NATIONAL COMMUNITY REINVESTMENT COALITION NCRC

Foreclosure in the Nation's Capital:

How Unfair and Reckless Lending Undermines Homeownership



NCRC DISPARITIES IN LENDING SERIES

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Executive Summary

The housing crisis has resulted in the loss of housing wealth of $2.7 trillion over the period 2007-2009, according to the U.S. Congress Joint Economic Committee. As the foreclosure crisis continues largely unabated, it is no surprise that homeownership rates have fallen. These effects have been especially pronounced in minority communities.

The housing crisis began with subprime lending. The exact nature of that lending has been much debated. Like the foreclosure crisis nationwide, the Washington, DC area crisis has been driven by subprime and non-traditional lending. This study takes a statistical sample of loans with 2004-2007 vintages, examining the borrower, loan and neighborhood characteristics that drove subprime lending and foreclosure. The study builds on other examinations of subprime lending and provides an expanded and sophisticated understanding of the causes of foreclosure.

Key findings

It is also documented that nearly 35 percent of subprime loans were issued to borrowers who could have qualified for fixed-rate, prime loans. It has been well documented that racial disparities exist in subprime lending. Subprime loans have experienced high rates of foreclosure. This study matches these facts, controlling for credit risk and other factors to isolate the effects that borrower, loan and neighborhood characteristics have on loans. Findings include:

- The econometric analysis of the study confirms that individual African-American and Hispanic borrowers obtained subprime loans more often than white borrowers with similar credit scores, incomes, loan-to-value ratios, and neighborhood characteristics. The study confirms that disparities in lending have a clear racial component that has not been adequately addressed through enforcement of the nation's fair lending laws.
    - Even controlling for other factors, Latinos were 70 percent more likely and African Americans 80 percent more likely than their white counterparts to receive a subprime loan. This finding suggests that race, in and of itself, alters the likelihood of receiving a subprime loan.
    - Previous studies by the National Community Reinvestment Coalition have repeatedly confirmed race disparities in lending nationwide. For example, an NCRC study found that middle and upper-income (MUI) African-Americans were at least twice as likely to receive a subprime loan than MUI whites in 155 metropolitan areas in 2006.
- Minority borrowers are facing foreclosure more often than white borrowers, even after controlling for borrower, loan, and neighborhood characteristics. The study finds that minorities are disproportionately affected by the foreclosure crisis, beyond levels that can be explained by objective criteria.
    - African Americans were almost 20 percent more likely and Latinos were 90 percent more likely than their similarly situated white counterparts to go into foreclosure. This suggests that race, in and of itself, alters the likelihood a borrower will go into foreclosure.
    - A recent survey by the National Community Reinvestment Coalition of borrowers in the loan modification process found that loans held by African Americans went to foreclosure more often than loans held by whites. This emerging area of concern requires additional study.
- Loans purchased by the Government Sponsored Enterprises (GSEs) are going into foreclosure at roughly half the rate of both portfolio loans and privately securitized loans. This suggests that the standards imposed by the GSEs have encouraged the origination of safe and sustainable loans.
- Loan characteristics, especially payment-to-income ratios, adjustable rates, high-costs (subprime) and balloon payments were found to have a significant effect on loan performance. The study breaks down the influence of each of these factors in a regression model.

Methodology

The study examines loans in the Washington, DC Metropolitan Statistical Area (MSA), which in addition to the District of Columbia includes counties in Maryland (Calvert, Charles, Frederick, Montgomery and Prince George) Virginia (Arlington, Clarke, Culpepper, Fairfax, Fauquier, Loudoun, Prince William, Spotsylvania, Stafford, Warren County) and West Virginia (Berkeley and Jefferson). We chose the Washington, DC area because it broadly mimics the procession of the foreclosure crisis elsewhere, led first by subprime and risky loan products. The study sampling is statistically significant and builds on the findings of other studies by Federal Reserve economists, academics and other consumer organizations.

The findings are particularly significant because the study controls for the most important factors used to determine risk during the origination process, including credit score. The study uses regression analysis, which separates out and controls likely causal factors, achieving a greater determination of causation than otherwise possible. The study controls for a number of influential factors, including:

- Loan characteristics: Loan-to-value ratio, loan type (purchase or refinance) adjustable rate mortgage, refinance, high-cost (subprime), extent of documentation, interest-only, pre-payment penalty, balloon term, payment-to-income ratio.
- Neighborhood characteristics: percent owner occupied, median year built, House Price Index, income level of zip code, moderate-income vs. upper-income zip code, middle-income vs. upper-income zip code, minority zip code.
- Investor identifiers: portfolio vs. government sponsored enterprises (GSE), private securitized vs. GSEs, year 2005 vs. 2004, year 2006 vs. 2004, year 2007 vs. 2004.

Recommendations

- The findings of the study clearly indicate risky and unfair lending practices that were not addressed by the banking regulators. We recommend the creation of a strong and independent Consumer Financial Protection Agency, dedicated to ensuring responsible access to capital and credit.
- Ongoing race disparities, which are unexplained by objective criteria, support the expansion and strengthening of the Community Reinvestment Act. The law should be expanded to non-covered financial institutions, which have been associated with higher levels of risky lending and foreclosure.
- The abusive and risky loan characteristics studied are not subject to rigorous oversight under the law, despite their problematic nature. We recommend the creation of a strong, national anti-predatory lending law.
- Reform of the Government Sponsored Enterprises (GSEs) should take into account that they may have a beneficial influence on loan quality and sustainability, as supported by this study.
- Studies conducted by other academics and Federal Reserve economists have found similar patterns lending in other geographic areas. Making the data presented here available publicly would have allowed for examination of subprime trends earlier in the foreclosure crisis. Problematic practices could have been identified earlier and perhaps stopped by stakeholders before spreading and creating a crisis. The financial reform bills being considered in Congress currently contain some data enhancements, but do not go far enough.

Introduction

Despite concerns raised by analysts and community groups about abusive practices in the lending market and the sustainability of some loan products, subprime mortgage markets grew rapidly in the first half of the last decade. The subprime share of total mortgage originations dramatically increased during that time, from about 6 percent of total residential mortgage originations at the beginning of the decade to about 25 percent by 2006.[1] Over this period, the dollar value of subprime loans rose from $100 billion to over $600 billion.[2]

Subprime mortgages are loans characterized by high interest rates or costly loan terms that theoretically compensate for the added risk of lending to borrowers with blemished or little credit history. In addition, high loan-to-value ratios or high debt-to-income ratios often occur on subprime loans.[3] Yet the rapid growth in origination of subprime loans suggests that a significant amount of this lending occurred at higher rates and less favorable terms than were justified by underwriting criteria and borrowers' financial qualifications. In fact, 35 percent of subprime loans were issued to borrowers who could have qualified for fixed-rate, prime loans.[4]

Several research studies clearly illustrate the spread of subprime loans and their pronounced effect on minorities.[5] In a study controlling for income and credit history, the Center for Responsible Lending found that minorities were significantly more likely than whites to receive subprime (high-cost[6]) loans.[7] Studies by the National Community Reinvestment Coalition have repeatedly confirmed race- and ethnicity-based disparities in high-cost lending after controlling for income[8]. For example, in 2006, middle- and upper-income African Americans were at least twice as likely to receive high-cost loans than middle- and upper-income whites in 155 metro areas across the nation.[9] Moreover, disparities in lending between minorities and whites increased as borrowers' incomes increased. These studies demonstrate that there may be a significant otherwise unexplained component in the loan origination process attributable to borrowers' race or ethnicity.

Lax underwriting standards and the popularity among lenders of nontraditional financial products contributed to a flourishing subprime market in the first part of the last decade.[10] When housing market conditions eventually reversed, the subprime market collapsed, leading to an unprecedented number of foreclosures all over the country and a series of failures among lending institutions. According to a report released by the Government Accountability Office in July 2009, approximately 1.6 million of

1 Federal Reserve Bank of San Francisco, "*The Subprime Mortgage Market: National and Twelfth District Developments*" (San Francisco: 2007), 8.

2 Government Accountability Office, "*Characteristics and Performance of Nonprime Mortgages*" (Washington DC: July 2009), GAO-09-848R.

3 There is no single definition for subprime mortgages. As pointed out by the Federal Reserve Bank of San Francisco (2007), "subprime" classification is generally a lender-given designation for loans. The above-stated definition is the general understanding of subprime mortgages, and similar definitions can be found in many academic papers (Federal Reserve Bank of San Francisco (2007); Government Accountability Office (GAO-09-848R), 2009; Kingsley, T. and K. Pettit (2009)).

4 Prepared Testimony of Michael S. Barr, Professor of Law, University of Michigan Law School, before the Committee on Financial Services, U.S. House of Representatives, hearing on "*The Community Reinvestment Act: Thirty Years of Accomplishments, but Challenges Remain*." February 13, 2008. Accessed at http://www.house.gov/apps/list/hearing/financialsvcs_dem/barr021308.pdf.

5 National Community Reinvestment Coalition, *Income is No Shield against Racial Differences in Lending*, (Washington, DC: 2006, 2008); Bocian, D., K. Ernst, and Wei Li. (2006); Paul Calem, Kevin Gillen, and Susan Watcher (2002); Amaad Rivera and others, "*Foreclosed: State of the Dream 2008*," (United for a Fair Economy, Boston, MA: 2008).

6 High-cost loans are loans with higher interest rates. Presently, federal regulators define high-cost loans as those with interest rates 3 percentage points higher than the treasury rate for first mortgages, and 5 percentage points higher for second mortgages.

7 Debbie Bocian, Keith Ernst, and Wei Li, *Unfair Lending: The Effect of Race and Ethnicity on Price of Subprime Mortgages.* (Durham, NC, Center for Responsible Lending: 2006).

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8 National Community Reinvestment Coalition, *Income is No Shield against Racial Differences in Lending*, (Washington, DC: 2006, 2008).

9 National Community Reinvestment Coalition, "*Income is No Shield Against Racial Differences in Lending II: A Comparison of High-Cost Lending in America's Metropolitan and Rural Areas*" (Washington DC: 2008).

10 Federal Reserve Bank of San Francisco, "*The Subprime Mortgage Market*" (San Francisco: 2007), 1.

the 14.4 million nonprime loans[11] originated from 2000 through 2007 had completed the foreclosure process as of March 31, 2009. Of the currently active nonprime loans, almost a quarter were either in default or in the foreclosure process, "indicating that hundreds of thousands of nonprime borrowers are at risk of losing their homes in the near future."[12] According to RealtyTrac, Inc., 2.3 million properties received a foreclosure filing in 2008 alone. In 2009, this number increased by 21 percent to 2.8 million, despite federal, state, and local efforts to stop foreclosures.[13] Even though the subprime market has considerably contracted in recent years, any plans aimed at meaningful economic recovery cannot overlook these irregularities in lending and the continued growth in defaults and foreclosures.

The devastating effects of the foreclosure crisis on wealth accumulation can hardly be overstated. The U.S. Congress Joint Economic Committee estimates a loss of housing wealth of $2.7 trillion over the period 2007-2009, as a direct result of foreclosures.[14] Moreover, as minorities and low-income individuals disproportionately maintain their wealth in their homes rather than in other assets,[15] the current foreclosure crisis seems sure to disproportionately affect minority communities. As a result, gains in minority homeownership that were achieved over the last decade have been reversed. For example, in the first quarter of 2009, the national African-American homeownership rate was at 46.1 percent, 3 percentage points below its peak in 2004 and lower than its 1999 level.[16] Homeownership among Hispanics was at 48.6 percent in the first quarter of 2009, registering a drop from its peak in 2007.[17] The reversal of gains achieved in homeownership, and the resultant loss of wealth, are likely to exacerbate the already notable wealth inequalities in the U.S., and in turn, burden the economy as a whole.

The subprime market and subsequent foreclosures in the Washington, DC, metropolitan area are not very different from what has been observed in the rest of the country. The Washington, DC, region has traditionally had a resilient economy, with its industries centered on the needs of the federal government. Seemingly stable in previous years, the DC housing market is currently showing alarming signs and is now one of the regions with the fastest growing foreclosure rates in the nation.[18] Although the region had one of the lowest foreclosure rates among major metropolitan areas in the first quarter of 2007, by the first quarter of 2008, the rate of homes going into foreclosure in the area was nearly six times higher than it had been in 2007.[19]

Like the foreclosure crisis nationwide, the DC crisis has been driven by subprime and nontraditional lending. Subsequently, as neighborhoods are left with an increasing number of vacant properties, neighborhood decay accelerates, due to loss of property tax revenue, decline of home values, and increased crime and vandalism. The importance of these transformations can hardly be overstated; as the latest report from Pew's Economic Mobility Project indicates, neighborhood conditions are the strongest predictor of adults' upward or downward economic mobility.[20]

We chose to analyze the Washington, DC, area because it was noted that the foreclosure crisis has accelerated in the region.

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11 Nonprime loans include both subprime loans and alt-A loans. Alt-A loans are generally given to borrowers with higher credit ratings than subprime borrowers, but are associated with more unconventional loan terms, such as limited or no documentation about income and assets, high loan-to-value ratios, high payment-to-income ratios, or some combination of these characteristics. Thus, Alt-A loans tend to be riskier than conventional prime loans.

12 Government Accountability Office (Washington DC: July 2009).

13 RealtyTrac, Inc., *Foreclosure activity remains near record level in August*." (September 2009).

14 Amaad Rivera and others, "*State of the Dream 2009: The Silent Depression"* (United for a Fair Economy, Boston, MA: 2009). *See also* U.S. Congress Joint Economic Committee at http://jec.senate.gov/index.cfm?FuseAction=ReportsReports&ContentRecord_id=392cb915-9c45-fa0d-5a46-f61f6e619381&Region_id=&Issue_id=.

15 Amaad Rivera and others, "*State of the Dream 2009*" (United for a Fair Economy, Boston, MA: 2009).

16 U.S. Census Bureau, "Homeownership Rates by Race or Ethnicity of Householder: 1994 to 2009," at http://www.census.gov/hhes/www/housing/hvs/annual08/ann08ind.html.

17 According to the Census Bureau (1994 to 2009 estimates), the Hispanic homeownership rate has dropped more than one percent since 2007.

18 John McClain and Lisa Fowler, "Foreclosures in *the Washington, DC, Region: Evaluating the Scope of the Crisis*" prepared for the Metropolitan Washington Council of Governments (Washington DC: 2008).

19 Ibid., p.18.

20 Patrick Sharkey, "*Neighborhoods and the Black-White Mobility Gap*" (The Pew Charitable Trusts Economic Mobility Project, Washington DC: 2009).

Moreover, as NCRC and other nonprofit organizations have been involved in foreclosure prevention activities in the DC area in recent years, we uncovered several examples of risky and problematic lending activity. Hence, we concluded that an analytical approach was necessary in order to assess which groups of borrowers received most of these risky loans and whether this type of lending was justified.

This paper focuses on two major issues outlined above. First, it focuses on potential disparities in subprime lending that are not explained by borrowers' financial qualifications or housing market characteristics. Then, the paper turns its attention to the impact of such lending disparities, among other factors, on foreclosure outcomes. The study is limited to mortgages originated in the Washington, DC, metropolitan statistical area[21] (henceforth referred to as the DC MSA) between 2004 and 2007, while tracking the life of each mortgage through the end of 2008. This paper provides a detailed exploration of mortgage lending practices across minority communities in the DC MSA, and looks at the performance of these loans at a deeper level than is possible with Home Mortgage Disclosure Act (HMDA) data alone. The study combines loan terms and performance information from a database obtained from a proprietary source, Lender Processing Services (LPS), Inc., together with HMDA data. In particular, the combined data allows us to control for borrower credit risk, as well as the terms of the loan at the point of origination.

Using loan-level data, the study employs a logistic regression approach to model both the event of a borrower receiving a subprime loan as opposed to a prime loan, and the event of a loan facing foreclosure.

The study's findings include:

- The econometric analysis confirms that individual African-American and Hispanic borrowers obtained subprime loans more often than white borrowers with similar credit scores, incomes, down payments, and neighborhood characteristics. Due to data limitations, the study does not provide a definitive conclusion as to whether the observed variations in subprime lending to African-Americans or Hispanics is a result of discriminatory or abusive practices of lending institutions. Yet this study confirms that disparities in lending have a clear racial component that has not been adequately addressed through enforcement of the nation's fair lending laws.

- Minority borrowers are facing foreclosure more often than white borrowers, even after controlling for borrower, loan, and neighborhood characteristics. The study finds that minorities are disproportionately affected by the foreclosure crisis, beyond levels that can be explained by objective criteria. A recent survey by the National Community Reinvestment Coalition of borrowers in the loan modification process found that loans held by African-Americans went to foreclosure faster than loans held by whites.[22] Further research is needed to assess why foreclosure rates are higher for minorities. Is it possible that for two similarly situated borrowers in default, white and minority, financial institutions act more quickly to foreclose upon the minority borrower?

- Loans purchased by Government Sponsored Enterprises (GSEs) are performing better than both the portfolio loans and private securitized loans. This suggests that the standards imposed by GSEs have encouraged the origination of safe and sustainable loans.

The paper's organization is as follows: first, a discussion of the data and methodology is provided in the next section, followed by a descriptive analysis of the data. The paper then discusses the econometric analysis of subprime lending and foreclosures. Finally, the study's conclusions and recommendations are presented.

21 The study uses the same OMB 1999 definition used by Census 2000 for the Washington, DC, metropolitan statistical area (http://www.census.gov/population/www/metroareas/pastmetro.html). It includes the District of Columbia; Calvert, Charles, Frederick, Montgomery, and Prince George's counties from the state of Maryland; Arlington, Clarke, Culpeper, Fairfax, Fauquier, King George, Loudoun, Prince William, Spotsylvania, Stafford, and Warren counties, and the cities of Alexandria and Fairfax, Falls Church, Fredericksburg, Manassas, and Manassas Park from the Commonwealth of Virginia, and Berkeley and Jefferson counties from West Virginia.

22 National Community Reinvestment Coalition, Home Affordable Modification Program (HAMP) Mortgage Modification Survey 2010 (Washington DC: 2010). http://www.ncrc.org/index.php?option=com_content&task=view&id=562&Itemid=118.

Data and Methodology

The study begins by examining the likelihood of receiving a subprime loan among borrowers of different races and ethnicities but similar financial credit risk. Subprime loans generally contain undesirable loan terms such as prepayment penalties, balloon terms, and negative amortization terms. Previous research has found that these loan terms are associated with higher default rates.[23] Hence, if one group of borrowers receives a higher share of subprime loans, such borrowers inadvertently face a greater threat of default. Next, controlling for borrower credit risk, loan terms, and housing and neighborhood characteristics, our study estimates how a borrower's race or ethnicity influences the loan's performance. Using loan-level data, the paper sheds light on how lending patterns have impacted the current wave of foreclosures in the DC MSA.

However, the lack of data tying foreclosures to borrower characteristics such as race and income places an impediment on these types of studies. To overcome this data deficiency, our study combines data from three sources: Home Mortgage Disclosure Act (HMDA) data (2004-2007), loan performance data from Lender Processing Services Inc. (LPS) Applied Analytics (January 2004-December 2008)[24], and Census 2000 data from the U.S. Census Bureau.

HMDA data is the most comprehensive source of mortgage lending data available to the public. But although it provides loan amount, borrower race or ethnicity, census tract location, and other characteristics, it does not provide credit scores, house values[25], and most importantly, up-to-date information about the loan's performance.

To bridge this gap, loan performance data at the loan level was purchased from LPS. The LPS data is compiled from mortgage servicing firms that collect mortgage payments for U.S. investors and lenders. As of December 2008, a total of sixteen firms, including nine of the top ten servicers, provided data to LPS. The data set provides information about all outstanding liens in a particular month between 2000 and 2008. A loan stays in the LPS data set until it completes a real-estate-owned (REO) process or is repaid. The data provides information about the terms of the loan at origination, property value, borrower credit score, and the loan's performance over time—information that is not available in the HMDA data set.

Neighborhood variables at the zip code level from the Census 2000 data set are used to capture the breakdown by race or ethnicity, as well as the local housing conditions in each zip code.

The matching of a specific HMDA loan to a loan in the LPS data was accomplished by using a series of variables, as the two data sources do not have a common identifier variable. The first study to match LPS and HMDA data in order to bring individual borrower information together with loan performance information was conducted by Laderman and Reid at the Federal Reserve Bank of San Francisco.[26] Our study follows a similar approach. For the purpose of this research, loans are restricted to first lien loans originated between 2004 and 2007 that are for owner-occupied, one-to-four family residences. Further, the study focuses on loans from the DC MSA, which, as defined above, includes the District of Columbia and selected counties/cities[27] of Maryland, Virginia, and West Virginia (see footnote 19). The loans were matched based on year of origination, geographic zip code, loan amount, loan purpose (purchase or refinance), and the type of purchaser of the loan[28] (i.e. Fannie Mae, Freddie Mac,

23 See Brent Ambrose, Michael LaCour-Little and Zsuzsa Huszar (2005); Anthony Pennington-Cross and Giang Ho (2006); Elizabeth Laderman and Carolina Reid (2008).

24 Lender Processing Services, Inc. was formerly known as McDash Analytics, Inc.

25 The lack of these two pieces of crucial information used in the assessment of risk by the lender from the HMDA data prevents an analysis of lending discrimination.

26 Elizabeth Laderman and Carolina Reid, "*Lending in Low- and Moderate-Income Neighborhoods in California: The Performance of CRA Lending During the Subprime Meltdown*" Working Paper (Federal Reserve Bank of San Francisco: 2008).

27 The Office of Management and Budget (OMB) identifies both the counties and the cities that make up the MSA as counties. Unless otherwise specified, henceforth this paper will also refer to both counties and cities simply as counties.

28 Depository and other financial institutions report their mortgage loan activity of each year to the Federal Financial Institutions Examination Council. It is this data that is made available to the public as HMDA data. The financial institutions have until March 31 of the following year to update any mortgage loan activity in a particular year. For example, the final set of information about all loans originated in 2007 is provided by the financial institutions in March 2008. If an originator sells a loan, the purchaser of the loan reported in the HMDA data is as of the third month of the year following the year of origination.

Portfolio loan, or Ginnie Mae). HMDA data is provided on county and census tract basis, whereas the LPS data only provides the zip code information for each loan origination. Hence, a geographic cross-walk file was used to match the census tracts to zip codes.

Table 1: *The Number and Share of LPS Loans Matched With HMDA Loans by Year*

Year of Origination	LPS Loans	Matched Loans	Percent Matched
2004	149,767	25,991	17.4
2005	172,692	30,030	17.4
2006	130,659	26,408	20.2
2007	96,318	22,850	23.7
All	549,436	105,279	19.2

Using the above variables, we were able to uniquely identify 19.2 percent of the loans in the LPS data set, or 105,279 loans for the years 2004 through 2007. The percentage breakdown of the match by year of origination is given in Table 1 above. In comparison, the Laderman and Reid (2008) study had a match rate of about 60 percent of the loans of the LPS data set for their area of study. The difference in the match rate is due to the fact that information about the month of origination of HMDA loans is available to federal regulatory agencies, but not released to the public. With 105,279 loans in the full matched file, we believe we have a sufficiently large number of observations to obtain robust estimates. This matched data file represents the full set of matched loans from the two data sources (HMDA and LPS), and is a subset of all first lien, owner-occupied, one-to-four family residence loans that were originated between 2004 and 2007 in the DC MSA. In addition, the LPS data set does not capture all loans in the market, and it over-represents prime and near-prime loans, while under-representing subprime loans.[29] Thus, to increase the data's representation of the universe of loans, and hence the confidence of inferences made using the matched sample, weights are created. Using HMDA data as the benchmark for weights,[30] each loan in the matched data file is weighted based on zip code, high-cost loan (rate-spread reported), and race or ethnicity (African-American, Hispanic, and white non-Hispanic) variables. The weights calculated using HMDA data are used to adjust for the under-representation of subprime mortgages on the market. They are applied to the matched data throughout the analyses.

Empirical Model Specification

Our objective is to examine the likelihood of two similarly situated borrowers receiving a subprime loan for reasons other than their creditworthiness, specifically their race or ethnicity. With a discrete outcome variable to identify subprime loans, '1' to depict a subprime loan and a '0' for a prime loan, the following logistic regression model is used to estimate the subprime likelihood:

$$Prob(S/X) = \psi(\beta' X), \text{-------} (1)$$

where S represents whether a loan is subprime or not, X is a vector of explanatory variables, β is a vector of parameter estimates, and ψ is assumed to have a cumulative standard logistic distribution. The series of explanatory variables included in the model are expected to depict the same factors the lender would consider in the underwriting decision-making process. The decision to offer a subprime loan, as opposed to a prime loan, arguably should be based on the borrower's credit risk or ability to pay, as well as housing market characteristics, and not on the borrower's race or ethnicity. Yet we include borrower race or ethnicity among the set of explanatory variables in equation (1), as the minority-white disparity of receiving a subprime loan is of particular interest.

29 Dan Immergluck, *The Accumulation of Foreclosed Properties: Trajectories of Metropolitan REO Inventories during the 2007-2008 Mortgage Crisis* (Federal Reserve Bank of Atlanta: Community Affairs, Atlanta, GA: 2008).

30 HMDA data covers about 80 percent of all originated loans in any given year (http://www.frbatlanta.org/invoke.cfm?objectid=37B810A9-5056-9F12-12E8EB312FB291A7&method=display_body). HMDA data provides the best approximation of the universe of all loans.

Variables that can indicate the borrower's continued ability to make mortgage payments, such as borrower income, mortgage payment-to-income (PTI) ratio, and borrower credit-worthiness as measured by their credit score, are relevant to the underwriting decision. The characteristics of the property and housing market will suggest the ability to recoup its investment in the event of a default in the future. Then down payment or the reciprocal, loan-to-value (LTV) ratio, will indicate to what extent the borrower is vested to the property purchased. The following expanded equation is used to model this prime versus subprime decision by the originators of the loan:

$$S_i = \beta_0 + \beta_1 \boldsymbol{X_1} + \beta_2 \boldsymbol{X_2} + \beta_3 \boldsymbol{X_3} + \lambda_t + \mu_k + \varepsilon_i \quad \text{-------- (2)}$$

Where $\varepsilon_i \sim N(0, \sigma_i^2)$ distributed error term.

Here S_i represents the expected likelihood that mortgage i is subprime, given borrower characteristics (***X1***), loan terms (***X2***), and housing market conditions (***X3***). The μ_k is a time-invariant county-fixed effect unique to county k, λ_t is a time-fixed effect common to all mortgages originated in year t, and ε_i is an individual time- and county-varying error component distributed independently across counties and time, and independently of all μ_k and λ_t. Table 2 provides the set of variables included under each vector of the above specification. Note that only two of the set of 'loan terms' (**X2**), the LTV ratio and the payment-to-income (PTI) ratio, are included in equation (2), as the other loan terms (such as pre-payment penalty and balloon term) are deemed to be the result of the subprime versus prime decision rather than factors causing this decision.

We then aim to determine to what extent the probability of foreclosure can be explained by observable variables like borrower characteristics, loan terms, and investor and housing market conditions. The outcome variable, again, is a discrete variable, but now it captures the most current status of a mortgage. A '1' in the outcome variable indicates the mortgage is in the foreclosure process ('presale' or 'post-sale') or is already a real estate owned (REO) property; otherwise '0'. Hence, we use the following logistic regression specification to estimate the probability that a mortgage will face default or foreclosure:

$$Prob(f/X) = \rho(\beta' \boldsymbol{X}), \quad \text{-------- (3)}$$

where f represents the event of a loan facing foreclosure, $\boldsymbol{X}$ is a vector of explanatory variables, $\boldsymbol{\beta}$ is a vector of parameter estimates, and ρ is assumed to have a logistic distribution. To be more precise, the different categories of explanatory variables included in X are spelled out below in equation (4):

$$F_i = Prob(f/X) = \beta_0 + \beta_1 \boldsymbol{X_1} + \beta_2 \boldsymbol{X_2} + \beta_3 \boldsymbol{X_3} + \beta_4 \boldsymbol{X_4} + \lambda_t + \mu_k + \varepsilon_i, \quad \text{-------- (4)}$$

Where $\varepsilon_i \sim N(0, \sigma_i^2)$ distributed error term.

Here F_i represents the expected default likelihood, given the borrower characteristics (***X1***), the loan terms (***X2***), the neighborhood characteristics (**X3**), and the investor characteristics (**X4**). The μ_k is a time-invariant county effect unique to county k, λ_t is a time effect common to all mortgages originated in year t, and ε_i is an individual time- and county-varying error component distributed independently across counties and time, and independently of all μ_k and λ_t.

Variable Definitions

Table 2 provides the set of variables included under each vector of the above equations (2) and (4). The dependent variable in equation (2) is a binary variable with '0' indicating a prime loan and '1' indicating a subprime loan. A subprime loan, for the purpose of this study, is defined as a loan categorized as a grade B or C loan, or an adjustable rate loan with an ARM margin greater than 3 percentage points above the ARM index.[31] [32]

Borrower characteristics include the borrower's FICO credit score[33] and reported income at the point of origination. Consistent with the existing literature, we have grouped the FICO score into three different categories: "low" (FICO<640), "middle" (640<=FICO<720), and "high" (FICO>=720).[34] To compensate for the higher risk taken by the lender when lending to a borrower with a lower credit score, a higher interest rate is offered. Therefore, interest rate and credit score are inversely related: the lower the credit score, the more likely it is that the loan is high-cost or subprime, and the higher the foreclosure risk. Borrower income, to the nearest $1,000, is obtained from the HMDA data file.

Borrower race or ethnicity information is obtained from the HMDA data files and coded to be consistent with the race or ethnicity classification from the U.S. Census.[35] This study is restricted to three race or ethnicity groups: white, African-American, and Hispanic. We refer to borrowers who were identified as "white" and "not Hispanic or Latino" as white. Borrowers identified as "African-American or black" and "not Hispanic or Latino" are referred to as African-American. "Hispanic and Latino" and "white" are identified as Hispanic borrowers. We have ensured that the three race or ethnicity categories are mutually exclusive.

Neighborhood-level information is obtained at the zip code level from Census 2000 data[36] and combined with LPS data. These variables capture the neighborhood demographics, variation in local housing stock, and occupancy rate by county within the MSA. Using the zip code median household income, each zip code is categorized as low income (income less than 50 percent of the MSA median), moderate income (income between 50 to 80 percent of the MSA median), middle income (income between 80 to 120 percent of the MSA median), or upper income (income above 120 percent of the MSA median). We create dummy variables that indicate each zip code's income category. In addition, we include an identifier for predominantly minority zip codes (i.e., zip codes with a minority share of 50 percent or higher), homeownership rate, and median year housing units were built. The homeownership rate per zip code is calculated as the percent of owner-occupied households relative to all housing units.

In addition to the above neighborhood-level variables, we constructed a variable that measures the annual house price appreciation by county, based on the change in median home sales price in the area. Existing research documents the importance of the housing cycle in explaining the share of subprime lending[37] and also the neighborhood level of foreclosures.[38] Yet the current home value dynamics may be endogenously related to the current foreclosure rate.[39] Thus, the increase in median

31 The ARM index is the benchmark interest rate to which an adjustable rate mortgage (ARM) is tied. An ARM interest rate consists of an index value plus a margin. The index underlying the ARM is variable, while the margin is constant. There are several popular indexes used for different types of ARMs (http://www.investopedia.com/terms/a/arm_index.asp).

32 The same definition of subprime was used by the Center for Responsible Lending (see chapter II of "Subprime Mortgage Lending in the District of Columbia," (2008), A Study for the Department of Insurance, Securities and Banking.

33 The FICO score that is reported in the LPS data is a third-party credit scoring system developed by Fair Isaac Corporation and used by most lenders to evaluate the creditworthiness of the borrower.

34 Elizabeth Laderman and Carolina Reid (2008).

35 http://www.census.gov/population/www/socdemo/race/racefactcb.html

36 The use of Census 2000 data might not depict all the demographic changes that occurred over time in the post-2000 period. Here we are assuming that the percentage breakdown of the population more or less remained the same over time. This approach might not be fully accurate, as it does not capture the demographic changes that occurred in the MSAs. Yet studies indicate that neighborhoods have a considerable attraction for people of the same race or ethnicity (Kahn and Bajari (2001)). Even though there has been a certain amount of gentrification in some neighborhoods, it is likely not large enough to change the percentage breakdown.

37 See Mian and Sufi, 2008; Mayer and Pence, 2008.

38 See Elizabeth Laderman and Carolina Reid, 2008; Gerardi, Shapiro, and Willen, 2007.

39 Elizabeth Laderman and Carolina Reid (2008).

home sales price by county in the three years prior to the origination of the loan, obtained from the Metropolitan Regional Information Statistics (MRIS), is used in the estimation of the Home Price Index (HPI). For example, the HPI of 2004 is calculated as the home sales price in 2003 divided by the home sales price in 2001. Home prices appreciated rapidly during the initial years of this study (i.e., 2004 and 2005) consistent with a 2007 study by Shiller.[40] The HPI would control for any systematic variation in the foreclosure rate, by both the year and the county of origination.

Some of the loan terms that became increasingly common in the last decade are found to be more prevalent in the subprime market and also have a higher default risk. Several of these loan terms that are included in specification (4) are prepayment penalties, interest-only payment clauses, high loan-to-value (LTV) ratios, balloon terms, and adjustable rate mortgages. Also included in the specification are a dummy variable for refinances (as opposed to purchase loans) and the ratio of monthly mortgage payment to borrower's monthly income.

Last, in addition to the variables discussed above, we include an identifier for the owner of the mortgage by the end of 2008. If the loan was purchased by Freddie Mac, Fannie Mae, or Ginnie Mae, it is identified as a "GSE" loan. If the mortgage was securitized, it is identified as a "private securitized" loan. If the mortgage is still in the lender's portfolio, it is said to be a "portfolio" loan.

Table 2: ***List of Variables from the Matched LPS/HMDA Data File Used in the Estimation of Equations (2) and (4)***

Variable	Description
Dependent Variables	
Subprime	A subprime loan is depicted by a '1' and a non-subprime loan by '0'. A subprime loan is identified as a loan categorized as a grade B or C loan, or an adjustable rate loan with an ARM margin greater than 3 percentage points above the ARM index.
Foreclosure	A loan that is in the foreclosure process (presale or post-sale) or is already a real estate owned property is identified by a '1'; all other loans are identified as '0'.
Independent Variables	
Borrower Characteristics	
Low FICO score	FICO credit score <640
Middle FICO score	640<= FICO credit score < 720
High FICO score	FICO credit score > =720
White	White and not "Hispanic or Latino"
Hispanic	Hispanic or Latino
African-American	African-American or black
Housing Market Characteristics	
Median year built	Median year housing units were built in census tract
Percent owner-occupied	Share of owner-occupied housing units in census tract
House price index (HPI)	House price appreciation (/depreciation) in the three years prior to the loan origination
Neighborhood Level Characteristics (from Census 2000)	
Minority zip code	Predominantly minority zip codes (those with at least 50 percent minority population) are depicted with "1" and other zip codes with a "0".

40 Robert J. Shiller, "*Understanding Recent Trends in House Prices and Home Ownership", NBER Working Paper* 13553 (National Bureau of Economic Research, Inc: 2007).

Low Income zip code	Median family income less than 50 percent of the area median income
Moderate income zip code	Median family income at least 50 percent and less than 80 percent
Middle income zip code	Median family income at least 80 percent and less than 120 percent
Upper income zip code	Median family income at least 120 percent or above
County	County dummies
Loan Characteristics	
Interest-only loan	Loan is interest-only
Balloon term	Loan has a balloon term
Adjustable rate mortgage	Loan that does not have a fixed interest rate
Refinance loan	Loan is a refinance loan
Prepayment penalty	Loan with pre-payment penalty
Payment-to-income ratio	Ratio of mortgage payment to borrower's income (PTI)
Loan-to-value ratio	Ratio of loan amount to house value (LTV)
Investor	
GSEs	Loan purchased by Fannie Mae, Freddie Mac, or Ginnie Mae
Portfolio	Loan that is still in the lender's portfolio
Private securitized	Loan is securitized

Descriptive Analysis and Summary Statistics

The majority of loans in our full matched data file were prime loans, and 1.65 percent of these were in foreclosure by the end of 2008 (see Table 3 below). Subprime loans represented about 13 percent of our data file, with almost 10.7 percent of subprime loans in foreclosure by the end of 2008. To test the validity of the above shares of loans, our matched loan population was compared against the whole LPS data population. The comparison reveals identical trends, with comparable shares of prime loans and subprime loans facing foreclosure by the end of 2008 (see Table A1 in the appendix).

Most of the loans issued to white borrowers were prime (93 percent) and only 1.36 percent of the loans to white borrowers were in foreclosure as of December 2008. In contrast, over 20.6 percent of the loans issued to African Americans were subprime (See Table 3 below). The corresponding share of subprime loans out of all loans issued to Hispanics was 19 percent. In addition, African-American borrowers had a share of loans in foreclosure of over 3.5 percent, and Hispanics' share of loans in foreclosure exceeded 7 percent.

Another borrower characteristic, the credit score, has been offered as an explanation for the terms of a mortgage product offered by many lenders. In our matched data, 25.3 percent of the loans issued to borrowers with low FICO scores (i.e., a score of 640 or less) were subprime. In addition, it should be noted that 65 percent of all subprime loans had a low FICO score. Almost 96 percent of loans issued to borrowers with low credit scores were not in foreclosure. Of the loans issued to borrowers with middle credit scores (i.e., a FICO score of 640 to 720), almost 12 percent were subprime and a little over 3.5 percent were in foreclosure. Loans issued to borrowers with high credit scores (i.e., over 720) were mostly prime (98 percent) and very few of those, .87 percent, went into foreclosure between 2004 and 2008.

Table 3: *Descriptive Data in Matched (Weighted) Population – Categorical Variables*

	Prime	Subprime	% Prime	% Subprime	Not In Foreclosure	In Foreclosure	% Not In Foreclosure	% In Foreclosure	Total (weighted)
White borrowers	387,594	28,980	93.04	6.96	410,926	5,648	98.64	1.36	416,574
Hispanic borrowers	80,736	18,972	80.97	19.03	92,614	7,094	92.89	7.11	99,708
African-American borrowers	172,781	44,909	79.37	20.63	209,908	7,782	96.43	3.57	217,690
Low FICO score	177,211	59,962	74.72	25.28	227,239	9,935	95.81	4.19	237,173
Mid. FICO score	202,204	27,522	88.02	11.98	221,472	8,254	96.41	3.59	229,726
High FICO score	261,696	5,376	97.99	2.01	264,737	2,335	99.13	0.87	267,072
Not interest-only	494,569	78,036	86.37	13.63	559,112	13,493	97.64	2.36	572,605
Interest-only	146,542	14,825	90.81	9.19	154,336	7,031	95.64	4.36	161,366
No pre-payment penalty	608,790	54,181	91.83	8.17	647,208	15,763	97.62	2.38	662,971
Pre-payment penalty	32,321	38,680	45.52	54.48	66,240	4,760	93.30	6.70	71,000
No balloon	638,338	85,567	88.18	11.82	705,281	18,624	97.43	2.57	723,905
Balloon	2,773	7,294	27.54	72.46	8,168	1,899	81.13	18.87	10,067
Fixed rate loans	401,013	18,865	95.51	4.49	414,726	5,152	98.77	1.23	419,878
Refinance loans	361,939	54,248	86.97	13.03	408,604	7,583	98.18	1.82	416,187
Low-income zip code	13,396	2,270	85.51	14.49	15,358	308	98.03	1.96	15,666
Moderate-income ZIP code	120,569	23,506	83.68	16.32	139,485	4,590	96.81	3.19	144,075
Middle-income zip code	317,074	50,328	86.30	13.70	355,631	11,771	96.80	3.20	367,402
Upper-income zip code	190,053	16,757	91.90	8.10	202,954	3,856	98.14	1.86	206,810
GSEs	396,471	5,185	98.71	1.29	398,357	3,299	99.18	0.82	401,656
Private securitized	131,463	67,008	66.24	33.76	186,018	12,452	93.73	6.27	198,470
Portfolio	97,749	16,313	85.70	14.30	109,489	4,573	95.99	4.01	114,062
Other	15,428	4,355	77.98	22.01	19,584	200	98.99	1.01	19,783
2004 origination	198,247	14,497	93.19	6.81	211,602	1,142	99.46	0.54	212,744
2005 origination	192,702	34,806	84.70	15.30	221,209	6,300	97.23	2.77	227,508
2006 origination	140,314	35,422	79.84	20.16	165,080	10,656	93.94	6.06	175,736
2007 origination	109,849	8,135	93.10	6.90	115,557	2,426	97.94	2.06	117,984
Prime	.	.	.	.	630,552	10,559	98.35	1.65	641,111
Subprime	.	.	.	.	82,896	9,964	89.27	10.73	92,861
Total	641,111	92,861	87.35	12.65	713,448	20,524	97.20	2.80	733,972

Note: The summary statistics are reported on the full matched dat file which includes mortgage originations from January 2004 to December 2007. The performance of the loans was tracked through 2008.

Table 4. *Mean Characteristics of Subprime Loans and Loans in Foreclosure*

	Prime	Subprime	Not In Foreclosure	In Foreclosure
Original credit score	712	624	702	656
Income	105	100	104	108
Loan-to-value (LTV) ratio	74	86	75	102
PTI ratio	0.2	0.3	0.3	0.3
Percent owner-occupied	67	66	67	67
Year built	1,975	1,975	1,975	1,976
Capitalization rate	0.64	0.68	0.64	0.68
HPI (median sold price)	140.42	145.86	140.90	148.42
Percent white	58.90	48.44	57.74	52.01
Percent black	25.38	37.21	26.74	31.75
Percent Hispanic	7.42	7.01	7.35	8.26
Total	641,111	92,861	713,448	20,524

On average, subprime loan recipients reported a loan-to-value ratio of 86 percent, while that of prime borrowers was 74 percent. Subprime borrowers had a lower original credit score (i.e., an average of 624) than borrowers receiving a prime loan (who had an average score of 712). In addition, subprime loans were characterized by riskier mortgage terms and conditions than prime loans. About 63 percent of prime loans were fixed-rate loans, while only 20 percent of subprime loans were fixed. Only 5 percent of prime loans had pre-payment penalty terms, compared to almost 42 percent of subprime loans. Less than one percent (0.4 percent) of prime loans had balloon terms, compared to 8 percent of the subprime loans. However, "interest-only" terms seem to be more common among prime loans, with almost 23 percent of them reporting interest-only clauses, compared to 16 percent of subprime loans.

Our descriptive findings also offer some clues to the role of securitization of mortgage products in the subprime market and the current foreclosure crisis. Of the loans owned by a GSE, almost 99 percent were prime, and over 99 percent were not in foreclosure. In contrast, almost 34 percent of securitized loans were subprime, with over 6 percent of them falling into foreclosure by the end of 2008. In addition, of the loans retained in lenders' portfolios (i.e., not securitized or sold), about 14 percent were subprime and close to 4 percent fell into foreclosure by December 2008.

Of all loans issued to residents of low- and moderate-income neighborhoods, 14.5 percent and 16.3 percent, respectively, were subprime. The corresponding share of subprime loans issued to residents of middle-income neighborhoods was 13.7 percent. The lack of variation among the share of subprime loans issued in low-, moderate-, and middle-income neighborhoods suggests that income is not a primary determinant of the decision to issue a subprime product. Moreover, the share of loans in foreclosure was smaller in low-income neighborhoods than in both moderate- and middle-income areas. In low-income neighborhoods, 1.96 percent of the loans were in foreclosure. In comparison, moderate- and middle-income neighborhoods had a share of loans in foreclosure of over 3 percent. Upper-income neighborhoods received the smallest share of subprime loans (8.1 percent). Yet 1.86 percent of the loans issued to residents of upper-income neighborhoods were in foreclosure, close to the share of loans in foreclosure in low-income neighborhoods.

Empirical Analysis: Determinants of Subprime Loans

The results for equation (2), the model estimating the likelihood of receiving a subprime loan in the DC MSA, are presented in table 5. The first column provides the list of explanatory variables. Columns 2-7 provide odds ratio estimates for models (1) – (6). Model (1) includes only the borrower's income and race. In model (2), we added controls for the borrower's credit risk. Model (3) includes housing market variables. Model (4) adds county-fixed effects and year-fixed effects. Model (5) adds neighborhood demographic characteristics. Model (6) includes PTI and LTV ratios.

As a comparison for the estimates in Table 5, and to verify that they are not necessarily biased by the somewhat lower match rate, we estimated equation (2) on the full set of LPS loans from the DC MSA that are first lien, owner-occupied, one-to-four family residences, and originated between 2004 and 2007. These unweighted estimates are provided in the Appendix Table A2. These estimates show the same pattern, except that the models include fewer variables (e.g., borrower race) than Table 5, as they are not available in the LPS data.

Table 5: ***Logistic Regression Estimates for Subprime Origination***

	Odds Ratio Estimates					
Variable	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model(6)
Borrower Characteristics						
Income of borrower	1.000***	1.001***	1.000***	1.001***	1.001***	1.002***
Hispanic or Latino	3.380***	3.013***	2.691***	2.779***	2.629***	1.744***
African-American	3.739***	2.720***	2.386***	2.386***	2.277***	1.844***
Low FICO score	--	15.373***	14.820***	14.443***	14.314***	13.280***
Middle FICO score	--	5.372***	5.211***	5.115***	5.073***	4.209***
Neighborhood Characteristics						
Percent owner Occupied	--	--	0.929***	0.846***	1.045***	1.111***
Median year built	--	--	1.002***	1.002***	1.004***	1.004***
HPI median sold price	--	--	1.034***	1.001	1.001	1.001
Low-income vs. upper-income zip code	--	--	--	--	1.110***	1.000
Moderate-income vs. upper-income zip code	--	--	--	--	1.379***	1.285***
Middle-income vs. upper-income zip code	--	--	--	--	1.290***	1.187***
Minority zip code	--	--	--	--	1.070***	1.068***
Year 2005 vs. 2004	--	--	--	2.361***	2.355***	2.231***
Year 2006 vs. 2004	--	--	--	2.836***	2.827***	2.293***
Year 2007 vs. 2004	--	--	--	0.816***	0.813***	0.599***
County dummies Included	No	No	No	Yes	Yes	Yes
Loan Characteristics						
Payment-to-income ratio	--	--	--	--	--	43.938***
Loan-to-value ratio	--	--	--	--	--	1.030***

Note: The dependent variable is an identifier of whether a loan is subprime or not. The logistic regression is on the full matched data file which includes mortgage originations from January 2004 to December 2007.

Legend: * p<.05; ** p<.01; *** p<.001

Borrower Characteristics

In general, all models are robust, with expected signs for the coefficients for most variables and consistent with the literature. In all models, the coefficient of the borrower's race or ethnicity variable is large and statistically significant. In model (1), we find minority (i.e., Hispanic and African-American) borrowers[41] to be more than three times as likely as white borrowers to receive subprime mortgages. As shown in model (6), even after controlling for all observable characteristics, Hispanic and African-American borrowers are 1.7 and 1.8 times, respectively, more likely to receive a subprime loan compared to white borrowers with similar risk profiles and housing market conditions. On the other hand, the borrower's income, with its odds ratio being close to one, has no bearing on the likelihood of a mortgage being subprime as opposed to prime.

As expected, the credit profile of the borrower is important. In model (2), borrowers with a FICO score of less than 640 are 15.3 times more likely to receive a subprime loan than borrowers with a FICO score greater than 720; for borrowers with FICO scores between 640 and 720, the likelihood is 5.4 times greater than for borrowers with high credit scores. The importance of

41 The term 'minority' in the findings and conclusion of the paper mainly refers to Hispanics and African-Americans.

the FICO score in determining the probability of receiving a subprime loan declines slightly when neighborhood characteristics are controlled for. However, it remains a significant factor in the prime versus subprime decision, with a borrower with a FICO score of less than 640 being 13.3 times more likely, and a borrower with FICO score between 640 and 720 being 4.2 times more likely, to receive a subprime loan in model (6).

Neighborhood Characteristics

Compared to upper-income zip codes, all borrowers in low-, moderate-, and middle-income zip codes have a greater likelihood of receiving subprime loans. For example, the odds of a borrower residing in a moderate-income zip code receiving a subprime loan is about 1.3 times greater than a borrower residing in an upper-income zip code. Consistent with the findings by Mayer and Pence, our estimates indicate that the racial and ethnic composition of the neighborhood affects the odds of receiving a subprime loan, even after controlling for the borrower's income, credit risk, loan terms, and other neighborhood factors that would influence the underwriting decision.[42] Residents of predominantly minority neighborhoods are about 7 percent more likely than residents of predominantly white neighborhoods to receive a subprime loan.

Loan Characteristics

Our analysis concurs with existing studies that find the loan-to-value ratio and debt-to-income ratio to be important to the underwriting decision. In model (6), loans with a higher loan-to-value ratio (LTV) are more likely to be subprime. The coefficient on payment-to-income is positive and statistically significant. Thus, applicants with higher payments as a fraction of their income are more likely to receive subprime loans. The odds ratio associated with the payment-to-income ratio is higher than the odds ratios on the credit score variables, suggesting that borrowers are more likely to receive subprime loans when their loan payments are a large portion of their income than when they have lower credit scores.

Adding county- and year-fixed effects has minimal impact on the likelihood of a loan being subprime. Loans originated in years 2005 and 2006 were significantly more likely to be subprime than loans originated in 2004. Loans originated in 2007 were less likely to be subprime than those originated in 2004. This finding is not surprising, given that, with the advent of the housing market crash in 2007, lenders began exercising more caution in originating subprime loans.

42 Mayer, Christopher J. and Pence, Karen M., "*Subprime Mortgages: What, Where, and to Whom?*" (June 2008). NBER Working Paper No. W14083. National Bureau of Economic Research, Inc.: June 2008).

Empirical Analysis: Determinants of Foreclosure

Table 6 presents the odds ratios where the dependent variable is a dummy variable capturing whether a loan has faced foreclosure by December 2008, as given by equation (4).

Table 6: *Logistic Regression Estimates for Likelihood of Foreclosure*

	Odds Ratio Estimates					
Variable	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
Borrower Characteristics						
Income	1.001***	1.001***	1.001***	1.000***	1.000***	1.000***
Hispanic	5.813***	5.045***	2.100***	1.998***	1.978***	1.932***
African-American	2.821***	2.191***	1.260***	1.260***	1.202***	1.184***
Low FICO score	--	4.469***	2.851***	2.815***	2.819***	2.615***
Middle FICO score	--	3.545***	2.454***	2.428***	2.426***	2.360***
Loan Characteristics						
Loan-to-value ratio	--	--	1.046***	1.044***	1.043***	1.041***
Adjustable rate mortgage	--	--	1.790***	1.916***	1.911***	1.628***
Refinance	--	--	0.968*	0.890***	0.883***	0.857***
High-cost	--	--	1.955***	1.574***	1.567***	1.359***
Full documentation	--	--	0.757***	0.819***	0.824***	0.776***
Interest-only	--	--	1.390***	1.181***	1.182***	1.143***
Pre-payment penalty Term	--	--	1.233***	1.154***	1.158***	1.024
Balloon term	--	--	1.960***	1.456***	1.456***	1.342***
Payment-to-income ratio	--	--	4.181***	3.572***	3.573***	3.602***
Neighborhood Characteristics						
Percent owner Occupied	--	--	--	--	1.323***	1.258***
Median year built	--	--			1.004***	1.006***
HPI median sold Price	--	--	--	--	0.998	0.997*
Low-income vs. upper-income zip Code	--	--	--	--	0.759***	0.796***
Moderate-income vs. upper-income zip Code	--	--	--	--	1.025	1.102***
Middle-income vs. upper-income zip Code	--	--	--	--	1.066***	1.129***
Minority zip code	--	--	--	--	1.263***	1.271***
Investor Identifier						
Portfolio vs. GSEs	--	--	--	--	--	2.191***
Private securitized vs. GSEs	--	--	--	--	--	2.092***
Year 2005 vs. 2004	--	--	--	2.973***	3.034***	2.809***
Year 2006 vs. 2004	--	--	--	5.765***	6.082***	5.786***
Year 2007 vs. 2004	--	--	--	3.317***	3.305***	3.244***
County dummies Included	No	No	No	Yes	Yes	Yes

Note: The dependent variable is an identifier showing whether a loan is in foreclosure or not. The logistic regression is on the full matched data file which includes mortgage originations from January 2004 to December 2007. The performance of the loan was tracked through 2008

. Legend: * p<.05; ** p<.01; *** p<.001

Borrower Characteristics

The initial significance of racial and ethnic differences in the likelihood of a foreclosure decreases when controlling for borrower credit risk, loan terms, neighborhood factors, and year of origination of the loan. However, even after controlling for these factors, a borrower's race or ethnicity remain statistically significant. Hispanic borrowers are almost twice (1.93 times) as likely as whites to be in foreclosure. African-American borrowers are 1.18 times more likely than their white counterparts to face foreclosure. The income of the borrower has a small impact on the default risk of the loan. Holding all other factors constant (model 6), having poor credit as opposed to good credit (a FICO score of more than 720) increases the foreclosure risk by a magnitude of 2.4 to 2.7.

The higher foreclosure likelihood among African-American and Hispanic borrowers as compared to white borrowers, even after controlling for income, credit risk, and loan terms, raises concerns and questions. Our model only controls for the likelihood of receiving a subprime loan. However, it is possible that minority borrowers received much higher rates on their subprime (as well as prime) loans compared to similarly situated white borrowers, resulting in higher monthly payments and quicker defaults and foreclosures.[43]

Also, minority borrowers and communities that received disproportionately high numbers of subprime loans had historically lower homeownership rates, as they were systematically excluded from home mortgages due to bank-redlining and discrimination until the early 1980s.[44] Then, when financial institutions rapidly expanded their lending to minority households it was associated with the use of high-cost, or otherwise unfair and abusive products. The resulting high density of subprime loans "increases the risk of foreclosures and negative spillover effects like declines in property values and increasing crime rates."[45] Hence, a larger proportion of homeowners are facing foreclosure in predominantly minority neighborhoods.

As another possible explanation, as Ladd pointed out, lenders and servicers exercise discretion about whether to foreclose and how quickly to move delinquent borrowers through the foreclosure process.[46] It could be that financial institutions that serve the majority of minority borrowers tend to move homes through the foreclosure process much faster than the other institutions.

Loan Characteristics

Consistent with previous studies, this study finds that even after controlling for borrower characteristics, the terms of the loan matter in the foreclosure outcome (in model (3)).[47] An adjustable rate mortgage is 1.6 times more likely to face foreclosure than a conventional 30-year fixed rate mortgage. A high-cost loan is almost twice as likely to be in foreclosure in model (3) and 1.4 times as likely in model (6). The high mortgage payment-to-income ratio is a strong determinant of foreclosure. While loans with full documentation are less likely to face foreclosure, those with pre-payment penalties, balloon terms, or interest-only terms are more likely to result in foreclosure.[48]

Neighborhood Characteristics

County- and year-fixed effects are added in model (4) to control for variation across space and time in the housing market.

Model (5) of Table 6 includes neighborhood factors that capture the housing market conditions and demographics in the

43 A study by Bocian, Ernst, and Li (2006) demonstrates that, even after controlling for legitimate risk factors, African-American and Hispanic borrowers received significantly higher rates on their subprime loans than white borrowers. Courchane (2007) also found 10-15 percent of the annual percentage rate (APR) gap could not be explained by observable underwriting, costing, and market factors.

44 See Dymski, 2009; National Community Reinvestment Coalition, 2008, p.5; Thomas Kingsley, Robin Smith, and David Price, 2009.

45 Thomas Kingsley, Robin Smith and David Price. "*The Impacts of Foreclosures on Families and Communities*" (Washington DC: The Urban Institute, 2009). http://www.urban.org/publications/411909.html.

46 Helen Ladd, "*Evidence on Discrimination in Mortgage Lending*" vol. 12 Journal of Economic Perspectives (1998), p.44.

47 Brent Ambrose, Michael LaCour-Little and Zsuzsa Huszar (2005); Anthony Pennington-Cross and Giang Ho (2006); Roberto Quercia, Michael Stegman and Walter Davis (2007).

48 Interest-only terms are more often associated with prime mortgages than with subprime mortgages, and this is confirmed by the data (see Table 3).

neighborhood. Several studies indicate house price appreciation to be an important determinant in the prevalence of foreclosures in a neighborhood[49]. This study finds that the home price index and foreclosures are inversely related, suggesting that there are fewer foreclosures when house prices are appreciating. In contrast, house price depreciation is a catalyst for more foreclosures.

Zip codes with a high proportion of minorities are more likely to face a higher risk of foreclosure compared to zip codes with a high proportion of non-Hispanic whites. Moderate- and middle-income zip codes are more likely to experience foreclosures than borrowers in upper-income zip codes. However, foreclosure risks in low-income zip codes are lower compared to upper-income zip codes. This could be a result of the smaller number of loans in the low-income zip codes that had a LPS-HMDA match. Only 8.7 percent of all zip codes in the DC MSA fall under the 'low-income zip code' category. Despite the weight correction, the fewer number of matched loans in the low-income zip codes might bias the estimates. This remains an area for future research.

Investor Type

Privately securitized and portfolio loans are 2.1 and 2.2 times, respectively, more likely to face foreclosure than loans owned by GSEs in model (6). GSEs appear to have succeeded in purchasing loans that were more carefully underwritten and less likely to go into foreclosure than either loans held in lenders' portfolios or privately securitized loans sold to investors.

Year of Origination

Year of loan origination has a strong and significant impact on the foreclosure risk. Loans originated in 2006 have the highest foreclosure risk and those originated in 2004 have the lowest foreclosure risk. It is likely that the smaller number of foreclosures among the 2007 originations is due to the shorter time period during which loans have been active since origination rather than to any other factor. Most of the high-risk loans, like 2/28 loans and 3/27 loans originated in 2007, have not yet experienced the rate change that would make the borrower unable to continue making mortgage payments.

Conclusions

This paper presents an empirical examination of subprime originations and loan performance in the DC MSA. By creating a unique data set that merges a borrower's race or ethnicity information from the HMDA data with the loan performance information in the LPS data, we were able to control for a wide range of factors influencing the lender's origination decision and the borrower's foreclosure decision.

The main findings of the study are the following:

(1) Even after controlling for borrower credit risk factors and local housing market conditions, minority borrowers (both African-American and Hispanic) are more likely to receive subprime loans compared to non-minority borrowers.

(2) Minority borrowers are also more likely to face foreclosure than white borrowers, even after controlling for borrower credit risk, loan terms, and neighborhood factors.

(3) On the other hand, borrower income has almost no statistical significance in explaining the likelihood of receiving a subprime loan or the likelihood of facing foreclosure.

(4) Loan terms that are more prevalent in subprime loans, such as prepayment penalties, adjustable rates, and balloon payments are associated with a higher risk of foreclosure. In addition, a high monthly payment-to-income ratio significantly increases the likelihood of foreclosure.

(5) Loans purchased by GSEs are considerably less likely to face foreclosure. This finding refutes the claim that the role of GSEs fueled the foreclosure crisis.

49 Elizabeth Laderman and Carolina Reid (2008); Chris Mayer and Karen Pence (2008).

The findings indicate that loans hazardous to borrowers' financial health and likely to end up in foreclosure were disproportionately issued to minorities. If regulatory agencies—which clearly have access to more detailed data than nonprofit advocacy organizations do—had more aggressively enforced fair lending laws and prosecuted discriminatory and abusive lending several years ago, the problematic lending may not have spread from communities of color to white communities. The lack of scrutiny by federal agencies during the last several years allowed problematic lending to cause a foreclosure crisis. In addition, GSEs appeared to have moderated foreclosures in the Washington, DC, area. Any future reforms regarding GSEs should take into account the fact that they may have a beneficial influence on loan quality and sustainability. Studies such as this one should be replicated in other metropolitan areas to assess whether GSEs played a positive role in communities across the country.

Stronger enforcement must be accompanied by regulatory reform that establishes a Consumer Financial Protection Agency (CFPA) dedicated to ensuring access to responsible loans for borrowers and communities of color. Currently, Congress is considering bills that would establish the CFPA, but it must also pass a strong anti-predatory lending law. Congress should also update the Community Reinvestment Act by strengthening it and expanding it to non-covered financial institutions, which are associated with higher levels of foreclosure[50]. Outlawing unfair and deceptive practices and also imposing an affirmative obligation to provide all communities with safe and sound loans are the keys to building community wealth through responsible lending and to avoiding future foreclosure crises.

Limitations and Future Research

These estimates are for the DC MSA housing market, and there are concerns about the external validity of these estimates. However, the findings seem to be fairly consistent with the existing literature; Laderman and Reid found similar results for California.[51] It would be interesting, however, to expand the study to other metropolitan areas across the country to examine the similarities and differences in those markets, as well as investigating whether the central findings remain consistent across the board.

Second, as a result of merging the two data sources to combine borrowers' race or ethnicity information with other borrower characteristics and loan terms and conditions, we lost a fair share of the mortgage information in the initial data set. Despite adjusting for any under-representation by the sample weights, there may still be a certain amount of attrition on the estimates. Thus, it is vital to increase the information about borrower and loan characteristics that is available to researchers.

Many of the initial unconditional differences that existed between minority and non-minority borrowers were explained by borrower credit risk factors, loan terms, and local housing market dynamics. However, the Hispanic and African-American coefficients in all models still remain statistically significant. This means that the observable characteristics cannot fully explain the differences in the probability of subprime origination or the probability of foreclosure for minority (African-American and Hispanic) and non-Hispanic white borrowers. At the same time, it raises the possibility of omitted variables in the specification. That is, certain characteristics that are observable to the lender but unobservable to the researcher may be influencing the subprime versus prime origination decision of the lender. These unobserved factors influencing the origination decision may also be causing the observed disparate outcomes in loan performance. For example, borrowers' other assets are not controlled for in the study and, most certainly, the availability of other assets would provide a cushion against foreclosure in cases of unemployment or other unexpected events. We therefore recommend additional research that can control for factors such as assets or wealth, which, due to data limitations, we were unable consider.

50 See Elizabeth Laderman and Carolina Reid (2008).

51 Ibid.

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Appendix

Table A1: *LPS Data Descriptive Statistics*

	Prime	Subprime	% Prime	% Subprime	Not in Foreclosure	In Foreclosure	% Not in Foreclosure	% In Foreclosure	Total
Categorical Variables									
Low FICO score	133,508	50,456	72.57%	27.43%	176,194	7,770	95.78%	4.22%	183,964
Middle FICO score	143,503	20,911	87.28%	12.72%	158,115	6,299	96.17%	3.83%	164,414
High FICO score	197,126	3,932	98.04%	1.96%	199,222	1,836	99.09%	0.91%	201,058
Interest only	126,917	13,190	90.59%	9.41%	133,631	6,476	95.38%	4.62%	140,107
Pre-payment penalty	28,564	34,916	45.00%	55.00%	59,467	4,013	93.68%	6.32%	63,480
Balloon	2,051	4,746	30.18%	69.82%	5,463	1,334	80.37%	19.63%	6,797
Fixed	284,845	14,825	95.05%	4.95%	295,750	3,920	98.69%	1.31%	299,670
Refinance	265,059	47,010	84.94%	15.06%	306,117	5,952	98.09%	1.91%	312,069
Low-income zip code	9,766	2,442	80.00%	20.00%	11,893	315	97.42%	2.58%	12,208
Moderate-income zip code	59,769	12,731	82.44%	17.56%	70,420	2,080	97.13%	2.87%	72,500
Middle-income zip code	178,199	32,499	84.58%	15.42%	203,374	7,324	96.52%	3.48%	210,698
Upper-income zip code	226,403	27,627	89.12%	10.88%	247,844	6,186	97.56%	2.44%	254,030
GSEs	56,448	5,848	90.61%	9.39%	61,091	1,205	98.07%	1.93%	62,296
Private securitized	128,316	1,525	98.83%	1.17%	128,295	1,546	98.81%	1.19%	129,841
Portfolio	15,116	131	99.14%	0.86%	14,946	301	98.03%	1.97%	15,247
Other	68,291	999	98.56%	1.44%	68,602	688	99.01%	0.99%	69,290
Prime	.	.	.	.	465,247	8,890	98.13%	1.87%	474,137
Subprime	.	.	.	.	68,284	7,015	90.68%	9.32%	75,299
Originated in 2004	133748	16019	89.30%	10.70%	148,929	838	99.44%	0.56%	149,767
Originated in 2005	145433	27259	84.22%	15.78%	167,380	5,312	96.92%	3.08%	172,692
Originated in 2006	105174	25485	80.50%	19.50%	123,300	7,359	94.37%	5.63%	130,659
Originated in 2007	89782	6536	93.21%	6.79%	93,922	2,396	97.51%	2.49%	96,318
Continuous Variables (Means)									
Original credit score	716.62	622.72	.	.	704.61	660.84	.	.	.
P&I Amount	2029.32	2334.32	.	.	2.58.68	2,486	·	·	·
Loan-to-value	70.65	79.5	.	.	71.23	93.10	·	·	·
Percent owner-occupied	66	66	.	.	66	67	·	·	·
Year built	1973	1974	.	.	1973	1975	·	·	·
Capitalization rate	0.62	0.6691	.	.	0.63	0.68	·	·	·
Black percent	23.52	35.62	.	.	24.77	28.52	·	·	·
Hispanic percent	7.83	7.58	.	.	8.04	8.92	·	·	·

Note: The summary statistics are reported on all LPS loans originated from January 2004 to December 2007 in the Washington DC metro area. The performance of the loans was tracked through 2008.

Table A2: *Logistic Regression Estimates of Subprime Origination*

Odds Ratio Estimates				
Variable	Model (1)	Model (2)	Model (3)	Model (4)
Borrower Characteristics				
Low FICO score	17.44***	14.48***	11.17***	11.06***
Middle FICO score	5.13***	4.47***	4.13***	4.03***
Loan Characteristics				
Loan-to-value ration	1.01***	1.01***	1.01***	1.01***
Fixed rate mortgage	0.12***	0.11***	0.18***	0.18***
Refinance	1.16***	1.02	1.07***	1.05***
Interest-only	0.21***	0.21***	0.18***	0.18***
Pre-Payment Penalty Term	8.24***	8.07***	5.10***	5.28***
Balloon term	7.23***	6.15***	3.90***	3.97***
Neighborhood Characteristics				
Payment-to-income ratio	1.0***	1.0***	1.0***	1.0***
Percent owner Occupied	--	3.19***	3.05***	1.98***
Year Built	--	1.00***	1.00***	1
HPI median sold Price	--	1.02***	1.01***	0.997***
Low income tract vs. Upper income tract	--	2.04***	2.19***	2.57***
Moderate income tract vs. Upper income tract	--	2.02***	2.20***	1.86***
Middle income tract vs. Upper income tract	--	1.73***	1.81***	1.49***
Black percent	--	1.013***	1.013***	1.01***
Hispanic percent	--	1.008***	1.004***	1.01***
Investor Identifier				
Portfolio vs. GSEs	--	--	5.24***	5.33***
Private Securitized vs. GSEs	--	--	12.13***	11.79***
Year 2005 vs. 2004	--	--	--	1.38***
Year 2006 vs. 2004	--	--	--	1.36***
Year 2007 vs. 2004	--	--	--	0.71***
County dummies Included	No	No	No	No

Note: The dependent variable is an identifier showing whether a loan is a subprime loan or not. The logistic regression is on the full LPS data file which includes mortgage originations from January 2004 to December 2007. The performance of the loan was tracked through 2008.

Legend: * p<.05; ** p<.01; *** p<.001

Table A3: *Logistic Regression Estimates of Likelihood of Foreclosure*

Odds Ratio Estimates				
Variable	Model (1)	Model (2)	Model (3)	Model (4)
Borrower Characteristics				
Low FICO score	3.466***	3.012***	2.808***	2.741***
Middle FICO score	3.25***	2.92***	2.854***	2.867***
Loan Characteristics				
Loan-to-value ration	1.039***	1.035***	1.033***	1.032***
Fixed rate mortgage	0.479***	0.496***	0.641***	0.565***
Refinance	0.61***	0.578***	0.584***	0.562***
Full documentation	0.596***	0.616***	0.599***	0.641***
Interest-only	1.439***	1.401***	1.335***	1.185***
Pre-Payment Penalty Term	1.702***	1.529***	1.315***	1.307***
Balloon term	3.966***	3.092***	2.662***	2.225***
Neighborhood Characteristics				
Payment-to-income ratio	1.000***	1.000***	1.000***	1.000***
Percent owner Occupied	--	1.976***	1.939***	1.842***
Year Built	--	1.007***	1.007***	1.004**
HPI median sold Price	--	2.254***	2.494***	2.788***
Low income tract vs. Upper income tract	--	1.033***	1.032***	1.011***
Moderate income tract vs. Upper income tract	--	1.315***	1.365***	1.26***
Middle income tract vs. Upper income tract	--	2.317***	2.431***	2.098***
Black percent	--	1.522***	1.606***	1.533***
Hispanic percent	--	1.002***	1.002***	1.007***
Investor Identifier				
Portfolio vs. GSEs	--	--	2.845***	2.825***
Private Securitized vs. GSEs	--	--	2.323***	2.344***
Year 2005 vs. 2004	--	--	--	3.886***
Year 2006 vs. 2004	--	--	--	5.626***
Year 2007 vs. 2004	--	--	--	4.929***
County dummies Included	No	No	No	No

Note: The dependent variable is an identifier showing whether a loan is in foreclosure or not. The logistic regression is on the full LPS data file which includes mortgage originations from January 2004 to December 2007. The performance of the loan was tracked through 2008.

Legend: * p<.05; ** p<.01; *** p<.001

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