

REDLINING IN MONTANA

by

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TABLE OF CONTENTS

LIST OF TABLES	vi
LIST OF FIGURES	vii
ABSTRACT	viii
1. INTRODUCTION	1
2. LITERATURE REVIEW	4
Review of Theoretical Literature	5
Review of Empirical Literature	9
3. THEORETICAL MODEL	13
4. DATA	22
HMDA Data	23
Variable Construction	27
5. EMPIRICAL RESULTS	31
Empirical Methodology	31
Empirical Model	33
6. RESULTS	39
Summary	56
7. CONCLUSION	58
REFERENCES CITED	63
APPENDICES	65
APPENDIX A: HMDA TABLES	66
APPENDIX B: DESCRIPTION OF VARIABLES	72
APPENDIX C: MODELS WITH ISSUED AS THE DEPENDANT VARIABLE	75

LIST OF TABLES

Table	Page
1: Data Reconciliation.....	29
2: Summary Statistics	30
3: Largest Lenders in the Combined Data Set	35
4: Probability of Mortgage Application Denial: Combined Data Set.....	40
5: Probability of Mortgage Application Denial: 2003 Data Set	42
6: Probability of Mortgage Application Denial: 2004 Data Set	44
7: Probability of Mortgage Application Denial: 2004 Data Set	46
8: Home Mortgage Disclosure Act: 2003	67
9: Home Mortgage Disclosure Act: 2004	69
10: Definition of Variables	73
11: Probability of an Issued Loan: Combined Data Set.....	76
12: Probability of an Issued Loan: 2003 Data Set	78
13: Probability of an Issued Loan: 2004 Data Set	80
14: Probability of an Issued Loan: 2004 Data Set	82

LIST OF FIGURES

Figure	Page
1: Taste-Based Discrimination.....	20

ABSTRACT

Redlining is the practice of using the attributes of geographic location of a mortgage loan as the basis for differential and typically adverse treatment of an application. This is a particularly important social problem in the home mortgage market due to benefits which have been shown to be correlated with home ownership. Minority and low income applicants may find redlining to be a major barrier to obtaining home ownership and the benefits associated with being a home owner. This thesis uses a data set collected under the Home Mortgage Disclosure Act to examine the mortgage market in Montana. A major focus is the effects of redlining on Montana's American Indian populations many of whom face substantial housing problems. A theoretical model is developed as a framework for the empirical section of this thesis. The empirical results of this study indicate variables that directly affect the expected return of a loan are relevant to the lending decision. Other variables that do not directly affect the expected return of loan are also found to be important to the lending decision, suggesting that either economic or taste-based discrimination may be occurring. In particular, other things being equal, American Indians are approximately 8 to 10 percent more likely to have a mortgage application denied than are non-American Indians. In addition, regardless of ethnicity, applicants located on reservations are approximately 4 percent more likely to have their mortgage applications denied. These results indicate that American Indians may be subject to economic discrimination in which their ethnic profile is used as an indicator of the expected return for a mortgage loan. Further, the study provides some evidence that property rights in tribal reservations are less well defined than elsewhere, partly because of the vagaries of tribal courts under which these rights are adjudicated and enforced.

CHAPTER 1

INTRODUCTION

Home ownership is commonly considered a major step on the ladder of economic success for American families. Most families need to obtain financing from a lending institution to achieve home ownership. As a result, a fair and efficient home mortgage market is of critical importance to potential home buyers. Discrimination in the home mortgage market therefore may have wide reaching social and economic implications. The purpose of this study is to assess the role of economic, geographic and personal characteristics, including race, on an applicant's ability to obtain credit to purchase a home in Montana. The data used in this study is collected under the Home Mortgage Disclosure Act that requires lenders to report information on their lending activity.

Previous empirical work has suggested that an applicant's race plays an important role in the lending process. These studies have generally indicated that minority applicants are more likely to have their loan application denied than non-minority applicants (Bradbury et al. 1989; Munnell et al. 1996; Tootell 1996; Berkovec et al. 1998). They have also shown that factors affecting the expected return from a potential loan have a statistically significant influence on the lending decision. These factors include an applicant's income, the ratio of the loan amount to a home's appraised value and an applicant's past credit history. A general model of the home mortgage market developed by Becker (1957), Bradbury et al.(1989), Ladd (1998),

Munnell et al. (1996), Tootell (1996), Ferguson et al. (1995), Holmes et al. (1994) and others is utilized here to obtain a more comprehensive understanding of the home mortgage market.

This study extends previous research in three directions. Studies based on HMDA data by Bradbury et al. (1989), Munnell et al. (1996), Tootell (1996) and Holmes (1994) focused on African American, Asian American, and Hispanic minorities. A major focus of this study is the American Indian population. The unique legal status of federally recognized tribal reservations presents challenges to Native Americans who are located on reservations which are not faced by other minorities in the mortgage market. A second focus is lending behavior in rural as opposed to urban areas. Previous work has typically examined lending in a single metropolitan area. Holmes et al. focused on Houston while Bradbury et al., Munnell et al. and Tootell examined the Boston area. The data used in this study are collected from the entire state of Montana, which is geographically much larger than these metropolitan areas and contains a substantial number of applications from rural areas. Third, this study examines mortgage lending among different lending institutions that differ with respect to the regulatory agency that oversees their operations.

The remainder of this thesis is divided into six chapters. Chapter 2 presents a review of the previous literature related to home mortgage markets, discrimination and legal jurisdiction. Chapter 3 develops a theoretical model of a lender's objective function. The data employed by this study are described in Chapter 4. In Chapter 5, the empirical methodology utilized to estimate models of mortgage lending decision

is described. The results obtained by applying the empirical methods from Chapter 5 to the data set developed in Chapter 4 are presented in Chapter 6. Chapter 7 summarizes the major findings and discusses some potential areas for future research.

CHAPTER 2

LITERATURE REVIEW

Discrimination against minorities has been a persistent problem in many aspects of American life. Understanding the prevalence, forms, and causes of discrimination is an essential prerequisite for developing policy incentives targeted toward mitigating barriers caused by discrimination. Discrimination takes many forms; some are easily identifiable while others are less recognizable. Researchers have studied discrimination in a wide range of settings, attempting first to identify and then to quantify particular forms of discrimination. The next step is often to endeavor to reduce or eliminate the cause of the discrimination.

Native American populations are unique among minority groups in that not only are these groups culturally different than the mainstream, but many members reside within federally recognized Indian reservations that have some degree of legal sovereignty and some independence from state and federal laws. Implications drawn from studies based on other minority groups are not always applicable to Native American populations because of their unique legal status. Research designed to deal with Native American concerns needs to address institutional and cultural issues specific to Native Americans as well as those that affect minorities in general.

Homeownership is correlated with a wide range of benefits in both social and financial contexts as well as being considered part of the “American Dream” (Bostic

et al. 2004). Government policies have encouraged homeownership by reducing obstacles faced by potential homeowners and offering them incentives. An individual's attainment of homeownership is likely to depend on their ability to obtain credit in the form of a home mortgage. Policymakers and researchers have recognized the importance of the home mortgage market and have worked toward identifying barriers faced by minorities in obtaining home mortgages.

Specifically, the United States Commission on Civil Rights reported that one third of Native American houses are overcrowded. Overcrowding affects an occupant's performance in school, stress levels and rates of infectious disease. They also noted that while six percent of housing nationwide is inadequate, forty percent of on-reservation housing is inadequate (Rights 2003). The cause of the housing problem for the Native American population may not be clear, but the fact that housing is a problem for Native Americans is clear.

Review of Theoretical Literature

Discrimination is often categorized as either economic or non-economic. Economic discrimination, also referred to as statistical discrimination, occurs when a group of individuals (often a minority group) is treated differently than other groups (often the majority) because the expected economic performance of that group differs from the expected economic performance of the other groups. One type of statistical discrimination is charging borrowers from one specific area a higher interest rate than other borrowers with otherwise identical characteristics because previous borrowers

from that specific area have had a higher default rate. In this example, lenders are using geographic location as opposed to individual characteristics to determine the credit worthiness of the applicant. The term redlining is used to describe the process of using the characteristics of a geographical area, such as racial composition or average income, to define a group within the general population that will receive differential treatment. In contrast, non-economic discrimination occurs when a group is discriminated against because the discriminator has a “taste” for discrimination rather than an economic motivation. This “taste” for discrimination cannot be rationalized by an expected monetary outcome. A lender requiring female borrowers to have higher down payments than equally qualified male borrowers, when the expected performance of male and female borrowers is identical, would be an example of non-economic discrimination. Although economic and non-economic discrimination are based on different rationales, both are illegal under either the Equal Credit Opportunity Act (ECOA), or the Fair Housing Act (FHA), or both (Ladd 1998).

Becker (1957) was among the first economists to develop a cohesive theory of discrimination. He posited that a firm’s profits will be lower if managers choose to satisfy a taste for discrimination because they will not exhaust all mutually beneficial transactions that are available to a firm with no taste for discrimination. He also posited that lending institutions will receive higher average profits on loans made to the group that is suffering the ill effects of discrimination (Becker 1993). Applicants from this group would be required to meet higher credit standards to be approved, or

the approved applicants would be charged higher interest rates than their equally qualified counterparts in the general population, or both higher credit standards and higher interest rates would be required. Becker referred to the difference in profits among the two groups as the discrimination coefficient. In competitive markets, marginal revenue equals marginal cost for the marginal applicant, but if taste-based discrimination is present then marginal revenue will equal the sum of marginal cost and the discrimination coefficient. In these situations marginal revenue exceeds marginal cost. The taste for discrimination obviates transactions that would have net benefits greater than zero but less than the value of the discrimination coefficient from occurring. The profits not realized from these transactions are the cost to firms of indulging their taste for discrimination.

Ladd (1998) provides a useful review of many of the previous studies on discrimination in mortgage markets. She argues that statistical discrimination occurs when a lender finds it less expensive to utilize the characteristics of an applicant's group as opposed to the applicant's personal characteristics to determine their credit worthiness. This behavior is easily explained by examining the incentives of a profit maximizing firm, but falls within the legal description of discrimination as defined in the Equal Credit Opportunity Act and the Fair Housing Act (Ladd 1998). The ECOA and FHA both prohibit discrimination on the basis of race, religion, sex and age while the ECOA also prohibits discrimination on the basis of the racial composition of an applicant's neighborhood.

Ferguson and Peters (1995) link the theoretical literature to the empirical literature by recognizing that the data most readily available to researchers to study discrimination consists of loan denial and default rates. They develop a simple lending model to examine the potential conclusions that could be drawn from research based on denial and default rates, specifically when one group within a population has a weaker average credit risk than the main population. The probability an applicant will not repay a loan is assumed to be a function of credit risk. Because one of the groups has a higher average credit risk than the other group, it can then be determined that one group's probability of repayment as represented by a cumulative density function (CDF) will exhibit first order stochastic domination over the other group's CDF. Previous studies have reported that minority groups typically have weaker average credit histories (Holmes et al. 1994; Munnell et al. 1996). As a result, it is likely that the minority group's credit worthiness CDF is first order stochastically dominated by the majority group's CDF.

If a uniform credit policy is applied to all applicants, then members of the minority group, which are assumed to have lower average credit worthiness, will have higher denial rates than members of the majority group. Equal denial rates would imply the majority is being held to a higher credit standard. The average approved majority applicant will have a higher credit worthiness than the average approved minority applicant based on the distribution properties of the two distribution functions. By coupling denial rates with default rates, Ferguson and Peters posit that the minority is being discriminated against when the minority group has a higher

denial rate coupled with a lower default rate and that the majority is discriminated against when the minority group has a lower denial rate and a higher default rate. However, their model does not provide inferences about non-economic discrimination. They also point out that careful attention needs to be paid to the marginal applicant as opposed to the average applicant when drawing conclusions about discrimination. Their findings focus attention on the potential inferences that can be drawn from research based on denial and default rates.

Review of Empirical Literature

Access to credit as a barrier to homeownership has also been the subject of empirical studies (Bostic et al. 2004). Bradbury et al. (1989) examined patterns of mortgage lending from 1982 to 1987 in the Boston area. They reported that after controlling for economic characteristics, such as income and wealth, race remained a significant factor in mortgage originations. They then noted that omitted variables may have been responsible for some of the 24% difference in the ratio of mortgage loans to potentially mortgageable housing units between predominantly white and black neighborhoods.

Subsequently, Holmes and Horvitz (1994) utilized a data set collected under the Home Mortgage Disclosure Act (HMDA) and default data obtained from a private firm to examine redlining and race. The HMDA reporting requirements were expanded to include many mortgage banking subsidiaries of depository institutions and some independent mortgage bankers during 1989 and 1990. They did not find

evidence that the racial composition of a borrower's neighborhood was a statistically significant factor (Holmes et al. 1994).

Munnell et al. (1996) utilized an even more extensive data set compiled by the Federal Reserve Bank of Boston during 1992 to investigate redlining. During 1992, thirty-eight additional variables were collected in the Boston metropolitan statistical area and combined with the HMDA data to create a data set that could address many of the concerns about omitted variables generated by the Bradbury et al. (1989) study. The expanded data set included information such as net wealth, liquid assets, obligation ratios, loan duration, applicant age, marital status and number of dependents. Munnell et al. (1996) reported that race remained a significant factor after controlling for economic factors contained in the expanded data set.

Tootell (1996) subsequently focused on redlining of neighborhoods rather than race. He reported that although race may be a significant factor in the mortgage approval decision, racial composition of the neighborhood was not a significant factor in the decision process. Tootell did note that the racial composition of an applicant's neighborhood was a significant factor in a lender's decision to require an applicant to obtain private mortgage insurance, which may indicate another form of discrimination.

Berkovec et al. (1998) used Federal Housing Administration data containing information on loan performance to test for non-economic discrimination. They were unable to reject the hypothesis that no taste-based discrimination was occurring.

They did not examine whether minorities were discriminated against based on economic factors.

The legal environment can also have an impact on credit markets. Both rules of law and the enforcement of those rules have been shown to have a direct effect on the development of financial markets. La Porta et al. (1997) examined legal rules and their enforcement in 49 countries and found that the quality of law enforcement and the character of legal rules affect equity and debt markets. Their results indicate that countries with relatively weak investor protections, a form of property rights, have less developed credit markets. They are careful to point out that weak protections can be a result of weak rules of law or lack of enforcement of strong rules of law.

Individual laws within a broad legal framework also affect credit markets. Gropp et al. (1997) examined the effects of personal bankruptcy exemption levels before and after federal deregulation took place in the early 1980's. They showed that as bankruptcy exemption levels increased, the amount of credit available to low income individuals was reduced. They argue that this was because the credibility of a borrower's pledge of collateral to a lender is reduced. The lender's ability to collect collateral after a bankruptcy affects the level of risk associated with a loan with any potential to have a bankruptcy filing during the term of the loan. These findings indicate that general and specific legal rules, as well as their enforcement, have the ability to affect the development of efficient credit markets. The character of tribal rules and their enforcement may have a direct affect on the credit markets within a tribe's legal jurisdiction, although empirical research in this area is incomplete.

Changing social mores have pressured policymakers to pursue the elimination of discrimination in most aspects of American life. These pressures are likely to continue. The benefits that are generally associated with homeownership have made discrimination within the home mortgage market a focal point for these pressures. Theoretical contributions by economists such as Becker and Ladd have provided a foundation for empirical research on discrimination. Since the early 1990's, other researchers have made important empirical contributions to our understanding of the prevalence of discrimination against African American and Asian American mortgage applicants (Holmes et al. 1994; Munnell et al. 1996; Tootell 1996). This body of research, however, has not addressed the unique legal status faced by many Native Americans. As a result, evidence applicable to Native American populations is unavailable. The research presented in this paper will focus on issues specific to Native American populations as well as those faced by minorities in general.

CHAPTER 3

THEORETICAL MODEL

A lender's fundamental business is to acquire funds and then lend them to borrowers at a higher rate than the rate at which the funds were obtained. In a competitive market, the spread between these two rates compensates the lender for operating expenses and provides a competitive return on the lender's financial investment. This suggests that a lender's objective function can be decomposed into two separate parts. The first objective is to minimize the cost of acquiring funds. The second objective is to maximize the return from lending these funds.

Lenders acquire funds by obtaining equity investment, issuing debt, or accepting deposits. The highly developed debt and equity markets in the United States provide support for the theory that these markets effectively transfer financial investments between lenders (Fama 1970). This effective transfer mechanism is assumed to result in relatively equal costs of acquiring funds in both debt and equity markets. Bank mergers and takeover threats provide other mechanisms of allocating financial capital to more efficient lenders (Grabowski et al. 1995). A lender's remaining source of funds is accepting deposits in the form of checking, savings and other types of accounts. Potential depositors can obtain low cost information about rates of return on various types of depository accounts from both local and national depository institutions. Assuming that potential depositors will allocate their deposits based on this information, the cost of obtaining funds from deposits is assumed to be

relatively equal.¹ For these reasons, this study assumes that lenders have similar costs of acquiring funds. A risk neutral lender's objective function can then be modeled as maximizing the expected return on the funds to be loaned.² To maximize the expected return on their funds, a lender estimates the probability that a loan will be a good loan, the expected return from a good loan, and the expected return if a loan is not a good loan.

Lenders maximize their return by completing a two-part decision process for each loan application. The first decision is either to offer the applicant a loan or to deny the applicant's request. If the applicant meets the lender's minimum credit worthiness standard then the lender must select the terms that will be offered. These terms include the loan amount, duration, fees and interest charges. The applicant then decides whether to accept or to reject the lender's offer. The lender has full control over the first part of the lending decision, but the lender's ability to choose the terms of the offered loan is limited. For example, if a lender offers a home loan applicant only half of the amount they requested, then it is probable that the applicant will be unable to purchase the home that they sought and the loan offer will not be accepted.

Competition among lenders and the requirement for an applicant's voluntary acceptance restrict the lender's ability to set the terms of the loan.

¹ Some lenders will have riskier loan portfolios than other lenders. Potential depositors are likely to incorporate this risk into their investment decision and expect a higher rate of return on their funds than those deposited with lower risk lenders. Federal deposit insurance programs mitigate this risk for many depositors. Equity investors are also expected to incorporate this risk premium into their investment decisions. The expected returns for potential depositors and equity investors are assumed to be similar when risk premiums are incorporated.

² Assuming lenders gain no utility from either being risk adverse or risk seeking allows for an accurate model of the lending decision. Including a risk measure for each lender would introduce current portfolio holdings of each lender into the lending decision, thereby increasing the complexity of the model greatly.

Accurately estimating the expected return of a potential loan allows the lender to maximize their profits. Certain characteristics affect the probability that a potential loan will be a good loan. An applicant's probability of repaying a loan increases as their income rises and their obligation ratios are reduced. Lowering obligation ratios, as measured by the ratio of housing expense to income and the ratio of total debt payments to income, decrease the likelihood that future variations in an applicant's income (for example, due to unemployment) or expenses (for example, due to unexpected health care costs) will cause an applicant to fail to meet the terms of the loan. The interest rate charged on the loan affects the applicant's obligation ratios because the interest rate charged is a determinant of the repayment amount. Past credit history is potentially a good predictor of an applicant's commitment to fulfilling the terms of future loans. Personal characteristics may also affect an applicant's risk to a lender. For example, a female applicant may be at higher risk of income uncertainty and increased health care costs if the applicant is of child bearing age. Future earning ability may be affected by an applicant's age. Theory implies that these and other characteristics will affect the probability that an applicant will fulfill the terms of the loan.

An applicant's location may affect the costs of recovering collateral and the percentage of collateral recovered in the event a potential loan becomes a bad loan. A lender is interested in reducing the magnitude of a loss associated with a bad loan. Expected future economic conditions of the area in which the home is located are hypothesized to affect the future value of the home, therefore affecting the expected

return of a loan application. Thus factors that affect the future value of a property are linked to each application. Areas with high vacancy rates or a low rent to value ratio indicate that the lender may have more difficulty reselling the property in a timely fashion for an amount greater than the outstanding loan balance if they obtain ownership in lieu of payment on a loan. Legal and administrative costs incurred during the foreclosure and repossession process cannot be decoupled from a property's location. The costs of enforcing property rights and expected future collateral values affect the expected return of a potential loan. As costs of recovering funds increase, the expected return to the lender is reduced. As the percentage of principal recovered increases, the expected return increases as well.

The terms of the offered loan also affect the expected return. Loans for a high proportion of the property's appraised value present an increased risk that the value of the collateral will drop below the outstanding principle balance as a result of real estate market fluctuations. This increases the risk to the lender by decreasing the applicant's incentives to repay the loan and increasing the losses associated with repossessing the collateral. Changes impacting the ratio of loan to the property's appraised value may affect the probability the borrower fulfills the terms of the loan. The interest charged on the loan affects the expected return of the loan through several channels. The direct effect is that as the interest rate charged increases, the revenue expected on the loan increases, causing the expected return of the loan to increase. The indirect effect of increasing the interest rate is that the applicant's obligation ratios increase, reducing the probability of a good loan and leading to a

lower expected return on the potential loan. Watts and Atwood (2005) develop a model explaining that at a critical level of credit worthiness the direct effect of the increase in interest charged is smaller in magnitude than the indirect effect caused by decreasing the probability of a good loan.³ This result is important because applicants with differing credit worthiness may be affected by either an offer of a higher rate loan or the lack of a loan offer as interest charges are increased.

The lender's objective function described above can be expressed as follows:

$$(3.1) \quad \text{Max } E(R) = p(P + I) + (1 - p)\lambda P + (1-p)\theta I - (1-p)c - (1+r)P - a$$

$$(3.2) \quad z = E(R)$$

The probability that a loan is a good loan is represented by p and is assumed to be a function of the interest (I) charged on a loan. Watts et al. (2005) develop a comprehensive model which postulates that as interest charges increase, the probability of a good loan decreases. A good loan repays the entire principal and interest amounts, represented by P and I , respectively. The probability of a good loan multiplied by the principal and interest amounts determines the expected return on a good loan less the costs of administering the loan, denoted by a .⁴ A bad loan is any loan that either does not repay the entire principle and interest amounts or requires the lender to incur additional recovery costs, c , to obtain full payment. The percent of principal and interest recovered on a bad loan are represented respectively, by λ and

³ Watts and Atwood utilize a two state model, which is mathematically tractable, to support their hypothesis that the relationship between debt levels and risk premiums are "U-shaped". Implying that a lender will not be able to indefinitely raise the interest rate to offset additional risk posed by a particular applicant. Thus, at some critical risk (or credit worthiness) level a lender will maximize their expected return by refusing to extend credit to the applicant.

⁴ Both fixed costs and variable costs of administering a loan are present for many lenders. For modeling purposes, it is assumed that all administrative costs are known at the time a loan is issued. These costs, including discounted variable costs, are represented by a in the model.

θ .⁵ A lender's cost of obtaining a unit of loanable funds expressed as a percentage is represented by r .

The model implies several constraints. The probability, p , that a loan is a good loan must be greater than zero but less than one. The same constraint holds for the probability, $1 - p$, of a bad loan. This constraint implies that a lender does not know with certainty the outcome of any particular potential loan. The principal amount, P , must be greater than or equal to zero. A principal amount of zero indicates that the lender chose not to offer the applicant a loan. The cost of acquiring loanable funds, r , and a lender's administrative costs, a , are positive. The percentage of principal recovered, λ , and interest recovered, θ , are limited to values greater than or equal to zero but not greater than 100 percent.

These constraints allow for several comparative statistic results to have meaningful interpretations. The first of these is that the expected return, represented by z , will increase as the probability of a good loan increases. This is expressed by the partial derivative with respect to p .

$$(3.3) \quad \partial z / \partial p = P(1-\lambda) + I(1-\theta) + c > 0$$

The affect of increasing the costs of recovering principle and interest on a bad loan decreases the expected return of a potential loan. The partial derivative with respect to c is:

$$(3.4) \quad \partial z / \partial c = -(1-p) \leq 0$$

⁵ The model allows the percentage of principal, λ , and interest, θ , recovered to differ, although some may argue they are equal. Allowing them to differ gives the model flexibility to accurately represent the expected return whether or not the percentage of principal and interest recovered are equal.

Increasing the percentage of principal or interest recovered increases the expected return for a potential loan. For example, a home that is located in an area that is experiencing economic growth may appreciate in value at a greater rate than a home in an economically depressed area resulting in a greater expected return on the home loan located in the economically advantaged area; that is:

$$(3.5) \quad \partial z / \partial \lambda = P(1-p) > 0$$

$$(3.6) \quad \partial z / \partial \theta = I(1-p) > 0$$

The affect of increasing the interest charged for a potential loan is uncertain. The derivative of expected return with respect to the interest rate is:

$$(3.7) \quad \partial z / \partial I = p + (1 - p)\theta + \partial p / \partial I(I - \lambda P - \theta I + c)$$

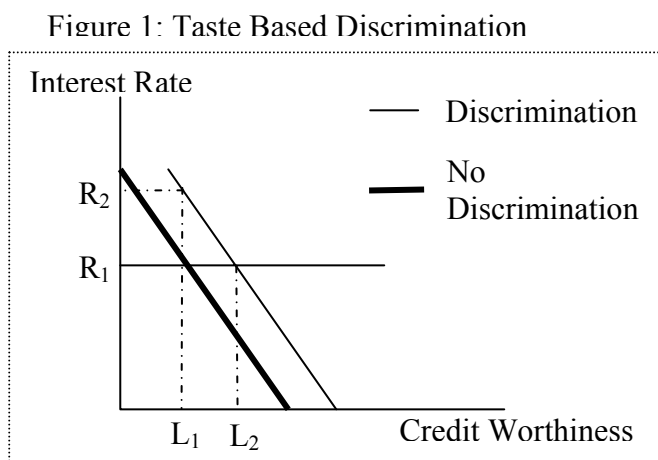
The marginal revenue from the higher interest charges is more than offset by a decrease in the probability the loan will be a good loan when $\partial z / \partial I$ is less than zero.

The model does not explicitly allow an applicant's race to affect the expected return of a potential loan. The applicant's race may play a role in the context of economic discrimination; for example, it may serve as an indicator of an applicant's probability of default. This would likely be due to a correlation between race and an omitted variable that impacts the expected return of a potential loan.

The above model can be modified to allow for taste-based racial discrimination for risk neutral lenders. Lenders that have a preference against lending to a particular group will charge a higher rate to applicants from that particular group than otherwise identical applicants. This implies that if equal rates are charged, then the denial rate will be higher for the particular group experiencing discrimination. In either case, if taste-based discrimination occurs, borrowers from the group being

discriminated against will have a higher expected return than their equally qualified counterparts in the general population.

Figure 1 illustrates the effect of taste-based discrimination. If lenders with a preference for discrimination charge equal rates to applicants from both groups, then members from the group being discriminated against with a credit worthiness of between L_1 and L_2 will have their loan application denied because of the taste for discrimination. If these same lenders choose to extend credit to all applicants with a credit worthiness of L_1 or greater, then applicants from the group being discriminated against will be charged the higher interest rate, R_2 . To examine the role of an applicant's race in the lending process, dummy variables are included in the empirical models presented in chapter 5.



The legal environment determined by an applicant's location is hypothesized to affect the costs of collecting collateral pledged on a loan in the event of repossession by the lender. In locations that have less efficient enforcement policies or weaker property rights, the expected return is expected to be lower, resulting in

higher denial rates. Such locations may be areas subject to the legal jurisdiction of tribal courts. Empirical models utilizing both ordinary least squares and logit estimation procedures are employed to examine these hypotheses.

Previous studies have used different lending models to investigate redlining and the influence of race and gender. Researchers have categorized the characteristics lenders commonly use to predict a borrower's default risk into four categories: personal characteristics, loan characteristics, costs of default, and probability of default (Munnell et al. 1996). This approach assumes the interest rate charged to a borrower is set by the market. Other researchers have also modeled the magnitude of losses incurred when a loan default occurs (Berkovec et al. 1998). Still others choose not to address these costs in their analysis (Ferguson et al. 1995). This research will attempt to address the issues in a comprehensive manner. The data set employed to test the above hypotheses is discussed in the following chapter.

CHAPTER 4

DATA

An ideal data set to test the hypothesis that Native American mortgage applicants in Montana are discriminated against would include the full set of information that is available to a lender at the time the institution is required to make an approval decision and information on the long term performance of these loans. Such a data set would also be ideal for testing the hypothesis that residing within a Federally Recognized Indian Reservation (reservation) has a negative impact on a potential borrower's ability to obtain a home mortgage. The model developed in the previous chapter allows the lender to determine who receives a mortgage, and therefore the lender's objectives need to be taken into account when identifying an ideal data set. A risk neutral lender's objective is to maximize the expected return of each loan application. Once the expected net return is identified a lending decision can then be made.

To accomplish this objective, lenders collect a wide variety of information about the applicant. This information includes an applicant's credit history, employment status and current income. The lender also gathers information about the risks associated with the property that is to be pledged as collateral for the loan, while seeking to minimize the costs of obtaining any given level of information.

Lenders consider their potential loss in the event of a default. Therefore, the applicant's ability to qualify for a loan product that is guaranteed by an agency such

as the Federal Housing Administration or the Veteran's Administration is important in the decision process. A lender's ability to reduce the potential loan's risk by offering a loan product that can be sold on the secondary mortgage market is also an important factor. As in most cases, a data set containing all of this information is not available; however, a data set is available that contains most of the relevant information available to a lender at the time the loan is issued. This data set is collected under the Home Mortgage Disclosure Act. Information about loan performance associated with these applications is not available.

HMDA Data

Information is collected on home mortgage lending activity under the HMDA for three reasons. The first is to measure whether or not lenders are meeting the home financing needs of their communities. The second is to identify underserved areas so that public and private funds can be encouraged to enter these areas. The third is to provide information necessary to enforce fair lending laws (FFIEC 2004). Prosecution of lenders that are engaged in illegal lending practices is not the stated purpose of the HMDA. The data collected from the HMDA loan application registrar (LAR) is one of the most useful and readily available sources of information on the home mortgage market.

Information that lenders are required to report for all home mortgage applications on the LAR includes data on the potential borrower, loan product, and property to be mortgaged. This information is reported for each application, whether

or not the loan is issued. Each applicant's race, sex and income are reported for each mortgage application, although applicants may elect not to provide information about their race to the lender. Two pieces of information are reported about the lender: their supervisory agency and their identification number. The amount and purpose of the loan are submitted on the LAR. The purpose of the loan may be reported as (a) for the purchase of a one to four family home, (b) home improvement, (c) refinancing of an existing home mortgage or (d) to purchase a dwelling capable of housing five or more families. The LAR reports conventional loans separately from loans that are insured or guaranteed by the Federal Housing Administration, Veterans Administration, Farm Service Agency or Rural Housing Service. Many of the applications in the LAR contain demographic information for the census tract where the property to be mortgaged is located. Finally, the data set includes a description of the action that the lender takes with respect to each application. All of the information that lenders were required to submit on the LAR in 2003 is listed in Appendix A.

Changes to the information required to be reported by lenders on the LAR were implemented in 2004. The new requirements provide additional information about each application. These changes include removing multifamily dwelling from the loan purpose category and placing it in a new category titled property type. The other options in this category are manufactured housing and one-to-four family housing. A preapproval category was also added to indicate if a preapproval decision was requested for an application. The lenders' action category was also expanded to

include actions taken with respect to preapproval applications. Hispanic was removed from the race category and added to a new ethnicity category. The type of lien and an indicator of a loan's HOEPA status were new reporting requirements. Limited interest rate information was also included for loan applications that resulted in an issued loan during 2004. A complete list of the information that lenders are required to report for loans during 2004 is provided in Appendix A. The data for 2003 and 2004 are pooled to construct a "combined" data set.

To ensure that all observations are homogeneous, some of the additional information about the 2004 observations is not be utilized in the combined data set. Information about an applicant's decision to seek a preapproval, lien status, HOEPA status and interest rate-spread data is excluded. The applications for multifamily homes, although reported in a different manner, are also excluded. No observations in which the lenders' decision to deny a preapproval request or an applicant's decision not to accept a preapproved loan request are present in the 2004 data set. Thus, this new reporting requirement does not affect the combined data set. The removal of Hispanic as a race has an insignificant impact on the data for two reasons. First, the number of Hispanics in Montana is relatively small. Second, no regression variables are directly impacted by the categorization change of loan applicants from the Hispanic population. The differences in data reporting are thus unlikely to have any substantive effect on the results reported in this study.

The HMDA currently gathers information on an estimated 80% of the home loans issued in the United States (Avery et al. 2005). Depository institutions and

mortgage companies are subject to different reporting requirements. Depository institutions are required to report if they have an office in a metropolitan statistical area (MSA) and possess at least \$34 million in assets. The rules regulating which mortgage companies are required to report their lending activities are more complex than the rules regulating depository institutions. Mortgage companies must meet two basic requirements to be required to report their lending activity. First, a mortgage company must issue at least 10 percent of their total loan originations as home loans or have a minimum of \$25 million in home loan originations per year. Second, the company needs to have a branch office in an MSA or to have originated five or more home loans in any one MSA during the previous year. In addition, the company must have \$10 million dollars in assets or have originated more than 100 home loans in the preceding year (FFIEC 2004). Over 8,800 lenders in the United States were required to report their home lending activities based on these requirements in 2004 (Avery et al. 2005).

Some lending institutions are not required to report their lending activities. Depository institutions with fewer assets than the \$34 million threshold are not required to report their activities. Some of these institutions are independent community banks and credit unions. Additionally, lenders that operate exclusively outside of MSAs are excused from reporting their home mortgage lending activity. Direct lending from government agencies also accounts for some of the unreported lending activity. For example, the Farm Service Agency's Direct Lending Program and the Veteran's Administration Direct Loan Program (for Native Americans) are

not reported under HMDA. Amendments to the original act have increased the number of loan applications that are reported under HMDA (Avery et al. 2005).

Variable Construction

The HMDA data collected during 2003 and 2004 for Montana contains information on 173,486 loan applications. Since the data were intended to permit a wide variety of research purposes, many of the observations are not concerned with home purchase loans. This section will describe the methodology used to develop the three data sets utilized in this study to examine a potential home buyer's ability to obtain credit to purchase a home. The three data sets developed are as follows:

1. A 2003 Data Set
2. A 2004 Data Set
3. A Combined Data Set

The 2003 data set contains loan applications reported in 2003, while the 2004 data set contains applications reported in 2004. The combined data set includes the observations from the first two data sets.

Purchased loans (31,756) are excluded because these observations involve institution-to-institution transactions and do not directly affect a borrower's ability to obtain a home mortgage. In certain circumstances, lenders are not required to report the census tract in which the property is located. In these cases, it is not possible to accurately represent the demographic characteristics associated with the property's location. In 2003 and 2004, 3,037 observations lacked census tract information and had to be excluded.

The focus of this research is on a borrower's ability to obtain a mortgage for a home purchase. Inclusion of multifamily dwellings would shift the focus to a borrower's ability to obtain a loan for commercial purposes. Therefore, another 207 observations were excluded because they are for dwellings designed for five or more families. Some applications were reported to be either closed due to a lack of information or withdrawn by the applicant before a lending decision was completed. An additional 19,875 observations had to be excluded for these reasons.

A small number of applications appear to indicate that the applicant was a business entity of some type, and not an individual. In these applications, the respondent indicated that gender or race of the applicant was not applicable. Thus an additional 252 observations were removed. Given that the issue of interest concerns a borrower's ability to purchase a home, 75,129 applications for refinancing an existing home loan were removed from the final sample. For similar reasons, applications for home improvement loans (7,935) were also omitted. Other applications (3,506) were omitted because of missing information on income, race, gender, or owner occupancy status. Table 1 provides a summary of the omitted observations. The remaining 31,789 observations are included in the data set used in this study.⁶

⁶ An additional subset of the combined data set was created. This data set excluded 1,697 observations that received a "quality edit failure only" designation. It appears some of these designations do not actually indicate a problem with the data submission, but some of these observations may have inaccurate data. To ensure that inaccurate data does not affect the empirical results obtained in this study, the models were estimated with and without the potentially problematic observations. The results were similar and are therefore not presented for the small data set.

Table 1: Data Reconciliation

2003	2004	Total	
98,196	75,290	173,486	Total Observations
19,505	12,251	31,756	Purchased Loans
1,679	1,358	3,037	Missing Census Tract Information
110	97	207	Multi-Family Dwelling Applications
1,750	1,521	3,271	Files Closed for Incompleteness
8,501	8,103	16,604	Applications Withdrawn
78	174	252	Corporate Applications
47,033	28,096	75,129	Applications For Refinancing
3,510	4,425	7,935	Home Improvement Applications
497	601	1,098	Incomplete Gender Information
220	73	293	Missing Owner Occupied Information
531	658	1,189	Missing Income Information
<u>388</u>	<u>538</u>	<u>926</u>	Missing Race Information
83,802	57,895	141,697	Total Exclusions
14,394	17,395	31,789	Usable Observations

The data indicates that there are large differences in denial rates, average income and loan request amounts between Native American applicants and Non-Native American applicants. The average income of Native American applicants is 28% lower, while the average amount of each loan requested is 26% lower. Denial rates for Native American applicants are over 130% higher than for non-native applicants. Important differences also appear between applications received from locations within a reservation and those located outside of a reservation. Average income is 25% higher, loan requests are 3% higher, and yet denial rates are over 90% higher for reservation applications. Table 2 presents additional summary statistics.

Table 2: Summary Statistics

	Native American Applicant	Non-Native American Applicant
Number of Applications	432	31,610
Average Income (1,000's)	53.90	75.40
Average Amount of Loan Request (1,000's)	91.63	124.07
Denial Rate	30.32%	13.08%
	Reservation Property	Non- Reservation Property
Number of Applications	616	31,174
Average Income (1,000's)	93.55	74.74
Average Amount of Loan Request (1,000's)	127.75	123.55
Denial Rate	25.00%	13.03%

CHAPTER 5

EMPIRICAL RESULTS

The previous chapter described the data set used to test the hypotheses about the home mortgage market developed in Chapter 3. This chapter discusses the econometric estimation procedures used to test the hypotheses presented in chapter 3. Chapter 6 presents and discusses the parameter estimates obtained using the estimation procedures discussed in this chapter applied to the data discussed in Chapter 4.

Empirical Methodology

Historically, ordinary least squares (OLS) estimation methods have been used in econometric analysis because of their ease of computation and interpretation. The same factors that make OLS appealing also make their application problematic in situations involving limited dependant variables. The variable of interest in the lending market is the probability that a loan application is accepted or denied. Results obtained from the application of OLS techniques are suspect since, under OLS procedures, the predicted value of the estimated dependent variable is not restricted to values within the range of zero and one. This fundamental problem is typically resolved by applying estimation procedures suited for limited dependent

variables. The logit model is commonly used for estimating dependent variables for which the observed outcomes are limited to values such as accepted or denied.

The statistical properties of the logit model allow for more accurate results when dealing with a limited dependent variable. Historically, the use of logit models was limited by the computing power they require, as compared to OLS models and the complexity of interpreting results obtained from the model. Decreases in costs and increased availability of computational power have usually obviated this concern. Previous studies of discrimination in mortgage lending markets have employed both OLS and logit models to take advantage of the simplicity of OLS and the accuracy of logit model (Munnell et al. 1996; Tootell 1996; Berkovec et al. 1998). The parameter estimates obtained using both logit and OLS estimation procedures are presented in this chapter to permit comparisons with the findings of previous studies.

The empirical models presented in this chapter examine the determinants of the lender's decision to accept or deny a loan application. Three outcomes are possible for any given application. The application may be denied, a loan may be offered by the lender but not accepted by the applicant, or a loan may be offered and accepted. A loan offer may not be accepted by the applicant for several reasons. One reason is that the applicant received a better offer from another institution. A second is that the terms of the offer were unsatisfactory to the borrower; for example, a high interest rate was offered or the loan amount offered by the lender was lower than expected. The percentages of applications resulting in an offer that was not accepted are similar between Native Americans (6.25%) and the general population (7.03%).

Due to the wide variety of possible explanations for this outcome and the similar rates of occurrence, little emphasis will be placed on these applications. The empirical models examine why loan applications were either denied or issued.

Several statistical issues are addressed with regard to the analysis presented below. First, likelihood ratio tests are utilized to determine whether or not groups of variables provide additional explanatory power. Each of these tests supports the selection of the explanatory variables included in the models presented below. Second, the potential problem of heteroscedasticity is addressed. In order to reduce the impact of heteroscedasticity on the results, the empirical models are estimated using logit and OLS procedures that generate robust standard errors. Parameter estimates obtained from both OLS and logit models are presented in the next chapter.

Empirical Model

The empirical models utilize four general categories of explanatory variables to examine the lending decision. These categories are applicant, lender, loan and location specific variables. Several variables do not fit neatly into any of these four categories and are discussed individually.

Applicant specific variables are variables tied directly to each loan applicant. *Income* is a measure of an applicant's annual income in tens of thousands of dollars. As an applicant's income rises, a lender is assumed to be less likely to deny the applicant's loan application. *Income Squared* reflects the possibility that the marginal impact of income on the lending decision decreases as income increases. The

variable *Not Owner Occupied* indicates that the property the applicant is attempting to purchase will not be the applicant's primary residence. Many of these homes are thought to be purchased as second homes. Applicants for second homes are theorized to have better than average credit histories. Thus, denial rates are expected to be lower for these applications. Applications that indicate *No Co-Applicant* are expected to have higher denial rates because of the household's high degree of income uncertainty.

The remaining applicant specific variables include gender and race. *Female* is a dummy variable, that takes on the value 1 if the applicant is female. The data set does not include information on marital status. Thus it is possible that the female variable may be correlated with single females and may capture some effects associated with the omitted variable. *Native* is a dummy variable that takes on the value 1 if the applicant is a Native American. *Other Minority* is a dummy variable that takes on the value 1 if the applicant is identified as a minority other than Native American. These variables account for the possibility that an applicant's probability of being denied for a home loan is affected by their race or gender, and are indicators of possible discrimination, either economic or taste-based.

Lender specific explanatory variables are included to control for differences in lending institutions. The six largest lending institutions in the combined data set are controlled for by individual dummy variables.⁷ These six lenders each account for a

⁷ The largest lenders are determined only by their numbers of applications in the combined data set. Other lenders with large loan portfolios may have a small market presence in Montana. This allows for the possibility that lenders with the hypothesized comparative advantage in portfolio risk

substantial share of the observations in the combined 2003 and 2004 data set as shown in Table 3. Large lenders are likely to have a comparative advantage in portfolio risk management and are likely to have a lower denial rate than small lenders. These perceived advantages are rooted in their access to secondary markets and larger overall portfolios of assets. The ability to quickly bundle loans for resale on the secondary market is one of these advantages. A larger portfolio of assets reduces the impact on portfolio performance from a particular loan, thereby decreasing the portfolio risk presented by any particular loan.

Table 3: Largest Lenders in the Combined Data Set

Lender	Number of Applications	% of Total Applications
Wells Fargo	5,013	15.77%
CountryWide	2,725	8.57%
First Interstate	2,609	8.21%
Heritage	1,801	5.67%
Stockman	1,197	3.77%
Intermountain	1,065	3.35%

Each lender required to report under HMDA is supervised by one of six regulatory agencies. Dummy variables are included to account for regulatory agency effects. They include the Federal Deposit Insurance Corporation (*FDIC*), Federal Reserve System (*FRS*), Office of the Comptroller of the Currency (*OCC*), National Credit Union Association (*NCUA*), Office of Thrift Supervision (*OTS*) and Housing and Urban Development (*HUD*).

management may not be indicated by a large lender dummy variable. If this is occurring, the parameter estimates may underestimate the actual effect of applying to a large lender.

A vector of loan specific variables is also included in the model. The *Loan Amount* is measured in ten thousand dollar increments. As the loan amount increases, ceteris paribus, the probability of default is expected to increase. Several types of loans comprise the combined data set, including Federal Housing Administration insured loans, Veterans Administration guaranteed loans, Rural Housing Administration or Farm Service Agency backed loans and conventional loans. *Conventional* loans do not carry a government agency sponsored guarantee for the lender. To account for the possibility that the regulatory guidelines of the insured or guaranteed loan programs affect loan decisions, a dummy variable for conventional loans is included as an explanatory variable.

Location specific variables are also important in a study that examines a large geographic area like Montana. *Population* is measured as thousands of individuals residing within a particular census tract. Denial rates are hypothesized to be higher in less populated tracts because of risks associated with population trends in rural areas. *Rural Housing Percent* is the percentage of housing units in a census tract that are classified as rural units. Tracts with a high proportion of rural housing units are also expected to have higher denial rates as the markets for these properties may be thinner. The variable *Income Ratio* is defined as the median family income in a census tract divided by the median family income in the metropolitan statistical area in which the census tract is located. Census tracts with high income ratios, relatively wealthy areas, are expected to have lower denial rates. *Vacant Unit Percent* is the percentage of units in the census tract reported as vacant by the census bureau.

Regional variables are also categorized as location specific variables. Dummy variables are included for each of Montana's seven largest cities (*Billings, Missoula, Great Falls, Butte, Bozeman, Helena* and *Kalispell*). These variables account for influences specific to each area that cannot be measured by other variables.

Each of Montana's federally recognized Indian reservations is also assigned their own dummy variable. The seven reservation specific dummy variables are Fort Peck, Flathead, Blackfoot, Northern Cheyenne, Fort Belknap, Rocky Boy, and Crow. These variables are also aggregated to create a more general *reservation* variable.

The remaining observations are categorized by crop reporting districts (*A, B, C, D* and *E*). Districts A through E do not include observations from the seven urban areas or the seven federally recognized Indian reservations. Regional indicator variables are also created. *Rural* consists of all five crop reporting districts and is expected to increase the probability of denial due to economic and population trends associated with rural areas. *Urban A* consists of Bozeman, Billings, Missoula, Kalispell and Helena. *Urban B* consists of Butte and Great Falls. *Urban A* is expected to reduce the probability of denial more than *Urban B* due to current population and economic trends in these regions (Census 2004). These variables attempt to control for regional influences affecting the lending process.

Several other variables included in the empirical model do not fit into the four main categories. A dummy variable for applications reported in 2004 is included to control for possible differences related to the passage of time. The variable *Loan to*

Income is defined as the loan amount divided by the applicant's income.⁸ An increase in the loan to income ratio is likely to increase the probability of denial. These two variables complete the empirical model.⁹

Several variables that may be relevant to the lending decision are omitted from the empirical model because data on them are not available. These include the applicant's net assets, liquid assets, employment history, past credit history, age and number of dependents. The ratio of loan amount to the property's appraised value is also not available. Ideally these variables would be included in the empirical model but data limitations preclude their use. Research by Bradbury et al. raised numerous concerns about omitted variables in the context of studies of redlining (1989). Studies that utilized the data collected by the Federal Reserve Bank of Boston were able to address many of the concerns about potential omitted variable bias (Munnell et al. 1996; Tootell 1996). The potential for omitted variable bias should be closely examined. The lack of loan performance data should also be considered when examining the results of this study.

⁸ This variable is constructed to capture similar information to a housing expense to income ratio variable.

⁹ A table containing all variable definitions is included in Appendix B.

CHAPTER 6

RESULTS

Two major objectives of this study are as follows. The first is to estimate the effect of an applicant's race on the home mortgage lending decision. The second is to examine the role of the legal environment in the lending decision. This section presents and discusses the parameter estimates obtained from the econometric estimation of empirical models of the lending decision by home mortgage lenders.

Models are estimated using three data sets: a data set of observations reported in 2003, a data set of observations reported in 2004, and a data set that combines the observations from these two years. Table 4 presents parameter estimates models using the combined 2003 and 2004 data set, Table 5 presents parameter estimates using the 2003 data set, and Tables 6 and 7 present parameter estimates using the 2004 data set. The empirical models presented in Tables 4, 5 and 6 include the same set of explanatory variables to permit a direct comparison of results obtained for each of the three data sets. Robust standard errors are estimated to correct for the possible pressure of heteroscedasticity. Table 7 presents parameter estimates using an empirical model which utilizes additional explanatory variables available only in the 2004 data set.¹⁰

The parameter estimates for lender specific explanatory variables are statistically significant in the lending decision model. Likelihood ratio tests support the inclusion

¹⁰ Tables 11, 12, 13 and 14 present similar parameter estimates with issued as the dependant variable in Appendix C.

Table 4: Probability of Mortgage Application Denial: Combined Data Set

Variable	Logit				OLS	
	Regression 1		Regression 2		Regression 1	Regression 2
	co-eff	dy/dx	co-eff	dy/dx	co-eff	co-eff
Constant	-0.5868 *** (-3.10)		-0.8995 *** (-6.01)		0.2543 *** (12.33)	0.2352 *** (14.28)
<i>Loan Specific</i>						
Conventional Loan	0.4181 *** (7.86)	0.0347 *** (8.83)	0.4149 *** (7.76)	0.0344 *** (8.68)	0.0447 *** (9.46)	0.0459 *** (9.47)
Loan Amount	-0.0289 *** (-5.27)	-0.0027 *** (-5.31)	-0.0290 *** (-5.18)	-0.0227 *** (-5.22)	-0.0025 *** (-8.34)	-0.0025 *** (-8.32)
Loan to Income Ratio	0.0004 ** (2.00)	0.0000 ** (2.00)	-0.0004 ** (1.97)	0.0000 ** (1.97)	0.0001 *** (3.36)	0.0001 *** (3.35)
<i>Applicant Specific</i>						
Applicant Income	-0.0124 * (-1.84)	-0.0011 * (-1.85)	-0.0127 * (-1.85)	-0.0012 * (-1.86)	-0.0004 (-1.30)	-0.0004 (-1.37)
Income Squared	0.0000 *** (2.57)	0.0000 *** (2.58)	0.0000 *** (2.58)	0.0000 *** (2.59)	0.0000 (1.64)	0.0000 * (1.68)
Native	0.7562 *** (5.41)	0.0923 *** (4.25)	0.8348 *** (7.15)	0.1045 *** (5.50)	0.1073 *** (4.58)	0.1355 *** (6.35)
Native-Reservation	0.3155 (1.33)	0.0328 (1.19)			0.1510 *** (2.96)	
Other Minority	0.2302 * (1.74)	0.0231 (1.60)	0.2346 * (1.77)	0.0235 (1.62)	0.0254 (1.61)	0.0235 (1.60)
White-Reservation	0.0109 (0.09)	0.0010 (0.09)			0.0170 (0.98)	
Female	0.1510 *** (3.91)	0.0143 *** (3.79)	0.1541 *** (3.99)	0.0145 *** (3.86)	0.0181 *** (4.07)	0.0188 *** (4.24)
Not Owner Occupied	-0.3563 *** (-5.79)	-0.0296 *** (-6.38)	-0.3510 *** (-5.67)	-0.0291 *** (-6.24)	-0.0431 *** (-7.83)	-0.0422 *** (-7.61)
<i>Location Specific</i>						
Population	-0.0146 (-1.62)	-0.0013 (-1.62)	-0.0152 * (-1.78)	-0.0014 * (-1.78)	-0.0028 *** (-3.03)	-0.0028 *** (-3.19)
Median Unit Age	0.0025 (1.32)	0.0002 (1.32)			0.0003 * (1.65)	
Rural Unit Percent	0.0023 *** (3.32)	0.0002 *** (3.32)	0.0019 *** (2.95)	0.0002 *** (2.95)	0.0003 *** (3.27)	0.0002 *** (2.81)
Vacant Percent	0.0043 ** (2.14)	0.0004 ** (2.14)	0.0060 *** (2.96)	0.0005 *** (2.96)	0.0005 ** (2.03)	0.0007 *** (2.81)
Median Income Ratio	-0.0102 *** (-10.40)	-0.0009 *** (-10.38)	-0.0098 *** (-9.69)	-0.0009 *** (-9.65)	-0.0009 *** (-11.06)	-0.0009 *** (-10.65)
Year 2004	-0.0237 (-0.68)	-0.0022 (-0.68)	-0.0193 (-0.55)	-0.0018 (-0.55)	-0.0026 (-0.70)	-0.0024 (-0.64)
Urban A	-0.3223 *** (-5.43)	-0.0282 *** (-5.69)			-0.0274 *** (-4.46)	
Urban B	-0.1541 * (-1.86)	-0.0135 * (-1.95)			-0.0130 (-1.57)	
Reservation			0.4149 *** (3.39)	0.0444 *** (2.94)		0.0596 *** (3.34)
Missoula			0.0622 (0.73)	0.0058 (0.71)		-0.0029 (-0.34)

Table 4: (continued)

Variable	co-eff	dy/dx	co-eff	dy/dx	co-eff	co-eff
Great Falls			0.2255 **	0.0223 **		0.0161 *
			(2.42)	(2.26)		(1.92)
Butte			0.2788 **	0.0284 *		0.0245 *
			(2.00)	(1.82)		(1.80)
Bozeman			0.0396	0.0037		-0.0005
			(0.34)	(0.33)		(-0.06)
Helena			-0.0975	-0.0086		-0.0200
			(-0.58)	(-0.60)		(-1.53)
Kalispell			0.3082 **	0.0317 **		0.0246 *
			(2.49)	(2.24)		(1.65)
District A			0.3368 ***	0.0330 ***		0.0249 ***
			(4.53)	(4.27)		(3.29)
District B			0.2263 ***	0.0220 ***		0.0092
			(2.74)	(2.59)		(1.13)
District C			0.4707 ***	0.0507 ***		0.0399 ***
			(4.94)	(4.28)		(4.22)
District D			-0.0350	-0.0032		-0.0175
			(-0.19)	(-0.19)		(-0.77)
District E			0.5547 ***	0.0604 ***		0.0495 ***
			(6.61)	(5.70)		(5.39)
<i>Lender Specific</i>						
Wells Fargo	-0.7204 ***	-0.0547 ***	-0.7433 ***	-0.0559 ***	-0.0799 ***	-0.0829 ***
	(-10.96)	(-13.23)	(-11.11)	(-13.46)	(-11.21)	(-11.48)
Countrywide	-0.2297 **	-0.0196 **	-0.2037 **	-0.0174 **	-0.0180 **	-0.0142 *
	(-2.35)	(-2.54)	(-2.06)	(-2.21)	(-2.48)	(-1.91)
First Interstate	-0.4813 ***	-0.0377 ***	-0.4907 ***	-0.0382 ***	-0.0347 ***	-0.0350 ***
	(-4.60)	(-5.46)	(-4.69)	(-5.59)	(-4.92)	(-4.94)
Heritage	-1.5987 ***	-0.0863 ***	-1.6171 ***	-0.0865 ***	-0.1289 ***	-0.1307 ***
	(-10.57)	(-19.72)	(-10.56)	(-19.70)	(-10.16)	(-10.13)
Stockman	-0.4924 ***	-0.0378 ***	-0.5680 ***	-0.0422 ***	-0.0594 ***	-0.0671 ***
	(-4.01)	(-4.86)	(-4.54)	(-5.67)	(-4.02)	(-4.50)
Intermountain	-3.7141 ***	-0.1111 ***	-3.7361 ***	-0.1108 ***	-0.2160 ***	-0.2189 ***
	(-9.75)	(-46.24)	(-9.79)	(-44.79)	(-35.81)	(-35.20)
OCC	0.0191	0.0018	0.0192	0.0018	0.0000	0.0013
	(0.21)	(0.21)	(0.21)	(0.21)	(-0.00)	(0.10)
FRS	-0.6943 ***	-0.0565 ***	-0.7129 ***	-0.0576 ***	-0.0782 ***	-0.0805 ***
	(-6.68)	(-7.49)	(-6.84)	(-7.66)	(-6.20)	(-6.37)
OTS	-0.0429	-0.0039	-0.0403	-0.0036	-0.0102	-0.0094
	(-0.42)	(-0.43)	(-0.39)	(-0.40)	(-0.73)	(-0.68)
NCUA	-0.5851 ***	-0.0428 ***	-0.6118 ***	-0.0442 ***	-0.0710 ***	-0.0739 ***
	(-3.05)	(-3.93)	(-3.17)	(-4.13)	(-3.55)	(-3.67)
HUD	0.3667 ***	0.0364 ***	0.3699 ***	0.0366 ***	0.0608 ***	0.0616 ***
	(4.21)	(3.90)	(4.24)	(3.93)	(4.82)	(4.89)
% correctly Predicted	86.78%		86.78%			
R ²					0.0707	0.0715
Number of Obs.	31,789		31,789		31,789	31,789

Numbers in parentheses are t stats for OLS and z stats for Logit. All models use robust standard errors.

* indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.

Table 5: Probability of Mortgage Application Denial: 2003 Data Set

Variable	Logit				OLS	
	Regression 1		Regression 2		Regression 1	Regression 2
	co-eff	dy/dx	co-eff	dy/dx	co-eff	co-eff
Constant	-0.4784 *		-0.6087 ***		0.2854 ***	0.2849 ***
	(-1.71)		(-2.82)		(8.73)	(10.36)
<i>Loan Specific</i>						
Conventional Loan	0.4373 ***	0.0355 ***	0.4344 ***	0.0350 ***	0.0479 ***	0.0487 ***
	(5.79)	(6.48)	(5.74)	(6.42)	(7.11)	(7.18)
Loan Amount	-0.0436 ***	-0.0039 ***	-0.0436 ***	-0.0039 ***	-0.0033 ***	-0.0033 ***
	(-5.47)	(-5.65)	(-5.44)	(-5.61)	(-7.66)	(-7.61)
Loan to Income Ratio	0.0008 ***	0.0001 ***	0.0009 ***	0.0001 ***	0.0001 ***	-0.0001 ***
	(4.03)	(4.07)	(4.18)	(4.22)	(5.83)	(5.99)
<i>Applicant Specific</i>						
Applicant Income	-0.0168 ***	-0.0015 ***	-0.0169 ***	-0.0015 ***	-0.0013 ***	-0.0013 ***
	(-2.62)	(-2.63)	(-2.61)	(-2.62)	(-2.78)	(-2.77)
Income Squared	0.0001 ***	0.0000 ***	0.0001 ***	0.0000 ***	0.0000 ***	0.0000 ***
	(3.54)	(3.55)	(3.42)	(3.44)	(3.10)	(3.04)
Native	0.8598 ***	0.1064 ***	0.8357 ***	0.1019 ***	0.1149 ***	0.1332 ***
	(3.87)	(2.95)	(4.63)	(3.55)	(3.18)	(4.24)
Native-Reservation	-0.0502	-0.0044			0.0945	
	(-0.15)	(-0.16)			(1.40)	
Other Minority	0.0991	0.0092	0.1008	0.0093	0.0127	0.0121
	(0.53)	(0.51)	(0.54)	(0.52)	(0.63)	(0.60)
White-Reservation	-0.0106	-0.0009			0.0176	
	(-0.06)	(-0.06)			(0.69)	
Female	0.1849 ***	0.0171 ***	0.1945 ***	0.0179 ***	0.0222 ***	0.0241 ***
	(3.22)	(3.09)	(3.37)	(3.24)	(3.38)	(3.66)
Not Owner Occupied	-0.4811 ***	-0.0375 ***	-0.4579 ***	-0.0357 ***	-0.0524 ***	-0.0494 ***
	(-5.08)	(-5.91)	(-4.80)	(-5.54)	(-6.47)	(-6.05)
<i>Location Specific</i>						
Population	0.0143	0.0013	0.0137	0.0012	0.0003	0.0003
	(1.05)	(1.05)	(1.06)	(1.06)	(0.22)	(0.25)
Median Unit Age	0.0056 **	0.0005 **			0.0006 **	
	(1.97)	(1.97)			(2.06)	
Rural Unit Percent	0.0024 **	0.0002 **	0.0016	0.0001	0.0003 **	0.0002 *
	(2.23)	(2.24)	(1.58)	(1.58)	(2.29)	(1.73)
Vacant Percent	0.0116 ***	0.0010 ***	0.0149 ***	0.0013 ***	0.0014 ***	0.0018 ***
	(3.88)	(3.87)	(4.90)	(4.91)	(3.68)	(4.54)
Median Income Ratio	-0.0101 ***	-0.0009 ***	-0.0093 ***	-0.0008 ***	-0.0009 ***	-0.0008 ***
	(-6.97)	(-6.95)	(-6.26)	(-6.23)	(-7.42)	(-6.90)
Urban A	-0.2282 ***	-0.0197 ***			-0.0157 *	
	(-2.58)	(-2.66)			(-1.78)	
Urban B	-0.2470 *	-0.0204 **			-0.0177	
	(-1.84)	(-2.00)			(-1.49)	
Reservation			0.2126	0.0205		0.0411
			(1.17)	(1.09)		(1.59)
Missoula			0.0804	0.0073		0.0016
			(0.67)	(0.65)		(0.12)

Table 5: (continued)

Variable	co-eff	dy/dx	co-eff	dy/dx	co-eff	co-eff
Great Falls			0.0874 (0.61)	0.0080 (0.59)		0.0063 (0.51)
Butte			-0.0734 (-0.29)	-0.0063 (-0.30)		-0.0049 (-0.26)
Bozeman			-0.2336 (-1.19)	-0.0190 (-1.30)		-0.0149 (-1.16)
Helena			-0.5213 * (-1.91)	-0.0379 ** (-2.39)		-0.0515 *** (-2.94)
Kalispell			0.4121 ** (2.28)	0.0429 ** (1.98)		0.0459 * (1.85)
District A			0.1398 (1.29)	0.0128 (1.25)		0.0040 (0.37)
District B			0.0203 (0.16)	0.0018 (0.16)		-0.0117 (-0.97)
District C			0.4482 *** (3.22)	0.0465 *** (2.79)		0.0367 *** (2.68)
District D			-0.0841 (-0.32)	-0.0072 (-0.33)		-0.0194 (-0.58)
District E			0.5201 *** (4.30)	0.0544 *** (3.71)		0.0497 *** (3.75)
<i>Lender Specific</i>						
Wells Fargo	-1.1077 *** (-11.03)	-0.0750 *** (-14.54)	-1.1332 *** (-11.04)	-0.0758 *** (-14.76)	-0.1233 *** (-11.42)	-0.1269 *** (-11.63)
Countrywide	-0.2912 ** (-2.01)	-0.0236 ** (-2.22)	-0.2572 * (-1.75)	-0.0210 * (-1.92)	-0.0205 ** (-2.04)	-0.0163 (-1.59)
First Interstate	-0.4551 *** (-3.21)	-0.0352 *** (-3.75)	-0.4745 *** (-3.33)	-0.0362 *** (-3.92)	-0.0309 *** (-3.28)	-0.0322 *** (-3.38)
Heritage	-1.8493 *** (-8.70)	-0.0914 *** (-16.86)	-1.9088 *** (-8.87)	-0.0922 *** (-17.40)	-0.1856 *** (-8.04)	-0.1914 *** (-8.19)
Stockman	-0.9015 *** (-4.96)	-0.0582 *** (-7.09)	-1.0392 *** (-5.57)	-0.0635 *** (-8.45)	-0.1240 *** (-4.86)	-0.1387 *** (-5.37)
Intermountain	-2.7406 *** (-6.02)	-0.0963 *** (-21.63)	-2.7701 *** (-6.08)	-0.0958 *** (-21.93)	-0.2149 *** (-17.75)	-0.2175 *** (-17.81)
OCC	-0.2217 (-1.61)	-0.0191 * (-1.66)	-0.2186 (-1.58)	-0.0187 (-1.64)	-0.0382 (-1.63)	-0.0358 (-1.53)
FRS	-1.1341 *** (-7.55)	-0.0872 *** (-8.49)	-1.1542 *** (-7.65)	-0.0880 *** (-8.61)	-0.1474 *** (-6.53)	-0.1497 *** (-6.63)
OTS	-0.5918 *** (-3.69)	-0.0431 *** (-4.59)	-0.5797 *** (-3.61)	-0.0421 *** (-4.48)	-0.0952 *** (-3.87)	-0.0936 *** (-3.81)
NCUA	-1.0091 *** (-3.53)	-0.0612 *** (-5.57)	-1.0656 *** (-3.72)	-0.0629 *** (-6.03)	-0.1401 *** (-4.38)	-0.1450 *** (-4.53)
HUD	-0.0244 (-0.18)	-0.0022 (-0.18)	-0.0226 (-0.17)	-0.0020 (-0.17)	-0.0034 (-0.15)	-0.0030 (-0.13)
% correctly Predicted R ²	87.06%		87.08%		0.0844	0.0871
Number of Obs.	14,394		14,394		14,394	14,394

Numbers in parentheses are t stats for OLS and z stats for Logit. All models use robust standard errors.

* indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.

Table 6: Probability of Mortgage Application Denial: 2004 Data Set

Variable	Logit				OLS	
	Regression 1		Regression 2		Regression 1	Regression 2
	co-eff	dy/dx	co-eff	dy/dx	co-eff	co-eff
Constant	-0.6501 *** (-2.58)		-1.1473 *** (-5.91)		0.2447 *** (9.17)	0.2072 *** (10.40)
<i>Loan Specific</i>						
Conventional Loan	0.4057 *** (5.42)	0.0327 *** (6.09)	0.3995 *** (5.29)	0.0322 *** (5.90)	0.0421 *** (6.36)	0.0421 *** (6.29)
Loan Amount	-0.0180 *** (-3.43)	-0.0016 *** (-3.44)	-0.0182 *** (-3.44)	-0.0016 *** (-3.45)	-0.0018 *** (-4.52)	-0.0018 *** (-4.52)
Loan to Income Ratio	0.0002 * (1.81)	0.0000 * (1.80)	0.0002 * (1.79)	0.0000 * (1.78)	0.0000 * (1.84)	0.0000 * (1.83)
<i>Applicant Specific</i>						
Applicant Income	-0.0219 *** (-2.65)	-0.0020 *** (-2.67)	-0.0224 *** (-2.70)	-0.0020 *** (-2.73)	-0.0007 ** (-2.15)	-0.0008 ** (-2.21)
Income Squared	0.0000 *** (2.90)	0.0000 *** (2.93)	0.0000 *** (2.96)	0.0000 *** (2.99)	0.0000 ** (2.35)	0.0000 ** (2.41)
Native	0.7109 *** (3.96)	0.0835 *** (3.13)	0.8492 *** (5.47)	0.1046 *** (4.18)	0.1040 *** (3.38)	0.1375 *** (4.74)
Native-Reservation	0.6807 * (1.89)	0.0795 (1.50)			0.2172 *** (2.74)	
Other Minority	0.3607 * (1.89)	0.0372 * (1.66)	0.3555 * (1.86)	0.0364 (1.64)	0.0406 (1.62)	0.0401 (1.60)
White-Reservation	0.0243 (0.15)	0.0022 (0.15)			0.0157 (0.67)	
Female	0.1022 ** (1.96)	0.0093 * (1.91)	0.0981 * (1.88)	0.0089 * (1.84)	0.0127 ** (2.11)	0.0126 ** (2.10)
Not Owner Occupied	-0.2133 *** (-2.72)	-0.0180 *** (-2.87)	-0.2219 *** (-2.82)	-0.0186 *** (-2.98)	-0.0305 *** (-4.12)	-0.0314 *** (-4.20)
<i>Location Specific</i>						
Population	-0.0379 *** (-3.15)	-0.0034 *** (-3.13)	-0.0378 *** (-3.29)	-0.0034 *** (-3.27)	-0.0054 *** (-4.30)	-0.0054 *** (-4.49)
Median Unit Age	-0.0003 (-0.11)	0.0000 (-0.11)			0.0001 (0.22)	
Rural Unit Percent	0.0022 ** (2.41)	0.0002 ** (2.41)	0.0022 ** (2.56)	0.0002 ** (2.55)	0.0003 ** (2.34)	0.0003 ** (2.33)
Vacant Percent	-0.0015 (-0.55)	-0.0001 (-0.55)	-0.0008 (-0.28)	-0.0001 (-0.28)	-0.0002 (-0.70)	-0.0001 (-0.36)
Median Income Ratio	-0.0099 *** (-7.47)	-0.0009 *** (-7.39)	-0.0097 *** (-7.04)	-0.0009 *** (-6.95)	-0.0009 *** (-8.02)	-0.0009 *** (-7.82)
Urban A	-0.4078 *** (-5.08)	-0.0343 *** (-5.35)			-0.0372 *** (-4.37)	
Urban B	-0.0930 (-0.88)	-0.0081 (-0.90)			-0.0089 (-0.77)	
Reservation			0.5785 *** (3.41)	0.0643 *** (2.82)		0.0728 *** (2.99)
Missoula			0.0305 (0.25)	0.0028 (0.25)		-0.0078 (-0.69)

Table 6: (continued)

Variable	co-eff	dy/dx	co-eff	dy/dx	co-eff	co-eff
Great Falls			0.3412 *** (2.74)	0.0343 ** (2.47)		0.0249 ** (2.17)
Butte			0.4937 *** (2.89)	0.0532 ** (2.45)		0.0452 ** (2.39)
Bozeman			0.2352 (1.55)	0.0229 (1.44)		0.0137 (1.10)
Helena			0.1789 (0.83)	0.0171 (0.77)		0.0028 (0.14)
Kalispell			0.2270 (1.31)	0.0221 (1.21)		0.0106 (0.58)
District A			0.4989 *** (4.83)	0.0494 *** (4.42)		0.0418 *** (3.98)
District B			0.3882 *** (3.46)	0.0383 *** (3.17)		0.0258 ** (2.32)
District C			0.4908 *** (3.73)	0.0520 *** (3.21)		0.0414 *** (3.19)
District D			0.0015 (0.01)	0.0001 (0.01)		-0.0170 (-0.56)
District E			0.5825 *** (4.97)	0.0626 *** (4.25)		0.0481 *** (3.80)
<i>Lender Specific</i>						
Wells Fargo	-0.3955 *** (-4.51)	-0.0318 *** (-5.00)	-0.4052 *** (-4.56)	-0.0323 *** (-5.05)	-0.0434 *** (-4.57)	-0.0444 *** (-4.62)
Countrywide	-0.1926 (-1.41)	-0.0162 (-1.50)	-0.1840 (-1.33)	-0.0154 (-1.41)	-0.0164 (-1.55)	-0.0147 (-1.34)
First Interstate	-0.5018 *** (-3.25)	-0.0379 *** (-3.89)	-0.5078 *** (-3.29)	-0.0381 *** (-3.96)	-0.0376 *** (-3.56)	-0.0379 *** (-3.55)
Heritage	-1.4396 *** (-6.46)	-0.0786 *** (-11.28)	-1.4376 *** (-6.37)	-0.0783 *** (-11.09)	-0.0958 *** (-6.48)	-0.0954 *** (-6.31)
Stockman	-0.1856 (-1.10)	-0.0155 (-1.18)	-0.2207 (-1.29)	-0.0181 (-1.40)	-0.0202 (-1.11)	-0.0232 (-1.27)
Intermountain	-4.6412 *** (-6.54)	-0.1191 *** (-38.91)	-4.6413 *** (-6.54)	-0.1187 *** (-36.64)	-0.2146 *** (-29.28)	-0.2159 *** (-27.94)
OCC	0.1766 (1.39)	0.0163 (1.35)	0.1657 (1.30)	0.0152 (1.26)	0.0184 (1.24)	0.0179 (1.20)
FRS	-0.3592 ** (-2.42)	-0.0298 *** (-2.60)	-0.3745 ** (-2.51)	-0.0309 *** (-2.70)	-0.0355 ** (-2.34)	-0.0374 ** (-2.45)
OTS	0.3524 *** (2.58)	0.0356 ** (2.30)	0.3398 ** (2.48)	0.0341 ** (2.22)	0.0416 ** (2.49)	0.0407 ** (2.43)
NCUA	-0.2394 (-0.92)	-0.0195 (-1.02)	-0.2468 (-0.94)	-0.0200 (-1.04)	-0.0273 (-1.04)	-0.0283 (-1.07)
HUD	0.6640 *** (5.59)	0.0675 *** (4.93)	0.6616 *** (5.56)	0.0670 *** (4.88)	0.0992 *** (6.78)	0.0995 *** (6.79)
% correctly Predicted R ²	86.58%		86.58%		0.0664	0.0665
Number of Obs.	17,395		17,395		17,395	17,395

Numbers in parentheses are t stats for OLS and z stats for Logit. All models use robust standard errors.

* indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.

Table 7: Probability of Mortgage Application Denial: 2004 Data Set

Variable	Logit		OLS
	Regression 3		Regression 3
	co-eff	dy/dx	co-eff
Constant	-1.5483 *** (-5.89)		0.1493 *** (5.62)
<i>Loan Specific</i>			
Manufactured	1.4653 *** (21.42)	0.2031 *** (14.74)	0.2503 *** (19.12)
Conventional Loan	0.4061 *** (5.17)	0.0316 *** (5.82)	0.0439 *** (6.54)
Loan Amount	-0.0025 (-0.57)	-0.0002 (-0.57)	-0.0004 (-1.19)
Loan to Income Ratio	0.0002 ** (2.08)	0.0000 ** (2.08)	0.0000 * (1.94)
<i>Applicant Specific</i>			
Applicant Income	-0.0140 ** (-2.20)	-0.0012 ** (-2.21)	-0.0007 ** (-2.20)
Income Squared	0.0000 ** (2.21)	0.0000 ** (2.22)	0.0000 ** (2.17)
Native	0.6666 *** (3.68)	0.0745 *** (2.93)	0.0948 *** (3.25)
Native-Reservation	0.4422 (1.08)	0.0455 (0.92)	0.1485 * (1.94)
Other Minority	0.3395 * (1.70)	0.0335 (1.50)	0.0367 (1.44)
White-Reservation	0.0343 (0.21)	0.0030 (0.21)	0.0174 (0.77)
Female	0.0218 (0.40)	0.0019 (0.39)	0.0012 (0.20)
Not Owner Occupied	-0.1766 ** (-2.27)	-0.0145 ** (-2.38)	-0.0217 *** (-2.96)
No Co-applicant	0.2800 *** (5.49)	0.0245 *** (5.36)	0.0295 *** (5.32)
<i>Location Specific</i>			
Population	-0.0379 *** (-3.07)	-0.0033 *** (-3.06)	-0.0051 *** (-4.09)
Median Unit Age	0.0046 * (1.83)	0.0004 * (1.83)	0.0005 * (1.89)
Rural Unit Percent	0.0009 (1.00)	0.0001 (1.00)	0.0001 (0.71)
Vacant Percent	-0.0002 (-0.06)	0.0000 (-0.06)	0.0000 (-0.10)
Median Income Ratio	-0.0084 *** (-6.23)	-0.0007 *** (-6.21)	-0.0007 *** (-6.06)
Urban A	-0.4298 *** (-5.30)	-0.0347 *** (-5.61)	-0.0364 *** (-4.38)
Urban B	-0.0467 (-0.43)	-0.0040 (-0.44)	-0.0018 (-0.15)

Table 7: (continued)

Variable	co-eff	dy/dx	co-eff
<i>Lender Specific</i>			
Wells Fargo	-0.4480 *** (-4.98)	-0.0341 *** (-5.60)	-0.0467 *** (-4.98)
Countrywide	-0.1952 (-1.39)	-0.0158 (-1.49)	-0.0161 (-1.52)
First Interstate	-0.5319 *** (-3.39)	-0.0382 *** (-4.11)	-0.0404 *** (-3.86)
Heritage	-1.3951 *** (-6.06)	-0.0742 *** (-10.44)	-0.0855 *** (-5.73)
Stockman	-0.1818 (-1.04)	-0.0147 (-1.11)	-0.0204 (-1.14)
Intermountain	-4.5417 *** (-6.39)	-0.1138 *** (-38.20)	-0.1938 *** (-26.38)
OCC	0.3000 ** (2.25)	0.0273 ** (2.13)	0.0315 ** (2.13)
FRS	-0.2271 (-1.46)	-0.0187 (-1.53)	-0.0196 (-1.29)
OTS	0.5383 *** (3.77)	0.0560 *** (3.19)	0.0614 *** (3.68)
NCUA	-0.0947 (-0.35)	-0.0079 (-0.37)	-0.0102 (-0.39)
HUD	0.7049 *** (5.63)	0.0698 *** (4.93)	0.0977 *** (6.73)
% correctly Predicted	87.12%		
R ²			0.1037
Number of Obs.	17,395		17,395

Numbers in parentheses are t statistics for OLS and z statistics for Logit.

All models use robust standard errors

* indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.

of the large lender and regulatory agency dummy variables. Dummy variables are used to examine the effects of an application's acceptance by the six largest lenders in the combined data set. These large lender dummy variables are *Wells Fargo*, *Countrywide*, *First Interstate*, *Heritage*, *Stockman* and *Intermountain*. The coefficients for the large lender dummy variables are uniformly negative and statistically significant at the 95% confidence level in the 2003 and combined data sets. In addition, four of the six coefficients are negative and statistically significant in the 2004 data set. These results are consistent with the hypothesis that large lenders are able to manage default risk in a more efficient manner by packaging loans for sale in the secondary mortgage market.

Likelihood ratio tests indicate that jointly the dummy variables indicating each lender's regulatory agency are statistically significant. These agencies include the OCC, FRS, OTS, NCUA, HUD and FDIC. FDIC serves as the default value in the empirical models. The parameter estimates for these variables indicate that differences in regulatory environments faced by lenders do affect their lending decisions. At least three of these five variables are statistically significant in each model.

Explanatory variables related to the loan itself also proved to be relevant to the lending process. *Conventional* loans are not insured or guaranteed by any government sponsored program or agency. An application for a conventional loan may have a higher probability of denial because of the potential for higher losses in the event of a default. Parameter estimates for the conventional loan variable are

consistently positive and statistically significant. Applying for a conventional loan is estimated to increase the probability of denial by 3 to 4 percent.

Increasing the *loan amount* is expected to increase the probability of denial. The results indicate that increasing the loan amount reduces the probability of denial and this effect is statistically significant. The hypothesized positive impact is not observed in any of the three data sets. An alternative explanation for this result is that applicants with better credit worthiness tend to apply to higher loan amounts, resulting in lower denial rates.¹¹

The empirical models contain several location specific explanatory variables. An increase in *Population*, measured in thousands of individuals in a census tract, is predicted to reduce the probability of denial. The impact of an increase in population is negative for the combined and 2004 data sets, but the magnitude of the effect is small. Parameter estimates are statistically insignificant for all of the models based on the 2003 data and some of those based on the combined data set.

The portion of housing units in a census tract listed as rural (*Rural Percent*) is expected to have a positive impact on the probability of denial. This variable has not been included in previous studies because they focused on metropolitan area lending. Parameter estimates for Rural Percent are generally positive and statistically significant. However, the marginal effect of increasing the percentage of rural

¹¹ Previous research has limited the use of the loan amount to the construction of obligation ratios (Munnell et al. 1996; Tootell 1996; Berkovec et al. 1998). Obligation ratios like the loan amount to appraised value, often referred to as the LTV ratio, and a housing expense to income ratio were often used in previous research as explanatory variables. Neither of these variables is available for this study.

housing units is small in magnitude. This variable may be serving as an instrument for the effects of the expected future economic conditions in rural areas.

The ratio of vacant housing units to total housing units (*Vacant Percent*) is also likely to have a positive affect on the probability of denial. Munnell et al. (1996) reported a positive but insignificant parameter estimate for a similar variable. Tootell (1996) employed a dummy variable to indicate high vacancy areas and obtained negative but insignificant estimates. Statistically significant positive parameter estimates are obtained using both the 2003 and combined data sets. Negative parameter estimates are obtained using the 2004 data set, but they are not statistically significant.

The relative wealth of a census tract is measured by the *Median Income Ratio*. Parameter estimates for this variable are negative and statistically significant in all three models. This result is consistent with the hypothesis that as median income increases, the probability of denial decreases, although the marginal effect of increasing this ratio is less than a one tenth of a percent decrease in the probability of denial. Tootell (1996) reported that higher denial rates are associated with low-income areas, as indicated by dummy variables, but the parameter estimates he reported were not statistically significant.

The remaining location specific variables are based on geographical information. Regression 2 includes dummy variables for individual regions with the *Billings* metro area serving as the default location. Parameter estimates for the variable *Kalispell* are positive in all three data sets, but are not statistically significant for 2004. The

parameter estimates for *Helena* are negative and statistically significant in 2003.

Estimates for *Bozeman* are statistically insignificant in all cases. Parameter estimates for *Great Falls* and *Butte* are positive and statistically significant for the 2004 and combined data sets. These results indicate that residents of Butte and Great Falls are more likely to be denied for a home mortgage than residents of Billings.

Parameter estimates for the dummy variables indicate rural districts obtained using the 2003 and combined data sets are positive except for district D. Parameter estimates obtained from the 2004 data sets are positive for all districts. Parameter estimates for the combined data set are statistically significant for districts A, B, C and E.

Two geographic variables, Urban A and Urban B, are utilized in regression 1 in Tables 4, 5, and 6. *Urban A* is comprised of applications from Kalispell, Missoula, Helena, Bozeman and Billings. These areas have experienced population increases since the early 1990's (Census 2004). It is hypothesized that loan applications from areas with higher population growth will have lower denial rates because of the economic conditions associated with population growth. The empirical results support this hypothesis. Parameter estimates for Urban A are negative and statistically significant. Thus, residing in Urban A decreases the probability of denial by 1.5 to 3.5 percent. *Urban B* is comprised of Butte and Great Falls, which have experienced low or negative population growth since 1990 (Census 2004). A likelihood ratio test supports the hypothesis that the coefficients for these two variables are not equal. The effect of an application originating from this Urban B is expected to reduce the

probability of denial by less than the effect of residing within Urban A. Parameter estimates for Urban B are negative and smaller in magnitude than the parameter estimates for Urban A in the combined and 2004 data sets. In the 2004 and combined data sets the Urban B parameter estimates are statistically significant. Residing in Urban A can be interpreted as reducing the probability of denial more than residing in Urban B. Residing in Urban B reduces the probability of denial by more than residing in a non urban area.

Applications for homes located on one of Montana's seven reservations are examined by employing a dummy variable. A single variable is used because a likelihood ratio test indicated that no additional explanatory power is obtained by utilizing individual variables for each reservation. The parameter estimates indicate that residing on a reservation increases the probability of denial by 2 to 6.5 percent. These results are statistically significant for the combined and 2004 data sets. One potential explanation for this result is that property rights on a reservation may not be as strong or as well defined as non-reservation property rights. Thus in the case of default, lenders may experience higher costs of repossession and higher rates of default. A second explanation may be discrimination. However, as discussed below, the applicant's race is included as a separate variable.¹²

A group of variables categorized as applicant specific are also included in the empirical models. An increase in an applicant's *Income* is expected to decrease the

¹² A positive correlation between a tract's percentage of minority residents and the reservation variable is present in the data set. The choice to include reservation as an explanatory variable was made based on the theoretical support that property rights are important to credit markets. Inclusion of both variables would have created multicollinearity problems.

probability of denial. It is also hypothesized that this effect decreases as income increases. *Income Squared* is introduced to account for this possible effect. The parameter estimates support both hypothesized effects and are statistically significant in most cases, but the magnitudes of these effects are small. These results are consistent with results obtained by Berkovec et al. (1998) in their analysis of the probability of loan default.

The hypothesized effect of the applicant choosing not to occupy the home (*Not Owner Occupied*) used as collateral is negative. Applicants for non-owner occupied homes are hypothesized to be purchasing second homes in Montana and to have better than average credit worthiness.¹³ Other studies have reported increased probabilities of denial for non-owner occupied applicants in the Boston area (Munnell et al. 1996; Tootell 1996). It is possible that non-owner occupied homes in the data set obtained from Boston in the early 1990's were for rental properties and not second homes. The parameter estimates reported here are negative, implying a lower probability of denial for homes that are not owner occupied. The magnitude of the reduction in denial probability is between 1.8 and 3.8 percent, and the parameter estimates are statistically significant at the 99% confidence level.

Variables, based on an applicant's race and gender, are included in the empirical model. These attributes are often perceived as grounds for possible discrimination. The affect of gender is examined by including *Female* in the empirical models. Tootell (1996) obtained parameter estimates that were negative but statistically

¹³ Montana contains several communities that have a large number of vacation homes. These communities include Big Sky and Whitefish, which are near world class ski areas.

insignificant. Munnell et al. (1996) also reported negative parameter estimates that were statistically significant. In this study, the parameter estimates for female are positive and statistically significant. The effect of being female increases the probability of denial from approximately 1 percent to approximately 1.5 percent. This effect could perhaps be associated with Becker's (1957) discrimination coefficient or it may represent a correlation with the marital status indicator which is omitted.

Applicants are grouped into three racial categories: *Native American*, *White*, and *Other Minority*. Applicants indicating their race as Asian, African American or Pacific Islander are categorized as other minorities. Past research has reported that African American applicants are more likely to be denied for a loan; thus *Other Minority* is expected to obtain similar results (Munnell et al. 1996; Tootell 1996). In this study, parameter estimates are positive and statistically significant (at the 90% confidence level) in some of the models based on the 2004 data set. These results are consistent with prior studies. A positive parameter for the *Native* variable could indicate possible discrimination in the data set. The parameter estimates are positive and statistically significant at the 99% level. Being a Native American increases an applicant's probability of denial by between 8 and 10.5 percent over non-minority applicants. This could imply that discrimination is prevalent in the data set, but possible correlation with omitted variables should be considered. If discrimination is present, it could be either economic or non-economic in nature. It is not possible to determine the type of discrimination from this data set.

The effect of an applicant residing on a federally recognized Indian reservation is also examined by utilizing interaction variables between each of the three race categories and the reservation dummy variable. The variable *Other Minority-Reservation* is not included in the empirical model due to a lack of observations in the data set. *Native-Reservation* and *White-Reservation* are hypothesized to increase the probability of denial, due to the legal jurisdiction of tribal courts. The parameter estimates for Native-Reservation based on the combined and 2004 data sets are positive and statistically insignificant. Parameter estimates based on the 2003 data set are negative and statistically significant. Some parameter estimates for the variable White-Reservation are positive and others are negative, but all are statistically insignificant. The reasons for these results could include that lenders put forth a concerted effort to extend credit to reservation applicants or that reservation rules and regulations are not a detriment to loan applicants.

The 2004 data set contains information on two additional variables that should be included in an empirical model of loan denials. The first of these is a dummy variable indicating the applicant did not have a co-applicant (*no co-applicant*). The empirical model indicates that the lack of a co-applicant increases the probability of denial by 2.5 percent. The second variable included in the 2004 model is an indicator that the home being purchased is a *manufactured* home. It is hypothesized that the marginal effect of applying for a loan to purchase a manufactured home increases the probability of denial. Parameter estimates are positive and significant at the 99%

confidence level in all cases, indicating that applying for a loan to purchase a manufactured home increases the probability of denial by 20%.

Summary

The empirical results presented above are consistent with the hypothesis that Native American applicants are required to meet higher credit standards. Correlation with omitted variables is possible and may be responsible for some of the magnitude of this impact. For example, no data is available on an applicant's credit score or default score. The variable indicating the applicant is Native American is consistently positive, statistically significant, and implies a large impact on the likelihood of denial. Thus, for whatever reason, Native Americans unambiguously have a significantly higher probability of denial when they apply for a home mortgage. The second hypothesis received more limited support from the empirical results. Parameter estimates for the reservation dummy variable are positive and statistically significant, implying denial rates are higher with respect to applicants located on reservations. These results are consistent with the hypothesis that residing on a federally recognized Indian reservation adversely impacts loan applicants. These results do not allow for any conclusions about whether denial rates are higher for residents of a reservation if they are Native American or non-Native American.

Several other interesting results have been addressed. The most striking of these is the very large increase in denial probability associated with manufactured homes. This effect is more important than any other attribute of a loan application. Another

important result is the substantially smaller denial rate for applicants who seek mortgages from large lenders. An applicant's probability of denial is 2% to 10% lower if the applicant has applied to a large lender. A final result of interest is the increased probability of denial for female applicants. Although the magnitude is in the 1% to 2% range, the results are persistent in the empirical results.

CHAPTER 7

CONCLUSION

The purpose of this study has been to examine the effect of factors such as race and legal jurisdiction on lending decisions in the home mortgage market in Montana. A particular focus has been access to home mortgages for Native Americans. Factors affecting loan applicants in general were also examined.

This study applied logit and OLS estimation procedures to loan application data for 2003 and 2004 collected under the Home Mortgage Disclosure Act. Parameter estimates were obtained for variables related to an applicant's location and personal characteristics, in addition to lender and loan specific variables. Many of these variables controlled for factors that directly affect a lender's expected return on a potential loan. Other variables examined the role of factors that may only indirectly affect the expected return or serve as proxies for other variables, which are omitted because data is not available, that do have direct implications (for example, credit scores and loan default rates).

Parameter estimates for lender and loan specific variables are consistent with the general hypothesis that lenders are more likely to deny a loan when the expected return of the loan is relatively low. Federal loan guarantee and insurance programs reduce the potential loss a lender would incur if a borrower defaults on a loan. Lenders in the study were more likely to deny applications for loans that are not guaranteed or insured by a government agency.

Large lenders are likely to have comparative advantage in portfolio risk management over small lenders. They issue a larger number of loans, allowing them to quickly package loans for resale in the secondary market. The overall size of the portfolio of assets maintained by these lenders also allows them to manage risk more efficiently. The results presented in this study are consistent with this hypothesis. The probability of a loan application being denied is lower when the application is received by a large lender.

Economic conditions also appear to affect the home mortgage market. Areas with high percentages of rural housing or vacant units are likely to be positively correlated with poor economic conditions that may affect a home's future value. The empirical results indicate that as variables which serve as proxy measures for poor economic conditions increase so does the probability of denial. Areas with relatively high median incomes are expected to be positively correlated with good economic conditions. More generally over the past fifteen years, urban areas in Montana have enjoyed better economic conditions than rural areas, although the economic conditions in some urban areas have been superior to other urban areas. In five of the seven largest cities in Montana, economic and population growth has been positive since the early 1990's, while the remaining two cities, Butte and Great Falls, have experienced low or negative growth rates. Parameter estimates provide support for the hypothesis that residing in an urban area with little or no growth reduces the probability of denial as compared to residing in a rural area, but residing in a growing

urban area reduces the probability of denial by an even greater amount. Current and expected future economic conditions are likely responsible for this effect.

The results presented in this study also indicate that an applicant's personal characteristics affect the lending decision. An applicant's race does not inherently affect the expected return of a potential loan. Thus, any increase in the probability of denial associated with race may represent either economic discrimination or taste-based discrimination. The affect of an applicant's status as a Native American is estimated to increase the probability of denial by 8 to 10.5 percent. Parameter estimates for other minority applicants are generally statistically insignificant. These results indicate that economic racial profiling is being practiced in the sense that being an American Indian may serve as a proxy for personal characteristics that do affect the expected rate of return, such as credit scores and loan default rates, which were omitted in this study.

Lending in areas with relatively weak property rights, established either by a weak rule of law or poor enforcement of a strong rule of law, is expected to increase the probability of denial for loan applicants. The results from this study indicate the effect of applicants residing on a reservation generally increased the probability of denial. This is consistent with the hypothesis that being subject to a tribal court's jurisdiction creates an environment that is detrimental to home mortgage applicants. This is also consistent with models that indicate financial markets function less efficiently in environments where property rights and contract enforcement are weaker.

The effect of an applicant's gender was also examined. Results indicate that female applicants had an increased probability of denial. The 1 to 1.5 percent increase in the probability of denial may represent taste-based discrimination against female applicants or a possible correlation with an omitted variable that increases an applicant's probability of denial because it reduces the expected return of a loan.

Results from this study are similar to some findings reported by previous studies and different from some others, and provide new insights about variables that have not been examined in previous studies. Munnell et al. (1996) and Tootell (1996) both reported that minorities (typically African Americans and Hispanics) have higher probabilities of denial. Berkovec et al. (1998) specifically include an American Indian variable in their work, although parameter estimates for this variable were statistically insignificant. The finding that there is a substantial increase in the probability of denial for American Indian applicants is a new finding. The effect of gender in this study was also different than the effect reported in previous studies. Decreases in the probability of denial have been reported in the past for female applicants, while increases were observed in this study.

Several effects that have not been extensively examined in previous analyses were considered in this study. The effect of an applicant being an American Indian and the effect of the legal jurisdiction of tribal courts have not received much attention in previous studies of mortgage lending. Also, past studies have not given much attention to the interaction between these two variables. The reduction in probability of denial for applicants applying to large lenders has not been previously

reported. Finally, the large geographic area examined in this study allowed for comparisons between rural and urban areas.

This study has several public policy implications. The results presented in this study expand the information available to Federal, State and private policy makers to fight poverty, discrimination and numerous other social goals. Most notably this study expands our knowledge about mortgage lending on American Indian tribal reservations and in rural areas. One of the stated purposes of the HMDA is to recognize underserved areas so that public and private funds can be encouraged to enter these areas. The results presented in this study may be useful in accomplishing this objective of the HMDA and in designing programs to reduce housing problems faced by American Indian populations.

Additional research topics in this area are numerous. Examining Native American issues in other geographic locations or over a longer time frame may yield useful information for public policy initiatives. Combining the HMDA data with survey data, similar to the survey collected by the Boston Federal Reserve Bank in 1992, may also expand our understanding of issues faced by rural residents and Native Americans. This study may also serve as a precursor to a more comprehensive study that includes loan performance data. This type of study would allow for a distinction between economic and taste-based discrimination. Future researchers will likely continue to extend the knowledge base about mortgage markets, discrimination and Native Americans.

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APPENDICES

APPENDIX A

HOME MORTGAGE DISCLOSURE ACT TABLES

Table 8: Home Mortgage Disclosure Act
Required Data submission for 2003

Year of Data	Year of Submission
Respondent ID	10 Character Identifier
Agency Code	1 - Office of the Comptroller of the Currency 2 - Federal Reserve System 3 - Federal Deposit Insurance Corporation 4 - Office of Thrift Supervision 5 - National Credit Union Administration 7 - Department of Housing and Urban Development
Loan Type	1 - Conventional 2 - Federal Housing Administration insured 3 - Veterans Administration guaranteed 4 - Farm Service Agency or Rural Housing Service
Loan Purpose	1 - Home Purchase 2 - Home Improvement 3 - Refinancing 4 - Multifamily Dwelling
Occupancy	1 - Owner-occupied as a principle dwelling 2 - Not Owner-occupied 3 - Not Applicable
Loan Amount	In thousands of dollars
Action Type	1 - Loan originated 2 - Application approved but not accepted 3 - Application denied by financial institution 4 - Application withdrawn by applicant 5 - File closed for incompleteness 6 - Loan purchased by the institution
MA	Metropolitan Area
State Code	Two-digit FIPS state identifier
County Code	Three-digit FIPS county identifier
Tract	Census Tract Number
Applicant Race	1 - American Indian or Alaskan Native 2 - Asian or Pacific Islander 3 - Black 4 - Hispanic 5 - White 6 - Other 7 - Information not provided by applicant in mail or telephone application 8 - Not applicable
Co-Applicant Race	Same as for applicant race
Applicant Sex	1 - Male 2 - Female 3 - Information not provided by applicant in a mail or telephone application 4 - Not applicable

Table 8: (Continued)

Co-Applicant Sex	Same as for applicant sex
Applicant Income	Gross Annual Income: in thousands of dollars
Purchaser Type	0 - Loan was originated or was not sold in calendar year covered by register 1 - Federal National Mortgage Association 2 - Government National Mortgage Association 3 - Federal Home Loan Mortgage Corporation 4 - Federal Agricultural Mortgage Company 5 - Commercial bank 6 - Savings bank or savings association 7 - Life insurance company 8 - Affiliate institution 9- Other type of purchaser
Denial Reason 1	1 - Debt-to-income ratio 2 - Employment history 3 - Credit history 4 - Collateral 5 - Insufficient cash (downpayment, closing cost) 6 - Unverifiable information 7 - Credit application incomplete 8 - Mortgage insurance denied 9 - Other
Denial Reason 2	Same as for denial reason 1
Denial Reason 3	Same as for denial reason 1
Edit Status	Blank - No edit failures 5 - Validity edit failure only 6 - Quality edit failure only 7 - Validity and quality edit failures
Sequence Number	One-up number scheme for each respondent to make each loan unique
Population	total population in tract
Minority Population	total tract population excluding whites
Minority Population Percentage	percentage of minority population to total population for tract
Median Income	Median family income in dollars for the tract
Tract to MA Income Percentage	Percentage of tract median family income compared to MA median family income
Number of Owner-Occupied Units	Number of dwellings, including individual condominiums, that are lived in by the owner
Number of 1-4 Family Units	Dwellings that are built to house fewer than 5 families

Table 9: Home Mortgage Disclosure Act
Required Data submission for 2004

Year of Data	Year of Submission
Respondent ID	10 Character Identifier
Agency Code	1 - Office of the Comptroller of the Currency
	2 - Federal Reserve System
	3 - Federal Deposit Insurance Corporation
	4 - Office of Thrift Supervision
	5 - National Credit Union Administration
	7 - Department of Housing and Urban Development
Loan Type	1 - Conventional
	2 - Federal Housing Administration insured
	3 - Veterans Administration guaranteed
	4 - Farm Service Agency or Rural Housing Service
Property Type	1 - One to four family
	2 - Manufactured Housing
	3 - Multifamily
Loan Purpose	1 - Home Purchase
	2 - Home Improvement
	3 - Refinancing
Occupancy	1 - Owner-occupied as a principal dwelling
	2 - Not Owner-occupied
	3 - Not Applicable
Loan Amount	In thousands of dollars
Preapproval	1 - Preapproval was requested
	2 - Preapproval was not requested
	3 - Not Applicable
Action Type	1 - Loan originated
	2 - Application approved but not accepted
	3 - Application denied by financial institution
	4 - Application withdrawn by applicant
	5 - File closed for incompleteness
	6 - Loan purchased by the institution
	7 - Preapproval request was denied
	8 - Preapproval request was approved but not accepted
MSA/MD	Metropolitan Statistical Area/Metropolitan Division
State Code	Two-digit FIPS state identifier
County Code	Three-digit FIPS county identifier
Tract	Census Tract Number
Ethnicity	1 - Hispanic or Latino
	2 - Not Hispanic or Latino
	3 - Information not provided by applicant in mail or telephone application
	4 - Not Applicable
	5 - No co-applicant

Table 9: (continued)

Applicant Race (up to 5 races may be provided)	1 - American Indian or Alaskan Native 2 - Asian 3 - Black or African American 4 - Native Hawaiian or Other Pacific Islander 5 - White 6 - Information not provided by applicant in mail or telephone application 7 - Not applicable 8 - No co-applicant
Co-Applicant Race	Same as for applicant race
Applicant Sex	1 - Male 2 - Female 3 - Information not provided by applicant in a mail or telephone application 4 - Not applicable 5 - No co-applicant
Co-Applicant Sex	Same as for applicant sex
Gross Annual Income	In thousands of dollars
Purchaser Type	0 - Loan was originated or was not sold in calendar year covered by register 1 - Federal National Mortgage Association 2 - Government National Mortgage Association 3 - Federal Home Loan Mortgage Corporation 4 - Federal Agricultural Mortgage Company 5 - Commercial bank 6 - Savings bank or savings association 7 - Life insurance company 8 - Affiliate institution 9 - Other type of purchaser
Denial Reason 1	1 - Debt-to-income ration 2 - Employment history 3 - Credit history 4 - Collateral 5 - Insufficient cash (downpayment, closing cost) 6 - Unverifiable information 7 - Credit application incomplete 8 - Mortgage insurance denied 9 - Other
Denial Reason 2	Same as for denial reason 1
Denial Reason 3	Same as for denial reason 1
Rate Spread	Interest rate spread on approved loans
HOEPA Status	Not Applicable 1 - HOEPA Loan 2 - Not a HOEPA Loan
Lien Staus	1 - Secured by a first lien 2 - Secured by a subordinate lien 3 - Not secured by a lien 4 - Not applicable (purchased loans)

Table 9: (continued)

Edit Status	Blank - No edit failures 5 - Validity edit failure only 6 - Quality edit failure only 7 - Validity and quality edit failures
Sequence Number	One-up number scheme for each respondent to make each loan unique
Population	Total population in tract
Minority Population Percentage	Percentage of minority population to total population for tract
Median Income	Median family income in dollars for the tract
Tract to MSA/MD Income Percentage	Percentage of tract median family income compared to MSA/MD median family income
Number of Owner-Occupied Units	Number of dwellings, including individual condominiums, that are lived in by the owner
Number of 1-4 Family Units	Dwellings that are built to house fewer than 5 families
Application Date Pre 2004 Flag	0 - No 1 - Yes 2 - Not Available

APPENDIX B

DESCRIPTION OF VARIABLES

Table 10: Description of Variables

<i>Dependent Variables</i>	Description
Issued	1 if action taken is 1
Denied	1 if action taken is 3
<i>Lender Variables</i>	
Wells Fargo	1 if respondent id is 1741 or 95-2318940
Countrywide	1 if respondent id is 1644643
First Interstate	1 if respondent id is 659855
Heritage	1 if respondent id is 34970
Stockman	1 if respondent id is 16191
Intermountain	1 if respondent id is 7069800005
OCC	1 if agency code is 1
FRS	1 if agency code is 2
FDIC	1 if agency code is 3
OTS	1 if agency code is 4
NCUA	1 if agency code is 5
HUD	1 if agency code is 7
<i>Loan Variables</i>	
Loan Amount	In ten thousand dollar increments
Loan to Income Ratio	Loan amount divided by income
Conventional	1 if loan type is 1
FHA	1 if loan type is 2
VA	1 if loan type is 3
FSA or RHA	1 if loan type is 4
<i>Applicant Variables</i>	
No Co-Applicant*	1 if co-applicant sex is code 5
Female	1 if sex is 2
Native	1 if applicant indicated Native as first race
Native Reservation	1 if Native1st is 1 and On Res is 1
Other Minority	1 if applicant indicated a non-native minority as first race
White Reservation	1 if Native1st and Otherminority1st are 0 and On Res is 1
Income	In ten thousand dollar increments
Income Squared	Applicant income * Applicant income
Not Owner Occupied	1 if owner occupied is 2
<i>Other Variables</i>	
Year 2004	1 if 2004
Manufactured*	1 if property type is 2

Table 10: (continued)

Location Variables

Population	Population / 1000
Minority Percentage	Percentage of minority population in the census tract
Median Unit Age	2003 or 2004 less median year built
Rural Unit Percentage	Rural Units / Total Units * 100
Vacant Percentage	Vacant Units / Total Units * 100
Fort Peck	1 if applicant is on Fort Peck Reservation
Fort Belknap	1 if applicant is on Fort Belknap Reservation
Rocky Boy	1 if applicant is on Rocky Boy Reservation
Blackfeet	1 if applicant is on Blackfeet Reservation
Flathead	1 if applicant is on Flathead Reservation
Crow	1 if applicant is on Crow Reservation
North Cheyenne	1 if applicant is on Northern Cheyenne Reservation
Billings	1 if applicant is in Billings area
Missoula	1 if applicant is in Missoula area
Great Falls	1 if applicant is in Great Falls area
Butte	1 if applicant is in Butte area
Bozeman	1 if applicant is in Bozeman area
Helena	1 if applicant is in Helena area
Kalispell	1 if applicant is in Kalispell area
District A	1 if applicant is in Com. Program District A but not in Metro area
District B	1 if applicant is in Com. Program District B but not in Metro area
District C	1 if applicant is in Com. Program District C but not in Metro area
District D	1 if applicant is in Com. Program District D but not in Metro area
District E	1 if applicant is in Com. Program District E but not in Metro area
Reservation	1 if applicant is located on 1 of the 7 reservations
Rural	Metro Area
Urban A	1 if applicant is in Billings, Bozeman, Kalispell, Missoula, or Helena
Urban B	1 if applicant is in Great Falls or Butte

* Indicates the variable is only available for 2004 observations.

APPENDIX C

EMPIRICAL MODELS WITH ISSUED AS THE DEPENDANT VARIABLE

Table 11: Probability of an Issued Loan: Combined Data Set

Variable	Logit				OLS	
	Regression 1		Regression 2		Regression 1	Regression 2
	co-eff	dy/dx	co-eff	dy/dx	co-eff	co-eff
Constant	0.7658 *** (4.80)		0.8735 *** (7.00)		0.7135 *** (29.79)	0.7192 *** (38.21)
<i>Loan Specific</i>						
Conventional Loan	-0.4796 *** (10.77)	-0.0610 *** (-12.03)	-0.4761 *** (-10.63)	-0.0605 *** (-11.82)	-0.0679 *** (-12.14)	-0.0681 *** (-12.07)
Loan Amount	0.0165 *** (5.09)	0.0023 *** (5.11)	0.0172 *** (5.21)	0.0024 *** (5.23)	0.0023 *** (6.40)	0.0024 *** (6.56)
Loan to Income Ratio	-0.0002 ** (-2.18)	0.0000 ** (-2.18)	-0.0002 ** (-2.12)	0.0000 ** (-2.12)	0.0000 *** (-2.65)	0.0000 *** (-2.63)
<i>Applicant Specific</i>						
Applicant Income	0.0096 *** (2.70)	0.0013 *** (2.70)	0.0099 *** (2.72)	0.0014 *** (2.72)	0.0007 ** (2.26)	0.0007 ** (2.31)
Income Squared	0.0000 * (-1.95)	0.0000 * (-1.95)	0.0000 * (-1.91)	0.0000 * (-1.91)	0.0000 *** (-4.59)	0.0000 *** (-4.60)
Native	-0.5701 *** (-4.32)	-0.0950 *** (-3.72)	-0.7092 *** (-6.44)	-0.1225 *** (-5.43)	-0.0969 *** (-3.90)	-0.1313 ** (-5.89)
Native-Reservation	-0.6069 *** (-2.66)	-0.1025 ** (-2.28)			-0.1769 *** (-3.55)	
Other Minority	-0.2596 ** (-2.33)	-0.0395 ** (-2.16)	-0.2645 ** (-2.36)	-0.0402 ** (-2.18)	-0.0402 ** (-2.17)	-0.0404 ** (-2.18)
White-Reservation	-0.0351 (-0.34)	-0.0050 (-0.33)			-0.0174 (-0.90)	
Female	-0.1208 *** (-3.69)	-0.0173 *** (-3.62)	-0.1229 *** (-3.75)	-0.0176 *** (-3.67)	-0.0191 *** (-3.71)	-0.0198 *** (-3.85)
Not Owner Occupied	0.3324 *** (6.92)	0.0431 *** (7.52)	0.3339 *** (6.91)	0.0432 *** (7.51)	0.0548 *** (8.29)	0.0547 *** (8.23)
<i>Location Specific</i>						
Population	0.0077 (1.02)	0.0011 (1.02)	0.0136 * (1.90)	0.0019 * (1.90)	0.0022 ** (1.99)	0.0030 *** (2.81)
Median Unit Age	-0.0035 ** (-2.20)	-0.0005 ** (-2.20)			-0.0006 ** (-2.34)	
Rural Unit Percent	-0.0023 *** (-3.79)	-0.0003 *** (-3.79)	-0.0018 *** (-3.17)	-0.0003 *** (-3.18)	-0.0004 *** (-3.69)	-0.0003 *** (-3.09)
Vacant Percent	-0.0051 *** (-2.97)	-0.0007 *** (-2.97)	-0.0064 *** (-3.69)	-0.0009 *** (-3.69)	-0.0008 *** (-2.78)	-0.0010 *** (-3.48)
Median Income Ratio	0.0076 *** (9.53)	0.0011 *** (9.54)	0.0076 *** (9.18)	0.0011 *** (9.17)	0.0010 *** (9.98)	0.0010 *** (9.88)
Year 2004	0.0153 (0.52)	0.0022 (0.52)	0.0127 (0.43)	0.0018 (0.43)	0.0018 (0.40)	0.0015 (0.34)
Urban A	0.2446 *** (4.92)	0.0332 *** (5.07)			0.0314 *** (4.31)	
Urban B	-0.0369 (-0.54)	-0.0052 (-0.54)			-0.0064 (-0.65)	
Reservation			-0.3685 *** (-3.43)	-0.0578 *** (-3.10)		-0.0653 *** (-3.31)
Missoula			-0.0126 (-0.18)	-0.0018 (-0.18)		0.0064 (0.64)

Table 11: (continued)

Variable	co-eff	dy/dx	co-eff	dy/dx	co-eff	co-eff
Great Falls			-0.2785 *** (-3.65)	-0.0421 *** (-3.41)		-0.0336 *** (-3.35)
Butte			-0.4685 *** (-4.36)	-0.0756 *** (-3.86)		0.0659 *** (-3.74)
Bozeman			-0.1409 (-1.54)	-0.0206 (-1.48)		-0.0121 (-1.03)
Helena			0.2626 * (1.90)	0.0338 ** (2.08)		0.0461 *** (2.93)
Kalispell			-0.1917 * (-1.75)	-0.0285 * (-1.66)		-0.0193 (-1.12)
District A			-0.2613 *** (-4.20)	-0.0382 *** (-4.05)		-0.0300 *** (-3.35)
District B			-0.1687 ** (-2.46)	-0.0245 ** (-2.38)		-0.0121 (-1.24)
District C			-0.3379 *** (-4.19)	-0.0520 *** (-3.85)		-0.0419 *** (-3.76)
District D			0.2383 (1.47)	0.0308 (1.59)		0.0501 ** (1.99)
District E			-0.3974 *** (-5.59)	-0.0616 *** (-5.13)		-0.0503 *** (-4.74)
<i>Lender Specific</i>						
Wells Fargo	0.1115 ** (2.17)	0.0153 ** (2.22)	0.1280 ** (2.45)	0.0174 ** (2.52)	0.0206 ** (2.36)	0.0240 *** (2.72)
Countrywide	0.1809 ** (2.32)	0.0241 ** (2.44)	0.1650 ** (2.09)	0.0221 ** (2.20)	0.0227 ** (2.49)	0.0193 ** (2.08)
First Interstate	0.5686 *** (6.62)	0.0679 *** (7.93)	0.5748 *** (6.69)	0.0684 *** (8.03)	0.0604 *** (7.04)	0.0613 *** (7.09)
Heritage	1.5532 *** (12.03)	0.1366 *** (21.54)	1.5477 *** (11.87)	0.1361 *** (21.12)	0.1652 *** (11.51)	0.1645 *** (11.26)
Stockman	0.5162 *** (4.68)	0.0615 *** (5.59)	0.5529 *** (4.94)	0.0650 *** (5.99)	0.0787 *** (4.79)	0.0844 *** (5.08)
Intermountain	4.1641 *** (10.94)	0.1856 *** (65.53)	4.1787 *** (10.97)	0.1854 *** (62.88)	0.2987 *** (44.87)	0.3018 *** (43.84)
OCC	-0.0573 (-0.70)	-0.0081 (-0.70)	-0.0629 (-0.77)	-0.0089 (-0.76)	-0.0077 (-0.54)	-0.0099 (-0.69)
FRS	0.4940 *** (5.51)	0.0642 *** (5.95)	0.5065 *** (5.63)	0.0656 *** (6.08)	-0.0745 *** (5.23)	0.0768 *** (5.37)
OTS	-0.2141 ** (-2.41)	-0.0319 ** (-2.27)	-0.2122 ** (-2.38)	-0.0315 ** (-2.24)	-0.0355 ** (-2.24)	-0.0357 ** (-2.25)
NCUA	0.9062 *** (4.92)	0.0936 *** (7.09)	0.9199 *** (4.96)	0.0944 *** (7.21)	0.1244 *** (5.96)	0.1267 *** (6.03)
HUD	-0.4815 *** (-6.20)	-0.0733 *** (-5.74)	-0.4859 *** (-6.25)	-0.0740 *** (-5.78)	-0.0955 *** (-6.85)	-0.0967 *** (-6.93)
% correctly Predicted R ²	79.91%		79.99%		0.0773	0.0781
Number of Obs.	31,789		31,789		31,789	31,789

Numbers in parentheses are t stats for OLS and z stats for Logit. All models use robust standard errors.

* indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.

Table 12: Probability of an Issued Loan: 2003 Data Set

Variable	Logit				OLS	
	Regression 1		Regression 2		Regression 1	Regression 2
	co-eff	dy/dx	co-eff	dy/dx	co-eff	co-eff
Constant	0.4827 ** (2.02)		0.4859 *** (2.58)		0.6589 *** (17.58)	0.6493 *** (21.04)
<i>Loan Specific</i>						
Conventional Loan	-0.4813 *** (-7.59)	-0.0622 *** (-8.45)	-0.4760 *** (-7.49)	-0.0614 *** (-8.28)	-0.0695 *** (-8.63)	-0.0696 *** (-8.60)
Loan Amount	0.0208 *** (3.48)	0.0029 *** (3.51)	0.0218 *** (3.59)	0.0031 *** (3.62)	0.0027 *** (4.38)	0.0028 *** (4.50)
Loan to Income Ratio	-0.0005 *** (-2.86)	-0.0001 *** (-2.86)	-0.0005 *** (-2.92)	-0.0001 *** (-2.92)	-0.0001 *** (-4.35)	-0.0001 *** (-4.57)
<i>Applicant Specific</i>						
Applicant Income	0.0128 ** (2.35)	0.0018 ** (2.35)	0.0127 ** (2.28)	0.0018 ** (2.28)	0.0016 *** (2.69)	0.0017 *** (2.67)
Income Squared	-0.0001 *** (-3.21)	0.0000 *** (-3.21)	-0.0001 *** (-3.10)	0.0000 *** (-3.10)	0.0000 *** (-3.21)	0.0000 *** (-3.18)
Native	-0.7360 *** (-3.64)	-0.1291 *** (-3.06)	-0.7453 *** (-4.51)	-0.1307 *** (-3.79)	-0.1237 *** (-3.18)	-0.1383 *** (-4.16)
Native-Reservation	-0.1104 (-0.35)	-0.0162 (-0.34)			-0.0870 (-1.28)	
Other Minority	-0.2373 (-1.58)	-0.0361 (-1.47)	-0.2531 * (-1.67)	-0.0386 (-1.55)	-0.0381 (-1.58)	-0.0392 (-1.61)
White-Reservation	-0.0613 (-0.41)	-0.0088 (-0.40)			-0.0262 (-0.90)	
Female	-0.1182 ** (-2.42)	-0.0170 ** (-2.37)	-0.1262 *** (-2.57)	-0.0181 ** (-2.52)	-0.0183 ** (-2.41)	-0.0202 *** (-2.66)
Not Owner Occupied	0.4054 *** (5.37)	0.0520 *** (5.98)	0.3861 *** (5.07)	0.0496 *** (5.62)	0.0626 *** (6.23)	0.0593 *** (5.86)
<i>Location Specific</i>						
Population	0.0002 (0.02)	0.0000 (0.02)	0.0091 (0.84)	0.0013 (0.84)	0.0010 (0.62)	0.0020 (1.26)
Median Unit Age	-0.0066 *** (-2.78)	-0.0009 *** (-2.78)			-0.0010 *** (-2.78)	
Rural Unit Percent	-0.0028 *** (-3.05)	-0.0004 *** (-3.06)	-0.0019 ** (-2.20)	-0.0003 ** (-2.20)	-0.0004 *** (-3.05)	-0.0003 ** (-2.28)
Vacant Percent	-0.0094 *** (-3.66)	-0.0013 *** (-3.66)	-0.0118 *** (-4.55)	-0.0017 *** (-4.56)	-0.0016 *** (-3.47)	-0.0020 *** (-4.31)
Median Income Ratio	0.0085 *** (7.10)	0.0012 *** (7.11)	0.0077 *** (6.27)	0.0011 *** (6.27)	0.0011 *** (7.31)	0.0010 *** (6.64)
Urban A	0.1983 *** (2.65)	0.0273 *** (2.72)			0.0225 ** (2.11)	
Urban B	0.0482 (0.45)	0.0067 (0.45)			0.0037 (0.25)	
Reservation			-0.2581 * (-1.65)	-0.0394 (-1.53)		-0.0537 * (-1.85)
Missoula			-0.0296 (-0.29)	-0.0042 (-0.29)		0.0009 (0.06)

Table 12: (continued)

Variable	co-eff	dy/dx	co-eff	dy/dx	co-eff	co-eff
Great Falls			-0.1182 (-1.01)	-0.0172 (-0.98)		-0.0145 (-0.98)
Butte			-0.4563 *** (-2.65)	-0.0739 ** (-2.35)		-0.0633 ** (-2.31)
Bozeman			0.0114 (0.08)	0.0016 (0.08)		0.0025 (0.14)
Helena			0.6581 *** (2.97)	0.0747 *** (3.79)		0.0871 *** (4.23)
Kalispell			-0.3106 * (-1.92)	-0.0482 * (-1.76)		-0.0442 (-1.60)
District A			-0.1778 ** (-1.96)	-0.0258 * (-1.91)		-0.0180 (-1.38)
District B			0.0475 (0.45)	0.0066 (0.46)		0.0189 (1.31)
District C			-0.3126 *** (-2.63)	-0.0481 ** (-2.44)		-0.0373 ** (-2.30)
District D			0.1657 (0.70)	0.0221 (0.74)		0.0363 (0.95)
District E			-0.3966 *** (-3.87)	-0.0618 *** (-3.57)		-0.0546 *** (-3.52)
<i>Lender Specific</i>						
Wells Fargo	0.5002 *** (6.55)	0.0633 *** (7.38)	0.5343 *** (6.86)	0.0669 *** (7.76)	0.0887 *** (6.78)	0.0947 *** (7.19)
Countrywide	0.1051 (0.94)	0.0144 (0.97)	0.0702 (0.62)	0.0097 (0.63)	0.0125 (0.96)	0.0065 (0.49)
First Interstate	0.4282 *** (3.75)	0.0539 *** (4.26)	0.4522 *** (3.93)	0.0564 *** (4.50)	0.0455 *** (3.90)	0.0485 *** (4.13)
Heritage	1.9105 *** (10.28)	0.1557 *** (20.64)	1.8885 *** (10.09)	0.1543 *** (19.77)	0.2359 *** (9.40)	0.2330 *** (9.17)
Stockman	0.7971 *** (4.93)	0.0878 *** (6.57)	0.8630 *** (5.23)	0.0928 *** (7.13)	0.1383 *** (4.94)	0.1487 *** (5.25)
Intermountain	3.1332 *** (6.90)	0.1692 *** (30.66)	3.1511 *** (6.93)	0.1688 *** (29.95)	0.2914 *** (22.70)	0.2935 *** (22.64)
OCC	0.1196 (0.97)	0.0166 (0.98)	0.0883 (0.71)	0.0123 (0.72)	0.0261 (1.03)	0.0195 (0.77)
FRS	0.9301 *** (7.08)	0.1174 *** (7.91)	0.9344 *** (7.06)	0.1176 *** (7.85)	0.1551 *** (6.32)	0.1559 *** (6.33)
OTS	0.3504 ** (2.51)	0.0447 *** (2.80)	0.3415 ** (2.44)	0.0436 *** (2.72)	0.0711 *** (2.62)	0.0694 ** (2.55)
NCUA	1.3372 *** (4.81)	0.1207 *** (8.57)	1.3550 *** (4.85)	0.1212 *** (8.70)	0.2027 *** (6.15)	0.2056 *** (6.22)
HUD	-0.0718 (-0.60)	-0.0103 (-0.59)	-0.0874 (-0.73)	-0.0125 (-0.71)	-0.0149 (-0.60)	-0.0175 (-0.70)
% correctly Predicted R ²	80.55%		80.71%		0.0825	0.0853
Number of Obs.	14,394		14,394		14,394	14,394

Numbers in parentheses are t stats for OLS and z stats for Logit. All models use robust standard errors.

* indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.

Table 13: Probability of an Issued Loan: 2004 Data Set

Variable	Logit				OLS	
	Regression 1		Regression 2		Regression 1	Regression 2
	co-eff	dy/dx	co-eff	dy/dx	co-eff	co-eff
Constant	0.9409 *** (4.41)		1.1669 *** (7.13)		0.7367 *** (23.74)	0.7591 *** (33.11)
<i>Loan Specific</i>						
Conventional Loan	-0.4699 *** (-7.44)	-0.0574 *** (-8.30)	-0.4638 *** (-7.28)	-0.0566 *** (-8.07)	-0.0649 *** (-8.35)	-0.0647 *** (-8.24)
Loan Amount	0.0129 *** (3.52)	0.0017 *** (3.53)	0.0135 *** (3.64)	0.0018 *** (3.65)	0.0018 *** (4.12)	0.0018 *** (4.25)
Loan to Income Ratio	-0.0001 (-1.53)	0.0000 (-1.53)	-0.0001 (-1.49)	0.0000 (-1.49)	0.0000 (-1.25)	0.0000 (-1.20)
<i>Applicant Specific</i>						
Applicant Income	0.0106 ** (2.37)	0.0014 ** (2.37)	0.0110 ** (2.46)	0.0015 ** (2.46)	0.0010 ** (2.46)	0.0010 ** (2.55)
Income Squared	0.0000 *** (-2.88)	0.0000 *** (-2.88)	0.0000 *** (-2.99)	0.0000 *** (-2.99)	0.0000 *** (-4.94)	0.0000 *** (-5.02)
Native	-0.4707 *** (-2.71)	-0.0739 ** (-2.38)	-0.6726 *** (-4.51)	-0.1118 *** (-3.80)	-0.0795 ** (-2.48)	-0.1222 *** (-4.10)
Native-Reservation	-1.0975 *** (-3.06)	-0.2042 ** (-2.46)			-0.2658 *** (-3.61)	
Other Minority	-0.2731 (-1.61)	-0.0404 (-1.48)	-0.2697 (-1.59)	-0.0398 (-1.46)	-0.0413 (-1.43)	-0.0407 (-1.41)
White-Reservation	-0.0148 (-0.10)	-0.0020 (-0.10)			-0.0104 (-0.40)	
Female	-0.1118 ** (-2.53)	-0.0154 ** (-2.48)	-0.1079 ** (-2.43)	-0.0148 ** (-2.39)	-0.0176 ** (-2.54)	-0.0174 ** (-2.51)
Not Owner Occupied	0.2597 *** (4.16)	0.0331 *** (4.41)	0.2731 *** (4.35)	0.0346 *** (4.63)	0.0440 *** (5.01)	0.0460 *** (5.21)
<i>Location Specific</i>						
Population	0.0148 (1.47)	0.0020 (1.47)	0.0183 ** (1.93)	0.0025 * (1.93)	0.0033 ** (2.20)	0.0039 *** (2.73)
Median Unit Age	-0.0009 (-0.41)	-0.0001 (-0.41)			-0.0002 (-0.54)	
Rural Unit Percent	-0.0019 ** (-2.34)	-0.0003 ** (-2.34)	-0.0018 ** (-2.39)	-0.0002 ** (-2.39)	-0.0003 ** (-2.24)	-0.0003 ** (-2.26)
Vacant Percent	-0.0014 (-0.63)	-0.0002 (-0.63)	-0.0020 (-0.85)	-0.0003 (-0.85)	-0.0002 (-0.51)	-0.0003 (-0.73)
Median Income Ratio	0.0069 *** (6.36)	0.0009 *** (6.33)	0.0072 *** (6.48)	0.0010 *** (6.44)	0.0009 *** (6.72)	0.0010 *** (7.08)
Urban A	0.2932 *** (4.38)	0.0382 *** (4.54)			0.0393 *** (3.94)	
Urban B	-0.0995 (-1.12)	-0.0139 (-1.10)			-0.0151 (-1.11)	
Reservation			-0.4435 *** (-2.96)	-0.0689 *** (-2.63)		-0.0709 *** (-2.65)
Missoula			0.0134 (0.13)	0.0018 (0.13)		0.0123 (0.90)

Table 13: (continued)

Variable	co-eff	dy/dx	co-eff	dy/dx	co-eff	co-eff
Great Falls			-0.4052 *** (-3.98)	-0.0615 *** (-3.61)		-0.0496 *** (-3.62)
Butte			-0.5026 *** (-3.61)	-0.0794 *** (-3.17)		-0.0694 *** (-3.01)
Bozeman			-0.2515 ** (-2.12)	-0.0367 ** (-1.98)		-0.0257 (-1.61)
Helena			0.0188 (0.10)	0.0025 (0.10)		0.0172 (0.73)
Kalispell			-0.0972 (-0.65)	-0.0136 (-0.63)		-0.0021 (-0.10)
District A			-0.3312 *** (-3.84)	-0.0474 *** (-3.67)		-0.0395 *** (-3.20)
District B			-0.3223 *** (-3.48)	-0.0467 *** (-3.29)		-0.0352 *** (-2.67)
District C			-0.3539 *** (-3.21)	-0.0530 *** (-2.93)		-0.0437 *** (-2.84)
District D			0.3281 (1.47)	0.0397 * (1.65)		0.0672 ** (2.03)
District E			-0.3863 *** (-3.91)	-0.0578 *** (-3.59)		-0.0444 *** (-3.07)
<i>Lender Specific</i>						
Wells Fargo	-0.2132 *** (-3.04)	-0.0303 *** (-2.89)	-0.2158 *** (-3.03)	-0.0307 *** (-2.89)	-0.0353 *** (-3.01)	-0.0354 *** (-2.98)
Countrywide	0.2521 ** (2.28)	0.0318 ** (2.45)	0.2646 ** (2.35)	0.0332 ** (2.55)	0.0320 ** (2.44)	0.0328 ** (2.44)
First Interstate	0.7252 *** (5.56)	0.0792 *** (7.04)	0.7217 *** (5.56)	0.0787 *** (7.04)	0.0758 *** (5.96)	0.0759 *** (5.90)
Heritage	1.3120 *** (7.18)	0.1180 *** (11.55)	1.3105 *** (7.08)	0.1177 *** (11.37)	0.1243 *** (7.17)	0.1238 *** (6.98)
Stockman	0.3630 ** (2.36)	0.0438 *** (2.67)	0.3802 ** (2.45)	0.0455 *** (2.79)	0.0494 ** (2.45)	0.0518 ** (2.54)
Intermountain	5.1239 *** (7.23)	0.1949 *** (54.68)	5.1269 *** (7.23)	0.1946 *** (50.15)	0.3026 *** (36.74)	0.3047 *** (34.89)
OCC	-0.1439 (-1.30)	-0.0199 (-1.27)	-0.1347 (-1.21)	-0.0186 (-1.19)	-0.0204 (-1.21)	-0.0196 (-1.16)
FRS	0.1825 (1.46)	0.0239 (1.50)	0.1876 (1.49)	0.0245 (1.54)	0.0253 (1.43)	0.0265 (1.49)
OTS	-0.5887 *** (-5.02)	-0.0938 *** (-4.35)	-0.5759 *** (-4.90)	-0.0913 *** (-4.25)	0.1002 *** (-5.16)	-0.0987 *** (-5.07)
NCUA	0.5859 ** (2.37)	0.0650 *** (2.97)	0.5925 ** (2.39)	0.0654 *** (3.00)	0.0760 *** (2.76)	0.0767 *** (2.77)
HUD	-0.7566 *** (-7.28)	-0.1150 *** (-6.51)	-0.7569 *** (-7.29)	-0.1149 *** (-6.50)	-0.1424 *** (-8.59)	-0.1430 *** (-8.63)
% correctly Predicted R ²	79.55%		79.55%		0.0801	0.0804
Number of Obs.	17,395		17,395		17,395	17,395

Numbers in parentheses are t stats for OLS and z stats for Logit. All models use robust standard errors.

* indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.

Table 14: Probability of an Issued Loan: 2004 Data Set

Variable	Logit		OLS
	Regression 3 co-eff	dy/dx	Regression 3 co-eff
Constant	1.7162 *** (7.72)		0.8465 *** (27.40)
<i>Loan Specific</i>			
Manufactured	-1.4504 *** (-23.00)	-0.2722 *** (-18.13)	-0.2887 *** (-21.81)
Conventional Loan	-0.4863 *** (-7.32)	-0.0578 *** (-8.23)	-0.0671 *** (-8.53)
Loan Amount	0.0011 (0.33)	0.0001 (0.33)	0.0003 (0.62)
Loan to Income Ratio	-0.0001 * (-1.75)	0.0000 * (-1.75)	0.0000 (-1.37)
<i>Applicant Specific</i>			
Applicant Income	0.0073 ** (2.06)	0.0010 ** (2.06)	0.0009 ** (2.44)
Income Squared	0.0000 *** (-2.88)	0.0000 *** (-2.88)	0.0000 *** (-4.38)
Native	-0.4184 ** (-2.35)	-0.0634 ** (-2.08)	-0.0689 ** (-2.25)
Native-Reservation	-0.8954 ** (-2.34)	-0.1561 * (-1.90)	-0.1865 *** (-2.71)
Other Minority	-0.2530 (-1.42)	-0.0364 (-1.31)	-0.0368 (-1.26)
White-Reservation	-0.0284 (-0.20)	-0.0038 (-0.19)	-0.0124 (-0.50)
Female	-0.0405 (-0.87)	-0.0054 (-0.86)	-0.0045 (-0.63)
Not Owner Occupied	0.2153 *** (3.45)	0.0271 *** (3.62)	0.0338 *** (3.89)
No Co-applicant	-0.2294 *** (-5.36)	-0.0307 *** (-5.28)	-0.0337 *** (-5.25)
<i>Location Specific</i>			
Population	0.0135 (1.31)	0.0018 (1.31)	0.0029 ** (1.96)
Median Unit Age	-0.0049 ** (-2.23)	-0.0006 ** (-2.23)	-0.0007 ** (-2.17)
Rural Unit Percent	-0.0007 (-0.90)	-0.0001 (-0.90)	-0.0001 (-0.60)
Vacant Percent	-0.0026 (-1.13)	-0.0004 (-1.13)	-0.0004 (-1.13)
Median Income Ratio	0.0053 *** (4.92)	0.0007 *** (4.91)	0.0006 *** (4.83)
Urban A	0.3025 *** (4.49)	0.0384 *** (4.65)	0.0384 *** (3.94)
Urban B	-0.1509 * (-1.68)	-0.0208 (-1.61)	-0.0234 * (-1.74)

Table 14: (continued)

Variable	co-eff	dy/dx	co-eff
<i>Lender Specific</i>			
Wells Fargo	-0.1929 *** (-2.67)	-0.0267 ** (-2.55)	-0.0315 *** (-2.71)
Countrywide	0.2539 ** (2.23)	0.0313 ** (2.41)	0.0316 ** (2.41)
First Interstate	0.7689 *** (5.79)	0.0809 *** (7.44)	0.0790 *** (6.26)
Heritage	1.2661 *** (6.68)	0.1126 *** (10.61)	0.1126 *** (6.42)
Stockman	0.3806 ** (2.38)	0.0446 *** (2.71)	0.0498 ** (2.48)
Intermountain	5.0489 *** (7.11)	0.1892 *** (52.85)	0.2787 *** (33.50)
OCC	-0.2559 ** (-2.18)	-0.0352 ** (-2.10)	-0.0354 ** (-2.10)
FRS	0.0583 (0.44)	0.0076 (0.45)	0.0070 (0.40)
OTS	-0.7607 *** (-6.16)	-0.1241 *** (-5.17)	-0.1230 *** (-6.31)
NCUA	0.4738 * (1.86)	0.0533 ** (2.22)	0.0563 ** (2.05)
HUD	-0.8011 *** (-7.27)	-0.1201 *** (-6.46)	-0.1407 *** (-8.52)
% correctly Predicted	80.99%		
R ²			0.1155
Number of Obs.	17,395		17,395

Numbers in parentheses are t statistics for OLS and z statistics for Logit.

All models use robust standard errors

* indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.