The extension of mortgage credit to underserved, minority, and higher credit-risk populations has been a topic of discussion among researchers and policymakers in recent years, as both the Clinton and Bush administrations have articulated policies that have sought to advance the homeownership opportunities of underserved and minority groups. Research accordingly has sought to identify the determinants of persistent disparities in both mortgage origination and homeownership attainment among targeted and non-targeted groups, (see, for example, Painter, Gabriel and Myers [2001], Coulson [1999], Deng, Quigley and Van Order [1996], and Rosenthal [2001]). On the mortgage side, studies have focused largely on the role of borrower credit risk and credit constraint in the analysis of mortgage loan origination and performance (see, for example, Ambrose and Capone [1998, 2000], Ondrich, Ross and Yinger [2000], Berkovec, Canner, Gabriel, and Hannan [1998], Avery, et al. [1996], Goering and Wienk [1996], Munnell, et al. [1996], Canner, Passmore, and Smith [1994], and Gabriel and Rosenthal [1991]).

Our recent study applies a state-of-the-art statistical model to assess the competing risks of FHA-insured mortgage default and prepayment simultaneously. Based on high-quality micro data, the study controls for borrower creditworthiness (credit scores) and other common underwriting variables among the approximately 30 contemporaneous indicators of borrower, loan, and locational risk.

While prior studies have provided substantial evidence of elevated default risk among lower-income, minority, and less creditworthy mortgage borrowers, little evidence exists about any offset of those risks via the slower prepayment speeds of underserved borrower groups. To mortgage lenders and investors, such an offset could serve to reduce total loan termination probabilities appreciably and boost investment returns.

The principal data used in this study consist of a large random sample of FHA-insured home purchase loans originated between 1992 and 1996. The FHA data are well suited for analyzing loan default, because the program includes large numbers of borrowers with relatively high credit risk. The data also enable us to assess whether those borrowers who pose higher credit risk and who are underserved prepay their mortgages more slowly, due perhaps to problems of access to mortgage finance, difficulties in mortgage qualification, limited knowledge of mortgage refinance opportunities, or reduced residential mobility. The extent to which the prepayment risk of mortgages originated among lower-income, lower credit-quality, and minority borrowers is relatively damped should be reflected in the pricing of
those loans. Indeed, from a mortgage pricing perspective, the reduced prepayment risk associated with those FHA-insured borrower groups may serve to mitigate their higher default probabilities.

Further, using a census tract indicator for each property location, each loan record file is matched to neighborhood socioeconomic and housing market indicators from the 1990 Census of Population and Housing. Other neighborhood or metropolitan area level variables, including unemployment rates, also are appended to the record file. FHA data on the race of the borrower and census measures of neighborhood racial composition enable us to assess race-related effects associated with the performance of FHA-insured loans. The FHA data set encompasses nearly 30 different metropolitan areas, allowing for substantial variability in the structure of local lending markets.

Our results confirm that a lower interest rate and a higher likelihood that the borrower’s equity value is negative are major factors driving prepayment and default, respectively. Our results also suggest that households with higher probability of negative equity have lower risk of mortgage prepayment.

In addition, our results point to the importance of other borrower, loan, and market characteristics in the estimation of mortgage termination risks. As expected, borrowers with higher credit scores are less likely to default, whereas borrowers with lower credit scores are less likely to prepay. Specifically, the five-year cumulative probability of prepayment is about 10 percentage points higher among borrowers with scores above 680 than among those with scores below 620. The five-year cumulative prepayment probabilities of black and Hispanic borrowers are about 14 and 7 percentage points lower than those of white borrowers, respectively.

The Analysis

Figures 1-4 report the simulated cumulative probabilities of prepayment and default by several borrower and loan characteristics. The probabilities are computed for one, three, and five years after loan origination. The simulations are based on a 10 percent random sample of loans originated in June 1992. The baseline borrower is assumed to be a white household purchasing an existing suburban home with a 30-year fixed-rate mortgage.

As expected, Figure 1 indicates that the five-year cumulative probability of prepayment rises substantially with borrower creditworthiness (as reflected in borrower credit scores). That probability is 23 percent higher among borrowers with scores above 680 than among those with scores below 620. Computing cumulative prepayment rates by race and creditworthiness illustrates the strikingly lower prepayment propensities of black borrowers relative to whites, Latinos, and Asians. For example, Figure 2 shows that, among white borrowers, the five-year cumulative probability of prepayment of 43.22% is about 1-1/2 times the 29.64% rate estimated for similarly creditworthy blacks. Likewise, cumulative default rates among black borrowers are estimated to be substantially in excess of those for other racial groups. At 5.3%, the five-year cumulative default rate of highly creditworthy black borrowers is 36 percent higher than that of similarly qualified white borrowers.

We also simulated the cumulative probability of prepayment and default by initial loan-to-value ratios (LTVs—see Figure 3). As expected, higher levels of credit risk serve both to elevate default likelihoods and to damp prepayment propensities. For example, at five years after loan origination, borrowers with high LTVs (95%) are characterized by 1.5 times the default risk of borrowers with lower LTVs. Also evident, however, are the substantially lower prepayment propensities of those borrowers with high LTVs; at five years after loan origination, the prepayment likelihoods of borrowers with high LTV were 20 percent below those of lower LTV loans. A similar outcome arises, for example, in the simulation of default and prepayment propensities among more or less creditworthy borrowers. Figure 1 shows that at five years after loan origination, borrowers with credit scores < 620 are characterized by...
higher total termination propensities. Loan investment opportunities relative to those groups with lower total loan termination risks represent more profitable equivalents to a prepayment. Clearly, borrower groups with Mae-insured loan investment via default is elegantly, from the perspective of the FHA-backed and Ginnie Mae guarantee of timely repayment of principal and interest in the event of borrower default. Accordingly, from the perspective of the FHA-backed and Ginnie Mae-insured loan investor, a loan termination via default is equivalent to a prepayment. Clearly, borrower groups with lower total loan termination risks represent more profitable loan investment opportunities relative to those groups with higher total termination propensities.  

The stacked bar charts in Figure 4 also provide an assessment of total termination risks of FHA-insured mortgage loans. Those risks are defined as the sum of the default and prepayment propensities at the end of years 1, 3, and 5. Total loan terminations (from all sources) are relevant to the profitability of investment in FHA-insured mortgages. Typically, those loans are not only FHA-insured, but, if pooled and sold, they also often are backed by a Ginnie Mae guarantee of timely repayment of principal and interest in the event of borrower default. Accordingly, from the perspective of the FHA-backed and Ginnie Mae-insured loan investor, a loan termination via default is equivalent to a prepayment. Clearly, borrower groups with lower total loan termination risks represent more profitable loan investment opportunities relative to those groups with higher total termination propensities.  

As Figure 4 shows, total loan termination risk is substantially elevated among borrowers with lower credit risk. In that regard, total termination risk among such borrowers is about 32 percent higher than that of borrowers with high credit risk. Furthermore, the substantially elevated default probabilities among the high credit risk group are more than offset by the damped prepayment propensities, resulting in significantly lower loan termination propensities overall. Indeed, among borrowers with high credit risk, loan termination probabilities via prepayment at the end of year five after origination are about 3.3 times that of loan termination propensities from default, while among borrowers with credit risk, prepayment probabilities at the end of year five after origination are about 33 times that of default probabilities. Clearly, loans originated among borrowers with high credit risk are relatively more profitable to the investor, given their substantially depressed overall termination propensities.

**Summary and Conclusion**

This paper applies micro-data from the FHA to estimate the competing risks of mortgage default and prepayment. The results confirm that the prepayment activities are highly associated with declines in the mortgage market rates; similarly, declines in the market value of the property also are positive and highly significant in the exercise of the default option. Our results further suggest that a higher probability of negative equity reduces the risk of mortgage prepayment. Such an outcome is indeed plausible, in that households with poor equity positions may be less willing to exercise the refinance option if their equity values are insufficient to refinance the remaining loan balance.

Our results also point to the importance of other borrower, loan, and market characteristics in estimating mortgage termination risks. For example, our findings indicate reduced consumer refinance propensity in more concentrated and less competitive loan markets. Among FHA borrowers, the initial LTV ratio is negatively associated with prepayment propensity and positively associated with default propensity. As expected, borrowers with higher credit scores are less likely to default, whereas borrowers with lower credit scores are less likely to prepay. In that regard, the five-year cumulative probability of prepayment is 23 percent higher among borrowers with scores above 680 than among those with scores below 620. Relative to white borrowers, estimates suggest that black and Hispanic borrowers are statistically less likely to prepay. Indeed, com-
putation of cumulative prepayment rates by race and creditworthiness illustrates the strikingly lower prepayment propensities of black borrowers, relative to whites, Latinos, and Asians.

Overall, our results indicate the appropriateness of the competing risk specification and indicate the importance of slower prepayment speeds among higher risk borrowers. As is evidenced, the substantially elevated default probabilities of higher credit risk borrowers are more than offset by their damped prepayment propensities, resulting in significantly lower loan termination propensities overall. Indeed, among high credit risk borrowers, at five years after loan origination, loan termination probabilities via prepayment are about 3.3 times those emanating from loan default, while for low credit risk borrowers, prepayment probabilities at the end of year five after origination are about 33 times that of default probabilities. For the investor in FHA-insured mortgage pools, the estimated five-year cumulative probability of mortgage termination among high credit risk and minority borrowers is only about three-fourths that of low-default risk and non-minority borrowers, respectively. Recognition of this mortgage performance advantage should enhance the willingness of lenders and investors to originate and acquire such loans and at more competitive pricing. Findings suggest that the extension of mortgage credit to less creditworthy and underserved borrowers, in a manner consistent with their lower termination risks, would serve to advance both their homeownership opportunities and related federal housing policy objectives.

References


2 Other simulations suggest that by the end the fifth year after origination, younger borrowers (household head is less than 25 years old) are characterized by 1.4 times the prepayment risks of older households (household head more than 45 years old). While the simulated risks of loan default similarly move up over the five-year period after origination, the differences between age groups is slight. Findings further suggest that the cumulative five-year risk of prepayment is relatively higher among married couples (41%) than single females (38%). In marked contrast, the five-year cumulative probability of default among single males is about 1.4 times that of single females. We further find little quantitative variation in the cumulative probabilities of default across first-time buyer status. Results of these analyses are available from the authors upon request.
Predicted Cumulative Prepayment and Default Risks
By LTV

Predicted Cumulative Prepayment and Default Risks
By Buyers Type
Predicted Cumulative Prepayment and Default Risks
By Housing Expense to Income Ratio

<table>
<thead>
<tr>
<th>Housing Expense to Income Ratio</th>
<th>End of Year 1</th>
<th>End of Year 3</th>
<th>End of Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>20%+HEI/38%</td>
<td>2.97%</td>
<td>2.04%</td>
<td>3.24%</td>
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<tr>
<td>Otherwise</td>
<td>0.41%</td>
<td>2.56%</td>
<td>4.19%</td>
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<td>20%+HEI/38%</td>
<td>21.57%</td>
<td>21.57%</td>
<td>20%+HEI/38%</td>
</tr>
<tr>
<td>Otherwise</td>
<td>17.51%</td>
<td>17.51%</td>
<td>Otherwise</td>
</tr>
<tr>
<td>20%+HEI/38%</td>
<td>43.73%</td>
<td>43.73%</td>
<td>20%+HEI/38%</td>
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<tr>
<td>Otherwise</td>
<td>36.51%</td>
<td>36.51%</td>
<td>Otherwise</td>
</tr>
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</table>

Predicted Cumulative Prepayment and Default Risks
By Credit Score

<table>
<thead>
<tr>
<th>Credit Score</th>
<th>End of Year 1</th>
<th>End of Year 3</th>
<th>End of Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit Score ≥ 680</td>
<td>3.23%</td>
<td>1.41%</td>
<td>2.24%</td>
</tr>
<tr>
<td>Credit Score &lt; 620</td>
<td>0.28%</td>
<td>1.04%</td>
<td>8.44%</td>
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<tr>
<td>Credit Score ≥ 680</td>
<td>22.88%</td>
<td>5.25%</td>
<td>45.67%</td>
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<tr>
<td>Credit Score &lt; 620</td>
<td>1.60%</td>
<td>16.74%</td>
<td>35.22%</td>
</tr>
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</table>

Predicted Cumulative Prepayment and Default Risks
By Overall Credit Risks

<table>
<thead>
<tr>
<th>Overall Credit Risk</th>
<th>End of Year 1</th>
<th>End of Year 3</th>
<th>End of Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Credit Risk</td>
<td>0.21%</td>
<td>1.03%</td>
<td>1.69%</td>
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<tr>
<td>High Credit Risk</td>
<td>3.99%</td>
<td>1.95%</td>
<td>3.64%</td>
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<tr>
<td>Low Credit Risk</td>
<td>27.55%</td>
<td>1.95%</td>
<td>53.12%</td>
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<tr>
<td>High Credit Risk</td>
<td>15.02%</td>
<td>15.02%</td>
<td>31.90%</td>
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