



Authors:

Yongheng Deng

Assistant Professor

School of Policy, Planning, and Development

ment

University of Southern California

331 Lewis Hall

Los Angeles, California 90089-0626

Voice: 213.821.1030

Fax: 213.740.6170

E-mail: ydeng@usc.edu

Stuart A. Gabriel

Director and Lusk Chair in

Real Estate

USC Lusk Center for Real Estate

Professor of Finance and Business

Economics, Policy, Planning, and

Development

University of Southern California

Voice: 213.740.5000

Fax: 213.740.6170

E-mail: stuart.gabriel@marshall.usc.edu



RESEARCH BRIEF

March, 2003

ENHANCING MORTGAGE CREDIT AVAILABILITY AMONG UNDERSERVED AND HIGHER CREDIT-RISK POPULATIONS: AN ASSESSMENT OF DEFAULT AND PREPAYMENT OPTION EXERCISE AMONG FHA-INSURED BORROWERS

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]).

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. Indeed, analyses of loan termination probabilities should account for the joint and competing nature of borrower prepayment and default option exercise (see, for example, Deng, Quigley, and Van Order [2000]).

Our recent study applies a state-of-the-art statistical model to assess the competing risks of FHA-insured mortgage default and prepayment simultaneously.¹ 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.

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

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.

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 300 different metropolitan areas, allowing for substantial variability in the structure of local lending markets.

THE ANALYSIS

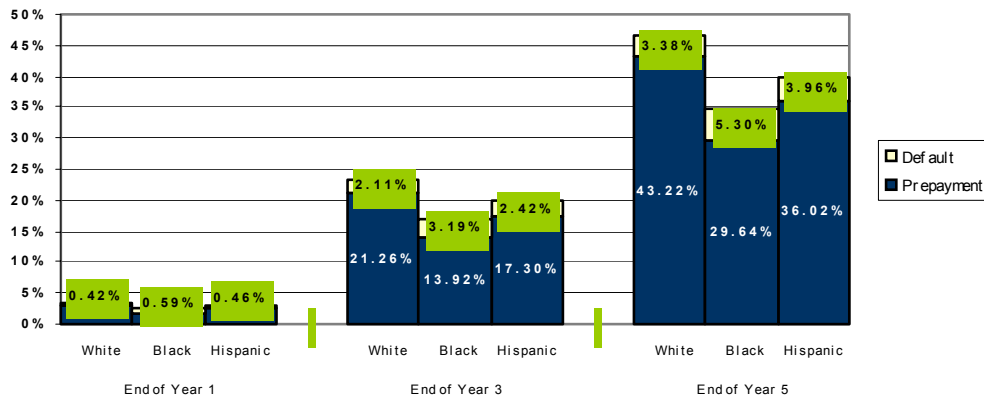
Figures 1-4 report the simulated cumulative probabilities of prepayment and default by several borrower and loan characteristics. The probabilities are computed for one, three, and five years after loan origination. The simulations are based on a 10 percent random sample of loans originated in June 1992. 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

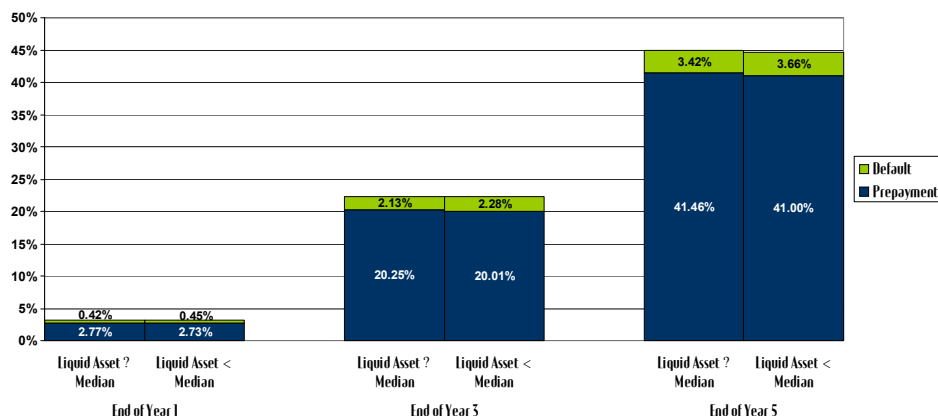
Predicted Cumulative Prepayment and Default Risks
By Borrower Race



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.

Predicted Cumulative Prepayment and Default Risks by Liquid Asset



3^{3/4} times the default risk of borrowers with credit scores 680, and they also pose damped prepayment risk relative to their higher credit score counterparts.²

Figure 4 shows simulations of default and prepayment propensities among borrowers with more fully specified high and low credit risk. In general, borrowers with high credit risk have lower levels of liquid assets, poor credit scores, and more aggressively underwritten mortgages (as regards loan-to-value and payments-to-income ratios). Borrowers with lower credit risk are the opposite.

Loan performance differs markedly over these borrower risk profiles. For example, by end of year five after loan origination, the simulated prepayment propensity of the lower credit risk borrower is about 21 percentage points higher than that of the higher credit risk borrower. However, borrowers with lower credit risk are characterized by a five-year cumulative default propensity that is about 8 percentage points lower than that of their higher credit risk counterparts. On net, our results provide clear evidence of elevated total loan termination probabilities among the lower credit risk group.

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 default 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

- Ambrose, Brent W., and Capone, Charles A. "Modeling the Conditional Probability of Foreclosure in the Context of Single-Family Mortgage Default Resolutions." *Real Estate Economics*, 1998, 26 (3), pp. 391-429.
- Ambrose, Brent W., and Capone, Charles A. "The Hazard Rates of First and Second Default." *Journal of Real Estate Finance and Economics*, 2000, 20 (2), pp.275-293.
- Avery, Robert, Bostic, Raphael, Calem, Paul, and Canner, Glenn. "Credit Risk, Credit Scoring, and the Performance of Home Mortgages." *Federal Reserve Bulletin*, 1996, 82 (7), pp. 621-648.
- Berkovec, James A., Canner, Glenn B., Gabriel, Stuart A., and Hannan, Timothy H. "Discrimination, Competition, and Loan Performance in FHA Mortgage Lending." *Review of Economics and Statistics*, 1998, pp.241-250.
- Canner, Glenn B., Passmore, Wayne, and Smith, Delores S. "Residential Lending to Low-Income and Minority Families: Evidence from the 1992 HMDA Data." *Federal Reserve Bulletin* 1994, 80.
- Coulson, Edward. "Why Are Hispanic- and Asian-American Homeownership Rates So Low? Immigration and Other Factors." *Journal of Urban Economics*, 1999, 45, pp. 209-227.
- Deng, Yongheng, Quigley, John M., and Van Order, Robert. "Mortgage Default and Low Downpayment Loans: The Costs of Public Subsidy." *Regional Science and Urban Economics*, 1996, 26 (3-4), pp. 263-285.
- Deng, Yongheng, Quigley, John M., and Van Order, Robert. "Mortgage Terminations, Heterogeneity and the Exercise of Mortgage Options." *Econometrica*, 2000, 68 (2), pp. 275-307.
- Gabriel, Stuart, and Rosenthal, Stuart. "Credit Rationing, Race, and the Mortgage Market." *Journal of Urban Economics*, 1991, 29 (3), pp. 371-379.
- Goering, John and Wienk, Ron, eds. "Mortgage Lending, Racial Discrimination, and Federal Policy," Urban Institute Press, 1996.
- Munnell, Alicia H., Tootell, Geoffrey M. B., Browne, Lynn E., and McEneaney, James. "Mortgage Lending in Boston: Interpreting HMDA Data." *American Economic Review*, 1996, 86, pp. 25-53.
- Ondrich, Jan, Ross, Stephen L., and Yinger, John. "How Common Is Housing Discrimination? Improving on Traditional Measures." *Journal of Urban Economics*, 2000, 47 (3), pp. 470-500.
- Painter, Gary, Gabriel, Stuart A., and Myers, Dowell. "Race, Immigrant Status, and Housing Tenure Choice." *Journal of Urban Economics*, 2001, 49 (1), pp. 150-167.
- Rosenthal, Stuart S. "Eliminating Credit Barriers to Increase Homeownership: How Far Can We Go?" Harvard University Joint Center for Housing Studies Working Paper, LIHO.01-3, 2001.

¹ A full version of the research paper can be downloaded from: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=330340 or http://www.usc.edu/schools/sppd/lusk/research/papers/pdf/wp_2003-1007a.pdf.

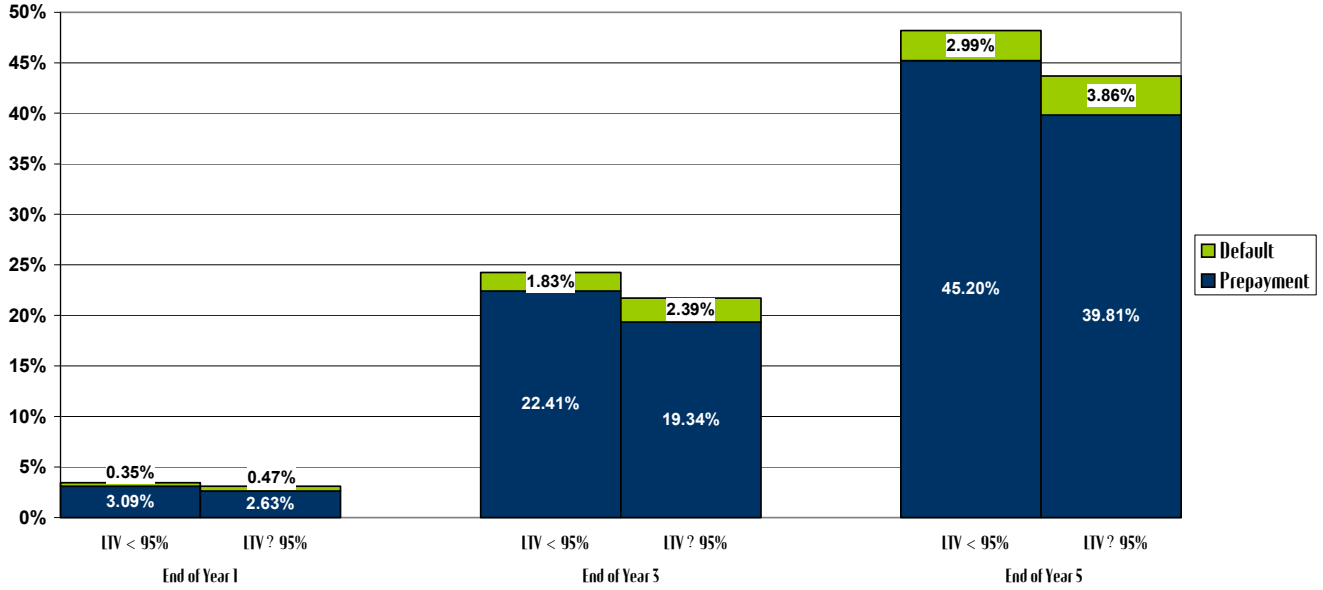
²Other simulations suggest that by the end the fifth year after origination, younger borrowers (household head is less than 25 years old) are characterized by 1.4 times the prepayment risks of older households (household head more than 45 years old). While the simulated risks of loan default similarly 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.



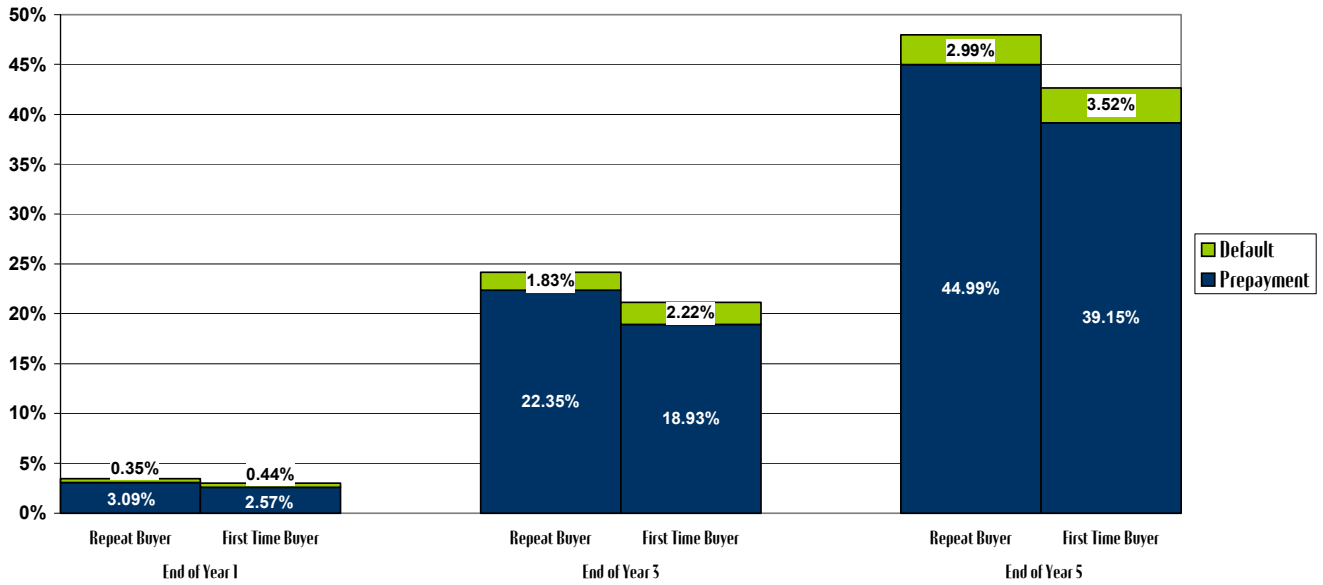
USC Lusk Center for Real Estate
A joint Center of the
Marshall School of Business and the
School of Policy, Planning, and Development
University of Southern California

650 Childs Way • 331 Lewis Hall
Los Angeles, California 90089-0626
Tel: 213.740.5000 • Fax: 213.740.6170
Internet: <http://www.usc.edu/lusk>

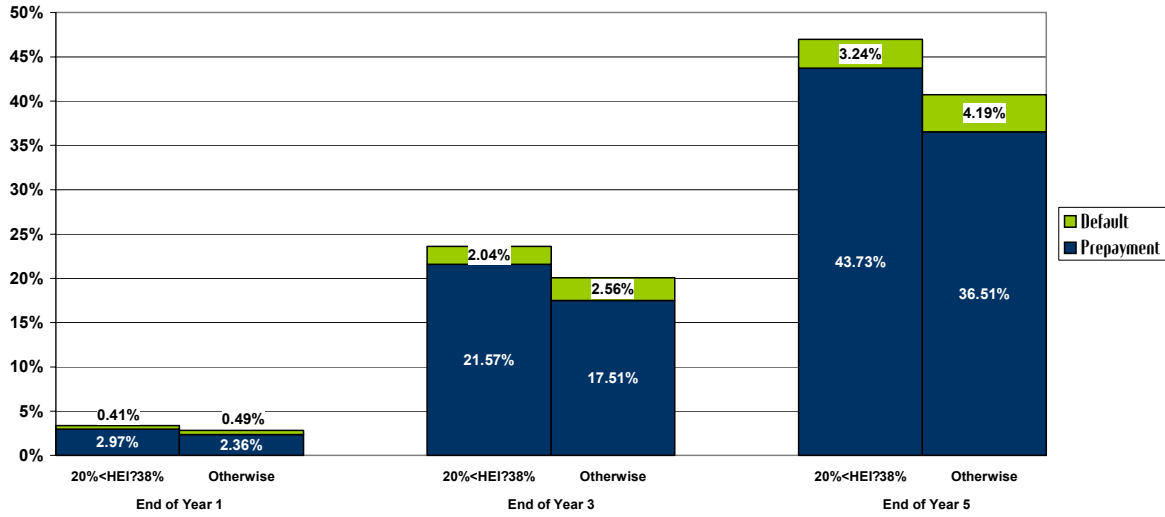
Predicted Cumulative Prepayment and Default Risks By LIV



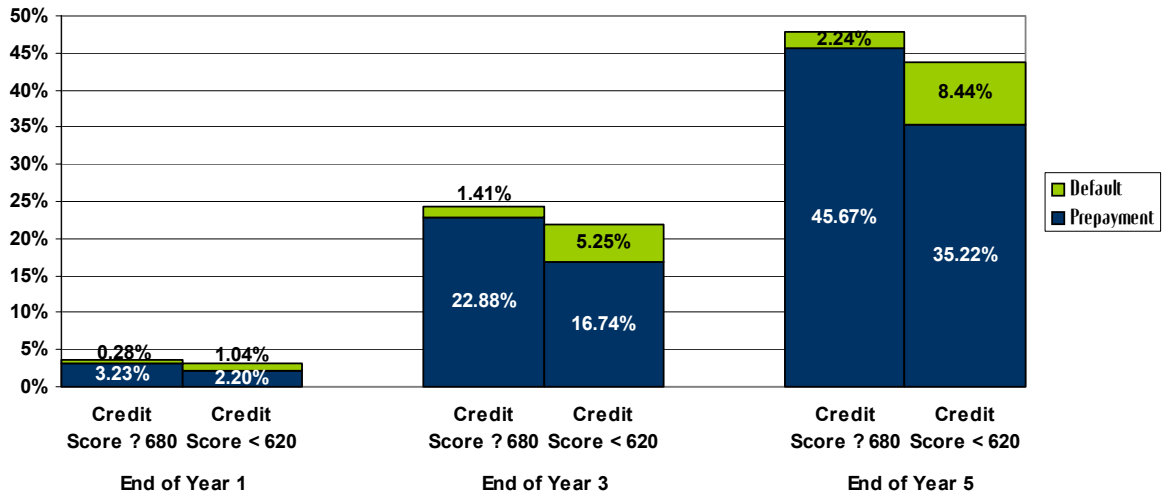
Predicted Cumulative Prepayment and Default Risks By Buyers Type



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



Predicted Cumulative Prepayment and Default Risks By Credit Score



Predicted Cumulative Prepayment and Default Risks By Overall Credit Risks

