

# FRBSF ECONOMIC LETTER

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## House Prices and Subprime Mortgage Delinquencies

The recent sharp increase in subprime mortgage delinquencies has captured the public spotlight and led analysts to search for the factors that are likely to have contributed to the problem. These factors commonly include the lack of income documentation, high loan-to-income ratios, the lowering of credit standards, and the resets on adjustable-rate loans, to name but a few. Although these factors are important to consider, it also is important to remember that the delinquencies have occurred during a time of seismic shifts in the patterns of house-price appreciation, shifts that were unprecedented in terms of their size and suddenness and that varied widely across metropolitan areas.

In this *Letter*, we explore how the pace of and change in house-price appreciation can affect the incentives and opportunities for borrowers in a market to avoid delinquencies and foreclosures. For instance, with likely gains in home equity in markets where house prices have risen significantly, a homeowner should have greater incentives and opportunities to keep a mortgage loan current. Indeed, we show that markets that recently experienced greater house-price appreciation tended to have lower delinquency rates and smaller increases in delinquency rates. We also find that metropolitan areas where house prices decelerated the most in 2006 have experienced the largest increases in subprime delinquency rates. One of several possible explanations for this relationship is that, in the face of sharp declines in the pace of house-price appreciation, some borrowers may have lowered their expectations about future appreciation rates, and, hence, the attractiveness of the investment component of homeownership also declined.

### **The subprime market**

One hurdle facing researchers in the subprime market area is that there is no readily agreed upon definition of “subprime.” Indeed, the subprime residential mortgage market barely existed in 1995, although since then it has grown rapidly, by some estimates accounting for approximately 20% of all first lien mortgages made in 2006. Generally speaking, subprime is a lender-given designation for borrowers with low credit scores (FICO score less than 620, for example), with little credit history, or with other types of observable credit impairment.

Although “subprime” is not rigorously and consistently defined in the mortgage industry, one firm, First American LoanPerformance (FALP), has produced a number of statistics on regional delinquency rates based on subprime mortgages in its database. The delinquency rate is defined as the percent of subprime loans that are delinquent 60 days or more. The data, which are from 2005 and 2006, contain observations on 309 metropolitan statistical areas (MSAs), and form the basis of our analysis (see also *The Wall Street Journal* 2007). It is worth noting that the FALP data do not represent the entire universe of mortgages; also, estimates of delinquency rates on subprime mortgages vary among sources, reflecting differences in the definition of subprime and sample coverage. However, where possible, we have compared the FALP data to those from other sources and have found high correlations among them.

The FALP data show considerable regional variation in the delinquency rates and in the changes in the delinquency rates. The median delinquency rate in 2006 among the 309 MSAs was 12.2%, with a range from about 3% to 25%. MSAs near the Gulf Coast that were severely affected by Hurricane Katrina were among those with the highest delinquency rates. Overall, however, the MSAs with the highest delinquency rates tend to be located in the Midwest; of the 18 MSAs with the highest subprime delinquency rates in 2006, 14 were in Michigan or Ohio.

In terms of changes in subprime delinquency rates, nearly all MSAs posted increases from 2005 to 2006. The median change was about 3 percentage points, and the largest increase was 11 percentage points. Of the 309 MSAs in the sample, only 25 had decreases in their delinquency rates, with the sharpest declines among MSAs near the Gulf Coast. Of the 18 MSAs that posted the largest increases in delinquency rates, 12 were in California and 3 were in Massachusetts. These MSAs typically had relatively low delinquency rates at the end of 2005.

### **Delinquency rates in 2006 and recent house-price appreciation**

There are a number of possible reasons for the observed differences in subprime delinquency rates among MSAs in 2006, including variation in eco-

economic conditions, differences in the riskiness of the subprime borrower pools across MSAs, and changes in the house prices. Parsing out the relative importance of these reasons involves a degree of complication that is beyond the scope of this *Letter*.

With that said, we examine the relationship between house-price appreciation and delinquency rates for subprime mortgages among MSAs. Specifically, we compare the share of subprime mortgages in delinquency at the end of 2006 and the percent change in house prices, as measured by the Office of Federal Housing Enterprise Oversight (OFHEO) indexes, from 2004 through 2006. For this period, the pace of house-price appreciation varied considerably. For the sample of 309 MSAs, appreciation rates ranged from  $-2\%$  in Kokomo, Indiana, to almost  $54\%$  in the Phoenix, Arizona, area.

Figure 1 provides a graphical perspective on the link between delinquency rates and house-price appreciation. The figure covers the largest 150 MSAs in the sample. Excluded from the figure are several MSAs near the Gulf Coast that were severely affected by Hurricane Katrina. The figure shows a very strong negative correlation between recent rates of house-price appreciation and the level of the subprime delinquency rate in 2006 (the correlation coefficient is 0.79); that is, higher rates of house-price appreciation are associated with lower rates of delinquencies.

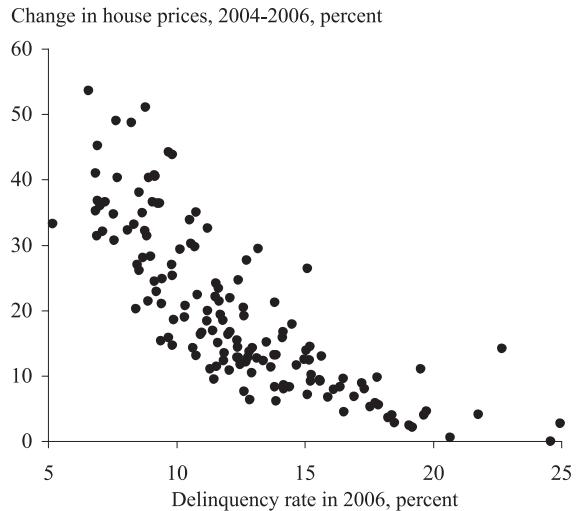
This negative correlation could arise for a variety of reasons. One possibility is that the economies in MSAs with rapidly appreciating house prices were strong, and, hence, relatively fewer households became delinquent in their payments. However, we find that controlling for economic conditions (as measured by employment growth and the unemployment rate) does little to alter the relationship displayed in Figure 1.

Another possibility is that distressed borrowers in strong housing markets have opportunities to pursue alternatives to delinquency. For instance, a homeowner in a market with rapid house-price appreciation is likely to have built up more home equity than a homeowner in a market with smaller gains in house prices. With higher home equity, homeowners have a greater incentive to keep their mortgage loans current. Further, homeowners with a greater equity stake would be in a better position either to sell their homes and pay back the remaining principal or to refinance existing mortgages to ones that would offer lower, more affordable payments, at least for a while.

### Changes in delinquency rates

We also find that *changes* in delinquency rates on subprime residential mortgages were strongly re-

**Figure 1**  
Changes in house prices and the subprime delinquency rate



All data at the MSA level. Sources: First American LoanPerformance and OFHEO.

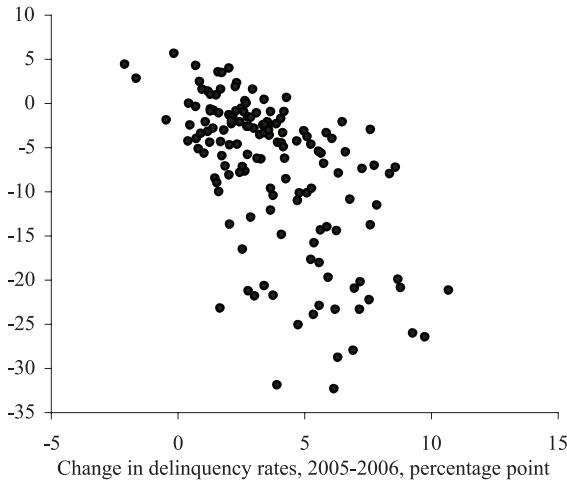
lated to *changes* in the pace of house-price appreciation. In the analysis we looked at the changes in the subprime delinquency rates from 2005 to 2006 and the changes in house-price appreciation rates in 2006 compared to 2005. An MSA experiencing a deceleration in house prices would have a negative change in its appreciation rate. For the overall sample, changes in appreciation rates ranged from about  $-32\%$  (deceleration) in the Cape Coral–Fort Myers, Florida, areas to over  $11\%$  (acceleration) in Lawton, Oklahoma.

Figure 2 plots the pairings of changes in mortgage delinquency rates and changes in house-price appreciation for the largest 150 MSAs in the sample. A negative value on the vertical axis implies that house prices in 2006 grew less quickly than house prices in 2005—that is, a deceleration in house prices. As the figure shows, MSAs that experienced large decelerations in prices tended to experience large increases in rates of subprime mortgage delinquencies (the correlation is 0.61).

In addition to the simple correlation illustrated in the figure, we used a variety of techniques to examine the empirical relationship. For example, we took into account differences in the pace of house-price appreciation among the MSAs in 2006, to control for the possibility that areas experiencing large decelerations in house prices were simply ones with low rates of appreciation in 2006. While we found evidence that low rates of appreciation were associated with large changes in delinquency rates, we still found a strong and highly statistically significant relationship between increases in the delinquency rates and

**Figure 2**  
**House-price acceleration and**  
**changes in subprime delinquency rate**

House-price acceleration, 2005-2006, percentage point



All data at the MSA level. Sources: First American LoanPerformance and OFHEO.

house-price deceleration. We also found that the relationship holds up when we control for changes in economic conditions in housing markets.

The finding that changes in delinquencies are related to house-price deceleration raises the possibility that the increases in delinquencies reflect not just borrower distress but also a decline in the demand for housing. This might be true if some borrowers originally were willing to spend more on their mortgages than they otherwise would because they expected large gains in equity from future house-price appreciation. When those gains did not materialize, some borrowers may have reassessed their expectations about future appreciation rates and thus their decisions about spending on housing.

Such an effect from changes in expectations about future house-price appreciation would be expected to affect the demand for housing more generally, not just subprime borrowers. Indeed, the data on home sales and surveys on the demand for home mortgages indicate a general decline in demand for buying homes. In addition, while delinquency rates on prime mortgage loans remain quite low, the MSA-based data show a positive correlation between changes in delinquency rates on subprime and prime mortgages.

It also is possible that the patterns of house-price appreciation are linked to delinquency rates through

their influence on mortgage lenders' assessments of risk. For example, MSAs that had large decelerations in house prices also had very high rates of house-price appreciation prior to 2006. The earlier rapid rates of appreciation may have paved the way for new, riskier borrowers to enter the market, as lenders were more willing to finance house purchases in markets with rising prices. However, in this case, the eventual rise in delinquencies would have been due to the previous high rates of house-price appreciation rather than the subsequent deceleration.

### Conclusion

The sharp rise in delinquency rates on subprime residential mortgages has raised concerns about credit underwriting practices and economic distress among borrowers and has drawn the attention of policymakers at the Fed and elsewhere. No doubt, this is a complex issue, influenced by a number of different dynamics. Our analysis focuses on one of the potential dynamics, and we find that differences in the performance of subprime mortgages among MSAs may reflect in part the effects of house-price appreciation on the incentives and the opportunities of some mortgage borrowers to keep loans current. Two of the potential channels through which house-price appreciation may affect the subprime delinquency rate that we suggest are the incentive to protect home equity associated with recent appreciation in house prices and the effect of changes in expectations about future house-price appreciation on the demand for housing.

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