

## **The Geography of Mortgage Delinquency**

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## ABSTRACT

In this paper we explore the geographic variation in mortgage delinquency and foreclosure rates across states in the U.S. Looking at the share of loans 60 or more days past due or in foreclosure for the country as a whole over the last several years, the trends over time in both the prime and subprime markets does not seem to imply that the performance of mortgages has worsened. However, national averages obscure significant variation across states. These geographic differences provide some context for understanding for why the current state of U.S. mortgage performance may look relatively bright or dismal depending on the location of the market observer and the level of data used. Examination of delinquency data also helps to illuminate why market observers' differing interpretations of the data may have to do with whether rates or counts of problem loans are in view. In addition to describing the patterns of mortgage default rates across the country, this paper also explores some reasons why we would expect these rates to vary geographically. These factors would include differences in local economic conditions, the composition of the borrowing population, loan terms, and lender behavior. This paper then proceeds to present an empirical model to examine which of these factors may help to explain the geographic variation we currently see in delinquency rates across the states. Important factors that stand out from these statistical results as affecting delinquency rates are changes in the employment situation in a state; how recently mortgages in a given geography were originated; and, very recently, the effects of the hurricanes that hit Gulf Coast in 2005. This statistical modeling effort is exploratory. In future work, we plan to refine these models, and examine other factors which could plausibly affect delinquency rates across different areas.

## **Introduction**

Many U.S. households hold a substantial portion of their wealth in the form of home equity they have accumulated through homeownership. This is especially true for lower income households who are more likely to own a home than to hold financial assets like mutual funds and bonds. According to the Federal Reserve's 2004 Survey of Consumer Finances, home equity constitutes over half of households' net worth for those in lowest quintile of the income distribution, and it makes up nearly 45 percent of net worth for households in the second lowest income quintile. In contrast, for all U.S. households as a group, home equity makes up only a quarter of households' net worth. Thus, while home equity is an important asset for many families, it is an even more important store of wealth for low and moderate income (LMI) households.

In light of the relatively large role that home equity plays in asset building for lower income households, LMI homeowners have a lot at stake in being able to sustain homeownership. Defaulting on a mortgage and facing the loss of a home is a potentially devastating circumstance for any family, regardless of income or wealth. But it is likely to be a particularly severe setback for households who have moved into homeownership hoping to build assets to instead lose ground financially due to the damage to their credit records and loss of home equity that comes with mortgage foreclosure. Mortgage default affects not only the financial wellbeing of those who may lose their homes, but also can produce significant burdens in the form of stress and dislocation for families, as well as potential negative effects on surrounding neighbors and communities.

For the U.S. as a whole, mortgage delinquency and foreclosure are somewhat infrequent events, on average. At year-end 2005, two percent of home mortgages in the U.S. were sixty or more days past due and additional one percent was in foreclosure, according to estimates from the Mortgage Bankers Association (MBA). These delinquency and foreclosure measures stood a little higher at the end of 2005 than they did a year before, but below their levels at year-end 2002 and 2003, and do not seem to indicate elevated levels of financial stress for households when evaluated against the pattern of the longer-run historical series. In summarizing the MBA's analysis of their delinquency survey data, Frantantoni (2006) interprets the relatively low delinquency and

foreclosure rates reported in the MBA data as indicating there is not a national crisis in mortgage performance or in foreclosures.

Yet in contrast to this apparently unremarkable trend in the delinquency trend for the U.S. as a whole, some local areas have seen sharp increases in the share of mortgage loans in default in the past few years. This has spurred research to document the problem and inform intervention strategies to stem the damage to households, lenders and investors, and communities. For example, Garcia (2003) found that the city of Buffalo experienced an increase in mortgage foreclosures of nearly 400 percent between 1990 and 2000; somewhat surprisingly, the foreclosures were twice as likely to occur in the suburbs of the Buffalo-Niagara metro area. Rose (2006) found the Chicago metro area experienced an increase in foreclosures of 54 percent between 1993 and 2005. Using a more descriptive analytical approach, Apgar and Duda (2004) found that 14,415 homeowners or nearly 1.4 percent of homeowners with a mortgage that live within the city or county of Los Angeles lost their house to foreclosure between 2003 and 2006.

In this paper, we explore mortgage delinquency and foreclosure rates in order to understand what factors may explain the sizeable variation in these rates across different areas of the U.S. The next section of the paper describes current delinquency and foreclosure rates across the states, as well as trends in these rates over the past few years. Included is a brief discussion of why different interpretations of data can lead to the opposing conclusions that we are (or are not) experiencing a default crisis. The following section lays out a framework for thinking about why delinquency rates may vary across different areas and proposes an empirical model of state mortgage delinquency rates for testing with available data. This model includes three categories of factors: local economic conditions, the composition of the borrowing population, and loan terms. With the modeling framework laid out, the next section of the paper discusses the results from estimation of the model. The final section concludes with a summary of our findings and some possible implications.

### **Trends and Patterns in Delinquency Rates**

In their paper exploring the impact of mortgage servicing innovations, Cutts and Green (2004) provide a taxonomy of mortgage servicing and default. Default technically

means that the borrower has failed to meet an obligation of the mortgage agreement. Thus, default is a broad measure of households having difficulty meeting their mortgage payment obligations, and would include a range of borrowers: from delinquent borrowers who have missed one payment and now have a second payment due, to those who are in the throes of the foreclosure process. For the purposes of this paper, we will focus on three measures of default. The primary measure will be the percent of the number of loans that are 60 or more days past due or in foreclosure. We chose this measure to provide a broad indicator of financial stress, omitting only the shortest category of delinquent loans – those thirty days past due – which would be likely to be affected by transient financial mishaps, like forgetting to mail a payment. Most of our discussion will focus on this broad 60 plus days delinquent measure. The other two measures are the components that make up the broad statistic: loans 60 or more days delinquent but not in foreclosure, and loans in foreclosure. In a few instances, these two component pieces move in opposite directions and we mention them separately, but all references to delinquent loans and loans in default will refer to the broad 60 plus measure unless otherwise noted.

MBA's National Delinquency Survey is a widely cited source of the historical trends in home mortgage delinquencies and foreclosures going back to 1979. The MBA compiles their quarterly delinquency statistics from mortgage servicers' data on more than 40 million loans collected from mortgage companies, commercial banks and other financial institutions. Their broad measure of the share of all home mortgage loans 60 plus days delinquent or in foreclosure has generally remained in the 2½ to 3 percent range since the late 1990s. Delinquency and foreclosure rates moved up over the 2000 to 2002 period, likely as a result of the 2001 recession. Over the past several years this broad overall measure has come down a bit as the share of loans 60 or more days delinquent has remained relatively steady, but the foreclosure rate has declined a little. The effect of hurricanes Katrina and Rita on delinquency rates resulted in an increase in the rate of loans 60 or more days delinquent in 2005:Q4. According to estimates made by the MBA (2006), the spike in delinquency rates in states affected by the storms

increased the national delinquency rate by about 0.15 percentage points at the end of 2005.<sup>1</sup>

Because prime mortgages make up most of the mortgages in the U.S., overall delinquency rates like the MBA delinquency rate measure tend to follow the trends in the prime market more so than the subprime market. That said, the subprime mortgage market has grown substantially in recent years, and thus the contribution of the performance of subprime mortgages to overall delinquency statistics has been growing over time. Figures 1 and 2 present separate trends for delinquency rates in the prime and subprime markets based on data from First American LoanPerformance from 2003:Q3 through 2006:Q2.<sup>2</sup> Like the delinquency measures compiled by the MBA, the LoanPerformance data is collected from loan servicers. The MBA and LoanPerformance delinquency rates show similar trends, although differences in the servicers they cover and in their methodologies generate some variation between the measures. The LoanPerformance database contains additional information on the characteristics of loans across different geographies, and this data will be used along with the delinquency rate measures to explore factors that explain the geographic variation in delinquency rates in subsequent sections of the paper.

Figure 1 shows that the share of loans that were 60 or more days delinquent or in foreclosure (the top line) for the prime market stood a little lower at the beginning of 2006 than it did at the end of 2003. Delinquencies (the middle line) have changed little, on net, over this period, but foreclosures (the bottom line) are down slightly, which accounts for the slight drop in the overall measure. As of 2006:Q2, about 1 percent of prime loans were 60 or more days past due and 0.25 percent were in foreclosure.

The delinquency rates for the subprime market are quite a bit higher than for the prime market. Given that many of these loans were made to borrowers with some degree of credit impairment, we would expect the subprime delinquency rates to be somewhat

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<sup>1</sup> Foreclosure rates have not spiked in the Gulf Coast states after the hurricanes, and in fact have fallen a bit. HUD, Fannie Mae, Freddie Mac and other mortgage finance institutions have instituted special forbearance programs for homeowners impacted by the hurricanes that have mitigated the impact of the disaster on foreclosures.

<sup>2</sup> The First American LoanPerformance data includes conventional loans as well as loans guaranteed by the Federal Housing Administration and the Veteran's Administration in their statistics for the prime market. While the share of subprime mortgages has been increasing over time, the share of FHA and VA loans has declined as of late.

higher than prime delinquency rates. But in addition to the difference in credit risk between prime and subprime borrowers, there are also differences in the prevalence of predatory lending practices across the two markets as well. So while we may expect subprime delinquency rates to be higher than those in the prime market, we are not able to determine to what extent that difference in loan performance is due to the underlying credit characteristics of the borrowers, and to what extent it is due to predatory practices that may be more prevalent in the subprime market. Figure 2 shows that although subprime delinquencies and foreclosures (the top line) have decreased some since 2003, they have risen a few percentage points in the last several quarters. As in the prime market, the measure of foreclosures trended lower after 2003, while delinquencies are relatively flat, on net, over the period. As of 2006:Q2, the share of subprime loans that were 60 or more days past due stood at 6.25 percent and the share in foreclosure at around 2.75 percent.

While the overall levels of these mortgage delinquency rates for the U.S. do not appear to have worsened over the past few years, an examination of rates across states indicate that the share of loans in default differs markedly in different areas of the country. Figure 3 and Figure 4 use data from First American LoanPerformance as of 2005:Q4<sup>3</sup> to rank states in quartiles according to their delinquency rates in the prime and subprime mortgage markets, respectively. The darkest shaded areas represent the areas of with the highest delinquency rates; the lightest areas show states with the lowest delinquency rates. In both the prime and subprime markets, delinquency rates tend to be the highest in the South and to some degree in the “Rust Belt”; both coasts, but the West Coast in particular, have lower levels of delinquency. As of year-end 2005, the Gulf Coast states had some of the highest rates of mortgage delinquency, owing to the destructive effects of the hurricanes that hit the region in the latter part of the year. The shares of prime loans in Louisiana and Mississippi that were 60 or more days late or in foreclosure were at an outsized 13.2 percent and 8.7 percent respectively as of 2005:Q4. Alabama and Texas also registered relatively high rates that quarter of over 3 percent.

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<sup>3</sup> In Figures 3 and 4 and in the statistical analysis of subsequent sections we are use data as of 2005:Q4. While delinquency rates are available quarterly for the states, these quarterly movements are influenced by changes in the underlying trend in the data and by a seasonal component. We use the year-end figures in our analysis in order to hold (roughly) hold constant the seasonal component.

Apart from these states, the range of this measure for prime loans ranged from just under 3 percent in Indiana down to 0.3 percent in California. The subprime market shows a much wider range of delinquency rates across states. Louisiana and Mississippi had the highest rates of subprime loans in default in 2005:Q4 at 29 percent and 24 percent, respectively. The rates for the remainder of the states spanned from around 16 percent for Ohio to around 3.25 percent for Hawaii. Only five states had subprime delinquency rates under 5 percent while 21 states had a rate greater than 10 percent.

Although the overall U.S. mortgage delinquency rates may have experienced little change over much of the 2003-2005 period, this rather steady national average obscures the fact that some areas of the country have experienced significant changes. Figures 5 and 6 depict the changes in delinquency between 2003:Q4 and 2005:Q4 for the prime and subprime markets, respectively. As mentioned earlier, the South and parts of the Midwest had the highest rates of delinquency at year-end 2003 and 2005; these regions also saw the largest increases in rates over this two year period. While most of the West saw delinquency rates fall, most of the South and large parts of the Midwest saw increases or only modest decreases in their delinquency rates. New England and the rest of the East Coast saw mixed changes: some states improved while others' situations worsened.

Apart from the large increases in Louisiana and Mississippi, ten other states saw their prime delinquency rates increase over the period from 2003:Q4 to 2005:Q4 and sixteen other states experienced increases in their subprime delinquency rates. Changes in the prime market ranged from a drop of -1.3 percentage points in Nevada to a rise of 10.6 percentage points in Louisiana, and in the subprime market ranged from a decline of -5.5 percentage points in the District of Columbia to a jump of 16.4 percentage points for Louisiana. These statistics illustrate that while the United States' prime mortgage market as whole has not changed much over the past few years, there have been significant movements in rates across states.

The variation across states in both levels and changes in mortgage delinquency and foreclosure rates provides one reason for why views on whether or not there is currently a crisis in the mortgage market may differ depending on whether the perspective is local or national. Even looking at delinquency rates at the state level is

likely to be masking significant variation within states. Because more populous areas carry much more weight in constructing national averages like delinquency rates, the relatively strong performance of mortgages on the more densely populated coasts has likely offset the effects of payment problems in the Southern and Central portions of the country in the U.S averages.

To illustrate this point, consider the contributions of the states of Louisiana and Florida to the aggregate change in subprime delinquency and foreclosure rates between 2003:Q4 and 2005:Q4. Louisiana's delinquency rate spiked from 13.0 percent to 29.3 percent over this period, while Florida's dropped from 7.5 percent to 6.5 percent. While the increase in Louisiana's delinquency rate is very large, Louisiana has a relatively small share of all subprime loans. On the other hand, Florida's drop in delinquency is modest by comparison, but as a state, it accounts for a significantly larger share of subprime mortgage loans. Taken by itself, Louisiana's increase would have increased the national measure of loans 60 plus days past due or in foreclosure by about 0.2 percentage points. However, the change in Florida alone offset about a fifth of that implied rise from the spike in Louisiana.

Another key point of difference in the interpretation of mortgage default statistics is whether the statistic of concern is the *number* or *rate* of loans in default. According to the Survey of Consumer Finances (SCF), the number of households with mortgages increased from 43 million mortgage loans in 1998 to 51 million in 2004. This reflects not only the rise in the homeownership rate, but also the increase in the share of homeowners with mortgages. Given the rising number of loans, the number of loans in foreclosure could easily rise by thousands even if the foreclosure rate showed little change.<sup>4</sup> Depending on the interested party, either the number or the rate of loans in default may be important. For example, a mortgage investor may care more about the rate of loan failure because this affects the underlying performance of a pool of mortgages or mortgage backed securities. But municipalities and community service organizations may be interested in the total number of homeowners that are delinquent on their

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<sup>4</sup> We appreciate Chris Herbert's sharing this observation regarding the implications of rising number of mortgage loans on the number of loans in foreclosure.

mortgage payments since their staffing decisions would be affected by an increase in the number of loans in default.

### **Modeling State Mortgage Delinquency Rates**

A significant amount of research has been conducted to examine the factors that affect the performance of individual mortgage loans. In fact, this research, much of which is proprietary, has spurred innovation in the mortgage market in areas such as automating underwriting and risk-based pricing. Capone (2002) provides a helpful and accessible summary of some key findings from this body of work, especially findings that pertain to the performance of loans to LMI families. The following observations are drawn from his overview of this literature.

Research clearly shows that loans with higher initial loan-to-value ratios have a greater likelihood of default, holding other factors constant. House price declines are also important to explaining default, but not all borrowers are equally “ruthless” in exercising their option to default if house prices decline. That is, even though the value of the loan may be greater than the price of the house by an amount significant enough to make default optimal, not all borrowers will choose to default. Borrowers who default when default becomes optimal have been dubbed “ruthless” in reference to the apparent conformity of their behavior to an optimization rule. Borrower income also matters for default probabilities. Interestingly, moderate income homeowners have a lower propensity for default than both very low and high income borrowers, conditional on having an incentive to default. Some research shows that census tract characteristics, like census tract income, are also quite important to mortgage performance, and perhaps more so than individual borrower characteristics. So called “trigger events” that a household might experience are significant factors for explaining delinquency and foreclosure as well. Trigger effects occur when there is a sudden change in the circumstances of the borrower, financial or otherwise. The sudden change then “triggers” default on the mortgage. Examples of trigger effects include job loss, health problems, change in marital status, death in the family and change in property value. Herbert (2004) provides a review of the literature on trigger events to date, and notes that while more study is

needed on the topic, the challenge of obtaining quality data on both trigger events and financial instruments like mortgages makes it difficult to research.

Much of this research on the factors that affect loan performance has been conducted on very large databases of mortgage loans that are held in investor portfolios or securitized in mortgage-backed securities. These databases include both loans that become delinquent and perhaps proceed to a failure of the mortgage through foreclosure, as well as mortgages that remain current. More recently, a literature has emerged with papers that explore trends and patterns of foreclosures in particular geographic areas. These studies use databases of foreclosed properties, and have often been done in response to a marked rise in the number of foreclosures in a particular location. While each area has its own unique factors, many of these studies, such as Apgar and Duda (2004), Apgar and Duda (2005), and Rose (2006), have found that recent increases in foreclosures have been in neighborhoods which have higher concentrations of minorities and low income households and a large share of mortgage loans made by nonprime lenders.

Drawing generally from these previous findings in the literature on individual mortgage performance and that on local foreclosure hotspots, we propose that mortgage default rates may vary across localities for at least four reasons. First, if the characteristics of the homeownership population vary geographically, these differences could affect delinquency rates. For example, in areas where the population has lower wealth, income, or human capital, the average homeowner may be more likely to be experience significant financial strain from negative economic shocks. Furthermore, if innovations in financing have enabled people to move from renting to owning who otherwise could not have afforded a home, the homeownership population may be more vulnerable to shocks in areas where these financing options have been more readily available. So if the characteristics of the homeownership population vary across areas and household level shocks (such as death, divorce, and health problems) are randomly distributed, we might expect higher delinquency rates in areas where the homeowners have fewer resources.

Second, some localities may have experienced economic shocks (positive or negative) recently, and these shocks may imply that their delinquency rates are below or

above “normal.” For example, a decline in employment is likely to lead to higher unemployment and stable or falling wage income, making delinquency more likely. Conversely, population growth and house price gains could imply a strong resale market for financially strapped homeowners to sell their properties, or to refinance and extract equity to smooth consumption, both of which could lower delinquency rates. Furthermore, because land is fixed supply, the effect of both positive and negative shocks may be more pronounced in more densely populated areas than in areas that are not as developed.

Third, homeowners in different areas may have chosen to take on different levels of risk through their choice of a loan product. We could imagine two areas that were similar in terms of the characteristics of the homeownership population and the economic shocks that each area had experienced. If homeowners in one of the areas were more likely to have chosen adjustable rate mortgages, then they would be more vulnerable to interest rate increases which would increase their payment burden. Alternatively, if owners in one area were more likely to have used high-LTV loan products, they may not have an equity stake in the property if house prices declined, and might choose to abandon the property in the event that a financial setback made it difficult to maintain the mortgage payment schedule. Thus, the prevalence of particular loan products by geography could imply that homeowners in some areas are more at risk from interest rate and house price changes because of the structure of the loan contract. There are a number of reasons why loan types could vary with geography, including differences in the preferences of borrowers, variation in the types of loans lenders offer or advertise in different areas, and economic conditions that make particular loan products more desirable. For example, adjustable rate mortgages may be particularly attractive if they lead to lower initial payments for homebuyers in areas where housing prices have appreciated rapidly.

Fourth, the behavior of lenders may vary over different geographic areas in ways that could affect delinquency rates. Pennington-Cross and Ho (2005) found that the loan servicer makes a significant difference in the performance of subprime mortgages. Apgar and Duda (2005) have noted that certain lenders in the Atlanta metro area had a very high fraction of loans they originated going into foreclosure within two years of origination.

While many lenders operate nationwide, others are active only in certain markets. If the quality of loans originated by a lender and the servicing practices on a loan are important, as the studies referenced above indicate, differences in who originates and services loans across different areas are likely to be significant factors in explaining the variation in delinquency rates.

With these thoughts in mind, we could think about modeling mortgage delinquency as follows:

$$\text{delinq}_{it} = \beta_1 * (\text{homeowner characteristics})_{it} + \beta_2 * (\text{area shocks})_{it} \\ + \beta_3 * (\text{loan terms})_{it} + \beta_4 * (\text{time period indicators})_t + \mu_i + \varepsilon_{it}$$

Here  $i$  indexes the geographic area over which the delinquency rate is calculated, and  $t$  indexes the time period. Within this modeling structure, variation across time and across geographic areas in explanatory variables like homeowner characteristics, area shocks and loan terms may help account for differences in delinquency rates. The effects of these three categories of variables would be captured through the vectors of coefficients  $\beta_1$ ,  $\beta_2$ , and  $\beta_3$ . The coefficients in  $\beta_4$  for the time period indicator variables will capture unobserved factors that affect all areas in the same way, but vary over time. For example, if a major lender changed their loss mitigation practices and began to offer more loan workouts, this could result in a change in delinquency rates for all areas over time. In principle, such lender effects could be modeled with explanatory variables analogous to those used for differences in the borrowing population, as geographic data on originations by lender is available through the Home Mortgage Disclosure Act data. But in practice, given the number of lenders that operate in an area like a state, determining the effect of a particular lender on delinquency rates is not likely to be feasible with analysis of state level averages. Thus, in this analysis, the lender effects are an unobserved factor that is captured in this time term or by one of the remaining two terms which pick up differences in delinquency rates that cannot be explained by the observed factors included in the model. The first of those – the term  $\mu_i$  – represents an indicator variable that is specific to each area but does not vary over time. For example, if a mortgage fraud scheme had been perpetrated in a particular locality over the course of several years, the estimated level of delinquency rates would likely be higher than we would expect based on observed factors, and thus the value for  $\mu_i$  for that area would

probably be positive. Alternatively, if homeowners in a particular region had a stronger than average commitment to paying off their debts due to a cultural norm, that unobserved population characteristic might result in the area having a value for  $\mu_i$  that was negative because the delinquency rate would likely be lower than we would predict by simply looking at observed factors. Finally, the error term  $\varepsilon_{it}$  captures idiosyncratic factors we do not observe that vary by area and over time.

### Estimation Results

The empirical model presented in the last section can be estimated with state delinquency rates over several years, enabling us to take advantage of the variation in delinquency rates both across areas and over time to identify which factors may be important for explaining mortgage default. We used the data from First American LoanPerformance discussed earlier to estimate separate models for the prime and subprime loan markets. For the dependent variables in these regressions, we use the share of loans 60 or more days delinquent or in foreclosure as of year-end 2003, 2004, and 2005 for each state and the District of Columbia.<sup>5</sup> Results from these regressions are presented in Table 1.<sup>6</sup>

As discussed in the previous section, the explanatory variables in our model can be grouped into four general categories of variables: household characteristics, area shocks, loan characteristics, and time effects. The time effects, state fixed effects, and error terms in the equation capture unobserved factors such as lender behavior and differences in borrower characteristics across states. We have included one state level variable that captures an aspect of the cross-state variation in household characteristics that could contribute to differences in delinquency rates. That variable is the share of borrowers with credit scores of less than 700, with a three-year lag. This variable was

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<sup>5</sup> The subprime database does not provide a delinquency measure for Alaska and South Dakota due to insufficient loan counts. Thus, for the subprime regression, we include forty-eight states and the District of Columbia.

<sup>6</sup> We use a fixed effects regression, which estimates a constant state-specific effect for each state, which is equivalent to including a dummy variable for every state. While this technique suffers from the limitation that we cannot include state specific variables that do not vary over time, it requires less restrictive assumptions than the alternative random effects model which would enable us to include such variables. We did estimate a random effects version of our model, but post-estimation testing indicated that the assumptions needed to for the random effects model to provide consistent estimates did not hold. We will continue to explore these specification issues as we refine this research.

constructed from TransUnion's Trendata product, and we expected that higher values would correspond to higher default rates: if a state's share of borrowers with marginal credit quality is higher, the share of homeowners with marginal credit may be greater too, and this could lead to higher mortgage default rates. Because credit scores are affected by borrower delinquency, we included this variable with a lag to capture the underlying credit quality in the state that is not a function of the contemporaneous delinquency rates. The results in Table 1 for this variable did not turn out like we expected. In both regressions, a larger share of lower credit quality borrowers implies lower delinquency rates, not higher rates. Although the coefficient is not significant in the prime regression, it is in the subprime regression. It is possible this share of borrowers with lower credit scores is correlated with unobserved factors that matter for delinquency in ways we did not expect. At present, we do not have a good interpretation for this result. As we continue to develop this model, we will explore if a different construction of a credit quality indicator – e.g. one that could express the share of “deep subprime” vs. “near prime” borrowers – would be feasible or helpful in the subprime regression.

For factors that might represent area-specific shocks, we included the three-year growth rate in the state house price index estimated by the Office of Federal Housing Enterprise Oversight (OFHEO), the three-year growth rate in the level of state employment from the Bureau of Labor Statistics, and a measure of what share of the state was affected by hurricanes Katrina and Rita that struck the Gulf Coast in the fall of 2005. For 2005:Q4, this hurricane variable was constructed as the number of counties in the state that were declared by FEMA to be eligible for individual assistance as the result of either of these hurricanes, divided by the total number of counties in the state for each of the states Alabama, Louisiana, Mississippi, and Texas. The value was set to zero for all states in 2003:Q4 and 2004:Q4, and for all states other than these four in 2005:Q4.

We expected that states that have experienced larger increases in housing prices would have lower delinquency rates. Households who have experienced house price declines may have an incentive to walk away from their loan and house if they are in a negative equity position. Families in markets with strong house price appreciation may be better able to sell their homes if they find themselves in financial distress. Both of these rationales would suggest that house price gains should decrease our broad measure

of delinquency. In the results in Table 1, the house price coefficient has the sign we expected in the subprime regression and is somewhat significant there; in the prime regression it does not perform as we expected, but it is not significant. Simple correlations show that house price growth is more highly (negatively) correlated with subprime delinquency rates than with prime delinquency rates. Most likely the unexpected sign and insignificance of house prices in explaining prime delinquency levels in our results is due to a moderate correlation between house price growth and several of the other variables in our model, including employment growth. Due to this correlation, the presence of the other variables in the regression apparently eliminates the explanatory power that the house price variable may have provided. Both of the remaining two area shock variables were significant, and as expected, employment growth damped delinquency rates, while the hurricanes produced a large increase in loans in default.<sup>7</sup>

The third category of variables included in our models is loan characteristics. As mentioned above, previous research using individual loan data to study the determinants of loan default has found that higher loan-to-value ratio mortgage liens have a higher propensity to enter default, all other things equal. We attempt to capture this possible effect through a variable measuring the share of prime or subprime loans in the state that have loan-to-value ratios greater than or equal to 0.9. The coefficient on this variable is not significant in either regression, and the estimated coefficients are of opposite signs in the two regressions.

Research has also shown that the probability of loan default changes over time as the loan ages or “seasons.” New loans do not typically become delinquent right away, because in many or most cases, the borrower has very recently been through the financial scrutiny necessary to be approved for the loan, and households with problems who perhaps are too great of a risk to get a loan have been screened out. However, over time, hardships like job loss, illness, divorce, etc. may occur, and these increase the likelihood that the household may fall behind on payments. Thus we created a variable to indicate what share of mortgages in the state are relatively new – i.e. originated in the last three

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<sup>7</sup> Because the hurricane variable was constructed as a share of the counties in a state that were significantly damaged by the hurricanes, the interpretation of the coefficient would be the percentage point increase in our broad delinquency measure that we would expect if the entire state suffered this level of damage.

years. The regression results support our expectation that in the areas where the share of new loans is larger, delinquency rates are lower, and that the “vintage” of the loans is a significant factor in explaining delinquency.

The remaining variables included in the regression are indicator variables for observations in the years 2003 and 2004. Thus, these coefficients measure any year-specific effects that are not captured through the other variables, relative to the omitted year 2005. Judging by their size and significance, these year effects appear to be more important in the subprime regression than in the prime regression. Pennington-Cross (2002) examined the difference between default and prepayment patterns in the prime and nonprime mortgage markets. He found that nonprime borrowers prepay and default more often than prime borrowers and that interest rates and credit scores effects on these decisions are more pronounced for nonprime borrowers than they are for prime borrowers. Because some of the effects of interest rate movements could be captured in these time dummy variables, the relative importance of these variables for the subprime regression in comparison with the prime regression may be consistent with a greater sensitivity of nonprime borrowers to interest rate movements.

### **Conclusions and Implications**

This paper has explored the geographic variation in mortgage delinquency and foreclosure rates across states in the U.S. When we look at the share of loans 60 or more days past due or in foreclosure for the country as a whole over the last several years, the trends over time in both the prime and subprime markets do not seem to imply that the performance of mortgages has worsened. However, national averages obscure significant variation across states. Overall delinquency rates are higher in the South and Midwest, and a number of the states that have seen their delinquency rates rise in the last few years are in these regions. In contrast, delinquency rates for the coasts and particularly the West Coast are generally lower than in the center of the country, and have fallen somewhat over the 2003-2005 period.

These geographic differences provide some context for understanding for why the current state of U.S. mortgage performance may look relatively bright or dismal depending on the location of the market observer and the level of data used. These

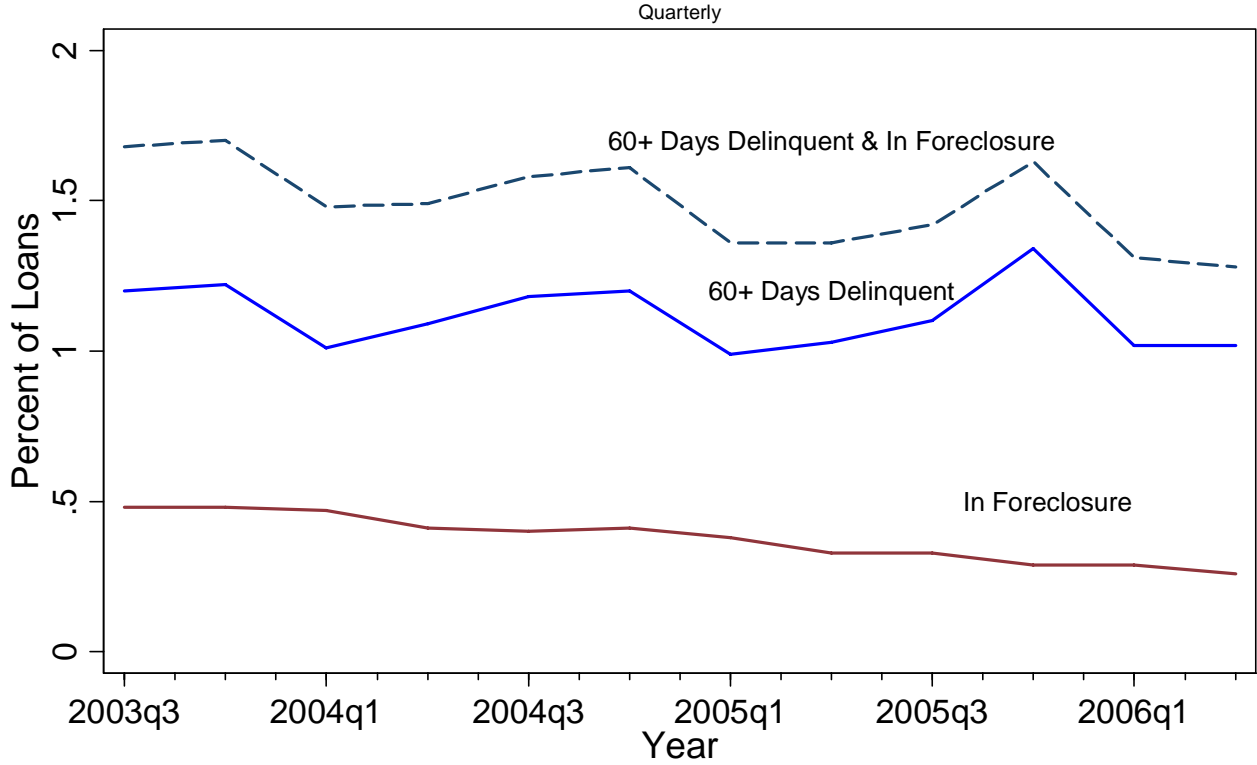
geographic differences also help to explain, albeit in a somewhat mechanical way, why the overall performance of mortgages nationally as measured by aggregate delinquency rates has been relatively stable over the last few years: mortgages in some of the most populous regions of the country (California and Florida, for example) have performed well, while the problem areas of the country are less densely populated and therefore have less of an impact on the aggregate statistics. One other noteworthy reason why market observers may differ in their interpretations of delinquency and foreclosure data may have to do with whether rates or counts of problem loans are in view. Although the rates of delinquent loans have not move markedly in the measures examined here, the increase in the homeownership rate and in the share of homeowners with mortgages imply that many more loans, and households, are affected even if the rate of troubled loans does not change. For those, like investors, who may be more focused on the performance of a portfolio of loans, the path of delinquency rates is likely to be of greater concern. However, municipalities and other institutions that provide direct services to troubled borrowers will clearly be impacted if the number of households struggling with mortgage payment problems increases.

In addition to describing the patterns of mortgage default rates across the country, this paper also explores some reasons why we would expect these rates to vary geographically. These factors would include differences in local economic conditions, the composition of the borrowing population, loan terms, and lender behavior. The importance of each of these factors has been raised in the existing literatures on mortgage default and on foreclosure hotspots. This paper then proceeds to present an empirical model to examine which of these factors may help to explain the geographic variation we currently see in delinquency rates across the states. Important factors that stand out from these statistical results as affecting delinquency rates are changes in the employment situation in a state; how recently mortgages in a given geography were originated; and, very recently, the effects of the hurricanes that hit Gulf Coast in 2005. This statistical modeling effort is exploratory; in future work, we hope to refine these models, and explore other factors (such as the share of adjustable rate mortgages) which could plausibly affect delinquency rates across different areas.

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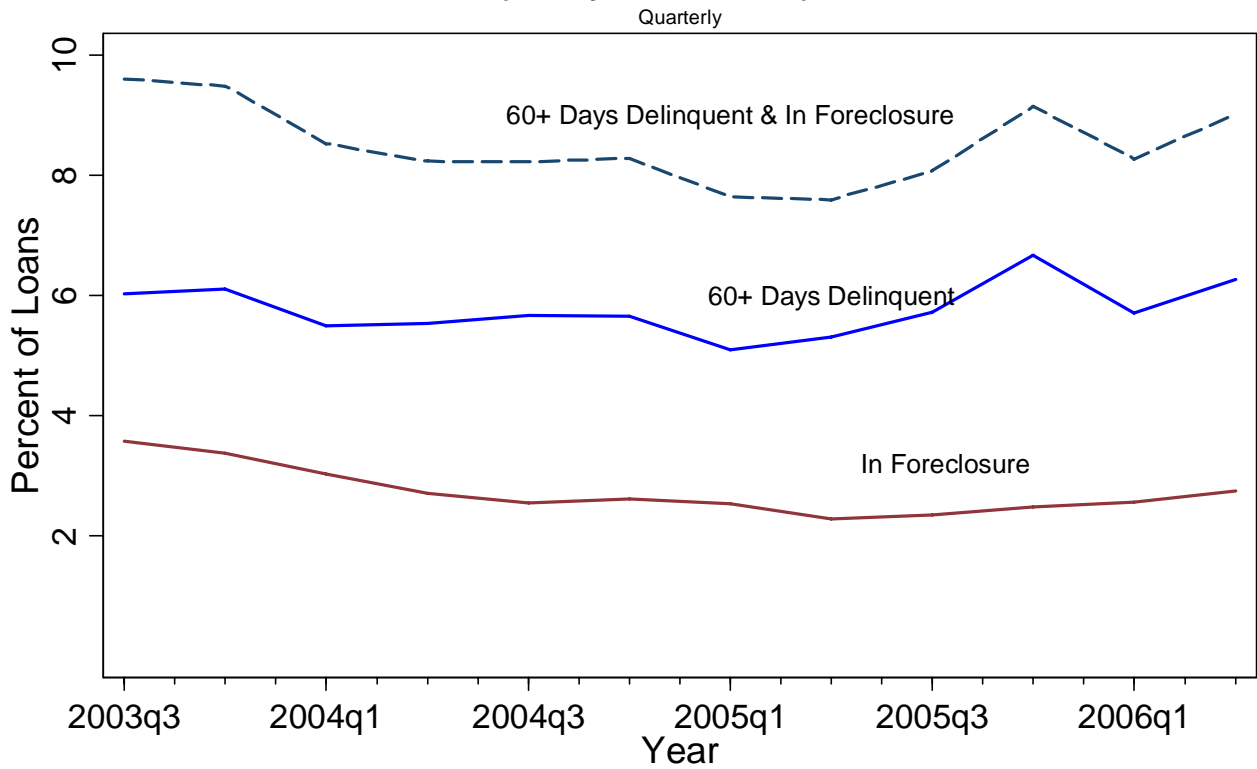
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Figure 1  
US Delinquency Rates: Prime Market



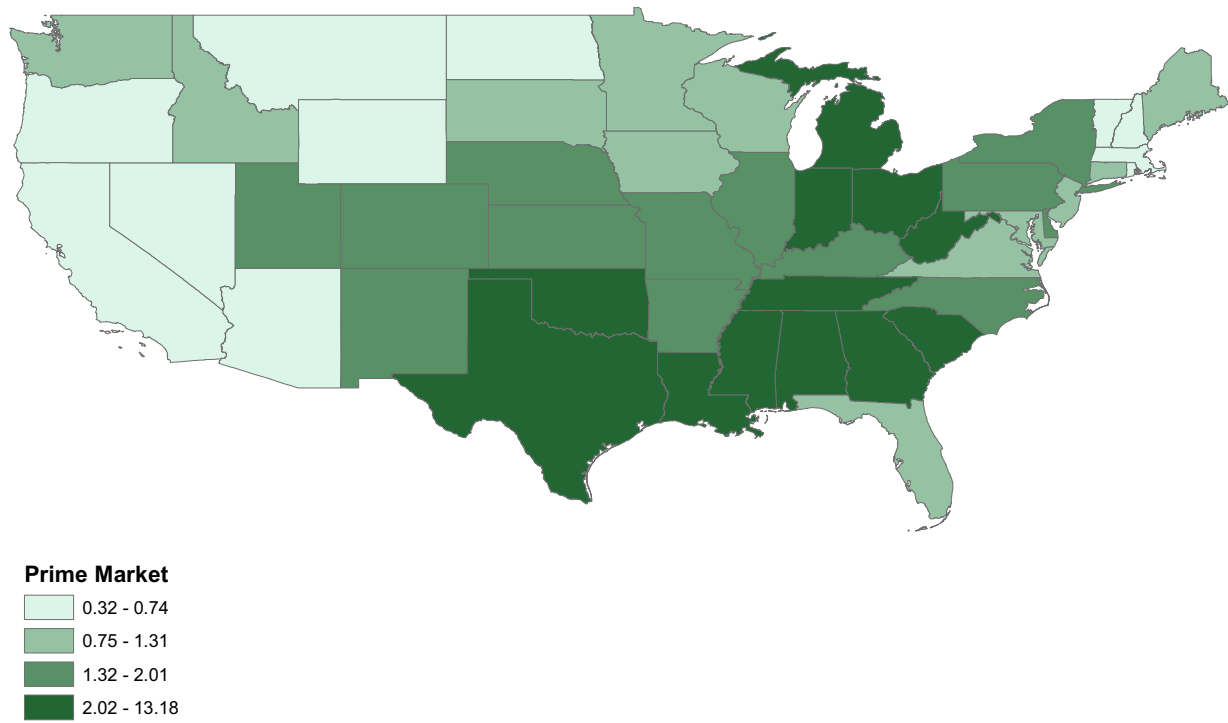
Source: First American LoanPerformance

Figure 2  
US Delinquency Rates: Subprime Market



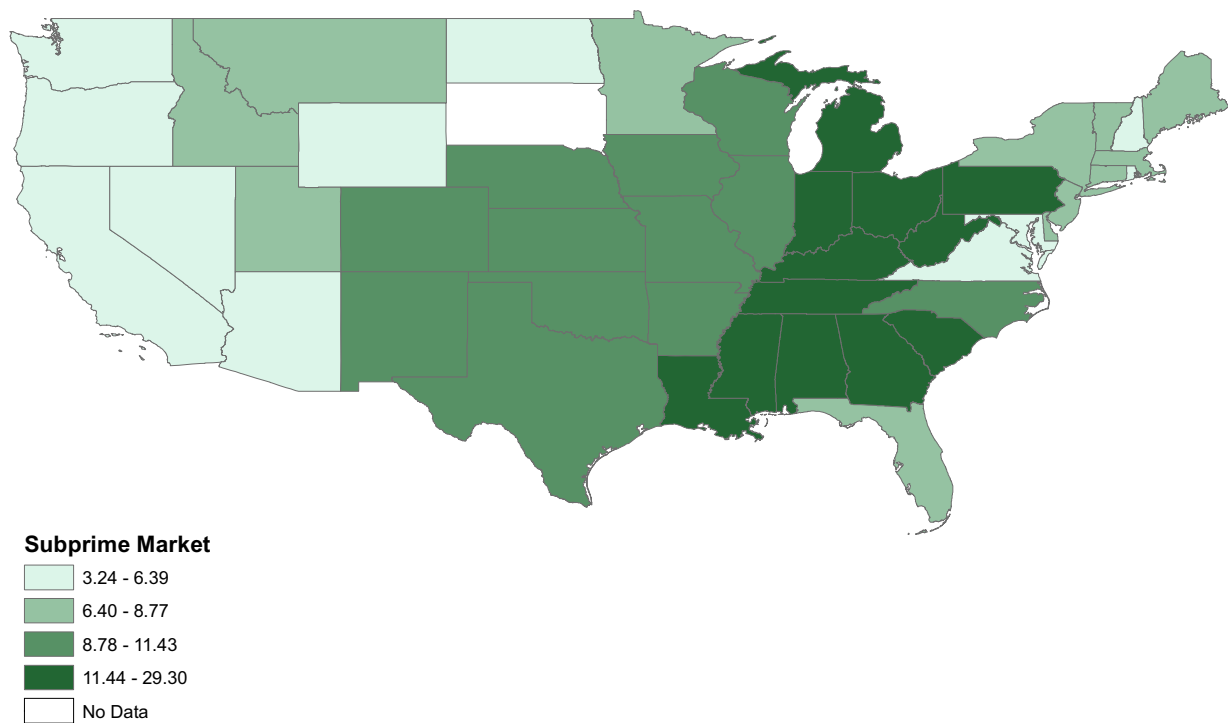
Source: First American LoanPerformance

Figure 3. Prime market, percent of the number of loans 60 or more days past due or in foreclosure, 2005:Q4.



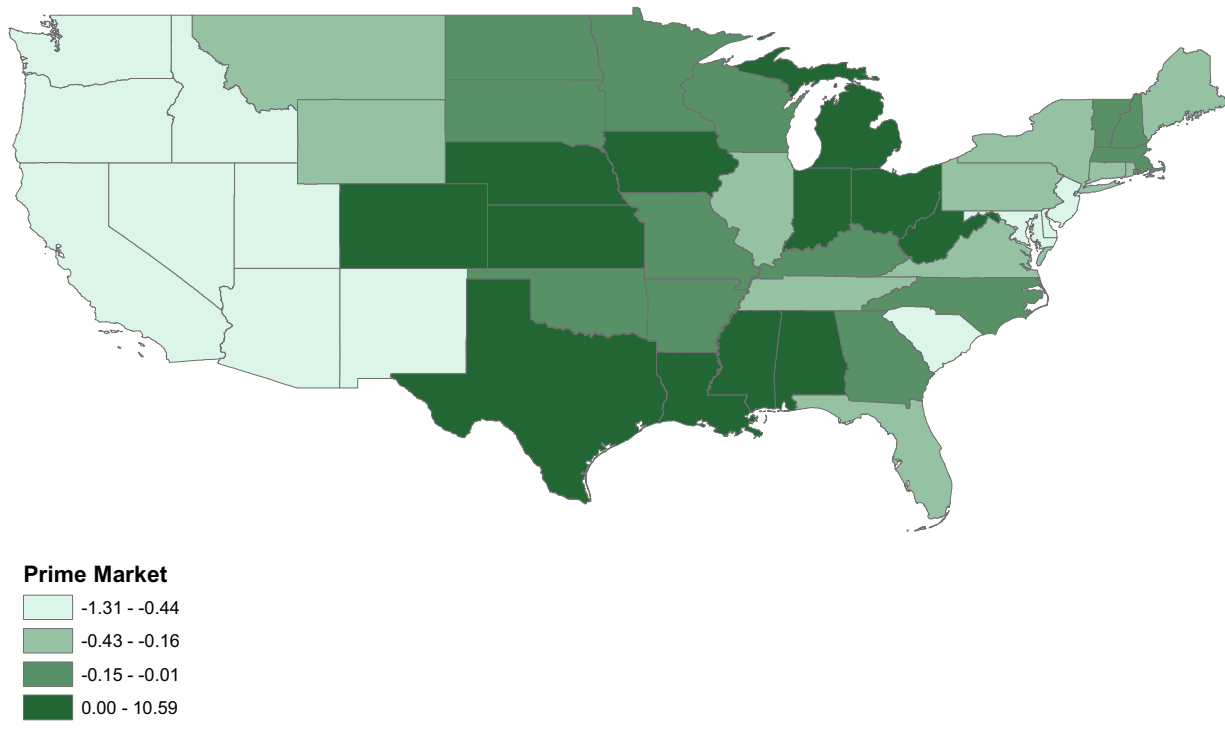
Source: First American LoanPerformance

Figure 4. Subprime market, percent of the number of loans 60 or more days past due or in foreclosure, 2005:Q4.



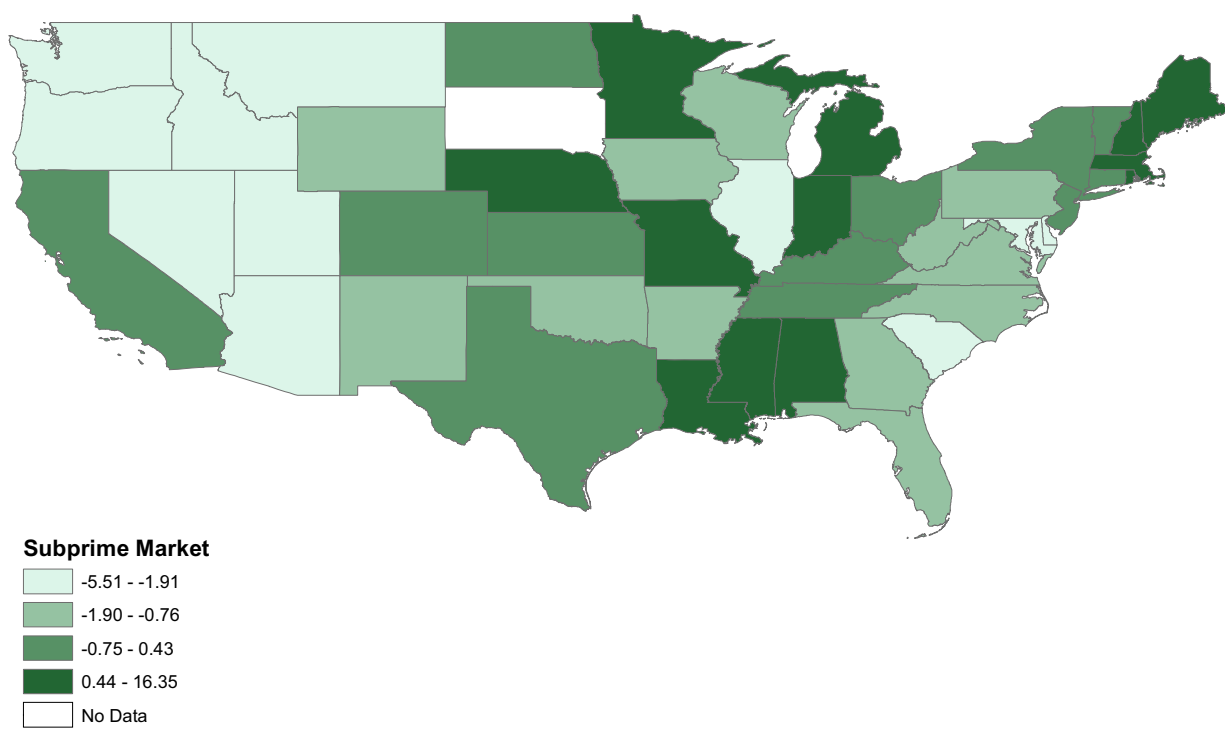
Source: First American LoanPerformance

Figure 5. Prime market, change in percent of the number of loans 60 or more days past due or in foreclosure, 2003:Q4 to 2005:Q4.



Source: First American LoanPerformance

Figure 6. Subprime market, change in percent of the number of loans 60 or more days past due or in foreclosure, 2003:Q4 to 2005:Q4.



Source: First American LoanPerformance

**Table 1**  
**Fixed Effects Regression Results**  
*Dependent variable: Share of loans 60+ days past due or in foreclosure*

<i>Independent Variables:</i>	<b>(1)</b> <b>Prime</b>	<b>(2)</b> <b>Subprime</b>
Share of borrowers with credit scores below 700, three years lagged	-0.00551 (.07522)	-.41276** (.20247)
Growth in state house price index over past three years	0.00412 (0.00625)	-.02691* (.01386)
Growth in state employment over past three years	-.12999*** (.02028)	-.28528*** (.05396)
Share of counties in the state with significant hurricane damage	.12261*** (0.00439)	.19510*** (.01145)
Share of mortgages with initial LTV>90%	.03389 (.04124)	-.02514 (.04217)
Share of mortgages originated within past three years	-.05484*** (.01822)	-.13736*** (.02866)
2003 dummy variable	-0.00033 (0.00196)	-.02661*** (0.00417)
2004 dummy variable	0.00302* (0.00161)	-.01598*** (0.00194)
Constant	.05314 (.04422)	.44701*** (.10424)
Total number of observations	153	147
Number of observations per year	51	49
R-squared	0.936	0.889

Notes:

a) Standard errors are in parentheses.

b) \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%