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Subprime Lending In the Primary and Secondary Mortgage Market

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Subprime Lending in the Primary and Secondary Markets

Anthony Pennington-Cross*

Abstract

This article provides an exploratory analysis of the role of subprime lending through an examination of the spatial distribution of Federal Housing Administration (FHA)–eligible home purchase loans in the primary and secondary mortgage markets. Loan originations are aggregated to the metropolitan statistical area level to examine the proportion of the market served by FHA, prime, and subprime lenders. The article then examines whether subprime lenders hold their loans in portfolio or sell them to private conduits.

Primary market results indicate that subprime lenders are more active in cities with worse economic risk characteristics. Secondary market results indicate that although subprime lenders sell most loans, they are more likely to hold loans in portfolio when economic risks are improving in historically high-risk locations. Finally, when more loans are originated in underserved census tracts, subprime lenders are much more likely to hold loans in portfolio.

Keywords: Asymmetric information; Primary mortgage market; Secondary mortgage market; Subprime mortgage market

Introduction

Borrowers who use subprime lending face a tiered pricing schedule and can pay interest rates 400 basis points higher than in the prime market. Lending standards also are enforced in a flexible manner, and low-documentation lending programs such as "No Income Verification" or "No Ratio" are available for borrowers with good credit history and a strong asset base (Steinbach 1998).

After loan origination, the servicing of current and seriously delinquent loans tends to be less automated and more labor intensive in the subprime market. This has led, at least in part, to estimates that the cost of servicing is four times higher for subprime loans (Kogler 1997).

Most of the unique factors associated with subprime lending relate to the price the borrower pays and the costs of originating and servicing the loans. Another factor is that the secondary market treats subprime loans differently than prime loans. For instance, very few subprime mortgages are held in portfolio by the financial institutions that originate the loans. Most loans are sold as whole loans to private investors or are securitized as asset-backed securities

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(ABS). This contrasts with prime loans, which typically are securitized as mortgage-backed securities (MBS).[1]

Although using a subprime lender to purchase a home or refinance an existing mortgage may be the most expensive option available to the borrower, the subprime market has been growing dramatically. For instance, between 1993 and 1998, the subprime market as a whole grew by more than 1,400 percent, from approximately 70,000 to 10,540,000 loans (Joint Center for Housing Studies of Harvard University 2000). In contrast, the whole market grew less than 22 percent. On average, subprime home purchase loans—which made up approximately 23 percent of all subprime loans—grew 900 percent during the same period. Therefore, although the refinance segment of the subprime market is larger than the home purchase segment, subprime lending has made strong inroads in the home purchase market. In fact, subprime purchases constituted more than 5 percent of the purchase market by 1998.[2]

The effect of local risk factors on the fraction of the market that uses subprime lending is examined in this article, as is the decision of subprime lenders to hold loans in portfolio or sell them to private conduits. This article extends previous work by Ambrose and Pennington-Cross (2000) that examined similar relationships for prime mortgages.

The basic premise of the first part of the analysis is that in areas with more risk, more borrowers are likely to use subprime mortgage financing because of differences in underwriting standards and the shape of the risk distribution. Risks vary by location and over time. Using local economic conditions as a proxy for risk, the relationships between these indicators and the market shares of prime, Federal Housing Administration (FHA), and subprime lending in more than 300 metropolitan statistical areas (MSAs) are examined.

The second part of the analysis examines what a lender does after the subprime loan is originated. A subprime lender can retain the mortgage in portfolio or sell the mortgage to a private conduit. Two primary questions are addressed. First, do subprime originators change their selling/retaining behavior as local economic conditions change? Second, if behavior does change, what patterns are visible, and what might the results mean?

This article examines the home purchase segment of the subprime market. It focuses only on loans that meet FHA loan limits to highlight results on the relationships between prime, subprime, and FHA lending. Although data limitations need to temper any conclusions drawn, results show that subprime lending in the primary and secondary mortgage markets is responsive to local economic conditions and clearly differentiated from prime lending.

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[1] ABS and MBS are very similar in that both are securities created from cash flow generated from loans that are backed by assets such as a home or car. In general, although mortgages are backed by an asset (real estate), they are securitized in the MBS market. However, at least traditionally, all home equity lines of credit and fixed-term loans, which tend to make up a large share of subprime loans, are securitized in the ABS market.

[2] All data tabulations are taken from the Joint Center for Housing Studies of Harvard University's *The State of the Nation's Housing 2000* report, table A-11. This report obtains its data from the Home Mortgage Disclosure Act (HMDA) data sets, which do not include manufactured housing. Subprime lending is defined as loans made by subprime specialists identified by the U.S. Department of Housing and Urban Development and based on industry sources, denial rates, refinance share, and lender name. These figures may overstate the growth in subprime lending as a result of (1) changes in the way entities (especially mortgage bankers) report to HMDA, and (2) increasing acquisitions of subprime lenders by depositories transforming them into mortgage banking subsidiaries.

The following sections of this article provide background and motivation for the empirical approach, detail the data sources and definitions of variables, discuss the results, and, lastly, provide a concluding discussion.

Background and Motivation

The selection of mortgage type has been studied extensively in the primary mortgage market. For example, Brueckner and Follain (1988), Sa-Aadu and Sirmans (1995), Capone and Cunningham (1992), Phillips and VanderHoff (1994), and Tucker (1989) examined the choice between adjustable-rate and fixed-rate mortgages. Similarly, Dhillon, Shilling, and Sirmans (1990) studied the choice between 15-year and 30-year fixed-rate mortgage contracts. Other studies have examined the choice between conventional and government-insured mortgages using microdata on individual households (Gabriel and Rosenthal 1991; Goodman and Nichols 1997; Hendershott, LaFayette, and Haurin 1997; Linneman and Wachter 1989; Pennington-Cross and Nichols 2000). Loan products offered by subprime lenders provide more alternatives for borrowers and should be included as one possible outcome.

Lenders use standards (payment-to-income ratios, loan-to-value ratios, and credit history) to limit credit and prepayment risks. Because FHA lending standards are more lenient than prime lending standards, wealth- and income-constrained borrowers are more likely to use FHA mortgage financing. Subprime financing is even less strict than FHA financing with respect to maximum front-end and back-end payment-to-income ratios. Credit history also plays a large role in the qualification process. Although subprime lenders allow 60 percent debt ratios and even current bankruptcies, they also may require a 30 percent down payment to mitigate the perceived risks of high debt ratios and poor credit history. In total, the mortgage market has the ability to provide mortgages to a wide range of borrowers, as lenders use a variety of approaches to compensate for weaknesses of an application. This flexibility is most visible in subprime lending, where credit scores and down payments can compensate for unverifiable income and high debt ratios.[3]

Assuming borrowers are utility maximizing, they will choose the lowest cost mortgage available. Prime loans are the least costly, FHA loans are more costly, and subprime loans are the most costly; therefore, rational borrowers should prefer prime mortgages to FHA mortgages and FHA mortgages to subprime mortgages. Let S_i represent the proportion of FHA-eligible borrowers in MSA i that select a subprime mortgage, such that

$$S_i = f\left(X_i \mid \Theta_p, \Theta_f, \Theta_s\right) \tag{1}$$

where X_i is a matrix of variables that captures variation in local economic risk and demographic factors, and Θ_p, Θ_f, and Θ_s are prime, FHA, and subprime underwriting standards, respectively. Assuming that prime underwriting standards are tighter than FHA underwriting standards,

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[3] The characteristics of the subprime lending environment are derived from Weicher (1997), Steinbach (1998), and the Sub-Prime Funding Corporation Underwriting Manual, downloaded from the Web site <http://www.allstatecapital.com/manual2.html> on 3/17/98.

and FHA standards are tighter than subprime standards $(\Theta_s > \Theta_f > \Theta_p)$, then an increase in local economic risk results in fewer borrowers meeting prime lending standards and an increase in subprime originations $\left(\partial S_i / \partial X_{x_i} > 0\right)$. The effect on FHA market share is more ambiguous and depends on the shape of the risk distribution. Because the majority of the mortgage market uses prime financing, it is likely that an increase in risk will increase FHA's market share. This article examines the prime/FHA/subprime outcome as a multinomial logit model that represents a cross-sectional analysis at the MSA level of the percent of FHA-eligible mortgages originated as prime, FHA, and subprime loans.

The second part of the analysis focuses on the disposition of FHA-eligible subprime loans in the secondary market. Although the government-sponsored enterprises (Fannie Mae and Freddie Mac) dominate the secondary market for prime loans, this article assumes that they did not purchase subprime loans during this period. Rather, the outlets in the secondary market for subprime loans have been private conduits that securitize and provide credit enhancements.

Previous analysis of the secondary market is very limited. Canner and Gabriel (1992) examined the role of lender specialization in the secondary markets, whereas Hendershott and Villani (1980) examined the impact of the secondary market on the cost of mortgage lending. Benjamin, Heuson, and Sirmans (1997) showed that for adjustable-rate loans, lenders who hold loans in portfolio are sensitive to factors that affect the long-term costs and benefits. Presumably this concern is dominated by the probability of the loan terminating through default or prepayment. Lenders who typically sell loans are more affected by the short-term secondary market commitment rates.

Both the private conduit and the originator know all the standard risk indicators (credit history, down payment, and payment-to-income ratios) associated with a mortgage or a group of mortgages. Given this information, the private conduit determines a price based on its own assessment of the probability of termination and loss severity. The lower the lender's assessment of risk relative to the private conduit's assessment of risk, the more likely the lender will hold the loan in portfolio. In general, if the internal rate of return is greater than the securitization rate of return (guaranteed payment streams less fees), the lender should hold the mortgage in portfolio (Gilkeson, Jacob, and Smith 1994).

Van Order (2001) has shown that secondary market institutions are likely to enter the mortgage market in individual risk segments and are attracted to those segments with the least internal variation in risk and the largest density of supply (volume of mortgages originated that can be securitized). This description indicates that the secondary market will not be successful in the subprime market, because the density of supply is relatively small, and the performance of subprime mortgages varies dramatically (Mortgage Information Corporation [MIC] 2000).

Notwithstanding this part of the theory, most subprime loans are sold to private conduits in the secondary market. This is because the cost of holding subprime loans in portfolio is very

high.[4] First, regulatory agencies typically require that depositories hold more capital for subprime mortgages than for prime mortgages; and second, the chances of large and unexpected losses are higher. For instance, MIC has estimated that subprime default rates can exceed 20 times the default rate for prime loans.

Although most subprime mortgages are sold into the secondary market rather than retained in portfolio, the subprime market is more likely to suffer from informational asymmetries than the prime market. These asymmetries are driven by the lack of homogeneity of subprime loans and the lack of sophisticated evaluation models being used by originators, making it more likely that information is lost as the mortgage moves from originator to the private conduit in the secondary market.

Lenders can capitalize on their asymmetric information advantage with respect to borrower credit quality and local economic conditions by trying to sell the higher risk loans and retain the lower risk loans in portfolio. Private conduits can try to control the potential adverse selection problem, or "lemons" problem, resulting from the information asymmetries between the lender and the securitizer by manipulating the lender's guaranteed rate of return or by including a right of recourse against lenders who securitize an excessive number of loans that default (Passmore and Sparks 1996).

In addition, even if both the originator and the private conduit have the same information set, there is no guarantee that they will estimate the same profitability for a pool of loans. If private conduits underestimate, relative to the originators, the effect of local economic factors on termination rates, lenders can try to sell more loans when local conditions are riskier and hold more loans in portfolio when local conditions are less risky.

This article tests for a relationship between the rate at which subprime lenders hold loans in portfolio and local economic conditions. To model the subprime lender's decision to securitize, let M_i be the proportion of subprime FHA-eligible mortgages in MSA i that are retained in portfolio. Assume that

$$M_i = f\left(\chi_i, \delta(\chi_i), u \mid \Theta_s\right) \tag{2}$$

where $\delta(\chi_i)$ represents the probability of borrower default dependent on local economic risk characteristics (χ_i) such that $\partial\delta(\chi_i)/\partial X_i > 0$, and u is the unobserved cost associated with securitization. If lenders are effective in selling lemons to the secondary market, a higher proportion of loans should be securitized in areas with greater economic risk $\left(\partial M_i/\partial X_i < 0\right)$. However, if the secondary market has effective controls (such as recourse against lenders) that mitigate the lemons problem, securitization activity will not vary, or perhaps will decline, in areas with higher economic risk $\left(\partial M_i/\partial X_i \geq 0\right)$. One other potential explanation for any pattern observed is that originators believe that local risk factors affect profitability differently than private conduits believe they do.[5]

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[4] Van Order (2001) also discusses the importance of the cost of holding a loan in portfolio as another determinant of secondary market viability.

[5] This (an arbitrage position) may not be sustainable in the long run; it is difficult at this point to know the true behavior of subprime mortgages until they have been traded on the open market for a longer period of time.

Data

A variety of information sources were used, including extracts from the FHA F-42 loan files and the Home Mortgage Disclosure Act (HMDA) database. To correct for potential underreporting in HMDA (Bunce and Scheessele 1996), FHA loans were identified from the F-42 database.[6] Using these sources, the total number of FHA-eligible mortgages originated was calculated for 1995 and 1996 for 306 MSAs that had economic data available from *Standard & Poor's DRI*. FHA eligible refers to all mortgages with loan amounts under the FHA loan limit as defined by the U.S. Department of Housing and Urban Development (HUD) by county. Because the study focuses on FHA, conventional, and subprime lending in metropolitan areas, it excludes all U.S. Department of Veterans Affairs and Rural Housing Service loans.

To separate the subprime and prime conventional loans, a list of subprime lenders that report to HMDA, created in 1998 by HUD's Office of Policy Development and Research, was used. The list has been updated every year, growing from 129 lenders to more than 200 by the year 2000. This list was created from trade publications and therefore may not include all subprime lenders who report to HMDA. In addition, not all subprime lenders report to HMDA. The probability of reporting to HMDA is likely to increase with lender size. Further, if brokers originate more subprime purchase-money mortgages, and those loans are not reported to HMDA, the sampled loans may be atypical. Measurement error may include some conventional loans categorized as prime that actually may be subprime and some loans categorized as subprime that may be prime loans.[7]

These data sources distinguish between prime, FHA, and subprime mortgages to determine the final disposition of the subprime mortgages, either retained in portfolio or sold to a private conduit.[8] The percentage of FHA-eligible loans insured by FHA was calculated for a

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[6] See the third quarter 1997 *U.S. Housing Market Conditions* published by the Office of Policy Development and Research, HUD.

[7] Although it is difficult to compare shares of loan numbers with dollar-value shares, HMDA estimates of subprime market share, which are based on the number of loans, are always less than the estimates created by industry analysts at Inside Mortgage Finance (2001), which are based on the dollar value of loans. Inside Mortgage Finance reports shares as 10.2 and 12.3 percent for 1995 and 1996, respectively, whereas HMDA reports 3.3 and 4.2 percent.

 Although important information (such as prepayment penalties, credit scores, down payments, and contract interest rates) is not available to compare data used in this study with other potential data sources, it is clear that the HMDA approach does not include all subprime loans. For instance, for 1995 the Inside Mortgage Finance estimate of subprime market share, using the dollar value of loans, is almost 7 percentage points higher than HMDA estimates for 1995. By 1998 this spread decreased to just over one point. This may indicate changing reporting in HMDA, changing methodology by Inside Mortgage Finance, or the changing market structure of subprime lending. In contrast to the approach used in this article, it is preferable to use the terms of a mortgage (e.g., interest rate, fees, and prepayment penalties) to identify subprime loans.

[8] Mortgages are classified as either held in portfolio or sold to a private conduit based on the types of institutions originating and (if sold) buying the loan. If the originator is a bank, thrift, or credit union, the loan is classified as held in portfolio if it is not sold or if the loan is sold to a parent that is either a bank, thrift, or credit union. All other sold loans are considered out of portfolio and sold. If the originator is a mortgage bank (reporting to HUD for HMDA data collection) that is not a subsidiary of a bank, thrift, or credit union, all loans sold are considered out of portfolio and sold. In contrast, if the parent of the mortgage bank is a bank, thrift, or credit union, loans sold to the parent are classified as held in portfolio. Note that it is possible that the parent depository could act as an aggregator for the subsidiary, but depositories may try to avoid direct ownership of subprime loans to avoid additional regulatory requirements (higher reserve requirements and increased regulatory scrutiny).

given MSA as the number of FHA originations divided by the total number of FHA-eligible loans in that MSA. Similarly, the percentage of FHA-eligible mortgages originated as prime or subprime loans was calculated by dividing the number of FHA-eligible prime or subprime originations by the total number of FHA-eligible loans in that MSA. Reflecting the dominance of prime lenders in terms of price and service, the calculations show that, on average, prime originations account for 79 percent of the FHA-eligible market. Table 1 provides a list of the variables used in the analysis as well as the descriptive statistics.

Table 1. **Descriptive Statistics for 1995 and 1996**

Description	Source	Variable	Mean	SD	Min	Max	Obs
Dependent: S_{jt}, Percent of FHA-Eligible Originations							
Percent of loans originated as prime loans in t	GSE PUDB, HUD/F-42, HMDA	Prime$_t$	79.05	11.21	43.14	99.53	612
Percent of loans originated as FHA loans in t	GSE PUDB, HUD/F-42, HMDA	FHA$_t$	19.83	11.10	0.38	55.64	612
Percent of loans originated as subprime loans in t	GSE PUDB, HUD/F-42, HMDA	Subprime$_t$	1.13	1.39	0.00	20.83	612
Dependent: M_{it}, Final Disposition of Subprime Loans							
Percent of subprime loans sold to private conduit in t	HMDA	Sold$_t$	93.36	11.75	0.00	100.00	589
Percent of subprime loans held in portfolio in t	HMDA	Portfolio$_t$	6.64	11.75	0.00	100.00	589
Economic Risk							
One-year percent change in house prices from t-1 to t	Freddie Mac	House price growth$_t$	4.33	2.62	-7.11	12.58	612
One-year change in the unemployment rate from t-1 to t	DRI	Change in unemployment rate$_t$	-0.20	0.93	-6.00	8.40	612
SD of percent change in house price for previous 10 years in t	Freddie Mac	Variance of house price growth$_t$	2.18	1.21	0.28	10.00	612
Six-year average of the unemployment rate in t	BLS	Unemployment rate$_t$	5.96	2.69	1.78	22.60	612
Demographic							
Percent of loans made in underserved census tracts in t-1	GSE PUDB, HUD/F-42, HMDA	Underserved$_{t-1}$	27.17	12.27	0.00	74.24	612
Percent of loan applications by minorities in t-1	GSE PUDB, HUD/F-42, HMDA	Minority$_{t-1}$	16.73	14.51	0.79	94.34	612
Gini coefficient for blacks in 1990	Census	Segregation$_t$	30.34	15.73	2.90	77.10	612

Table 1. **Descriptive Statistics for 1995 and 1996** *(continued)*

Description	Source	Variable	Mean	SD	Min	Max	Obs
			Location				
High-cost location—median house prices greater than 75 percent of the Freddie Mac/Fannie Mae conforming loan limit	HUD	High cost$_t$	0.700	0.460	0	1	612
Medium-cost location—median house prices between 75 and 38 percent of the Freddie Mac/ Fannie Mae conforming loan limit	HUD	Medium cost$_t$	0.140	0.350	0	1	612
Vermont, Maine, Connecticut, Massachusetts, Rhode Island, New Hampshire	HUD	New England$_t$	0.036	0.186	0	1	612
Alaska, Idaho, Oregon, Washington	HUD	Northwest$_t$	0.046	0.209	0	1	612
Utah, Colorado, South Dakota, Wyoming, Montana, North Dakota	HUD	Mountain$_t$	0.055	0.228	0	1	612
Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin	HUD	Midwest$_t$	0.180	0.384	0	1	612
New York, New Jersey	HUD	New York/ New Jersey$_t$	0.069	0.253	0	1	612
Nevada, California, Arizona, Hawaii	HUD	Pacific$_t$	0.101	0.302	0	1	612
Texas, Oklahoma, Arkansas, New Mexico, Louisiana	HUD	Southwest$_t$	0.150	0.358	0	1	612
Missouri, Iowa, Kansas, Nebraska	HUD	Great Plains$_t$	0.056	0.230	0	1	612
Florida, Georgia, Kentucky, Mississippi, Tennessee, South Carolina, Alabama, Puerto Rico, North Carolina	HUD	Southeast$_t$	0.212	0.409	0	1	612
Delaware, West Virginia, District of Columbia, Virginia, Maryland, Pennsylvania	HUD	Middle Atlantic$_t$	0.098	0.298	0	1	612

Notes: ABA, American Bankers Association; BLS, Bureau of Labor Statistics; Census, U.S. Bureau of the Census; DRI, *Standard & Poor's DRI;* GSE PUDB, government-sponsored enterprise public-use database; Max, maximum; Min, minimum; MBA, Mortgage Bankers Association of America; Obs, observations; SD, standard deviation.

Within the subset of subprime originations, the share of mortgages lenders held in portfolio was calculated for each MSA by dividing the number of loans held in portfolio in the MSA by the total number of FHA-eligible subprime originations in that MSA. The percentage of loans in each MSA sold to private conduits was calculated similarly. Given the elevated risks of termination for subprime loans, it is not surprising that 93 percent of the FHA-eligible subprime mortgages were sold. As indicated by the large standard deviations in table 1, there is substantial variation in loan dispositions by MSA.

To assess the risk associated with each MSA, measures of economic and demographic characteristics are included. Economic characteristics include the performance of the housing market and the labor market. Demographic characteristics include racial indicators, the presence of underserved households (as defined by HUD), and the extent of racial segregation.

Economic Risk

The movement of house prices can have a strong effect on credit risk, default probabilities, loss severity, and the profitability of loans.[9] The yearly percentage change in local house prices and the standard deviation of change in house prices over the past 10 years are included to measure whether house prices moved up or down and whether they were stable or volatile. If prime lenders are more active in lower risk areas or high-growth areas, the percentage change in house prices should be positively associated with prime market shares and negatively associated with FHA and subprime shares. The standard deviation in house prices may indicate greater risk to lenders; therefore, FHA and subprime market shares should be higher as volatility increases.

To measure local labor market conditions, changes in local employment, as measured by the yearly change in the local unemployment rate and the average unemployment rate for each MSA over the past six years, are included. Again, it is expected that if unemployment increases or is historically high, it will be more likely that homeowners will have trouble making timely payments on outstanding debt and, as a result, will be considered higher risk borrowers.

When considering the disposition of subprime mortgages after their origination, it is useful to group the economic risk proxies into short-run changes and long-run characteristics. For instance, the change in house prices and the change in the unemployment rate represent short-run events, whereas the stability of house prices and the average unemployment rate are determined over a longer historical period. If information asymmetries exist as originators of subprime loans sell loans to private conduits, it may be easier to take advantage of short-run events rather than historical trends. In addition, different participants in the secondary market may value risks associated directly with the housing market differently than risks associated with the labor market. Lastly, originators that sell most of their loans should be more concerned with short-run changes in conditions (warehousing risk) than entities that hold the long-term risk of termination (Benjamin, Heuson, and Sirmans 1997).

Demographics

Demographic factors such as race, spatial segregation, and living in traditionally underserved locations are not measures of risk but have been included in econometric models on the selection of FHA insurance in the mortgage market (for example, Gabriel and Rosenthal

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[9] See Capozza, Kazarian, and Thomson (1997), Deng and Calhoun (1997), and Ambrose and Capone (1998). Other components of economic risk, including prepayment risk, cannot be addressed with the data used in this article.

1991, and Pennington-Cross and Nichols 2000). If the racial/ethnic characteristics of home buyers are uncorrelated with missing variables, there should be no relationship between race/ethnicity and mortgage type. Gabriel and Rosenthal (1991) and Ambrose and Pennington-Cross (2000) found that minorities are more likely to use FHA than conventional financing. In contrast, Pennington-Cross and Nichols (2000) showed that after including detailed credit history in addition to other measures of lending standards, African-American households actually were less likely than white households to use FHA financing. Because the analysis in this article does not include credit history, it is expected that results will suggest that minority households are more likely to use FHA-insured financing and subprime lending.

Pennington-Cross and Nichols (2000) and Ambrose and Pennington-Cross (2000) have shown that whether or not credit history is included, home buyers use FHA financing more often in underserved locations, as defined by HUD. If this is one way that lenders adjust behavior to meet Community Reinvestment Act (CRA) requirements, the same results might hold for subprime lending.

A measure of local segregation is included to determine whether market shares vary depending on the level of racial segregation. Segregation was measured by the spatial distribution of different groups across the local region and was derived using census data from 1990 from the Lorenz curve with values between 0 and 100, with 100 indicating maximum segregation (Massey and Denton 1988). This typically is referred to as the Gini coefficient.

Finally, indicators of whether the MSA is high-, medium-, or low-cost are included. Because of the way FHA sets loan limits, FHA-eligible borrowers in the more expensive areas cover a smaller fraction of the market.[10] The borrowers examined in this article represent those in the cheapest part of the market in high-cost areas. Therefore, in high-cost areas borrowers would tend to have more difficulty amassing a down payment or meeting other financial obligations, and they may use FHA and subprime lending more frequently. In addition, variables to control for regional (HUD-defined regions of the United States) and time (a 1995 indicator) effects are included.

When considering the demographic variables and their role in the final disposition of subprime loans, the focus of the analysis shifts to the costs and benefits of holding loans in portfolio versus selling them into the secondary market. An institution that needs to increase its CRA-eligible loan count may decide to hold more of these loans in portfolio to get credit beyond origination. It also may be more difficult to make homogeneous or large enough pools with loans from underserved locations for aggregation.[11] Ambrose and Pennington-Cross (2000) found that prime loans are more likely to be held in portfolio in areas with more underserved households. If borrowers in underserved census tracts are more likely to be

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[10] FHA loan limits are capped at the same fixed nominal dollar amount for all high-cost metropolitan areas. In contrast, loan limits vary depending on house prices in medium-cost metropolitan areas.

[11] CRA-eligible loans are not double counted, however. For instance, loans that are counted because they are originated do not get counted again if securities from these same loans are purchased by the same lender.

CRA eligible, it is likely that depository institutions, or subprime lenders who wish to merge with depository institutions, may hold more loans in portfolio to improve their marketability. Lastly, the growth of subprime lending is a relatively new phenomenon and its acceptance (in both the primary and secondary markets) is unlikely to be uniform in different locations or in different segments of the mortgage market.

Results

The market shares were calculated for 306 MSAs for 4,584,351 1995 and 1996 loans. Loan disposition of subprime lending was calculated for 45,359 loans from 1995 and 1996 in 294 MSAs. The logistic estimation technique weights each observation (market share) by the number of loans in each MSA. For large samples such as the primary market estimates, this technique may lead to artificially low standard error estimates (Greene 1990). Sensitivity analysis using graphical displays and standardized marginal effects were used to identify the economic importance of individual factors.

Primary Market

Table 2 provides the results of the multinomial logit estimation, and table 3 presents the standardized marginal effects evaluated at the mean. The model predicts that the prime market share (evaluated at the data means) is 78 percent, the FHA market share is 21 percent, and the subprime market share is 1 percent. This compares with the actual mean market shares of 79 percent, 20 percent, and 1 percent for prime, FHA, and subprime lending, respectively. The results show that prime lending is more likely in locations with less economic risk, and FHA and subprime lending are more active when local risks are higher. No single factor implies that subprime lending can become a substantial proportion of any local mortgage market.

Economic Risk. If the growth in house price increases one standard deviation from the mean of 4.3 percent, then prime, FHA, and subprime market shares change from their means by 2, –7, and 2 percent, respectively.[12] The market share of subprime lending is most sensitive to changes in the unemployment rate. If the change in the unemployment rate is moved from the mean of –0.2 percent to 0.73 (one standard deviation increase), the subprime market share increases 5 percent. In comparison, the magnitude of the same effect on prime and FHA market shares is negligible (less than 0.1 percent). In locations where the unemployment rate has been historically high, there tends to be more subprime lending and slightly less FHA-insured lending. In summary, subprime lending is most prevalent in locations with weak labor market conditions and declining house prices. FHA insurance is most active in locations with very poor housing market conditions—declining and volatile house prices.

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[12] Note that the percent change is defined as a percent increase, not a percentage point increase. For example, 0.05, or 5 percent, indicates that a market share of 30 percent would increase to 31.5 percent = 30 × 1.05.

Table 2. **Multinomial Logit Model of Mortgage Choice**

Variable	FHA		Subprime	
	Parameter	*t-statistic*	Parameter	*t-statistic*
Constant	−0.75	−57.1	−4.05	−77.6
House price growth$_t$	−3.43	−57.8	−1.47	−6.3
Change in unemployment rate$_t$	0.41	2.0	10.98	16.0
Variance of house price growth$_t$	5.18	49.4	−4.43	−9.7
Unemployment rate$_t$	−0.71	−9.6	1.63	6.1
Underserved$_{t-1}$	−1.65	−81.5	−0.86	−11.0
Minority$_{t-1}$	0.71	45.4	0.38	6.3
Segregation$_t$	0.00	−12.6	0.00	5.3
Medium cost$_t$	0.34	41.2	−0.33	−12.6
High cost$_t$	0.22	23.0	−0.52	−16.2
Northwest$_t$	−0.75	−93.5	0.22	5.7
Midwest$_t$	−0.55	−76.6	−0.02	−0.5
New York/New Jersey$_t$	−1.04	−124.4	0.18	4.8
Pacific$_t$	−0.21	−30.8	0.86	25.3
Southwest$_t$	0.06	8.0	0.86	23.5
Great Plains$_t$	−0.29	−33.8	0.04	0.8
Southeast$_t$	−0.30	−44.0	0.55	15.6
New England$_t$	−1.62	−152.5	0.08	1.8
Middle Atlantic$_t$	−0.04	−5.1	0.00	0.0
1995	−0.11	−37.7	−0.33	−28.1
Log of likelihood	−2,557,716			

Note: The excluded category is the market share of prime mortgages. Therefore, coefficients are to be interpreted as increasing or decreasing the market share of the column choice relative to prime. Because it is difficult to interpret these coefficients, see the standardized marginal effects in table 3 for an economic interpretation of the results.

Demographic Characteristics. There is some limited evidence that HUD affordable housing goals may increase the presence of prime lending instead of subprime lending in underserved census tracts. In support of the positions taken by some housing advocates and government agencies (for example, the Woodstock Institute and HUD), the presence of subprime lending is higher in locations that experience more racial isolation. One standard deviation increase in the segregation index leads to a 4 percent increase in the subprime market share but has no effect on prime lending.

As shown in table 3, borrowers located in the least expensive MSAs are more than one-third less likely to use subprime lending than borrowers in medium- and high-cost locations.[13] In addition, FHA lending is more likely to be used in medium- and high-cost locations. This is logical, because FHA's insurance program focuses on low down payments, which may be a more important factor in high-cost locations.

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[13] In table 3, for the reported dummy variables (0,1 indicators, which includes all variables after Segregation), standardized marginal effects show the percent change in the probability of the outcome if the dummy variable is increased from 0 to 1 and all other variables are evaluated at their means.

Table 3. **Standardized Multinomial Logit Model Marginal Effects**

Variable	Prime	FHA	Subprime
House price growth$_t$	0.02	–0.07	–0.02
Change in unemployment rate$_t$	0.00	0.00	0.11
Variance of house price growth$_t$	–0.01	0.05	–0.06
Unemployment rate$_t$	0.00	–0.02	0.05
Underserved$_{t-1}$	0.04	–0.15	–0.06
Minority$_{t-1}$	–0.02	0.08	0.03
Segregation$_t$	0.00	–0.02	0.04
Medium cost$_t$	–0.06	0.32	–0.33
High cost$_t$	–0.04	0.19	–0.43
Northwest$_t$	0.12	–0.47	0.39
Midwest$_t$	0.11	–0.36	0.08
New York/New Jersey$_t$	0.16	–0.59	0.40
Pacific$_t$	0.03	–0.17	1.44
Southwest$_t$	–0.02	0.04	1.31
Great Plains$_t$	0.05	–0.21	0.09
Southeast$_t$	0.05	–0.22	0.82
New England$_t$	0.21	–0.76	0.31
Middle Atlantic$_t$	0.01	–0.03	0.01
1995	0.03	–0.08	–0.26

Note: Standardized marginal effects for continuous variables are defined as the percent change in the fraction of loans using prime, FHA, or subprime lending in response to one standard deviation increase in the explanatory variable. For dummy variables, which include all variables after Segregation in the table, standardized marginal effects indicate the percent change in the dependent variable as the explanatory variable is increased from 0 to 1. In all cases all other variables are evaluated at their means. The percent change is defined as a percent increase, not a percentage point increase. For example, 0.05 indicates that a market share of 30 percent would increase to 31.5 percent = 30 × 1.05.

Looking at variations across regions, prime market share is highest in New England, whereas FHA and subprime market shares are highest in the Southwest. The magnitude of the marginal effects indicates that there is a substantial amount of regional variation not explained by the model, which requires further study.

Subprime Loan Disposition

This section examines the disposition of FHA-eligible subprime mortgages in the secondary market. Loans are either held in portfolio or sold to a private conduit. The results are presented in tables 4 and 5. Table 4 provides the coefficient estimates and *t*-statistics, and table 5 provides the standardized marginal effects. These marginal effects represent the percent change, not the percentage point change, in the fraction of loans that subprime lenders hold in portfolio in response to an increase of one standard deviation in the explanatory variable from its mean value. For dummy variables, which include all variables after Minority in the table, the percent change is in response to an increase of the explanatory dummy from 0 to 1, whereas all other variables are evaluated at their means.

Table 4. **Logit Model of Subprime Loan Disposition**

Variable	Contemporaneous Information		Contemporaneous and Lagged Information	
	Parameter	*t*-statistic	Parameter	*t*-statistic
Constant	–3.83	–17.82	–2.40	–10.22
House price growth$_t$	1.77	2.08	8.63	8.39
House price growth$_{t-1}$			–9.00	–14.39
Change in unemployment rate$_t$	–0.11	–5.04	0.01	0.48
Change in unemployment rate$_{t-1}$			–0.32	–9.56
Variance of house price growth$_t$	0.12	7.02	0.10	5.84
Unemployment rate$_t$	0.04	4.49	0.03	3.54
Underserved$_{t-1}$	3.97	14.25	4.36	14.66
Minority$_{t-1}$	–1.49	–6.00	–1.49	–5.74
Segregation$_t$	0.02	12.10	0.02	12.23
Medium cost$_t$	–1.30	–17.41	–1.43	–19.07
High cost$_t$	–1.44	–13.94	–1.96	–18.03
Northwest$_t$	0.20	1.09	–0.08	–0.41
Midwest$_t$	0.57	3.31	0.01	0.04
New York/New Jersey$_t$	–0.64	–3.25	–1.48	–7.15
Pacific$_t$	0.96	5.90	–0.13	–0.74
Southwest$_t$	–0.12	–0.66	–1.10	–5.90
Great Plains$_t$	0.41	2.09	–0.44	–2.17
Southeast$_t$	0.15	0.87	–0.68	–3.82
New England$_t$	1.60	8.18	1.07	5.22
Middle Atlantic$_t$	–0.08	–0.44	–0.91	–4.66
1995	–0.50	–10.20	–1.23	–18.27
Log of likelihood	–11,255		–11,085	

Note: Coefficient estimates are interpreted as increasing or decreasing the fraction of loans that the lender holds in portfolio. See table 5 for economic interpretation.

Table 5 shows that for the contemporaneous information results (the first column), all of the economic and demographic variables are significant at the 5 percent level. In general, as local economic risks deteriorate, subprime lenders are contemporaneously more likely to sell loans and less likely to hold loans in portfolio. However, when local economic conditions are historically poor, subprime lenders are more likely to hold loans in portfolio. These potentially contradictory results imply either that subprime lenders and private conduits must have different views of the effects of local economic conditions on the profitability of mortgages, or that informational asymmetries are affecting the retain/sell decision.

One potential explanation is that long-term or historical indicators of risk are likely to be known by both local originators and "arm's-length" participants in the secondary market. In contrast, changes in local economic conditions are more likely to be known locally (by the originating institution) first, and only later become known by arm's-length private conduits as the information disseminates. Therefore, the potential for information asymmetries is greatest for changes in risk conditions. The results support this assertion of asymmetric information and potential adverse selection by finding that subprime originators sell more loans when

Table 5. **Standardized Marginal Effects of Loan Disposition**

Variable	Contemporaneous Information, Marginal Effect	Contemporaneous and Lagged Information, Marginal Effect
House price growth$_t$	0.05	0.25
House price growth$_{t-1}$		−0.40
Change in unemployment rate$_t$	−0.10	0.01
Change in unemployment rate$_{t-1}$		−0.28
Variance of house price growth$_t$	0.16	0.13
Unemployment rate$_t$	0.12	0.10
Underserved$_{t-1}$	0.64	0.72
Minority$_{t-1}$	−0.20	−0.20
Segregation$_t$	0.35	0.36
Medium cost$_t$	−0.73	−0.76
High cost$_t$	−0.76	−0.86
Northwest$_t$	0.22	−0.07
Midwest$_t$	0.76	0.01
New York/New Jersey$_t$	−0.47	−0.77
Pacific$_t$	1.61	−0.12
Southwest$_t$	−0.11	−0.67
Great Plains$_t$	0.50	−0.35
Southeast$_t$	0.16	−0.49
New England$_t$	3.96	1.91
Middle Atlantic$_t$	−0.08	−0.60
1995	−0.40	−0.71

Note: Standardized marginal effects for continuous variables are defined as the percent change in the fraction of loans held in portfolio in response to one standard deviation increase in the explanatory variable. For dummy variables, which include all variables after Segregation in the table, standardized marginal effects indicate the percent change in the dependent variable as the explanatory variable is increased from 0 to 1. All other variables are evaluated at their means. The percent change is defined as a percent increase, not a percentage point increase. For example, 0.05 indicates that a retention rate of 30 percent would increase to 31.5 percent = 30 × 1.05.

risks increase and hold onto more loans (whether in pipeline or in portfolio) in locations historically known for high-risk conditions.[14]

To further test this result, the second columns of tables 4 and 5 report the contemporaneous change in house prices and unemployment rates and the previous year's change in house prices and unemployment rates. The persistence of house prices and unemployment rates requires that this set of results be viewed with caution. The results support the hypothesis that information asymmetries are an important part of the subprime secondary market. For instance, if house prices increase one standard deviation above the mean contemporaneously, subprime lenders are 25 percent more likely to hold loans in portfolio. In contrast, if this same increase occurred in the previous year, the lender is 40 percent more likely to sell loans to private conduits.

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[14] To test for the sensitivity of the results to any potential outliers, all observations with shares of loans held in portfolio over 0.50 were excluded, and the regressions rerun. The results were found to be consistent with the reported results. Detailed results are available from the author upon request.

The results for changes in unemployment rates are not as consistent and may indicate that the attention paid by subprime lenders and private conduits to labor market conditions may differ. Although contemporaneous changes in the unemployment rate are insignificant (almost zero), an increase in the previous year's change in unemployment by one standard deviation leads to a 28 percent decrease in loans held in portfolio. Assuming that information this old must be known by both parties, this result cannot be driven by asymmetries. However, a long-run increase in unemployment rates does lead to higher rates of loan retention in portfolio.

Theoretical work (Benjamin, Heuson, and Sirmans 1997) has shown that firms that sell their loans into the secondary market are more concerned with short-term changes than long-run cost and benefits. Because most subprime loans are sold, the results also are consistent with this hypothesis.

Focusing on the contemporaneous results, subprime lenders sell their loans 93.36 percent of the time. The model predicts that 5.44 percent of subprime loans are held in portfolio, and 94.56 percent are sold.

To highlight some of the most dramatic results, figures 1 and 2 provide a graphical representation of the sensitivity analysis. As shown in figure 1, an increase in change in the unemployment rate from the mean of –0.2 percent to the maximum of 8.4 percent decreases the share of loans held in portfolio from a mean of 5.4 to 2.1 percent. Consistent with previous findings (Ambrose and Pennington-Cross 2000), figure 2 shows that as the underserved fraction increases from a mean of 27.3 percent to the maximum of 74.2 percent, the share of loans held in portfolio increases from 5.4 to 35.8 percent. This may be explained partly by the possibility that subprime lenders were positioning themselves for acquisition by depositories during this time, or that it is more difficult to bundle underserved loans for sale into the secondary market. Although equating subprime lending with CRA eligibility is not accurate, the ability of subprime lenders to deliver high volumes of CRA-eligible loans likely has played a role in acquisition strategies of depositories since the mid-1990s.

Table 5 shows the standardized marginal estimates for all the variables, and it reinforces the finding that most of the indicators are economically important in addition to being statistically significant. The magnitude of the location and demographic marginal effects indicates that there is substantial variation left unexplained by economic effects. Although the causes of these effects are beyond the scope of this article, further research is needed to identify why there are such large regional differences in loan retention rates.

Conclusion

This article provides an exploratory look at the role of subprime lending in the primary and secondary markets by examining the spatial distribution of FHA-eligible subprime loans. A list of subprime lenders published by HUD was used, loans were aggregated to the MSA level, and geographic differences in market shares were modeled as a function of lending standards and local economic risk factors.

Figure 1. **Contemporaneous Change in the Unemployment Rate and Loans Held in Portfolio**
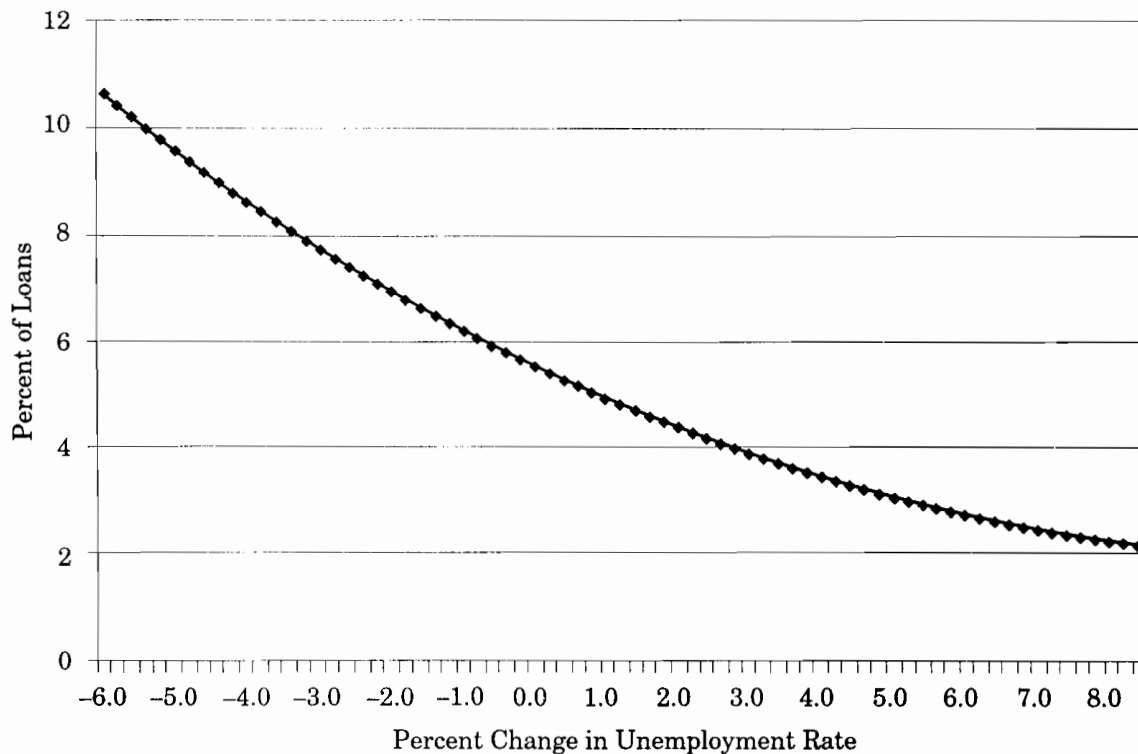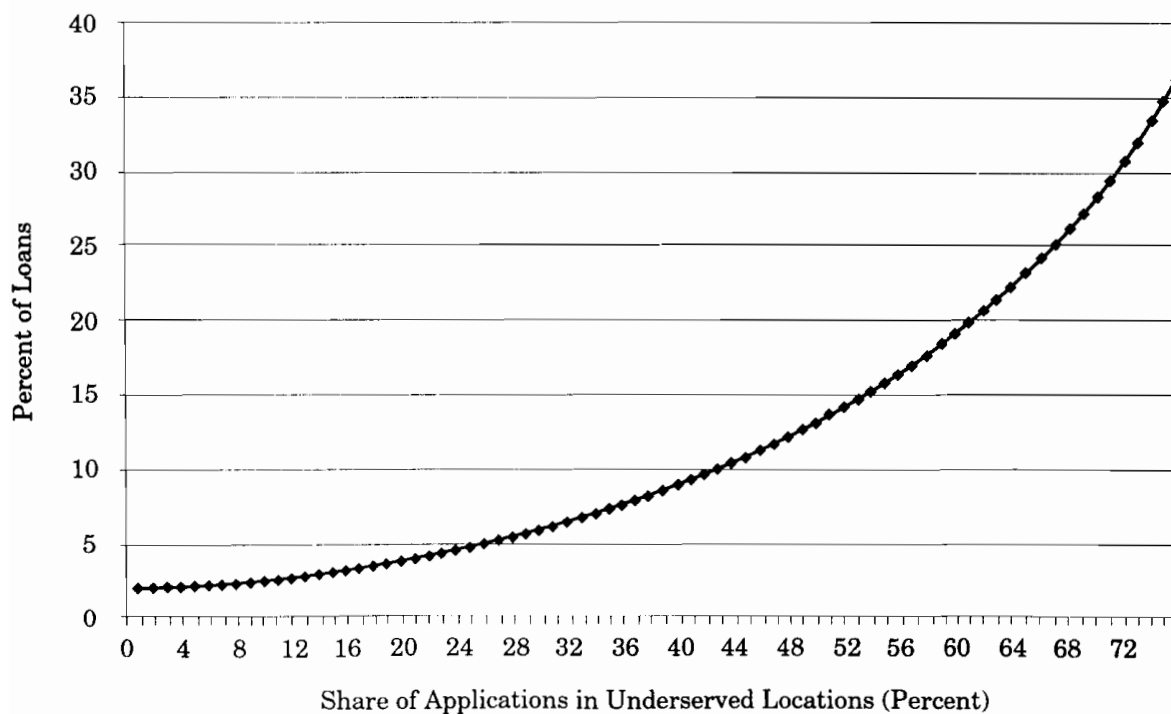

Percent Change in Unemployment Rate

Figure 2. **Underserved Borrowers and Loans Held in Portfolio**

Share of Applications in Underserved Locations (Percent)

The empirical results clearly indicate that subprime and FHA market shares are higher in cities with higher economic risk characteristics. Subprime lending is most active in locations with weak labor markets (high and increasing unemployment rates) and declining house prices, whereas FHA lending is most prevalent in locations with poor housing market conditions (declining and volatile house prices). In contrast, prime lenders concentrate their origination activity in markets with lower economic risk.

Subprime lenders sell most of their loans to private conduits. They tend to hold more loans in portfolio when local economic risks are improving and in locations that have high long-term risk profiles. In essence, subprime lenders are more willing to accept more risk in locations that are improving than in those that are deteriorating. Two potential explanations for this result are that (1) information asymmetries make it easier to sell higher risk loans in changing economic conditions, and (2) primary and secondary market participants estimate the effect of local conditions on the profitability of loans at different rates. In addition, although the vast majority of subprime loans are sold, the presence of underserved borrowers makes it more likely that the loans will be held in portfolio.

These results represent the first step in understanding the role of subprime lending in the mortgage market. Future research must identify more precisely how households decide to use subprime lending to purchase a home. This requires knowing borrower reserves, credit history, income, and assets, as well as the extent that this information is verifiable. It is also important that researchers and market participants gain a better understanding of how subprime loans perform relative to prime mortgages. The private information company MIC has shown that subprime loans are seriously delinquent (90 days or more delinquent or in foreclosure) at least 10 times more often than prime mortgages, and they are prepaid at least twice as fast as prime mortgages (MIC 2000), but very little is known about how these mortgages will perform in changing economic environments. For subprime lending and the securitization of subprime loans to become part of the mainstream mortgage market, it is vital that the details of how subprime loans perform be better understood.

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