

# **Racial Disparities in Home Mortgage Lending Practices Before, During, and After the Financial Crisis of 2008**

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## **ABSTRACT**

America remains marred by inequality as major discrepancies persist in access to opportunity largely on the basis of race. Unequal lending practices have both excluded and exploited predominantly minority communities. This study aims to assess the prevalence of biased home mortgage lending practices through a case study of lending practices in Denver, Colorado. Using HMDA data from 2007-2013, this study examines the extent of lending discrepancies and how they have changed across varying financial and regulatory conditions stemming from the build up to and fall out from the financial crisis of 2008. The results of this study suggest minority applicants are denied loans and receive subprime loans at higher rates than white applicants. Furthermore, applications for loans in predominantly minority neighborhoods are subjected to greater rates of loan denial and subprime loans than majority white neighborhoods. In addition, white applicants were the main beneficiaries of the low home purchase prices following the financial collapse. The consequences and significance of these racial discrepancies are discussed.

## **INTRODUCTION**

Purchasing a home is an important investment many Americans, regardless of financial standing, choose to participate in. While trillions of dollars in loans are applied for annually, the home mortgage lending market has historically been mostly unregulated by the government under the assumption that market forces will prevent imbalanced practices. However, the practice of evaluating risk is an incredibly subjective one, and as a result prejudiced tendencies have occurred.

The biases are presented in many forms, including higher denial or interest rates, and occur for countless reasons. However, some of the most common and noteworthy reasons for lending bias are related to race. Specifically, an applicant's race and the prevailing racial composition of the area in which the home purchase loan is applied for. Moreover, if racially biased lending is happening regularly, then the recipients of higher loan denial and interest rates are most likely being targeted. Neighborhoods in which loans are denied at higher rates are largely excluded from accessing credit in a process known as redlining. Redlined neighborhoods and communities suffer from higher rates of loan application denial, thus limiting the amount of homeowners and community investment. Reverse redlining, another exploitive practice, involves lending institutions exploiting traditionally redlined neighborhoods for loans with higher interest rates. These individuals have conventionally been denied access to credit and have thus missed opportunities to accumulate wealth. Therefore, reverse redlining explicitly exploits those who were disadvantaged by previous practices.

The effects of redlining and reverse redlining on both individuals and communities are immense. Communities excluded from access to credit, or subjected to increased levels of subprime loans, often have lower levels of community investment, higher rates of foreclosure,

and subsequently suffer from increased crime and decreased tax revenues (Warren 2004; Atlas, Dreier, Squires 2008; Immergluck 2008). Perhaps most troubling about the exploitation of borrowers by lenders is the racial discrepancies in regards to whom is exploited. Previous studies have found considerable evidence to suggest African American and Hispanic applicants and communities are the main targets of these exploitive practices (Munnell, Tootel, Browne, McEaney 1996; Ladd 1998; Warren 2004; Shlay 2005; Faber 2013; Rugh, Albright, Massey 2015). These practices unevenly create considerable community level issues which further perpetuate racial inequality. Moreover, the combination of unequal lending practices and America's constantly fluctuating financial standing has the potential to further propagate inequality.

This study aims to assess whether, and to what degree, racially biased lending is evident in the Denver metropolitan area through a statistical analysis of lending patterns. Moreover, by utilizing a temporal approach to the study by encompassing data from 2007 until 2013, lending discrepancies can be compared across time to highlight potential connections between lending inequity and the strength of financial markets.

## LITERATURE REVIEW

### *The Evolution of Institutionalized Discrimination*

Race has been a determining factor in access to resources since America's conception. Minority individuals and communities have been subjected in both social and institutionalized manners to a perpetual cycle of discrimination and unequal opportunity. One way this cycle of inequality has been perpetuated historically, as well as recently, is through inequitable access to credit and homeownership. Much of the differences stem from unequal access to quality loans (Calem, Hershaff, and Wachter 2004; Warren 2004; Oliver 2008). Since homeownership is a major way to accumulate wealth, those who do not own a home are missing a major portion of their wealth portfolio (Terall 1967; Oliver and Shapiro 1995; Aizcorbe, Kennickell, and Moore 2003; Warren 2004; Shlay 2005; Shapiro, Meshede, and Osoro 2013). There are many applicant and neighborhood level factors, in addition to historic factors, which contribute to the lower rates of homeownership among African Americans and Hispanics compared to whites (Ehrenreich and Muhummad 2009; Rugh et al. 2015). However, Hispanics and African Americans have also been the targets of many systematic and institutionalized discriminatory lending practices (Calem et al. 2004; Warren 2004; Anderson 2010; Coates 2014).

From the very start, racial discrimination was present and significant among lending institutions. The Federal Government created the Federal Housing Administration (FHA) as a part of the National Housing Act of 1934 in an attempt to improve and stabilize the mortgage market through a home financing system of private mortgages (Coates 2014). Indeed the practices of the FHA benefited prospective homeowners as the FHA insured private mortgages, which caused a drop in both interest rates and the size of the down payment necessary to buy a (Coates 2014). However, the practices also systematically discriminated against African Americans while privileging white homeowners. The FHA created a system of rating, and subsequently ranking, neighborhoods based off the soundness of an investment in them (Coates 2014). This government-sponsored organization became the first to utilize redlining as African Americans were treated as a contagion, and thus neighborhoods with more African American inhabitants were viewed as less sound investments (Shlay 2005; Coates 2014). Redlining practices essentially excluded entire neighborhoods from access to credit and thus many African Americans who had the aspirations and means to afford a home were often unable to and instead

confined to inexpensive and undesirable communities (Coates 2014). Moreover, since they were often excluded from loans, African American homes and communities deteriorated and declined in value, especially compared to communities deemed desirable by the FHA appraisers, therefore further perpetuating the cycle of redlining (Warren 2004; Coates 2014). Although not explicitly outlawed until 1968, the damaging effects of redlining had formed the foundations of the wealth gap today (Oliver and Shapiro 1995; Shapiro et al. 2013; Coates 2014).

As a result of their exclusion from FHA backed loans, African Americans in the 1930s became targets for more predatory forms of lending. One of the original predatory lending practices was buying “on contract,” a practice which gives the purchaser all of the responsibilities of homeownership with all of the disadvantages of renting (Coates 2014). This practice was specifically targeted at the traditionally underserved, with estimates that 85% of all African American homeowners in Chicago between 1930 and 1960 bought “on contract” (Coates 2014). Historical discrimination, such as the decades of exclusion from traditional forms of credit through institutionalized discriminatory practices such as redlining, positioned minorities as a relatively untapped market for lenders and thus the obvious targets for current biased lending practices (Shlay 2005; Lacy 2012). The modern day version of the exploitive practice of buying “on contract” is receiving a similarly predatory subprime loan.

#### *Subprime Lending*

Subprime loans are idealistically intended to provide homeownership opportunities to new-homeowners who may not qualify for more traditional loans while duly compensating lenders for taking on greater risks (Sichelman 2001; Warren 2004; Atlas et al. 2008; Coates 2014). Although lenders do assume more risks in subprime loans, predatory lending practices are exceptionally profitable and thus attractive for lenders as the rates of interest accrued are in excess of the risks (Sichelman 2001; Warren 2004). As a result, lenders often attempt to prescribe subprime loans to applicants who would have qualified for reasonable, prime loans (Warren 2004). Some studies have found that between 40% and 50% of applicants issued subprime loans would have qualified for prime-rate loans (Sichelman 2001; Carr and Kolluri 2001). Moreover, since its beginning in the 1980s until the financial crisis of 2008, subprime lending developed into a prominent segment of the residential mortgage market (Calem et al. 2004).

Lenders are often able to convince qualified candidates to accept a subprime loan because of the case-by-case discretion lenders possess (Munnell et al. 1996). Since most applicants are not perfect, as they frequently fail to meet at least one of the standards set by the secondary market, lenders are able to determine the extent to which other factors compensate for the applicants shortcomings (Munnell et al. 1996). The discretion appointed to lenders allows for many factors, such as an applicant’s race, to subtly influence the subjective measure of an applicant’s creditworthiness and the subsequent conditions of the assigned loan (Carr and Megbolugbe 1993). Also, predatory lenders have been caught utilizing various abusive practices which target populations least likely to be able to carry out the terms of the agreement (Atlas et al. 2008). One practice, sometimes referred to as “Loan to Own,” involves banks issuing loans they anticipate to be eventually foreclosed on, which although devastating for the borrower can be very profitable for the lender (Warren, 2004). Additionally, subprime lenders are not fiscally incentivized to act in the best interest of the borrower and in some cases may have been incentivized to market unaffordable loans to less savvy applicants (Gramlich 2007; Satter 2009; Faber 2013). For instance, major banks, such as Wells Fargo and Bank of America, have been

convicted in court of systematic, discriminatory lending practices, such as targeting minorities for predatory loans (Coates 2014).

The large number of subprime loans allotted frequently to minority applicants and communities perpetuates cyclical discrimination as the conditions of the loans are in excess of the risk and therefore almost impossible for borrowers to successfully payoff (Carr and Megbolugbe 1993; Munnell et al. 1996; Ladd 1998; Calem et al. 2004; Warren 2004; Shlay 2005; Boehm, Thistle and Schlottmann 2006; Oliver 2008; Faber 2013; Shapiro et al. 2013; Rugh et al. 2015). African Americans are disproportionately more likely to receive higher risk and cost loans, which ultimately lowers their disposable income and wealth, and makes them a greater risk for foreclosure and home repossession (Rugh et al. 2015). Moreover, previous studies have found that an applicant's race remains influential in the lending decision process even after controlling for applicant, loan, and neighborhood characteristics, thus indicating the presence of racially targeted lending practices (Carr and Megbolugbe 1993; Munnell et al. 1996; Calem, Herschaff, and Wachter 2010). Furthermore, according to the 2008 report by the research and advocacy group United for a Fair Economy, African Americans lost between \$71 and \$93 billion dollars in home value wealth because of the negative effects of subprime loans, such as increased fees and rates of foreclosure, between 1998 and 2006 (Gramlich 2007; Rivera, Cotto-Escalera, Desai, Huezo, and Muhammad 2008; Faber 2013). The serial displacement of wealth through racialized and institutionalized lending practices and policies undermines hard earned education and job advances among both minority individuals and communities towards equality (Oliver 2008; Rugh et al. 2015).

Despite the overwhelming evidence suggesting that subprime loans exploit vulnerable populations for the benefit of lenders, justification on behalf of subprime lenders does exist. A difference in lending rates cannot be assumed to be discriminatory unless it can be proven that loans to minorities are not more risky than loans to whites, when holding all other applicant level characteristics constant (Brimelow and Spencer 1993). Therefore, discrepancies in lending rates along racial lines could potentially be a reflection of the perceived profitability of loans to applicants of certain races (Ladd 1998). Ladd (1998) further suggest that if applicants of all races were equally qualified candidates other lenders would capitalize on the excluded groups of applicants in the competitive market and prescribe them complete loans. However, discrepancies in rates of loan denial and subprime loans remain present, suggesting that there are either differences in applicant qualifications across race or that discrimination is very widespread. While this theory may begin to explain why rates of lending are different to applicants of different races, it does not clarify why minorities receive subprime loans significantly more than their white peers. Another counterargument against claims of discriminatory practices is that the HMDA dataset does not include enough of the information lenders utilize in the decision making process and thus some of the difference in rates of lending to minorities can be explained by the missing pieces of data rather than discrimination (Munnell et al. 1996). Moreover, on average, minority applicants have weaker credit histories, less wealth, and higher loan-to-value ratios than the average white applicant, and thus these discrepancies in applicant characteristics account for a sizable percentage of the disparities in denial rates (Munnell et al. 1996). But, even after controlling for property and personal characteristics, an economically and statistically significant difference in lending rates for white and minority applicants remains (Carr and Megbolugbe 1993; Munnell et al. 1996).

While there are factors unaccounted for by the HMDA data, which may overstate the effects of race on lending, there are also factors that understate the role of race in lending. For

example, minorities may have experienced discrimination in their lives leading up to their loan application, such as in education or labor markets, which may have resulted in lower incomes, and therefore predisposes them to higher loan-to-value ratios or poorer credit histories (Munnell et al. 1996). Also, differential treatment may occur at any stage during the lending process, such as applicants being discouraged from applying because of the prescreening process or anticipating their application may be denied (Maddala and Trost 1982; Munnell et al. 1996; Horne 1997). Similarly, African Americans and Hispanics may be discouraged for a multitude of social, economic, or cultural reasons from moving into neighborhoods that are predominately white, and thus may limit their search only to neighborhoods that have higher minority populations and subsequently higher rates of loan denial and subprime loans (Munnell et al. 1996). All of these effects are difficult, if not impossible, to account for in a regression to understand the influence of race in mortgage lending, and thus understate the effect of race on lending rates.

#### *Spatial Effects of Unequal Lending*

Inequality is further drawn along racial lines because of the influence of neighborhood and spatial patterning of lending practices. Many African Americans and Hispanics are relegated to predominately minority neighborhoods because of lending practices which makes receiving financial support to move into majority white neighborhoods very difficult (Holloway 1998). The discrimination has shifted since the FHA's inception, with a systematic shift from declining loans to entire communities of minorities to also targeting minority neighborhoods for loans with excessive risks and costs, a process referred to as reverse redlining (Oliver 2008). Redlining, reverse redlining, and predatory lending destabilize and devastate entire communities by undermining both neighborhood and individual level revitalization and economic prosperity (Calem et al. 2004).

When homeowners, a select population with enough financial stability to purchase a home, are compared, the rates of bankruptcy for African Americans are five times those of whites (Warren 2004). These higher rates of foreclosure among African Americans suggest the financial stresses associated with homeownership are significantly more damaging for African Americans than whites. The increased financial stresses are most likely linked to lower rates of wealth among minorities and higher rates of subprime loans (Munnell et al. 1996; Aizcorbe et al. 2003; Warren 2004; Faber 2013). However, even African American borrowers of higher socioeconomic status also suffer from systematic lending discrimination as higher socioeconomic status has been shown in some studies to exacerbate the loss of income and wealth (Faber 2013; Rugh et al. 2015). Foreclosures, the outcome of loans with unmanageable interest rates, are very detrimental for neighborhoods because as the rate of foreclosures increases, so do crime rates (Immergluck 2008). As a result, aesthetics plummet, as do property values, and subsequently local property tax revenues (Immergluck 2008). The spatial locations of these subprime loans and the subsequent foreclosures are concentrated heavily in low-to-moderate income neighborhood, especially those with higher rates of minorities (Bocian, Li, and Ernst 2010). According to one study, African Americans and Hispanics were almost twice as likely as white homeowners to have lost their home to foreclosure between 2007 and 2009 (Bocian et al. 2010). Moreover, the damaging effects of foreclosures in predominantly minority neighborhoods depreciate millions of dollars from nearby properties (Bocian et al. 2010).

Communities with high rates of minorities and poverty are often seen as risky investments for lenders, but the lack of lending in these areas is one of the many factors which contribute to the financial stagnation and growing inequality of these communities (White 2015).

Victims of these discriminatory practices consider them crimes against their communities because without investment, these neighborhoods are often without opportunity (Coates 2014; White 2015).

#### *Unequal Lending and the Discrepancies in Homeownership*

The result of discrepancies in access to credit, wealth, income, education, esteem, and a host of other factors have created significant differences in homeownership rates in America. According to a study of the 2006 HMDA data by Faber (2013), Hispanics who applied for home-purchase mortgages were 2.0 times more likely and African Americans 2.8 times more likely to have their application denied than whites were, after controlling for loan, borrower, and neighborhood factors. Moreover, according to the US Census Bureau in 2001 74.3% of whites owned homes, compared to only 47.3% and 47.7% for Hispanics and African Americans respectively (US Census Bureau 2002; Warren 2004). Similarly, at the peak of the housing bubble in 2006 owner-occupied homeownership rates were within one percent of their 2001 levels (US Census Bureau 2007; Faber 2013). White families are, on average, 57% more likely to own their home than their African American counterparts. Furthermore, not only do whites own homes at higher rates, but also homes owned by whites are on average 41.3% more valuable than homes owned by African Americans (Aizcorbe et al. 2003; Warren 2004).

Minorities often get less return on their investment in their homes than white families do, partially because the home values of minorities are often depreciated by residential segregation but also because of the prevalence of subprime loans among minority borrowers (Warren 2004). If their loan was approved, Hispanic and African American borrowers were 2.4 times more likely to be offered subprime loans than whites (Faber 2013). These disparities in lending further perpetuate wealth inequality along racial lines. Additionally, homeowners usually have significantly more wealth than renters, as the average homeowner in 2001 had a median net worth of \$171,000, compared to only \$4,800 for renters (Warren 2004).

#### *The Value of Wealth*

Wealth is more substantial than income because it allows families to move to better and safer neighborhoods, save for retirement, invest in businesses, support their children's educational aspirations, assist their children with acquiring their first home, and cushions families against setbacks (Oliver and Shapiro 1995; Shapiro et al. 2013). Often, an individual's home is their largest investment, and thus also the main element of their wealth portfolio, but for low income and minority individuals it is also often a substitute for other types of investments such as 401Ks, stocks, or mutual funds (Aizcorbe et al. 2003; Warren 2004; Shlay 2005; Shapiro et al. 2013). Moreover, an overinvestment in housing by individuals with only modest savings results in an underinvestment in financial assets that grow at a safer rate and will provide resources for retirement (Shlay 2005). A 1967 study by Henry Terall found that African Americans invest the majority of their financial resources, nearly two thirds, into functional assets, such as in their house or car, whereas whites invest nearly two thirds of their wealth into income producing and financial assets (Terall 1967).

#### *The Importance and Consequences of Homeownership*

Purchasing a home is a risky endeavor, especially if the purchaser has limited financial resources (Shlay 2005). Between 1970 and 1980 the market value of the average American home tripled, far surpassing the effects of inflation (Oliver and Shapiro 1995). However, minorities were largely kept out of homeownership during this time and thus missed out on one of the greatest opportunities for wealth accumulation in American history (Oliver and Shapiro 1995). Conversely, during the housing collapse and Great Recession of 2008 African American families

lost, on average, half of their wealth because of both their overinvestment in housing and the prevalence of subprime loans their neighborhoods (Shapiro et al. 2013). There are a multitude of reasons why minority homeownership fails to generate greater economic security, but there is substantial evidence to suggest minority homeowners are targeted for institutionalized practices which make them more vulnerable to economic struggles (Warren 2004; Shlay 2005; Oliver 2008; Shapiro et al. 2013).

The cumulative disadvantage accrued by African Americans and Hispanics has been building substantially over time and across generations (Rugh et al. 2015). The effects of reduced income and the subsequent loss of wealth because of housing expenses are felt throughout the borrower's life and are eventually passed on to future generations, thus perpetuating disadvantage across generations (Blau and Duncan 1967; Rugh et al. 2015). Cumulative disadvantage is cyclical, as racialized systems, such as the mortgage and housing markets exacerbate the disparities already present in other systems, such as the labor market and educational system, which perpetuates wealth inequality and further enables other forms of inequality and discrimination (Anderson 2010). Today, targeted and exploitive lending practices preserve and perpetuate the cycle of cumulative disadvantage (Munnell et al. 1996; Shapiro et al. 2013).

Despite the financial precariousness of homeownership, especially for minorities, there are social and personal benefits to homeownership. Ideologically, homeownership has been a symbol of the middle class and subsequently an assertion of success, stability, and security (Darden and Kamel 2000; Warren 2004). Individuals of all races have seen owning a home as a symbol of being an American, even back in the highly discriminatory 1950s, as homeownership came to be viewed as a political right, akin to voting (Shlay 2005; Coates 2014). President Bill Clinton made increasing homeownership among low-income families a part of his political agenda under the assumption that owning a home was directly correlated with a better life (Shlay 2005). While there is evidence to suggest homeowners have higher levels of happiness, these findings could either indicated the individual level benefits, both socially and financially, of owning a home or highlight the problems rampant in neighborhoods comprised primarily of renters (Shlay 2005). Similarly, studies have shown the children of homeowners of all socioeconomic statuses benefit from homeownership, but this too could be a product of the neighborhoods they inhabit (Green and White 1997; Shlay 2005).

#### *This Study*

This study aims to compare lending practices before, during, and after the financial crash of 2008, specifically to identify if the accessibility of credit is dependent on an applicant's races and or spatial location, and if these potential differences vary across time. The prevalence of discriminatory lending can be assessed by contrasting lending rates across applicants of different races. Moreover, a comparison of rates of loan denial in neighborhoods of varying racial compositions can be used to assess the prevalence of redlining. Similarly, a study into the rates of subprime loans in different neighborhoods can be utilized to assess the pervasiveness of reverse redlining practices. Finally, the use of data from different years allows for potential changes in the frequency and extent of these lending practices to be assessed over time.

## METHODS

This study utilizes data reported under the Home Mortgage Disclosure Act (HMDA) of 1975, which requires the vast majority of lending institutions to report information on all loan applications received. The HMDA was originated due to concerns of unequal lending practices

on both spatial and applicant levels and is made public by the Federal Financial Institutions Examination Council (FFIEC) on an annual basis. The act mandated the data collection process and the subsequent dataset provides information about applicant demographic characteristics, loan type, purpose and amount, and the income and racial composition of the tract for which the loan is applied for in. Finally, the HMDA also reports the outcome of the application, whether it was approved or denied, and if approved, the difference in interest rate between the loan and the prevailing average. It is important to note the FFIEC does not conduct government sanctioned investigations into the HMDA data. Therefore, the purpose of the data collection is to make the raw data publically available for individual and scholarly scrutiny.

The goal of this study is to identify potential disparities in the rates of denial and subprime loans for applicants of different races to determine if redlining and reverse redlining practices are present. Therefore, this study focuses on whether loans were approved and, if applicable, their subsequent rate of interest. The sample of applicants is restricted to loan applicants in the Denver-Aurora-Lakewood Metropolitan Statistical Area in the years 2007, 2009, 2011, and 2013. In keeping with the existing literature (Faber 2013; Munnell et al. 1996; Rugh et al. 2015), and the underlining question of access to homeownership, the study focuses only on borrowers applying for home purchase loans for homes they anticipate living in. Restricting the sample to applicants who intend to inhabit their home requires fewer assumptions about the borrowers reasoning. Another method by which the sample was restricted was through the exclusion of second lien loans. These loans were excluded by the study because they do not necessarily fully represent the risk to borrowers or lenders as many are piggy-back loans on top of existing loans, and the majority of existing studies do not include second lien loans (Faber 2013). The sample was further restricted to only conventional loans. Loans in the conventional loan sector have historically been less regulated than the other types of loans, and are therefore most prone to unequal and exploitive lending practices. Furthermore, the existing literature focuses almost exclusively on loans generated in the conventional market (Munnell et al. 1996; Faber 2013).

Loan denial rates, as well as rates of subprime loans, were compared across applicants of different races to measure the presence or absence of discriminatory lending practices. To account for the level of risk a loan poses for lenders, a ratio of applicant income to requested loan amount was calculated. This variable was used to assess an applicant's financial capacity in relation to their loan request in absence of a reported credit score. While not all encompassing, the data set does contain applicant level data which facilitates a comparison of the rates of denial and subprime loans by applicant race. The dataset contains both a race and ethnicity variable. Applicants who identified as Hispanic or Latino in the ethnicity variable were coded as such regardless of how they identified in the race variable. Therefore, applicants who were coded as white had self-identified as both white and not Hispanic or Latino, applicants coded as black self-identified as both black and not Hispanic or Latino, and so on.

Tract level variables, such as the racial or economic composition of a tract, allow for spatial discrepancies in the percentage of denied and subprime loans across tracts to be identified. When tract and applicant variables are utilized in combination, discrepancies in lending practices can be identified. If tracts which have greater rates of minority inhabitants have higher levels of denial, those areas are likely being subjected to exclusionary redlining practices. Similarly, if tracts which are comprised of predominantly minority inhabitants also experience



higher rates of subprime loans, targeted exploitive lending practices, such as reverse redlining, are likely occurring.

Furthermore, the use of HMDA data from four, evenly separated years allows for findings to be aggregated as well as compared across time. Finally, the presence of data from before, immediately after, and a few years removed from the financial crisis of 2008 allows data from drastically different fiscal circumstances to be compared. Home prices fluctuate with the national financial standing, thus before the crash prices were near their peak whereas immediately afterwards prices were considerably lower. Therefore, access to home loans during periods of collective economic downturn can benefit borrowers considerably because homes on average cost less. Similarly, homes purchased before the collapse often depreciated considerably during the financial crisis. Thus, contrasting the prevalence of redlining and reverse redlining practices during periods of varying national financial status is important because the timing of a loan greatly affects its practical value.

To check for racially charged lending disparities at the applicant and neighborhood levels other variables, such as an applicant's fiscal capacity, average tract income, and tract level racial composition, had to be identified in addition to the aforementioned restricting conditions. Logistic regression was used and margins (predicted probabilities) calculated using the `predxcon` and `predxcat` commands in Stata to compare the percentage of applicants approved, denied, and given subprime loans by race and tract over the different years.

## RESULTS

### *Race and its Effect on Approval and Denial Rates*

The number of loans applied for in the study area varies considerably across the four years studied. Table 1 displays the racial breakdown of loan applicants in the sample. The number of loans applied for decreased by over 65% between 2007 and 2009. While the number of loans applied for did increase considerably between 2011 and 2013, the total amount of loans applied for in 2013 was still only 76% of the 2007 level. Additionally, by 2013, the housing market had rebounded somewhat but home prices had not returned to pre-recession levels.

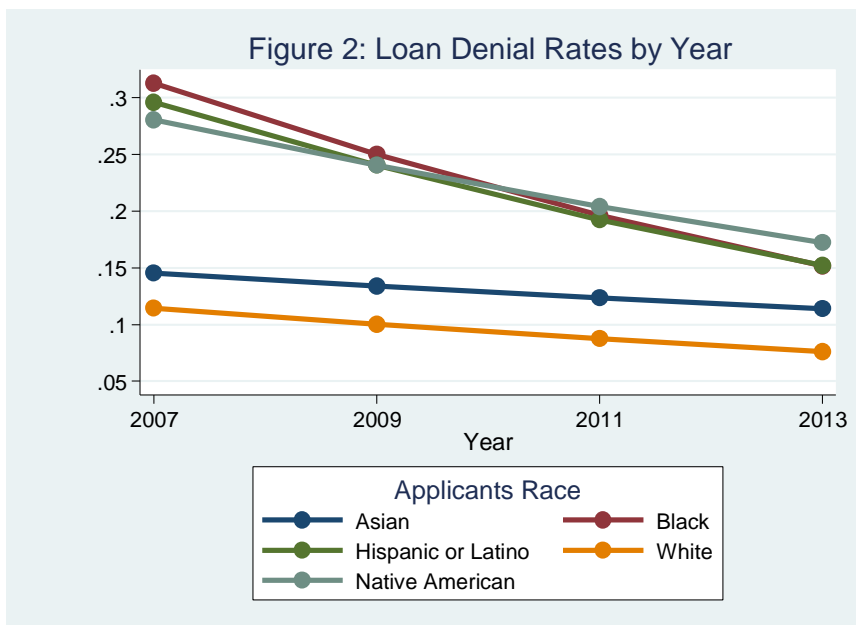
Table 1: Number of Loans Applied for Per Year

Year	Number of Loans Applied for in Sample	Percentage of Loan Applicants Who Identify As:				
		White	Black	Hispanic	Asian	Native American
2007	46,355	78.0%	3.3%	13.8%	3.7%	1.2%
2009	15,900	86.2%	1.5%	6.0%	5.8%	0.6%
2011	17,347	87.8%	1.6%	5.2%	4.8%	0.7%
2013	35,032	86.8%	1.5%	5.9%	5.0%	0.7%

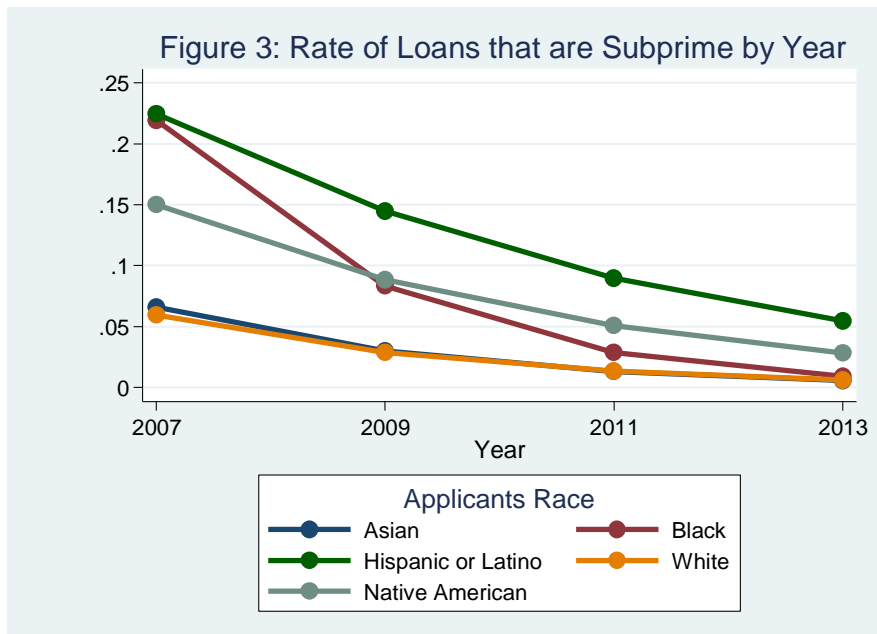
The fluctuations in annual loan applications in the sample were not consistent across all applicant characteristics. Overall, white applicants make up the vast majority (83.3%) of all loan requests. Moreover, in each year aside from 2007 white applicants contributed to over 86% of all loan applications. However, it is important to note the Denver-Aurora-Lakewood Metropolitan Statistical Area is approximately 82% white according to the 2013 census (U.S. Census Bureau 2012). Both black and Hispanic applicants requested loans in 2007 at greater than twice the rate

of any other year. Hispanic applicants account for approximately four times as many loan applications each year as African Americans do. Additionally, as the percentage of loan requests received by black, Hispanic, and Native American applicants generally decreased between 2007 and 2013, the proportion of loans applied for by Asian applicants generally increased.

Figure 2 highlights the discrepancies in denial rates for applicants of different races in the sample. In 2007 black (31.7%) and Hispanic (29.5%) applicants were almost three times as likely to be denied as white (11.3%) applicants. Throughout each of the next two years studied, 2009 and 2011, the rates of denial for black and Hispanic applicants are still above 20%, compared to white applicant denial rates at or below 10%. Even in 2013, when loan denial rates were the lowest for applicants of all races, black (15.5%) and Hispanic (14.2%) applicants were still denied loans at essentially twice the rate of white applicants (7.3%).



Similar to Figure 2, Figure 3 highlights inconsistencies in the number of originated loans which are subprime by an applicant's race. The discrepancies become less pronounced across the years studied. In 2007 the percentage of black (21.9%) and Hispanic (22.5%) applicants who received subprime loans was far in excess of the rates of subprime loans among white applicants (6.0%). While the overall number of subprime loans generated in this sample decreased over time, subprime loans remained remarkably present among Hispanic applicants, who registered the highest rates of receiving subprime loans each year. For example, in 2009 the proportion of approved loans for



Hispanic borrowers which were subprime was over five times greater than those of white applicants. Moreover, even in 2013, the year with the lowest percentage of subprime loans for applicants of all race, massive discrepancies in rates of subprime loans persisted. The proportion of originated loans which were subprime was less than 0.7% for both white and Asian applicants. Meanwhile, African American, Hispanic, and Native American applicants were receiving subprime loans at rates of 1.0%, 5.5%, and 2.9% respectively.

As an applicant's income increases their chances of being denied a loan decreases considerably for Hispanic and Native American applicants, slightly for Asian and white applicants, and actually increases negligibly for black applicants. Conversely, as an applicant's income increases the chances of receiving a subprime loan decreases for applicants of all races, except those who identify as Asian, who have a slightly higher likelihood of receiving a subprime loan as their income increases.

Table 4 displays the results of a logistic regression model conducted to determine the effect of an applicant's characteristics on the likelihood of being denied a loan or receiving a subprime loan. The model contains tract level variables, such as the percentage of tract inhabitants who identify as minority and the ratio of the average household income of the tract to

<b>Table 4:</b>	Loan Denied			Originated Loan Which are Subprime		
	Odds Ratio	95% CI	Margins	Odds Ratio	95% CI	Margins
Year (Ref: 2007)						
2009	0.901**	0.849-0.957		0.296***	0.261-0.335	
2011	0.838***	0.789-0.890		0.229***	0.200-0.263	
2013	0.579***	0.550-0.609		0.148***	0.131-0.166	
Race (Ref: White)			0.094***			0.020***
Black	2.568***	2.321-2.842	0.211***	3.352***	2.862-3.936	0.064***
Hispanic	2.416***	2.282-2.558	0.201***	3.908***	3.593-4.250	0.074***
Asian	1.371***	1.253-1.501	0.125***	1.153	0.955-1.392	0.023***
Native American	2.481***	2.118-2.906	0.205***	2.574***	1.979-3.347	0.050***
Percent Minority	1.007***	1.006-1.008		1.003**	1.000-1.005	
Loan to Income Ratio	1.069***	1.057-1.081		0.786***	0.761-0.811	
Tract to MSA Average	0.997***	0.996-0.998		0.989***	0.988-.0991	
Constant	0.126***	0.114-0.141		0.383***	0.313-0.468	

\*p<.05 \*\*p<.01 \*\*\*p<.001 (two tailed test of significance)

the metropolitan statistical area average, in addition to applicant level variables, such as an applicant's race and the ratio of applicant income to the value of the loan.

The odds ratios displayed in Table 4 confirm the aforementioned results that both loan denial and subprime loan rates were the most likely to occur in 2007. As the years progressed the likelihood of being denied a loan decreased. Moreover, the likelihood of receiving a subprime loan decreased considerably.

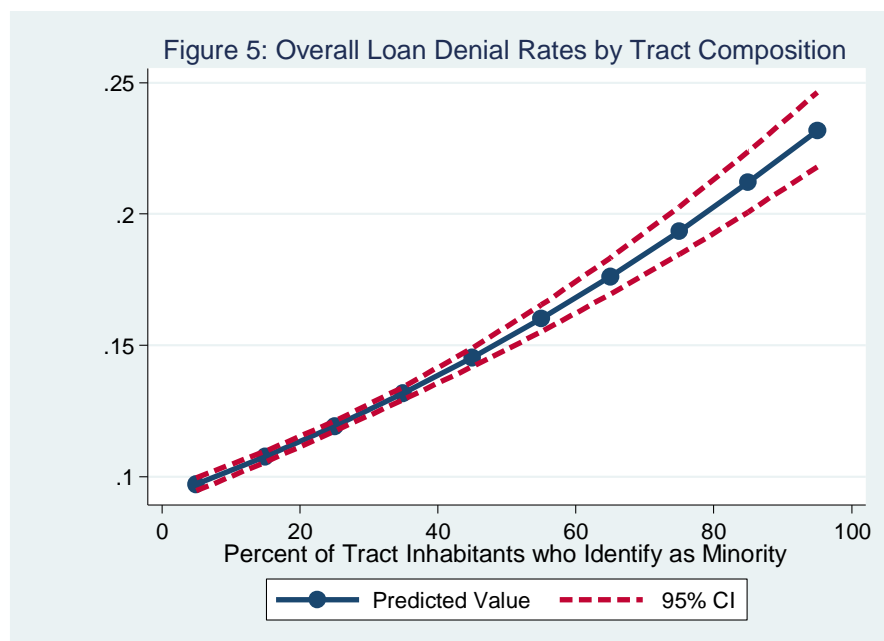
There is a statistically significant effect of race on the likelihood of denial and receiving a subprime loan. Black, Hispanic, and Native American applicants have a higher likelihood of both being denied a loan and receiving a subprime loan than white applicants on average. The margins value indicates white applicants in the sample have a 9.4% probability of having their loan application denied with all other factors held constant at their means. Meanwhile, black and Hispanic applicants respectively have a 21.1% and 20.1% probability of having their loan applications denied. The probabilities of denial for black and Hispanic applicants are more than twice those of white applicants with all other factors held at their means. Similarly, white applicants in the sample have a 1.7% likelihood of having their approved loan be subprime, compared to 4.1% for black and 4.9% for Hispanic applicants, when all other factors are held constant at their means. Therefore, when controlling for the applicants income to loan value ratio, the relative wealth of the tract, the percentage of tract inhabitants who identify as minority, and the year the loan was applied for in, there is still a statistically significant difference in both rates of denial and of subprime loans based off of an applicant's race.

### *The Prevalence of Redlining Practices*

In order to isolate the effects of the racial composition of a tract on loan rates, the average tract income in relation to the sample average and the fiscal capacity of the applicant were both controlled for. The increase in denial rates for loan applications in tracts with higher percentages of minority inhabitants continues regardless of applicant race, as shown in Figure 5. Moreover, the rates of denial are more than twice as high in predominantly minority tracts compared to tracts comprised of mostly white inhabitants.

Therefore, as the percentage of tract inhabitants who identify as minority increases the chance of loan denial also increase regardless of an applicant's race.

As conveyed in Figure 6, as the percentage of individuals who identify as minority in a tract increases, the rate of loan denial also increases on average for applicants of all races. While rejection rates are higher for

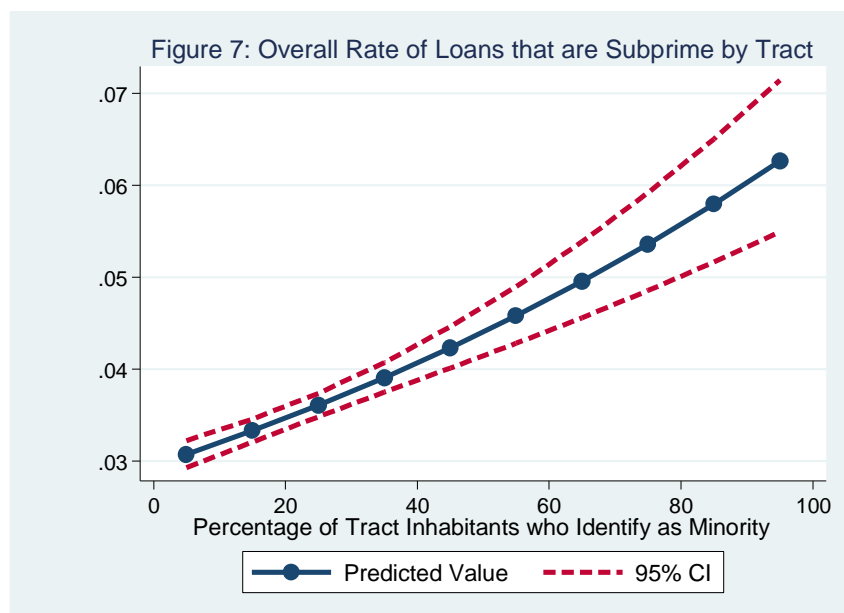
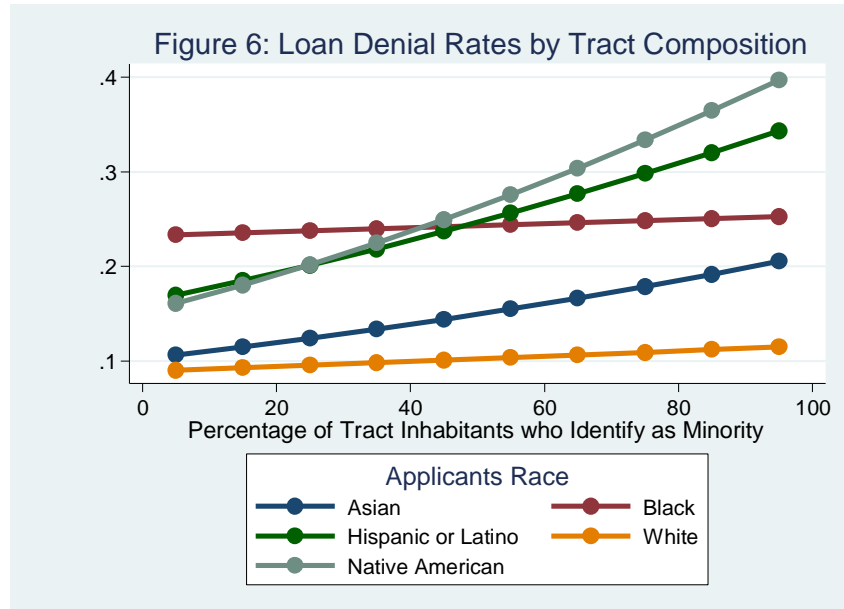


applicants of all races, the increase in denial rate is most pronounced among Hispanic, Black, and Native American applicants with loan rejection rates well above 25% in predominantly minority tracts. White individuals applying for loans in tracts with predominantly minority compositions do see higher rates of denial than white applicants in primarily white tracts. However, the difference in denial rates for white applicants' only

changes slightly from 9.0% in tracts that are comprised of 5% minority inhabitants to 11.5% in tracts that are 95% minority. Conversely, denial rates for Hispanic applicants are at their lowest at 17.0% in majority white tracts, already much higher than denial rates for white applicants in any tract, and at their highest at 34.4% in predominantly minority tracts. Denial rates for African American applicants do increase as the composition of the tract changes, but more gradually than the change in denial rates for Hispanic applicants. African American applicants are subjected to the highest average denial rate in predominantly white communities, at 23.4% in communities which minorities represent only 5% of the population. As the percentage of the tract identifying as minority increases, so to the denial rate for African American applicants. In predominantly minority tracts, African American applicants are rejected at rates of over 25%.

### *The Pervasiveness of Reverse Redlining Practices*

Of the loans which are approved, a small percentage are initiated at subprime rates. For applicants of all races, aside from Native Americans, as the percentage of a tract that identifies as minority increases, the likelihood of receiving a subprime loan decreases slightly. However, as the percentage of applicants who identify as minority increases the overall likelihood of receiving a subprime loan also increases. Figure 7



highlights the relationship between tract composition and the rate of receiving a subprime loan. Therefore, as the average percentage of tract inhabitants who identify as minority increases, so too does the likelihood of an originated loan having a subprime interest rate. It is important to note the tracts with the higher rates of subprime loans, the tracts with a greater percentage of minority inhabitants, are the same tracts with higher denial rates, as shown in Figure 5. Furthermore, a graph depicting the rates of subprime loans by a disaggregated race variable does not prove useful given the small number of results for applicants of certain races, particularly in the later years of the study.

## DISCUSSION

This study identified significant racial discrepancies in access to quality home purchase loans, as well as evidence of redlining and reverse redlining practices in the Denver-Aurora-Lakewood Metropolitan Statistical Area. Applicants who identified as black or Hispanic were denied home purchase loans at rates far in excess of the denial rates for white applicants. Moreover, denial rates were significantly greater in tracts with higher percentages of minority inhabitants, suggesting the presence of redlining practices. Furthermore, the percentage of originated loans which are subprime increased as the percentage of the tract which identified as minority increased, signifying the existence of reverse redlining practices. Therefore, both individual minority applicants and entire predominantly minority communities were negatively impacted by unequal lending practices.

Although the financial standing of America changed significantly throughout the period of study, the prevalence of unequal loan opportunities persisted. For the most part denial rates tended to decrease for applicants of all races as the years progressed. However, the denial rates for minorities remained at least double those of whites. Similarly, although subprime loans became substantially less common overall after the financial collapse of 2008, the rates of subprime loans among minority borrowers and in predominantly minority communities remained much higher than for all other applicants. Also, considerably fewer people applied for loans in the years immediately after the collapse, but the percentage of overall applicants who were white increased. In the years following the collapse housing was considerably cheaper than it was before, thus making it an ideal time to purchase a home. However, whites benefited the most from these low prices.

The findings of this study, both on the individual applicant and neighborhood levels, align with the findings of previous studies which also focused on racially biased lending practices. Studies such as those conducted by Munnell et al. (1996), Ladd (1998), Faber (2013), and Rugh et al. (2015), also found evidence for racially biased unequal lending practices on the individual and spatial levels. Although the quantifiable differences in rates of denial and subprime loans between white and minority applicants fluctuated in each study, a difference which can be attributed to diverse geographic samples and years studied, the trend of minority applicants being denied loans and receiving subprime loans at higher rates remained consistent. Moreover, the aforementioned studies all found evidence on spatially clustered lending, suggesting the areas with higher rates of denial were being discriminated against through redlining practices. Similarly, many other studies utilizing HMDA datasets also found evidence of geographically targeted predatory lending (Munnell et al. 1996; Ladd 1998; Rugh et al. 2015). Moreover, while the rates and pervasiveness of reverse redlining practices varied between samples, the trend of targeted exploitation remained constant.

Differences in access to home purchase loans have considerable consequences for racial equality. Purchasing a home is a major investment, regardless of one's financial status. Therefore, acquiring a home at a competitive price is extremely important as excess fees, such as increased interest rates or purchasing a home during market peaks, often results in decreased wealth or sometimes even foreclosure. This study, in addition to the preexisting literature, has found evidence that African Americans and Hispanics are excluded from purchasing homes at significantly greater rates than whites, therefore diminishing their chances to increase their wealth through homeownership (Munnell et al. 1996; Ladd 1998; Faber 2013). Moreover, a particularly advantageous period to purchase a home is when home prices are low, such as in the years immediately following the financial crisis of 2008 (Warren 2004; Bai and George 2014). However, African Americans and Hispanics represent a smaller percentage of home purchase loans during this buyer friendly period than they do at less advantageous times, such as prior to the financial crisis of 2008 when home prices were near their peak (Bai and George 2014). Additionally, both this study and the existing literature found minority applicants who are approved for a loan were considerably more likely to receive a subprime loan than their white peers (Munnell et al. 1996; Calem et al. 2004; Warren 2004; Rugh et al. 2015). The unrelenting exclusion of minorities from the fair housing market has significant negative effects for both individual and neighborhood equality. Communities with a high percentage of minority inhabitants are subject to higher loan denial and interest rates which contribute to higher rates of foreclosure, diminished average wealth, and lower rates of homeownership (Calem et al. 2004; Rugh et al. 2015). Moreover, redlining practices make acquiring funding to purchase a home in the neighborhood difficult, further decreasing demand and undermining appreciation in home values. Both the existing literature and this study found evidence to strongly suggest that unequal lending practices further destabilize already challenged communities (Munnell et al. 1996; Warren 2004; Rugh et al. 2015).

Although homeownership is only one element of inequality in America, it is nevertheless incredibly important. The severity of many of the issues plaguing Americans today such as poverty, crime, and access to education, are clustered geographically. Practices such as redlining subject entire neighborhoods to increased difficulty in accessing credit because of their racial composition, making purchasing a home immensely difficult. Moreover, the intentional targeting of minority applicants and neighborhoods for loans with higher rates of interest unreasonably reduces the wealth of individuals of specific communities. When the prevalence of these predatory loans are concentrated geographically, neighborhoods suffer greatly as rates of foreclosure increase and a community's average wealth decreases (Immergluck 2008; Rugh et al. 2015). With lower rates of homeownership, higher rates of foreclosure, and lower levels of average wealth, neighborhoods often experience a decline in aesthetics, investment in schools and public spaces, and ultimately desirability, therefore perpetuating the vicious cycle of decreased wealth and social esteem and increased cumulative disadvantage for minorities (Calem et al. 2004; Immergluck 2008; Shapiro et al. 2013; Rugh et al. 2015).

Fortunately for home purchase loan applicants the percentage of loans assigned subprime rates has decreased since the financial crisis of 2008. Many experts have attributed the financial crisis of 2008, often referred to as the subprime mortgage crisis, to an inflated home mortgage market, largely formed because of the lack of regulation and oversight of subprime lending practices (The Economist 2013). The large quantities of loans which had the potential to be defaulted on were exposed when the housing market turned and the following chain reactions

revealed a very delicate financial system (The Economist 2013). In 2009 there was significant discussion among economists and politicians regarding lending reform, specifically increasing regulation, which ultimately led to the signing of the Dodd-Frank Wall-Street Reform and Consumer Protection Act of 2010 (The Economist 2012). One of the major tenants of lending reform allowed for lending institutions to fail without being bailed out by taxpayers, effectively putting the hazards associated with approving riskier loans on the lending intuitions (The Economist 2012). Increased regulation, in addition to the growing concerns regarding subprime mortgages, likely contributed to the considerable decline in the amount of subprime loans issued between 2007 and 2011.

Although the prevalence of subprime loans decreased, thus mitigating the effect subprime loans have on homeownership inequality for applicants of different races, discrepancies in denial rates remained. Differences in denial rates, even when controlling for the average income of the tract and the ratio of applicant income to the loan amount applied for, suggest the presence of racially biased lending practices. Even in 2013, when the rates of denial were most equal, African Americans and Hispanics were still denied loans at close to twice the rate of whites. Moreover, denial rates were more than twice as high in predominantly minority neighborhoods than in mostly white communities. Homeownership increases personal and monetary investment in communities, and through intentionally biased lending, lenders are unreasonably damaging minority communities.

The HMDA data is the most extensive lending dataset available with applicant level information from millions of loan applications annually. The depth of applicant and tract level characteristics, in addition to the information provided regarding the features of each loan, facilitates exceptionally detailed and exploratory analysis. However, the HMDA datasets is not without limitations. A commonly cited critique of studies utilizing the HMDA dataset exclusively is the lack of information regarding an applicant's credit qualifications, or lack thereof (Munnell et al. 1996; Horne 1997). For instance, there is no information about an applicant's credit history or outstanding debt burdens in the dataset. Lenders and their supporters argue claims regarding racially biased unequal lending practices, such as those made in this study, can be attributed to missing pieces of data rather than discrimination (Munnell et al. 1996). In this study a variable was created to identify the ratio of loan amount to applicant income to mitigate the data gap and attempt to quantify an applicant's fiscal capacity. Another factor which is not identified in the data is the disparities between applicants in exposure to experiences. However, it is impossible to separate the detrimental effects of past discrimination against minorities, such as in access to education, income, and credit, from present lending disparities. Moreover, white and minority applicants may have had differential exposure to discrimination, an influential discrepancy which the data cannot account for.

Future research could expand upon the temporal study modeled in this study and apply the comparison to other geographic locations across time. Specifically, there is limited research outside of this study into the effect of the financial crisis of 2008 on lending disparities. It would be interesting to study lending rates a few years prior to the collapse in addition to a few years afterwards in other American cities. Future research could also expand on lending discrepancies during both opportune and inopportune periods for investing in a home. For instance, the results of this study suggest white applicants benefited the most from low housing prices during the recession following the 2008 financial crisis. Future research could expand upon these finding by exploring lending rates in other metropolitan areas throughout varying fiscal statuses. Another



potential opportunity for expanded research would utilize applicant level information from lending institutions, such as an applicant's credit score or fiscal history, in a study of lending discrepancies.

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