chris Mayer (Columbia University) and Karen Pence, FEDS Working Paper 2008-29.

Table 1
LP Subprime Loans as a Share of Housing Units by State, 2005

STATE	# Subprime Loans / # Units	STATE	# Subprime Loans / # Units
NV	0.100	WI	0.030
AZ	0.077	NH	0.029
CA	0.071	ME	0.028
FL	0.062	OH	0.026
RI	0.062	WY	0.026
MD	0.061	IN	0.025
DC	0.052	KS	0.021
IL	0.048	MS	0.021
NJ	0.043	NM	0.021
GA	0.040	NC	0.021
UT	0.039	OK	0.021
CT	0.038	SC	0.020
CO	0.037	IA	0.019
VA	0.036	KY	0.019
WA	0.035	NE	0.019
MA	0.034	PA	0.019
MI	0.034	AL	0.018
MN	0.034	LA	0.018
MO	0.034	AR	0.017
ID	0.033	SD	0.014
OR	0.033	VT	0.014
DE	0.032	MT	0.012
NY	0.032	ND	0.012
TX	0.031	WV	0.009
TN	0.030		
Total		0.041	

Sample is restricted to first liens that are not backed by manufactured housing or buildings with more than four units; are greater than \$25,000 in 2006 dollars; and are backed by a property located in a metropolitan statistical area. Subprime loan indicates loans that were packaged into subprime mortgage pools as reported by First American LoanPerformance.

Table 2
Subprime Mortgages as a Share of All Mortgages by State, 2005

STATE	Subprime Loans / Loans	STATE	Subprime Loans / Loans
NV	0.25	PA	0.16
FL	0.24	SC	0.16
MI	0.24	UT	0.16
TX	0.24	WI	0.16
TN	0.23	AR	0.15
OH	0.22	CO	0.15
AZ	0.21	KS	0.15
IL	0.21	KY	0.15
IN	0.21	NE	0.15
MD	0.21	WY	0.15
MS	0.21	ID	0.14
MO	0.21	IA	0.14
RI	0.21	MA	0.14
CA	0.19	NC	0.14
GA	0.19	OR	0.14
NY	0.19	VA	0.14
OK	0.19	WA	0.14
CT	0.18	NM	0.13
LA	0.18	NH	0.12
NJ	0.18	SD	0.10
AL	0.17	MT	0.09
DC	0.17	VT	0.08
DE	0.16	ND	0.08
ME	0.16	WV	0.08
MN	0.16		
Total		0.19	

Sample is restricted to first liens that are not backed by manufactured housing or buildings with more than four units; are larger than \$25,000 in 2006 dollars; and are backed by a property located in a metropolitan statistical area (MSA). Subprime loan indicates loans that were packaged into subprime mortgage pools as reported by First American LoanPerformance.

Homeownership and Mortgage Initiatives
April 6, 2008
Fred Furlong
Federal Reserve Bank of San Francisco

Drivers of Subprime Mortgage Delinquencies and Foreclosures

Overview/Summary

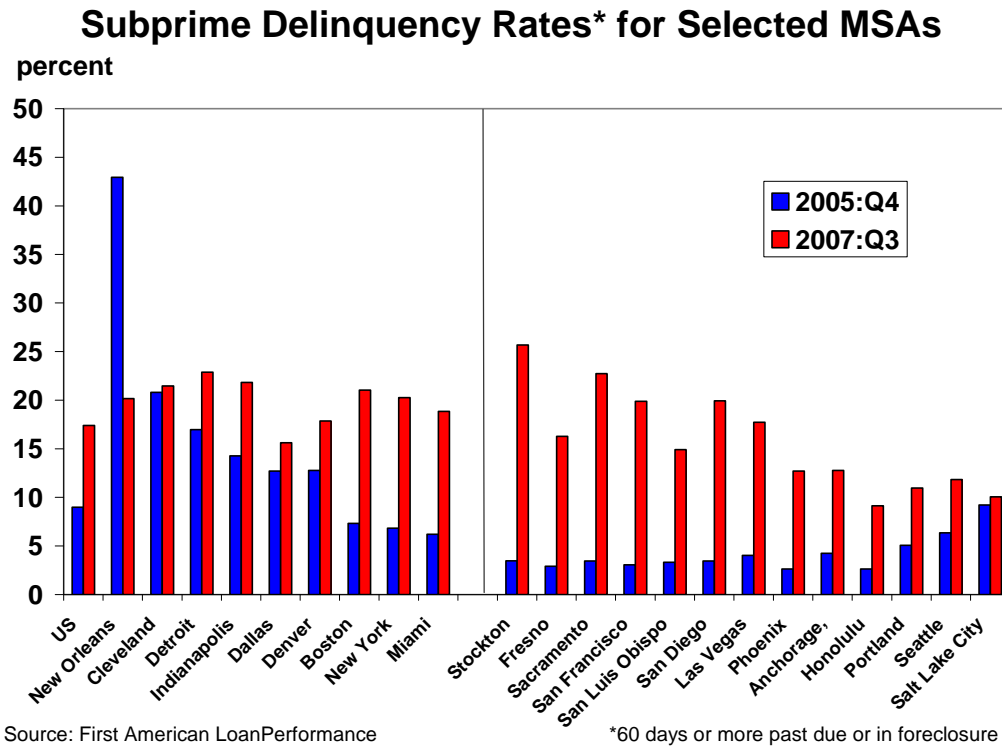
Subprime mortgage delinquencies and defaults have risen substantially since 2005 and were at very high levels in a large number of markets in late 2007. Recent research shows that the drivers of the performance of subprime mortgages are very similar to those that earlier studies found to affect the performance of mortgage loans more generally—that is, variables related to regional economic conditions, borrower and loan risk characteristics, and housing market conditions. Specific drivers affecting subprime performance include regional labor market conditions, loan-to-value ratios, the extent of loan documentation, and borrower credit scores. What especially stands out in the results from the recent research on subprime mortgages performance is the role of house prices. The evidence points to house price appreciation as the single best predictor of subprime delinquency rates. The findings related to house price appreciation are consistent with borrowers that have low or no home equity being more liquidity constrained. They also are consistent with the option-theoretic model of mortgage defaults, which in its simplest form predicts a borrower will default on a mortgage when the value of a home moves below the value of the mortgage obligation. In addition, the empirical evidence shows that changes in subprime delinquency rates across regions after 2005 are highly correlated with the degree of house price deceleration, suggesting changes in expectations about house price appreciation can affect the performance of mortgage loans.

Rise in subprime Delinquencies

In 2005, delinquency rates were elevated in some areas such as the Gulf Coast State markets hit hard by Hurricane Katrina and Midwest markets that had experienced sub par economic performance. Elsewhere, however, delinquency rates on subprime mortgages generally improved from 2001 through 2005. In fact, delinquency rates on risky subprime mortgages were remarkably low in a number of markets, especially those in the West.

The picture is quite different today, with delinquency rates having shot up rapidly in the markets in which subprime mortgage performance had been remarkably good (Figure 1). Among MSAs in the U.S., the median subprime delinquency rate (60 days or more past due or in foreclosure) in the markets covered by the LoanPerformance data moved up sharply to 17.4 percent, with a range from about 7 to over 30 percent, as of September, 2007.¹ Subprime delinquency rate hotspots include inland areas of California and parts of Nevada, Florida, and Ohio.

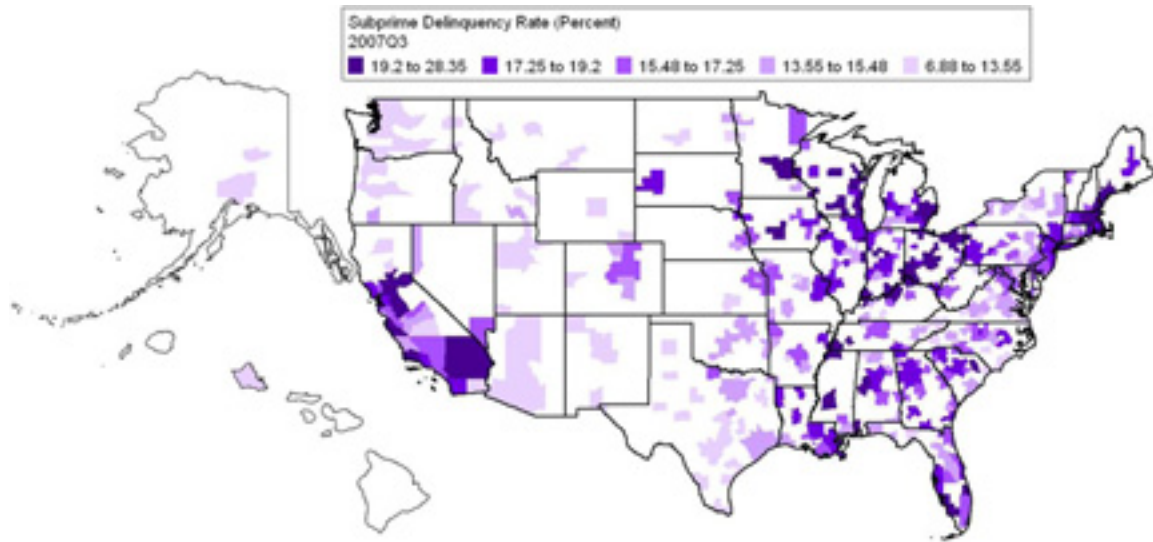
Figure 1
Sharp rise in subprime delinquency rates for many MSAs



Key research questions are: what accounts for the rapid turnaround in the performance of subprime loans? and what accounts for the marked differences in the experiences among regions (Figure 2)?

¹ Source: First American LoanPerformance.

Figure 2
Subprime delinquency rates vary considerably among MSAs



Mortgage loan defaults

The decision by a borrower to become delinquent on a mortgage depends on the ability and the willingness of the borrower to repay the loan. In terms of ability to pay, past research has found that certain life events such as unemployment and divorce are associated with a higher likelihood of a borrower defaulting on a mortgage loan.² Such events lead to disruptions to income and shocks to expenses.

In the face of such events, borrowers with greater liquidity constraints have higher probabilities of defaulting. One such indicator is argued to be the initial loan-to-value (LTV) ratio since a borrower with limited financial assets or other liquid assets is likely to purchase a home with a low or no down payment. Indeed, past research consistently finds that initial LTV is a significant driver of loan defaults. Some research also finds that higher debt burdens relative to income are associated with a higher incidence of default. A borrower's overall credit rating also would reflect the historical incidence of

² Yongheng Deng, John Quigley, and Robert Van Order. "Mortgage Terminations, Heterogeneity, and the Exercise of Mortgage Options," *Econometrica*, 68 (March 2000), pp. 275-307.

adverse events as well as the ability and perhaps willingness of the borrower to keep payments on debt current.³

The ability to keep mortgage loan payment current in the face of shocks also would be expected to be related to the amount of equity in a house. The amount of equity in a house will be related to the down payment and the extent any subsequent home equity borrowing. Also important would be housing market conditions and the amount of house price appreciation (depreciation) since the origination of the loan. In a market in which house prices have been stagnant or even declining, a borrower with a recent mortgage secured with little or no down payment would not have the flexibility to tap equity in the house to weather a life event. In contrast, in a market with rising house prices a homeowner is more likely to have more equity in the house.

Housing market conditions also can affect the probability that a borrower in stress will be able to avoid defaulting on a mortgage loan through another channel. Instead of default, a borrower can terminate a mortgage by prepaying it, either by refinancing or selling the house. In the case of the latter, in a strong housing market, a stressed homeowner is more likely to be able to sell a house in time to avoid default. That is, in robust housing markets, houses are more liquid.

The amount of home equity and overall housing market conditions can also affect the willingness of a borrower to keep mortgage loan payments current. With regard to the amount of equity, researchers have used the option-based approach to analyze defaults and prepayments. A mortgage loan can be seen as having two imbedded options. First, with the choice of default, a borrower has the option of putting the house back to the lender. In its simplest form, when the value of the house falls below the value of the mortgage obligation, a borrower has the incentive to default. Note that the choice of default does not involve a question of affordability of the mortgage per se. That is, a borrower can have no change in income or expenses and still decide to default if home equity becomes sufficiently negative.

³ See Ronel Elul, "Residential Mortgage Defaults," Federal Reserve Bank of Philadelphia, **Business Review** Q3 2006, 21, for a review of the issues and research on mortgage defaults.

Consistent with this option-based approach to modeling mortgages, past studies have found that housing equity is a significant predictor of mortgage default.⁴ However, research also has found that borrowers do not act “ruthlessly;” that is, they do not default whenever home equity is negative.⁵ There are a number of reasons that a borrower would not choose to default even with negative equity. One might be a commitment to meet the contract agreement. There also are costs associated with defaulting on a mortgage such as adverse effects on a borrower’s credit rating and the expenses involved in relocation. The latter costs may be more relevant for owner-occupied houses than for second homes or investment properties.

Another reason homeowners may not default when their home equity is negative is that mortgages have another option, the option to prepay the loan. As indicated earlier, the prepayment may be through refinancing or selling the house. Being able to prepay a loan represents a call option, since in paying off a loan the borrower in effect buys back the outstanding debt.⁶ The value of the prepayment option to the borrower can offset the value of the option to default. For example, for a homeowner with a mortgage interest rate above current interest rates, the prepayment option could be more valuable than the default option. Since defaulting on the loan would mean the homeowner could not exercise the call option through refinancing, the borrower may not choose to default even if the value of the house is less than the balance on the current mortgage.

Evidence on subprime mortgages

Elevated default rates for subprime mortgages per se should not be surprising given the risk of the loans. However, the very rapid turnaround in subprime mortgage performance and the severity of the subprime crisis in a number of regions are quite notable. Based on the findings from previous research, the potential explanations for the subprime meltdown include a substantial shift in economic conditions, a substantial change in the

⁴ Yongheng, Quigley, and Van Order (2000).

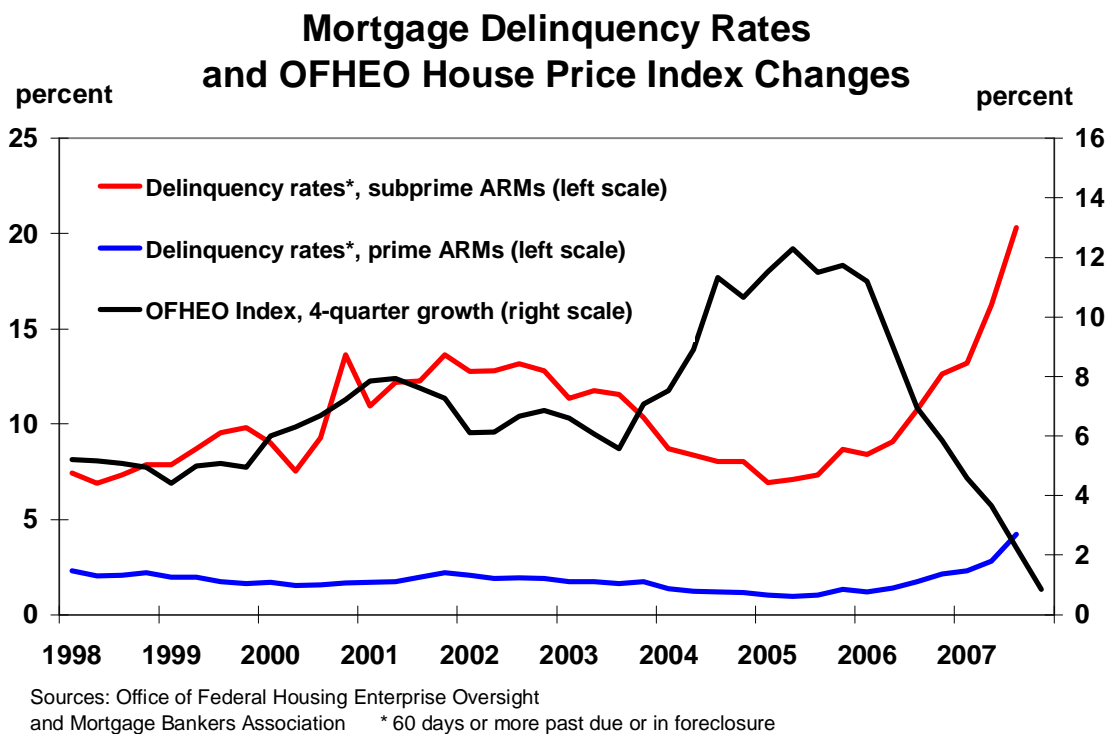
⁵ Chester Foster and Robert Van Order. “An Option-Based Model of Mortgage Default,” *Housing Finance Review*, 3 (October 1984), pp. 351-72.

⁶ Mortgages often include prepayment penalties, which reduce the net value of the call option.

riskiness of the pool of subprime loans, and/or a serious deterioration in housing market conditions.

Research on the performance of subprime mortgages based on loan level data prior to meltdown finds that subprime loan performance was related to risk factors such as borrower credit scores, high LTVs, and the degree of loan documentation regarding borrower income and assets.⁷ Differences in regional economic conditions measured by unemployment rates also affected subprime loan performance. In addition, the research indicates that financial incentives play important roles in determining subprime loan outcomes—that is prepayments and defaults. In particular, measures of housing market conditions indicate that subprime loans are strongly affected by incentives to become delinquent and default on a mortgage.

Figure 3
Mortgage delinquency rates rise with cooling of house prices



⁷ Michelle A. Danis and Anthony Pennington-Cross, The Delinquency of Subprime Mortgages, Federal Reserve Bank of St. Louis, Working Paper 2005-022A.

In terms of the sudden and extensive deterioration in performance of subprime loans after 2005, it appears that the main drivers were an increase in the risk of the pool of subprime loans combined with the bursting of the housing bubble, rather than overall economic conditions. One study directly examines evidence relating to the deterioration of mortgage underwriting standards from 2001 to 2006.⁸ The study, using loan level data (LoanPerformance), estimates probabilities of delinquency and probabilities of defaults for subprime loans. The study's findings indicate that, during the explosive growth of the subprime market in 2001 to 2006, the quality of loans monotonically deteriorated as underwriting criteria eased. The degeneration of the loan quality was not the same for all types of loans. Over time, high-LTV loans became increasingly risky compared to low-LTV loans. Overall, the findings suggest that, when adjusting loan performance for differences in borrower characteristics, loan characteristics, and economic circumstances, the marked deterioration of the loan quality was already apparent by the end of 2005. A key aspect of economic conditions up to 2005, of course, was the robustness of housing markets in a number of regions. Strong house price appreciation appears to have masked the decline in credit quality among subprime loans into 2005.

Other research confirms the importance of house prices to the performance of subprime loans. A particularly important study provides an assessment of the homeownership experiences in Massachusetts from 1989 to 2007.⁹ In the study, the observation level is the owner of a given house, where ownership can continue or end in a sale or a default. The study finds that high cumulative house price appreciation significantly reduced the likelihood of default over the entire sample period. Regarding the current subprime crisis, the results suggest the declines in house prices have been the main driver behind the rise in mortgage defaults in Massachusetts.¹⁰

⁸ Yuliya Demyanyk and Otto Van Hemert "Understanding the Subprime Mortgage Crisis," Federal Reserve Bank of St. Louis, 2007.

⁹ Gerardi, and Shapiro, and Willen, "Subprime Outcomes: Risky Mortgages, Homeownership Experiences, and Foreclosures," Federal Reserve Bank of Boston, 2007.

¹⁰ Among the other findings for the full sample period, Gerardi, and Shapiro, and Willen (2007) find the initial LTV for a homeowner and the unemployment rate (town level) are positively related to defaults. They estimate that the likelihood that a foreclosure will occur for borrower (one that financed the purchase of the home with a subprime loan) in the first twelve years of homeownership is about 18 percent. The outcome in any give period depends on the house price appreciation experienced. For some particularly

Other research based on regional-level data on subprime performance indicates that the findings regarding the role of house price on mortgage loan performance in Massachusetts extend to other regions.¹¹ The analysis based on regional data is targeted directly at understanding the reason for the variation in the performance of subprime loans in different markets. The overall findings are the same whether based on state-level or MSA-level data.

First, consistent with the research using loan level noted earlier, analysis of the performance subprime loans across regions shows that house price appreciation was the single best predictor of subprime delinquency rates before the breakdown in performance. In 2005, the markets with extremely low subprime delinquency rates also had very rapid house price appreciation in 2004 and 2005 (Figure 4). Other factors also help explain regional differences in subprime loan performance prior to the recent crisis. Regional differences in the risk of the pool of subprime mortgages accounts for some of the differences in subprime performance at the end of 2005.¹² Economic conditions also help explain regional differences in subprime performance as of 2005. At the end of 2005, delinquency rates on subprime mortgages were elevated in Gulf Coast State markets hit hard by Hurricane Katrina and in Midwest markets that had experienced sub par economic performance. At the end of 2005, for example, subprime delinquency rates (60 days of more past due or in foreclosure, from LoanPerformance) were already above 20 percent in Cleveland and close to 17 percent in Detroit. Nevertheless, house price appreciation was by far the most important driver of the regional differences in subprime performance in 2005.¹³

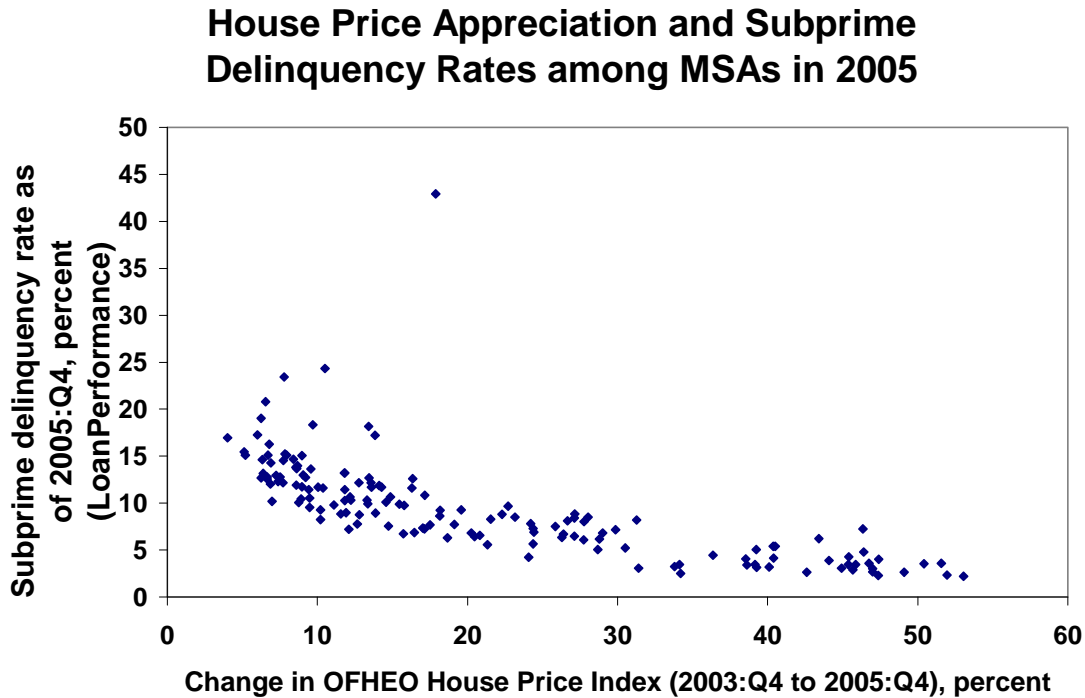
bad house price outcomes, they believe the probability of foreclosure is higher, but for good scenarios, the likelihood of foreclosure is significantly lower.

¹¹ Doms, Furlong, and Krainer (2007).

¹² One measure of the risk of the pool of subprime mortgages used in Doms, Furlong, and Krainer (2007) is the median APR on higher-priced loans for MSAs as reported in data collected under HMDA.

¹³ In multivariate regressions of MSA-level subprime delinquency rates at the end of 2005, the results in Doms, Furlong, and Krainer (2007) show an adjusted R² of .79 when measures of house price appreciation are included along with measures of borrower risk and economic conditions in the set of explanatory variables, compared to .37 when house price appreciation is excluded.

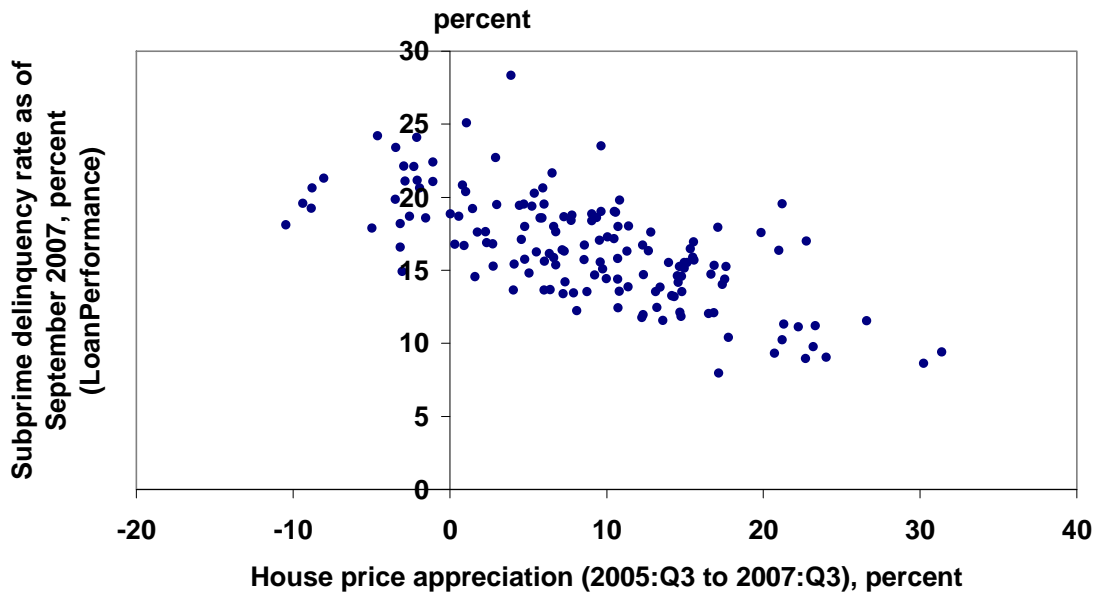
Figure 4
Regional house price appreciation and mortgage delinquency rates negatively related prior to subprime crisis



Results from empirical analysis examining the period since 2005 are similar to those from the analysis of the pre-crisis period in terms of the relative importance of the drivers of subprime mortgage performance across geographic regions. In particular, the statistical evidence indicates that since 2005, changes in house prices have been the most reliable indicator of subprime delinquency hotspots. Figure 4 provides a graphical perspective on this link between delinquency rates and house-price appreciation. The figure covers the largest MSAs, and it shows a strong negative relationship between the past two years of house-price appreciation and subprime delinquency rates in late 2007.

Figure 5
Regional house price appreciation is the single best predictor of mortgage delinquency rates after the slump in housing

House Price Appreciation and Subprime Delinquency Rates Among Large MSAs in 2007



The findings related to house price appreciation are consistent with borrowers that have low home equity being more liquidity constrained. They also are consistent with the option-theoretic model of mortgage defaults. Another way to see how house price changes can figure into the default decision is to appeal directly to the theory of housing demand. Houses are, to some extent, factors of production in the local economy and their values should reflect economic conditions. House prices should be influenced by expectations about future economic conditions and these expectations figure prominently in a household's housing demand. This is most clearly seen through the user cost of capital (housing). A standard representation of the real after-tax user cost of capital (housing) is as a function of the real mortgage interest rate, property tax rate, marginal tax rate, depreciation of housing, and expected house price appreciation (capital gains). For housing, the user cost is negatively related to expected house price appreciation.

To the extent that expectations about house price appreciation are formed based on recently realized rates of appreciation, the shift from very rapid house price appreciation to slower or negative price changes after 2005 would have led to increases in the user cost of capital (housing) for homeowners in many markets. The rise would be expected to reduce that demand for housing, both for new and existing homeowners, reducing the underlying value of houses and affecting the willingness of borrowers to maintain payments on mortgage loans. This suggests there would be a relation between the change in subprime mortgage delinquencies (defaults) and the degree of deceleration in house prices.

Consistent with this hypothesis regarding expectations about house price, MSAs that experienced a combination of strong house price appreciation between 2002 and 2004 and then relatively weak appreciation between 2004 and 2006 had the largest increases in subprime delinquency rates. This relationship holds up in regression analysis which controls for the level of house price appreciation, changes in the risk of pools of subprime loans, and changes in economic conditions.¹⁴

¹⁴ Doms, Furlong, and Krainer (2007).

Homeownership and Mortgage Initiatives
March 23, 2008
Liz Laderman
Federal Reserve Bank of San Francisco

The Efficacy of Mortgage Loan Workouts¹

Introduction

In his March 4th speech to the Independent Community Bankers of America Annual Convention, Chairman Bernanke reported that a recent estimate based on subprime mortgages foreclosed in the fourth quarter of 2007 indicated that total losses from foreclosures exceeded 50 percent of the principal balance, with legal, sales, and maintenance expenses alone amounting to more than 10 percent of the principal.² “Workouts,” including repayment plans and loan modifications, are an alternative to foreclosure for defaulted mortgages. The Chairman noted that the magnitude of, and uncertainty about, expected losses in a foreclosure suggest considerable scope for workouts that are mutually beneficial to investors and borrowers who want to stay in their homes, and he called on mortgage lenders to offer borrowers more workouts.

In this synopsis, I discuss the home mortgage default and foreclosure process, discuss workout options, present the issues related to mortgage workouts that are of concern to the System, present the research literature’s main empirical findings regarding the efficacy of workouts, and analyze these findings.

The evidence indicates that the high cost of foreclosures provides considerable scope for loan workouts such as repayment plans and loan modifications. At the same time, the evidence points to high rates of re-defaults among borrowers that receive workouts. One framework used to balance these contrary forces is the so-called break-even probability approach, which indicates the share of workout offers that must succeed for the total cost of all workouts (including the cost of re-defaults) to equal the cost of foreclosing on all

¹ Much of the material in this document is contained in the Federal Reserve Board’s Mortgage Foreclosures and Workouts memo, by Karen Dynan, Andreas Lehnert, Nellie Liang, and Karen Pence, dated March 13, 2008.

² Estimates based on 911 foreclosures on subprime mortgages in a securitized pool serviced by a single firm. The average principal balance was about \$190,000 in this sample.

loans. The results from one study suggests that, under current market conditions and given a large enough pool of loans, the break-even probabilities should be relatively low for loan workouts, and lower for workouts than for the alternatives to terminating a mortgage such as short-sales. However, lenders/servicers still need a process for assessing the likely success of workouts for individual (or groups) of borrowers. Also, the break-even probability approach relies on the law-of-large numbers and would not be applicable to smaller pools of mortgage loans.

Default and Foreclosure

Default and Foreclosure Process

Borrowers are in “technical default” on their mortgage whenever they fail to meet any of the obligations of the mortgage contract. “Legal payment default” occurs when one payment has been completely missed and a second is due and payable. “Default” in *industry practice* means loans that are more than 90 days delinquent, and such loans are considered as “in foreclosure” for standard statistical purposes. However, the lender might not begin actual legal foreclosure proceedings immediately.

State laws govern the foreclosure process, the legal process for liquidating a property to pay off the mortgage debt of a defaulted borrower. In most states, either a court filing of intent or the posting of notice of intent to foreclose initiates the process. Historically, the foreclosure process alone has usually taken from a couple months to up to a year and a half, depending on the state and whether the borrower files for bankruptcy. The period of borrower delinquency before the commencement of the foreclosure process and the time it takes the lender to actually dispose of the property can add up to a year more. In practice, the lender usually is the purchaser of the property at the foreclosure sale and must then manage and liquidate the property to recover funds. In most states, at any time before the foreclosure sale, the borrower may “reinstate” (“cure”) the mortgage by bringing the loan current (paying the missed payments plus late fees and attorney costs), thereby retaining the home.

Incidence of Foreclosure

Foreclosure starts rose in 2007. Federal Reserve Board staff estimates that foreclosure starts in 2007 totaled about 1.5 million, up 50% from 2006 levels, which themselves were up 53% from 2005 levels. More than half of the foreclosure starts in 2007 were on subprime mortgages, even though subprime loans accounted for only about 13% of the 54.5 million mortgages outstanding as of the end of 2007. The rise in foreclosures likely contributed materially to the number of vacant unsold existing homes, estimated to have been above 2 million at the end of 2007.

With house prices still soft or declining in many areas and the number of mortgages entering serious delinquency (at least 60 days delinquent) continuing to increase, foreclosure starts are likely to continue to rise. In the past, many borrowers were able to refinance into a new loan before entering delinquency or foreclosure, but the decline in house prices and tighter credit conditions have limited this option. Indeed, recent FHA refinancing activity has been low relative to the increase in the number of mortgages entering serious delinquency or foreclosure.

Foreclosure Costs

Foreclosure costs for the lender vary with the length of time from the date of the last payment to foreclosure and then to disposition of the property. Costs include the missed mortgage payments during that period, taxes, legal and administrative fees, real estate owned (REO) sales commissions, and maintenance and repair expenses (both routine maintenance that may have been deferred by the borrower and “trash out” costs for restoring the property to a condition suitable for sale.) Additional losses arise from the potentially significant reduction in value associated with repossessed properties, particularly if they are unoccupied for some period. It is likely that foreclosure losses as a percent of principal will grow in the coming months as reports from REO liquidators indicate that the time period between the last mortgage payment and REO liquidation has lengthened and as house prices continue to decline.

Workout Options

Loan workouts might be able to help those defaulting borrowers who cannot refinance, but can commit to a reasonable monthly payment and do want to remain in their homes.

Home Retention Options

Under one category of workouts, the lender provides either forbearance or forgiveness of part of the debt owed, and the borrower gets to keep the home. “Short-term forbearance” allows for the suspension of up to three payments or a reduction of payments for up to six months, followed by a “repayment plan.” Under a repayment plan, the borrower repays the entire amount due, including any arrearages. One source mentions that the repayment plan may require the immediate resumption of only standard full payments, with arrearages capitalized into a second lien to be paid off over a period of years. “Long-term forbearance” allows for the suspension or reduction of payments for a period of four to twelve months followed by a repayment plan to be completed within the next twelve months.

A “loan modification” is a permanent change in one or more terms of a borrower’s loan that results in a payment the borrower can afford. A loan modification is negotiated when a borrower has indicated a desire to retain ownership of the property, a capacity to support a mortgage under the new terms, and does not qualify for a refinance of the loan under lender/investor policies. In a loan modification, the lender may extend the term of the loan, reduce the interest rate, reduce the principal, or allow borrowers to simply skip some payments. The proposal by the Hope Now Alliance to freeze interest rates at the introductory rate for five years for some borrowers with subprime ARMS is an example of a modification.

Voluntary Title Transfer Options

Foreclosure involves the involuntary transfer of title to the home from the borrower to the lender. There are several options under which the borrower can voluntarily transfer title to either the lender or to a third party. These alternatives usually are less expensive than foreclosure.

A “deed-in-lieu of foreclosure” is an amicable agreement between lender and borrower and involves the borrower giving title to the lender in exchange for release of the debt obligation. A “short sale,” “short payoff,” or “preforeclosure sale,” is a lender-approved sale of the home to a third party for an amount that is less than the borrower’s debt to the lender. In this case, the lender either negotiates an unsecured repayment plan with the borrower for the additional amount owed or forgives the remaining debt. A “workout mortgage assumption” permits a qualified applicant to assume title to the home and the mortgage obligation from a borrower who currently is delinquent or is in imminent danger of default because of involuntary inability to pay.

Incidence of Workouts

Surveys of servicers by the Mortgage Bankers Association, the Conference of State Bank Supervisors, the Hope Now Alliance, and others provide information on the scale of recent activity. These surveys generally indicate that servicers substantially increased the number of loan workouts in the latter part of last year. The survey by the Hope Now Alliance, which contains the most recent data, estimates that workouts of subprime mortgages rose from around 250,000 in the third quarter of 2007 to 300,000 in the fourth quarter, while workouts of prime mortgages rose from 150,000 to 250,000 over the same period. However, the number of mortgages seriously delinquent or in foreclosure rose by substantially more than did workouts in the fourth quarter.

Modifications increased by more than repayment plans for subprime mortgages, but still accounted for only about half of the workout plans. It is possible that servicer surveys underestimate the number of modifications because, for example, some servicers offer borrowers a repayment plan with a lower monthly rate for several months that upon successful completion would lead to a permanent modification. Information on the specific terms of loan modifications is sketchy. We have information based on confidential data to BS&R from several large servicers, surveys by the state of California, and conversations with servicers. These data indicate that most modifications in the

recent past involve a reduction in the interest rate, while reductions of principal balance have been quite rare.

Issues

In evaluating a workout program, who are the specific relevant parties whose interests are to be considered?

For example, regarding borrowers as: only victims of fraud? Only victims of unforeseeable events? Anyone who is involuntarily unable to fully pay their mortgage debt?

What is the goal of a workout program?

How should the various expected benefits and costs, as well as the risks, of the workout program relative to those of foreclosure for the relevant parties (generally, borrowers, lenders/investors, and society) be weighted?

What are the benefits, costs, and risks of the workout program for the relevant parties, in theory and empirically?

How do the benefits, costs, and risks depend on a host of variables? Are the empirical values of those variables known or unknown? Are the empirical values controllable or uncontrollable? If the variables are random, what are their stochastic properties?

What are the parties' incentives, what information do they have, and how do we model their behavior?

Which type of workout program meets the goal most effectively?

Is there enough variation in circumstances that different programs are called for in different situations?

What are the roles, if any, for the Federal Reserve and other government agencies in facilitating a workout program or programs?

Are there obstacles to implementing a chosen workout program or to implementing it in an ideal fashion, and can government agencies help overcome those obstacles in a cost effective manner?

What does existing empirical evidence tell us that is relevant to addressing these issues?

How is the relevance of the empirical evidence qualified by considerations such as different economic environments, different research questions, and different underlying assumptions?

Main Empirical Findings on Workout Efficacy

Foreclosure costs often are substantial.

As noted by the Chairman, total losses from a sample of recent foreclosures on subprime mortgages exceeded 50 percent of the principal balance.

Some evidence suggests that foreclosure losses in general account for about 20 to 30 percent of the loan balance.³ Another estimate, which assumes a 15-month period from date of last payment to final disposition of the property, is 40 percent.⁴

Using a model calibrated to industry parameter values, Ambrose and Capone (1996) calculate the minimum probabilities of success (borrower compliance with the workout)

³ Mason (2007) reports that the cost of a typical foreclosure has been estimated to be about \$60,000, about 20 to 25 percent of the loan balance. Joseph R. Mason, "Mortgage Loan Modification : Promises and Pitfalls," October 3, 2007, p.2.

⁴ Capone (1996) estimates a loss severity rate of 30 percent for an eight-month period between date of last payment and property disposition, and 50 percent for a 25-month period. Charles Capone, "Providing Alternatives to Foreclosure: A Report to Congress," U.S. Department of Housing and Urban Development, May 1996.

of various workout programs that would make the programs profitable, as compared with foreclosure, for risk-neutral lenders (“break-even probabilities”).⁵

For loan-to-value ratios of 80 percent, 90 percent, or 95 percent, no probability of borrower self-cure (conditional on no cure in the 90-120 day delinquent period), and expected rates of return on houses of -5 percent, -10 percent, or -20 percent, loan modifications and repayment plans have the lowest break-even probabilities. Deed-in-lieu and preforeclosure sale have the highest.

The break-even probabilities for loan modifications and repayment plans are relatively low. For loan modifications, the probability ranges from 3.3 percent to 10.1 percent, while for lender forbearance, it ranges from 14.3 percent to 23.4 percent.

Based on a sample of loans owned by Freddie Mac that entered into 60-, 90-, or 120-day delinquency between January and September 2001, Cutts and Green (2005) find that, controlling for a wide range of loan quality variables, the probability of ultimate failure (foreclosure, deed-in-lieu, preforeclosure sale, or lender charge-off or repurchase) drops sharply when the borrower is in a repayment plan.⁶

At sample means, being in a repayment plan lowers the probability of failure by 68 percent for low-and moderate-income borrowers.

Cutts and Merrill (2008) find that about 60 percent of prime conforming mortgages that were 90-days delinquent at the start of a repayment plan had re-defaulted by the end of

⁵ Brent W. Ambrose and Charles Capone, “Cost-Benefit Analysis of Single-Family Foreclosure Alternatives,” *Journal of Real Estate Finance and Economics*, vol. 13, pp. 105-120 (1996).

⁶ Amy Crews Cutts and Richard K. Green, “Innovative Servicing Technology: Smart Enough to Keep People in Their Houses?” in *Building Assets and Building Credit: Creating Wealth in Low-Income Communities*, James A. Johnson Metro Series. Washington, D.C.: Brookings Institution Press; Cambridge, MA: Joint Center for Housing Studies of Harvard University, edited by Nicolas P. Retsinas and Eric S. Belsky, pp. 348-77 (2005).

the repayment period and an even higher percentage of loans at least 120-days delinquent had done so.⁷

However, the historical re-default rate on modified conforming mortgages is only 20 percent.

Fitch (2007) reports a 35 to 40 percent re-default rate on modified loans within 12 to 24 months.⁸

Moody's (2005) reports a re-default rate on modified subprime loans of 50 percent for average servicers.⁹

Stegman, Quercia, and Davis (2007) conclude that the likelihood that the servicing of affordable housing loans may be undercapitalized and that the likelihood that a delinquent affordable housing borrower will ultimately default varies significantly across servicers.¹⁰

The authors suggest that policy makers incorporate foreclosure prevention servicing into affordable homeownership programs.

Analysis

Taken at face value, even Ambrose and Capone's (1996) highest estimated break-even success probabilities for loan modifications and repayment programs combined with the highest estimated re-default rates for workouts imply that the break-even probabilities would always be met. If this is the case, then lenders and servicers likely should pursue such programs, for borrowers can only benefit. Even though some borrowers may not

⁷ Amy Crews Cutts and William A. Merrill, "Interventions in Mortgage Default: Policies and Practices to Prevent Home Loss and Lower Costs," Freddie Mac Working Paper #08-01, March 2008.

⁸ Fitch Ratings, "Changing Loss Mitigation Strategies for U.S. RMBS," June 4, 2007.

⁹ Moody's, "2004 Review and 2005 Outlook: U.S. Servicer Ratings," January 12, 2005.

¹⁰ Michael A. Stegman, Roberto G. Quercia, Janneke Ratcliffe, Lei Ding, and Walter R. Davis, "Preventive Servicing is Good for Business and Affordable Homeownership Policy," *Housing Policy Debate*, vol. 18, iss. 2, pp. 243-78 (2007).

want to stay in their homes, it is difficult to imagine that the offer of the option to do so would harm such borrowers.¹¹

However, even if break-even probabilities are always met, one might want to consider costs other than those faced directly by lenders and borrowers. These might include the moral hazard effects of a workout program on future lending or political costs arising from any perceived “unfairness” of a workout program that is applied too liberally. In addition, one might want to consider costs under the assumption that the lender is not risk neutral

If the net benefits to the lender, taking into account moral hazard, are positive, then the government’s role might focus on helping mitigate institutional obstacles to workouts. Given the results of Stegman et. al. (2007), agencies might help disseminate best practices in servicing.

In addition, agencies might facilitate communication between servicers and borrowers. Board staff reports that servicers believe that more loan modifications could be made if the servicers could connect with more borrowers, and at earlier stages before mortgage arrears mount. A survey conducted by the Mortgage Bankers Association suggests that 23 percent of foreclosure actions started in the third quarter of 2007 were in cases where the borrower did not respond. Others have reported that nearly 50 percent of foreclosures were completed with borrowers never having corresponded with their servicer.

Agencies also might help facilitate communication between servicers and investors. Servicers might help reduce avoidable foreclosures if they had the consent of investors to increase the types of modifications that the servicers use for distressed borrowers—for example, if the servicers could more readily choose to write down principal rather than

¹¹ Some argue that, given the relatively high re-default rates, loan modifications simply delay and raise the distress costs for borrowers. Under this line of thinking, policy should focus on simply reducing foreclosure expenses or on helping borrowers and communities address problems related to foreclosures. One initiative that the Federal Reserve is undertaking with NeighborWorks America is to help communities to develop strategies with regard to vacant properties and neighborhood stabilization.

the interest rate when it would significantly reduce the risk of foreclosure and create an appreciation benefit that is shared by borrowers and investors.

Agencies might also play an insurance role. Ambrose and Capone (1996) point out that because they are dealing with probabilities, the abilities of lenders to exploit profitable loan workouts in their model rely on large-number theory. They state that, for this reason, such risks can be more efficiently carried by national mortgage insurers or secondary market agencies such as Fannie Mae and Freddie Mac rather than by individual lenders.

But, break-even probabilities of success may not always be met, even by large entities. True break-even probabilities may in fact be higher than those reported by Ambrose and Capone (1996), because, for example, underlying assumptions about, say, the structure of the mortgage contract, are not consistent with current realities.¹² Alternatively, actual success rates may, in reality, just be lower than the stated break-even probabilities.

If the break-even probability of success for a particular workout program is not always met, then the expected net present value of the workout, relative to foreclosure, for the lender is negative. In such a case, the workout program definitely entails a cost-benefit tradeoff and, as a consequence, numerous other issues mentioned above need to be addressed. First, whose benefits will count? All borrowers or just some?

And how will we measure aggregate benefits? Board staff points out that the number of borrowers who would benefit from a workout arrangement is likely to be less than the number of borrowers who are delinquent or in foreclosure. For example, some borrowers who purchased houses as financial investments may not be interested in pursuing a workout. The survey by the Mortgage Bankers Association suggests that 18 percent of foreclosure actions started in the third quarter of 2007 were on properties that were not

¹² Here, we note that Ambrose and Capone's (1996) empirical results show a negative correlation between loan-to-value ratios and break-even probabilities, so that higher loan-to-value ratios than 95 percent, which might pertain to the current situation, would be associated with *lower* break-even probabilities of success than presented above. However, it is not clear whether this correlation would hold once loan-to-value ratios go above 100 percent.

occupied by the owners. Also, some borrowers may not be able to afford to stay in their homes, even at a lower monthly payment. For example, 29 percent of the foreclosures involved the borrower re-defaulting on a repayment plan or loan modification.

It is also possible that the number of borrowers who would benefit from a workout would be greater than those already delinquent or in foreclosure. Some borrowers may not have missed a payment, but may not be able to make the next payment because of a change in circumstances, such as an interest rate reset.

With the net benefit to lenders of the workout program being negative, public benefits may become relevant. This would be especially so if the aggregate private benefits to borrowers does not outweigh the net costs to lenders. Such benefits of a workout program might include reducing possible negative externalities of foreclosures, both for neighborhoods and, while costs remain not fully charged off, for credit markets and the financial system.

Homeownership and Mortgage Initiatives
March 23, 2008
Carolina Reid
Federal Reserve Bank of San Francisco

The Spillover Effects of Foreclosures

Introduction

Foreclosures can exact significant costs and hardships for individual borrowers, involving not only the loss of home equity and impaired credit, but also potentially limiting access to stable, decent housing and disrupting labor market participation. There are potential psychological and emotional costs as well. Of growing concern, however, is whether or not foreclosures have additional economic and social costs that “spillover” to the wider community, for example, by negatively affecting house values or by increasing crime. If these spillover effects do occur, it can suggest the need for more robust and direct policy intervention—at either the local or federal level—to help stabilize the housing market and minimize negative externalities to the community.

Measuring the impact of foreclosures on neighborhoods is difficult, however. Few—if any—datasets contain information on all the factors that can influence neighborhood change. Even measuring the spillover effects on the housing market is empirically challenging, since changes in house values are the result of a complicated constellation of macroeconomic, lender, borrower, and place-based factors that influence both the foreclosure outcome and its resulting impact. In addition, it is often hard to tease out causal direction: does a foreclosure depreciate house values, or do declining house values trigger foreclosure?

Economists and other researchers have begun to quantify these effects, at least in some markets, with some degree of success. To date, research on the negative impacts of foreclosures has focused in three primary areas: the impacts on how foreclosures affect nearby property values; the costs to city governments as the result of property dispensation and the loss of tax revenues; and the impacts of foreclosure on crime or other neighborhood features. This synopsis reviews the research that has examined each

of these questions, and identifies remaining gaps in the literature on the spillover effects of foreclosures.

Given the caveats noted above about the limits of research, empirical evidence does suggest that foreclosures depress the value of other homes in a neighborhood. The measured effects vary among studies, and it appears that the degree of the impact depends on factors such as the distance from the foreclosed property, the time since the foreclosure, and the overall strength of conditions in the local housing market. Estimates of the cost to municipalities from a foreclosure also vary, with one study putting the range from a few dollars to as much as \$34,000. Finally, there is evidence indicating that foreclosures can lead to increases in crime rates in affected neighborhoods.

Research on Housing Market Spillovers

Few researchers have explicitly modeled the impact of foreclosures on neighboring house values, although the number of studies in this area has grown in recent years. By and large, research that has examined the effect of foreclosures on nearby property values has found that, all things being equal, foreclosures can *decrease* neighborhood house values. However, the magnitude of those effects differ depending on the strength of the local housing market, the distance between the foreclosure and the surrounding homes, as well as the length of time between the foreclosure and the sale of the nearby properties.

In one of the earlier academic studies, Simons, Quercia and Maric (1998) attempt to measure the impact of neighborhood disinvestment on house values in Cleveland, Ohio. Although not precisely analogous to foreclosures, they find that a 1 percent increase in tax delinquencies was associated with a drop of \$788 in average sale prices within a one-to-two block area. Two early policy studies also find negative effects of foreclosure. In a study of Federal Housing Administration foreclosures in Minneapolis, Moreno (1995) estimated that each foreclosure cost neighbors an average of \$10,000.

More recently, Shlay and Whitman (2004) examined vacant properties in Philadelphia and found that homes located within 150 feet of an abandoned unit sold for over \$7,000

less than other properties. Using data from Chicago, Immergluck and Smith (2006b) present estimates suggesting that, conservatively speaking, each conventional foreclosure within an eighth of a mile results in a .9 percent decline in value (or \$1,481 for the \$164,599 average priced home in Chicago at that time). Yet unpublished research by Goldstein and Voith (2006) in Philadelphia also find that foreclosures decrease nearby property values, and that the number of foreclosures influences the size of that decline. For example, within one year, they find that, while two foreclosures within an eighth of a mile reduce house values by 5 percent, 20 foreclosures reduce the value by about 18 percent.

Lin, Rosenblatt and Yao (2007) extend this research by examining both the temporal and geographic variation in housing market spillovers. Using data from Chicago, they find foreclosures do depress neighborhood property values, with the greatest effects observed within 2 years and on properties located within a 10 block radius of the foreclosure property.¹ The most severe effect is an 8.7 percent discount, which gradually drops as the distance in time and space between the foreclosure and the affected property increases. Yet the magnitude of the effect is also influenced by the general strength of the local housing market; foreclosures during a “housing boom” have only about half of the effect on nearby properties as do foreclosures during a downside market.

One critique of this literature is that the measured effects may be more of a function of the rise in vacant properties as a result of foreclosure, rather than the foreclosure per se. Relevant to this critique is the question of whether or not foreclosed properties sell for less than comparable houses in the neighborhood, thereby driving down house values even if they do not stand vacant. Literature on the effect of foreclosure status has found varied results. Two early studies using hedonic price models, one in Baton Rouge, Louisiana (Schilling et al. 1990), and one in Arlington, Texas (Forgey, Rutherford and VanBuskirk 1994), found a discount of about 23-24 percent on foreclosed homes. However, subsequent research by Carroll, Clauretje, and Neill (1995) demonstrated that

¹ The model also controls for neighborhood variables that may influence foreclosures and property valuation, such as median incomes, demographic composition, and crime rates, as well as for possible sample selection bias.

this effect disappeared when the conditions of the foreclosed property and neighborhood characteristics were controlled for in the model.

More recent research has used other methods, and has found that foreclosed properties do sell for less, but that this effect varies in strong versus weak housing markets (Pennington-Cross 2006). In Cuyahoga County, Sumell (2007) found that foreclosed residential property sells for significantly less than its market value, and that the magnitude of the price reduction is sensitive to attributes of both the property and the neighborhood.

The focus of much of this research on cities in Ohio and Pennsylvania may limit the applicability of this research to other housing markets, particularly in areas that have strong labor markets or unmet demand for housing. In a yet unpublished study on New York, Been and her colleagues (2007) found a significantly smaller correlation between foreclosures and nearby prices than previous research, although they too find a negative effect. They conclude that their results are different both because they use more precise geographic and time controls, and because the New York City housing market experienced more rapid price appreciation during the study period than the other cities studied to date.

Research on the Municipal Costs of Foreclosure

Several studies, both academic and more policy oriented, have attempted to measure the costs of foreclosures to municipalities. The costs can be directly related to the foreclosure itself—for example, managing the foreclosure process and the loss of tax revenue associated with either vacant properties or house price depreciation—or they can be incurred by the need for other services associated with the foreclosure, such as the need for increased policing to deter crime around abandoned properties. As a result, estimates of the municipal costs of foreclosures can vary greatly, depending on what is included, as well as how long the property stands vacant. In Minneapolis, Moreno (1998) estimated the municipal cost to be around \$27,000. In a much more carefully detailed study of Chicago, Apgar (2005) estimates that, depending on the circumstances

surrounding the foreclosure, the cost to the municipality can range from a few dollars to as much as \$34,000.

A recent report released by the U.S. Conference of Mayors projected the foreclosure crisis would result in 524,000 fewer jobs being created this year and a potential loss of \$6.6 billion in tax revenues in ten states.

Research on Non-Price Spillovers

Beyond the cost impacts of foreclosures, a few researchers have tried to measure other neighborhood impacts related to foreclosures. Using data on foreclosures in New Orleans between 1985 and 1990, Baxter and Lauria (2000) explore the inter-related economic restructuring, racial transition, and foreclosures, and find that foreclosures hasten the process of neighborhood racial transition from white to black. Immergluck (2006a), studying data from Chicago, found that an increase of one standard deviation in the foreclosure rate (about 2.8 foreclosures for every 100 owner-occupied properties in one year) correspond to an increase in neighborhood violent crime of approximately 6.7 percent. Results for property crime, however, were insignificant.

Conclusion: Remaining Research Gaps

While the studies cited above provide valuable insights into the potential spillover effects of foreclosures, important research gaps remain. There are several difficulties in conducting neighborhood effects studies. First, omitted variables are a primary concern in neighborhood-effects studies (Dietz, 2002), and may significantly influence the research findings. Second, as mentioned above, exploring the relationship between mortgage foreclosure and neighborhood impacts also suffer from potential reverse causality. Third, the research would benefit from a more explicit methodological treatment of spatial autocorrelation—meaning that the way foreclosures are spatially related—perhaps by using Geographic Information Systems (GIS) analysis. The use of GIS analytical techniques and the incorporation of more specific geographic variables in other neighborhood effects studies have improved the precision of estimates and increased the predictive power of models (Can, 1998).

Another important question that remains is whether there may be a “tipping point” or threshold effect for foreclosures in a neighborhood. It is difficult to separate the impact of individual foreclosure on neighborhood from that of aggregated foreclosures.

References

Apgar, William C. and Mark Duda (2005). *Collateral Damage: The Municipal Impact of Today's Mortgage Foreclosure Boom*. Minneapolis: Homeownership Preservation Foundation.

Baxter, Vern and Mickey Lauria (2000). “Residential Mortgage Foreclosure and Neighborhood Change,” *Housing Policy Debate* 11(3): 675-699.

Been, Vicki, Solomon Greene and Jenny Schuetz (2007). “Spillover Effects of Foreclosures on Property Values in New York,” paper presented at the NYC Subprime Lending and Foreclosure Summit, December 12, 2007.

Can, Ayse (1998). “GIS and Spatial Analysis of Housing and Mortgage Markets,” *Journal of Housing Research* 9(1): 61-86.

Carroll, Thomas M., Terrence M. Clauretje, and Helen R. Neill (1995). “Effects of Foreclosure Status on Residential Selling Price: Comment,” *Journal of Real Estate Research*.

Dietz, Robert (2002). “Estimation of Neighborhood Effects in the Social Sciences: An Interdisciplinary Approach,” *Social Science Research* 31(4):539-575.

Forgey, F.A., R.C. Rutherford and M.L. VanBuskirk (1994). “Effect of Foreclosure status on Residential Selling Price,” *Journal of Real Estate Research* 9(3): 313-318.

Goldstein, Ira and Richard Voith (2006). “One Industry’s Risk is Another Community’s Loss: The Impact of Clustered Mortgage Foreclosures on Neighborhood Property Values in Philadelphia,” paper presented at the Federal Reserve Bank of Philadelphia, *Reinventing Older Communities*, April 2006.

Immergluck, Dan and Geoff Smith (2006a). “The Impact of Single-family Mortgage Foreclosures on Neighborhood Crime,” *Housing Studies* 21(6): 851-866.

Immergluck, Dan and Geoff Smith (2006b). “The External Costs of Foreclosure: The Impact of Single-Family Mortgage Foreclosures on Property Values,” *Housing Policy Debate* 17(1): 57-79.

Lin, Zhenguang, Eric Rosenblatt, and Vincent W. Yao (2007). "Spillover Effects of Foreclosures on Neighborhood Property Values," *Journal of Real Estate Finance Economics Online*.

Moreno, Anne (1995). *The Cost-Effectiveness of Mortgage Foreclosure Prevention*. Minneapolis: Family Housing Fund.

Pennington-Cross, Anthony (2006). "The Value of Foreclosed Property," *Journal of Real Estate Research* 28(2): 193-214.

Shlay, Anne B., and Gordon Whitman (2004). *Research for Democracy: Linking Community Organizing and Research to Leverage Blight Policy*. A paper published by Comm-Org, available online at <http://comm-org.wisc.edu/papers2004/shlay/shlay.htm#influence>. (Accessed March 7, 2008.)

Simons, Robert A., Roberto G. Quercia, and Ivan Maric (1998). "The Value Impact of New Residential Construction and Neighborhood Disinvestment on Residential Sales Price," *Journal of Real Estate Research* 15(2): 147-161.

Sumell, Albert J. (2007). "The Determinants of Foreclosed Property Values: Evidence from Inner-City Cleveland," Youngstown State University Working Paper.