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The question of gender discrimination in mortgage lending : a cross regional analysis

Amatta Sangho Diabate

To the Graduate Council:

I am submitting herewith a dissertation written by Amatta Sangho Diabate entitled "The question of gender discrimination in mortgage lending : a cross regional analysis." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Economics.

Matthew N. Murray, Major Professor

We have read this dissertation and recommend its acceptance:

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

To the Graduate Council:

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Interim Vice Provost and
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THE QUESTION OF GENDER DISCRIMINATION IN MORTGAGE LENDING: A CROSS REGIONAL ANALYSIS

A DISSERTATION

Presented for the

Doctor of Philosophy Degree

The University of Tennessee, Knoxville

Amatta Sangho Diabaté

December, 2000

DEDICATION

This dissertation is dedicated to my late sister,

Oumou Sidi Sangho,

who left this world twenty one years ago,

at the young age of twenty six, but who's short lived life

has been and will be an inpiration for mine, forever.

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ABSTRACT

This study analyses the question of gender discrimination in mortgage lending. The federal fair lending regulations prohibit discrimination in granting credit with respect to race, gender, marital status, color, religion, age or receipt of public assistance. If discrimination exists in the mortgage market, it will keep creditworthy applicants from accessing home ownership, which represents the principal mean of capital and wealth accumulation.

During the last two decades, studies regarding the problem of discrimination in mortgage credit have principally focused on the race issue. Race appeared to have, in most empirical studies, a significant impact on the outcome of mortgage application, with, in every instance, higher rejection rates for minorities than for non-minorities. Very few studies found interest in factors other than race affecting the distribution of mortgage loans. One of the variables mostly ignored in the analysis of discrimination in mortgage lending seems to be the one related to gender bias, raising the question whether sex discrimination in the mortgage lending market no longer represents a significant problem.

The data used to examine the impact of gender on the mortgage lending market in this study were obtained from the 1996 Home Mortgage Disclosure Act (HMDA). Mortgage applications and outcomes in six Metropolitan Statistical Areas (MSAs) (Atlanta, GA; Austin TX; Memphis, TN; Boston, MA; Chicago, IL; and New York, NY) were analyzed, using a model of mortgage lending incorporating applicant and loan characteristics available in HMDA data. The study undertook both an MSA and a cross

regional comparison (South-North), in order to account for socio-economic and cultural differences across MSAs and across regions.

Due to some limitations of the HMDA data, particularly the unavailability of information about the applicant's credit history, this study used a particular sampling method, the matched-pair method, similar but somewhat different from the one used by the Federal Reserve System. This statistical sampling method allowed the obtaining of exact matches of male and female applicants in terms of income levels and loan amounts requested. The results of probit regressions on the matched-pairs data sets were compared to those obtained using unmatched data sets in order to assess whether close matching of male and female applicants allows a better use of HMDA data as an instrument for fair lending regulations screenings.

The comparative analysis of these results suggested that the matching process makes a sensible difference in the *gender* variable's ability to predict mortgage lenders' action. The empirical results indicated that once male and female applicants are exactly matched (in terms of *income* and loan *amount* requested), for any income group, little differentiation in the outcome of their mortgage loan application would be linked to gender.

Moreover, the findings suggested that variables such as *race*, loan *amount*, *income*, mortgage *type,* and *purpose* could be predictors of mortgage lender's decision only for low and median income applicants. In contrast with several findings in the literature discussing racial discrimination in mortgage lending, the results of this study asserted that an applicant's nonwhite status is not a deterrent to obtaining a mortgage loan. Moreover, the grouping of the observed MSAs into regions uncovers little

geographical differences in mortgage decision. In sum, once a mortgage loan applicant is in the high-income group (over $75,000), none of the explanatory variables used in the present study seems to play any significant role into predicting lenders' action.

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Chapter One

INTRODUCTION

This research project focuses on the question of equal access to credit. More precisely it explores the question of gender discrimination in the mortgage lending market in the United States. Unfortunately, no current empirical evidence is available on the subject.

A key roadblock in knowing whether discrimination exists (and is or is not a widespread problem) in the mortgage lending market, and in identifying the best way to detect it, has been the lack of solid theoretical foundation on defining the concept itself (Longhofer and Peters, 1999). From the definition indicated in the Merriam Webster's Collegiate Dictionary, 10th Ed., discrimination is "the act, practice, or an instance of discriminating [making a distinction] categorically rather than individually". In other words, any difference in treatment across individuals based solely on group membership – rather than on personal characteristics specifically related to the performance of the loan – would constitute discriminatory behavior under the law (Longhofer and Peters, 1999).

Lenders may have a Beckerian type of "taste for discrimination" that would manifest itself through differences in, for instance, the creditworthiness required from otherwise similar members of each group. They may also have an incentive for statistical discrimination, if the overall pool of minority applicants is known to be, on average, less creditworthy than the non-minority applicants' pool (Longhofer and Peters, 1999).

Available literature has, in general, demonstrated that minorities, including women, have been victimized through unfair and inequitable barriers in their attempts to access credit in general, and residential mortgage credit in particular, regardless of their income, employment, race, age, marital status or geographical location (e.g., Black, Schweitzer and Mandell, 1978; Squires and Velez, 1987; Avery, 1989; Gabriel and Rosenthal, 1991; Canner, Gabriel and Wolley, 1991; Munnell et al., 1992; Avery, Beeson, and Sniderman, 1993, Avery, Beeson, and Calem, 1993-94). Thus, the residential mortgage lending process is being more and more subjected to public scrutiny as charges of unfair and inequitable practices are made in communities across the country.

Justification of the study:

Analyzing lending practices in the residential mortgage market is important because the majority of home purchases are financed through mortgages[1]. Therefore, residential mortgage lenders through their lending practices affect the supply of mortgage funds to individual mortgagors and consequently, the opportunity for home ownership.

Home ownership is considered the dominant method of capital or wealth accumulation for low and middle-income households in the United States as in many other countries. If it is ascertained that discrimination exists in the mortgage market, it will keep creditworthy applicants from receiving mortgage financing, this in turn resulting in an arbitrary constraint on their status of "home owner". Consequently, this reduction in opportunities adversely affects wealth accumulation.

[1] U.S Department of Commerce, 1978.

Home ownership is also argued to support "community" shared values. Therefore, it may be what Richard Musgrave calls a "merit good" (Musgrave, 1978), the provision of which society (as distinct from the preferences of the individual consumer) wishes to encourage.

In addition to asset accumulation and the support of community shared values, home ownership offers many favorable income tax provisions in the United States. Homeowners may deduct interest and property tax payments from their tax liabilities. Moreover, capital gains are taxed at a lower rate than other taxable incomes. If, by discrimination in the housing or capital markets, minority and female-headed households are kept from being able to purchase their own homes, as the literature suggests, then they will not be able to fully realize these tax benefits and their welfare is lowered. Therefore, it is clear that discrimination in the residential mortgage market prevents an equitable distribution of mortgage money among all potential mortgage borrowers.

Discrimination also imposes higher costs, not only on those potential borrowers, but also on the welfare of the society as a whole (Galster, 1992, Long and Caudill, 1992, Vandell, 1995, Kain, 1992). These costs on social welfare vary from simple search costs incurred by potential minority borrowers (and the resulting negative impact on consumer surplus at the micro level), to the global impoverishment of one part of the population, the reduction of investment and the overall decay of society (Swire, 1995; Galster, 1992; Vandell, 1995; Long and Caudill, 1992).

Mostly for those reasons, but certainly for many others, the Courts have ruled discrimination in mortgage lending to be illegal. The legal response to discriminatory practices in mortgage credit will be discussed in Chapter II.

During the last two decades, studies regarding the problem of discrimination in mortgage credit have principally focused on the race issue (Black, Schweitzer and Mandell, 1978; Squires and Velez, 1987; Avery, 1989; Gabriel and Rosenthal, 1991; Canner, Gabriel and Wolley, 1991; Munnell et al., 1992; Avery, Beeson, and Sniderman, 1993; Avery, Beeson, and Calem, 1997). Race appears to have, in most empirical studies, a significant impact on the outcome of mortgage application, with, in every instance, higher rejection rates for minorities than for non-minorities (whites) (Black, Schweitzer and Mandel, 1978; Schafer and Ladd, 1980; Canner, Gabriel and Woolley, 1991; Avery, Beeson and Sniderman, 1993; Munnel, Browne, McEneaney and Tootel, 1992; Canner and Passmore, 1994,1995). There is, however, a great deal of a debate as to what the sources of these disparities are. Some studies argue that objective lending criteria and the variance in application rates are responsible for the differences (Avery, Beeson and Sniderman, 1993; Gabriel and Rosenthal, 1991). Others argue that the differences are simply based on the race of the applicant and/or redlining, which refers to the discriminatory practice of refusing to extend mortgage credit based on the racial composition of the neighborhood in which the property is located (Yinger 1995; Munnel et al., 1992).

Very few studies found interest in factors other than race affecting the distribution of mortgage loans, as indicated by Goering and Wienk (1996): "Discrimination in mortgage lending can have a major impact on minority households' access to housing. Despite this potential importance, and despite the evidence that some discrimination exists, several aspects of lending discrimination remain largely unexplored. Indeed, there

is far less research on this topic than on discrimination in the housing or labor markets. Further research on discrimination in mortgage lending clearly is warranted".

One of the variables mostly ignored in the analysis of discrimination in mortgage lending seems to be the one related to gender bias [2], raising the question whether sex discrimination in the mortgage lending market no longer represents a significant problem. This lack of interest might also be justified by the fact that more economists are males, rather than females.

Scope and contribution of the study:

This study aims to contribute into the analysis of gender as a discriminatory variable in the mortgage lending market. The difference between this study and others resides in its main focus on the question of gender in the analysis of discrimination in mortgage lending. Moreover, the dual aspect of Metropolitan Statistical Areas (MSAs) and cross-regional empirical applications will also be a contribution to the literature.

In the cross regional comparison, the lending patterns in three southern metropolitan areas – Atlanta, GA; Memphis, TN; Austin, TX – and three northern ones – Boston, MA; New York, NY; and Chicago, IL – are compared. The goal is to identify gender differences, if any, in the mortgage loan distribution, across vastly different regions with unique historical and demographic patterns.

The data used to examine the impact of gender on the mortgage lending market in this study come from the Home Mortgage Disclosure Act (HMDA). This 1975 Act

[2] "Women have been all but invisible with regard to mortgage lending research since the 1970s" (Snuggs, Thelma Louise, *Equality of Lending: Racial and Sex Discrimination in Residential Mortgage Lending,* (1981).

requires that lending institutions provide systematic statistical data on their lending practices, and make that information available to the public.

Social scientists have used HMDA data to calculate and compare the number of applications received and loans extended across geographic, race and income lines. The fact of racial disparities in mortgage application acceptance or rejection rates based on HMDA data is thoroughly documented in academic literature, the popular press and in government funded studies, as briefly described in Chapter One.

Limitations of the study:

HMDA data have some serious limitations worth indicating. These limitations have mainly been related to HMDA's utility in race-related research. But some of the limitations are also pertinent to studies on gender. While the data make clear that credit extension disparities exist, the data alone are insufficient to confirm that the disparities are a result of unlawful practices. For example, HMDA does not reveal the applicant's employment history, assets, and credit record, debt obligation and several other factors that determine applicant creditworthiness. In addition, the data do not provide any characteristics of the property other than the census tract in which it is located, nor do they provide information about the loan characteristics such as interest rate or loan maturity.

Another constraint of HMDA data is the limited information provided about the loan demand. Applications alone may be an inaccurate measure for loan demand, since there is no pre-application information available. It is possible that creditworthy applicants, especially racial minorities and women, are discouraged in the screening

process from filing a formal application. This could result from personal tastes for discrimination on the part of lenders or informal forms of statistical discrimination.

Due to these limitations, particularly the unavailability of information about the applicant's credit history, this study uses a particular sampling method - the matched-pair method - similar but somewhat different from the one used by the Federal Reserve System. This statistical sampling method allows the obtaining of exact matches of male and female applicants in terms of income levels and loan amounts requested. Each sample in each MSA is therefore made of pairs of male/female applicants, with "perfectly matched" income and loan amount. The results of probit regressions on the matched-pairs data sets were compared to those obtained using unmatched data sets in order to assess whether close matching of male and female applicants allows a better use of HMDA data as an instrument for fair lending regulations screenings (Avery, Beeson and Calem, 1997).

It is nevertheless, worth indicating that the use of this new sampling method may still not give a clear view of the existence or not of gender discrimination in the mortgage lending market. However, it may take researchers a step closer to more accurate findings.

Summary of the empirical results:

The comparative analysis of empirical results from probit regressions on matched and unmatched HMDA data suggests that the matching process makes a sensible difference in the *gender* variable's ability to predict mortgage lenders' action. The empirical results indicate that once male and female applicants are exactly matched (in

terms of *income* and loan *amount* requested), for any income group, little differentiation in the outcome of their mortgage loan application would be linked to gender.

Moreover, the findings suggest that variables such as *race*, loan *amount*, *income*, mortgage *type,* and *purpose* could be predictors of mortgage lender's decision only for low and median income applicants. In contrast with several findings in the literature discussing racial discrimination in mortgage lending, the results of this study assert that an applicant's nonwhite status is not a deterrent to obtaining a mortgage loan. Moreover, the grouping of the observed MSAs into regions uncovers little geographical differences in mortgage decision. In sum, once a mortgage loan applicant is in the high-income group (over $75,000), none of the explanatory variables used in the present study seems to play any significant role into predicting lenders' action.

Layout of the study:

This study is organized as follows: Chapter Two presents a review of the available relevant literature on the economics of discrimination in general, and on discrimination in mortgage lending in particular. Chapter Three gives a theoretical discussion of demand and supply in the mortgage lending market. The empirical model, as well as the method and data used in the study, are then presented in Chapter Four. Chapter Five presents findings from the probit regression functions used in the study and Chapter Six summarizes these findings and provides conclusions.

Chapter Two

REVIEW OF THE LITERATURE

Economic theories of discrimination

In an analysis of discrimination in the labor market, Suzan Schmidt (1996) discusses the primary approaches to the economics of discrimination in the economics literature: (1) the neoclassical theory of discrimination or taste-based discrimination (Becker, 1971; Arrow, 1972; Blinder, 1973; and Oaxaca, 1973a and 1973b) and (2) statistical discrimination (Aigner and Sian, 1977).

Becker's 1959 book (revised in 1971) is generally considered the original treatment of discrimination in the economics literature. While his analysis focuses on racial discrimination between whites and blacks in labor markets settings, the theory is general enough to apply to prejudice against any group (LaCour Little, 1999).

The second edition of Becker's book contains a short discussion of discrimination and segregation in housing. There, Becker describes residential segregation, which may occur as a result of public policies, private preferences, or discriminatory barriers, which he called "residential discrimination", arguing that the matter can only be demonstrated through differences in prices paid for equivalent housing. This type of discrimination has been identified as "taste-based discrimination" since it reflects the tastes and preferences of economic agents and is thought to vary across individuals, geographic locations, and time.

Another approach to the theory of economic discrimination is attributed jointly to Arrow (1972, 1973) and Phelps (1972), again based on labor market analysis. If information is scarce, imperfect and costly to obtain, and an employer believes women and blacks to be, on average, less qualified than white males, the employer may use race or gender as a proxy for unobservable individual characteristics. In the mortgage-lending context, if the lender believes that minority status is negatively correlated with creditworthiness, it may be rational, in some sense, to simply reject minority loan applicants.

This second type of discrimination is identified in the literature as "statistical" discrimination. It is mainly the result of imperfect information, where employers (in the labor market or lenders in the credit market), base their decisions on information that is thought to be correlated with productivity, e.g., education, experience, etc. (or borrowers creditworthiness). By basing their decisions on average measurable characteristics of a group, employers (or lenders) may give systematic preference to one group over another, even in cases where they are not motivated by prejudice (Schmitz, 1996).

The Becker –Arrow frameworks assume that "some economic agents have some negative valuation" on associating with certain labor groups (Arrow, 1973). The possible discriminating agents are the employers who might be willing to sacrifice profits to reduce or eliminate the avoided group, or employees, who might be willing to accept a lower wage as to avoid working with the shunned group (Schmitz, 1996). "Statistical" and "taste" discrimination have, in fact, been identified as being the main underlying explanations of discrimination in the mortgage lending market.

Theories of discrimination in mortgage lending:

As many studies have pointed out, a key issue in discrimination in the mortgage lending market is the identification of the causes of discrimination in that market, because this is essential in the design of policies to combat discrimination (Cain, 1986; Yinger, 1986 and 1995; and Ayres and Siegelman, 1995).

Two characteristics of mortgage financing make it especially difficult to reach definitive statistical estimates of discrimination. The first characteristic is that the home mortgage lending process is a complex series of stages. Researchers list four stages of the mortgage lending process: the stage of advertising and outreach, the stage of pre-application inquiries, the stage of loan approval or denial and terms and conditions, and the final stage of loan administration. Discrimination could be occurring at any or more of these stages, and could take different forms at different stages. But until the stages themselves are clearly distinguished, and the incidence on discrimination measured at each stage, its overall incidence cannot be properly interpreted (HUD[3], 1999).

The second characteristic is that "what everyone now acknowledges to have been deliberate discrimination by many institutions in American society in the past has left a legacy of economic inequality between whites and minorities that still exists today. This legacy includes racial and ethnic differences in characteristics that influence the creditworthiness of any mortgage applicant – income, accumulated wealth, property values, and credit history" (HUD, 1999).

Much of the debate about mortgage lending discrimination stems from disagreement about how much of minorities' or female applicants' differential success in

[3] The Department of Housing and Urban Development.

obtaining mortgage loans is due to credit-relevant factors that vary with race, ethnicity and/or gender (and that may flow from the Nation's past discrimination or socio-cultural beliefs), and how much is due to ongoing discrimination.

Different forms of discrimination

The literature indicates that discrimination in mortgage lending can take different forms. This is important to take into account, because different forms of discrimination may require different measurement strategies, as well as different remedies. The fundamental distinction is between differential treatment and disparate impact discrimination (HUD, 1999).

Differential treatment discrimination is thought to occur when equally qualified individuals are treated differently due to their race, ethnicity or gender. In mortgage lending, differential treatment might mean that minority (or female) applicants are more likely than white (or male) applicants to be discouraged from applying for a loan, to have their loan application rejected, or to receive unfavorable loan terms, even after taking into account characteristics of the applicant, property, and loan request that affect creditworthiness. A finding of differential treatment discrimination means that minorities (or women) receive a less favorable treatment from a given lender than majority applicants with the same credit-related characteristics (as observed by the lender).

Disparate impact discrimination, on the other hand, is said to occur when a lending policy, which may be color or gender-blind in the way it treats mortgage loan applicants, disqualifies a larger share of minorities (or women) than whites (or males).

Possible motives for discrimination

The most straightforward explanation for why discrimination occurs is prejudice, or in terms of Becker's work, "tastes" for discrimination. If lenders or their employees are prejudiced against minorities, they consider them to be inherently inferior and prefer not to interact with them or have them as customers.

Several other discussions of taste-based discrimination in mortgage lending, are also provided in the literature (Shear and Yezer, 1985; Sunstein, 1990; Galster, 1992; Squires, 1995). All of these authors point out that, in the mortgage market as in many other markets, the personal prejudice of individual decision-makers may lead them to discriminate. In the particular case of mortgage lending, there may be personal prejudice on the part of the lender, or particular employees of the lender, denying mortgage loans to some creditworthy minorities just because of their own prejudice against minorities. Moreover, there may be prejudice on the part of residents of the neighborhood in which the lender operates, so that the lender's business would suffer in some ways if he provides financing to assist so called undesirable individuals in moving into the neighborhood.

Another possible cause of discrimination in mortgage lending is thought to be "statistical" discrimination, based on unobservable credit characteristics of minority applicants that are less favorable, on average, than those of majority applicants[4]. This type of lenders' behavior has been widely discussed in the literature (Goering and Wienk, 1996). As defined above, it is usually due, in the mortgage lending market, to imperfect information that causes the lender to use demographic characteristics that are imperfectly

[4] This is analogous to the controversial issue of "racial profiling."

correlated with creditworthiness, or linked to systematic social beliefs and coercive social norms (Swire, 1995). Common beliefs may be, for example, that minority occupancy reduces property values. If lenders believe this to be true, they might avoid lending to minorities seeking to purchase properties in predominantly white neighborhoods, for fear of damaging the collateral value on loans they had already extended in the neighborhood. Another type of discrimination in mortgage lending, seemingly similar to statistical discrimination, resides in the fact that lenders may face a type of "prisoner's dilemma"[5], in that they do not wish to make loans in (minorities) neighborhoods in which other lenders do not also make loans.

Becker (1993) argues that the appropriate test for discrimination is whether loans to minorities are, on average, more profitable than loans to whites. Defaults rates by race might be studied, for instance. If loans to blacks were more profitable than loans to whites, the argument runs, discriminating banks would be willing to accept marginally profitable white applicants who would be turned down if they were black" (Becker, 1993).

Although no study formally shows that statistical discrimination exists, several studies found that minority applicants are more likely to default, controlling for their observable characteristics at the time the loan was granted (Shear and Yezer, 1985, Sunstein, 1990, and Swire, 1995).

[5] The prisoner dilemma is the type of game in which an agent's optimal choice of action depends both on states of nature and the optimal choices other agents make.

The implications of discrimination:

The negative consequences of discrimination in mortgage lending are extensive. Beyond arousing in people a sense of injustice, discriminatory practices may result in market failure, calling for public intervention, and as in any market failure, this imposes real costs on social welfare.

The efficient operation of the invisible hand implies that markets will provide all goods and services where demand is sufficient to cover the cost of supplying these goods and services. Obviously this would not occur in a mortgage lending market characterized by discrimination, which would fail to generate equitable outcomes even when economically efficient ones are possible. This would eventually leave the demand for mortgage loans from minorities (or women or other discriminated-against groups) unsatisfied by discriminating lenders. Market failure is therefore one of the primary consequences of discrimination in the mortgage lending market.

Several authors discussed the consequences, i.e. costs of discrimination in housing and mortgage markets. Galster (1992) demonstrated how discrimination contributes to residential segregation. Similarly, Vandell (1995) indicates how a wide range of strictly market factors may produce spatial heterogeneity, including some degree of residential segregation by income or race, among urban neighborhoods. Discrimination may also foster interracial economic disparities. Because blacks are less likely than whites to own homes, and black-owned houses are thought to be less valuable -- both of which may possibly be related back to prior discrimination -- blacks' share of home equity wealth, which is recognized as being a major source of net worth and inter-generation transfers of wealth for most households, will be below average (Long and

Caudill, 1992). Moreover, minority housing and neighborhood quality (e.g., schools financed by property taxes) may be reduced due to housing discrimination. Since education is positively related to income, reduced educational opportunities for minorities will tend to reinforce other economic inequalities. Finally, minorities' perceptions of market opportunities and their associated search behavior will be altered. Swire (1995) argues that minority expectations of discrimination may cause reduced investment in creditworthiness, henceforth perpetuating the cycle. That behavior from lenders may result in a change in how discrimination victims perceive the payoffs for investment in human capital in the labor market context, or creditworthiness in the credit market context. In particular, if members of a group believe that they will be discriminated against any way, then they may choose to reduce investment in human capital or creditworthiness, given that the payoffs for such costly investments would be minimal. In his analysis, Swire (1995) indicates that blacks were less likely to have even a checking account, after controlling for income, net worth, and educational attainment.

To the preceding list of consequences of discrimination in mortgage lending could also be added the reduction in bank profits, if mortgage lenders, through discriminatory practices, forego profitable lending opportunities to minorities or females applicants. Some fraction of these foregone profits would have contributed on the one hand to neighborhood revitalization and improvements, with likely resulting positive spillover benefits, and on the other hand to the overall social welfare.

Discussing the notion of increased search costs, Yinger (1994) attempted to quantify the costs of discrimination in housing and mortgage markets, both to minority households and to the economy as a whole. Based on previous empirical studies Yinger

(1989) found that black and Hispanic households are shown about 20% fewer properties. Using Courant's (1978) model of search behavior, Yinger estimated the reduction in consumer surplus for minorities facing discrimination. He arrived at an estimate of about $3,000 per minority household per housing search event, or $4 billion in costs to the economy annually.

Massey and Denton (1993) argued that residential segregation is the essential factor underlying black poverty in the United States today, and that despite fair housing laws, racial segregation has been reduced little in recent decades. They further argued that such segregation is not a function of income or social class, since blacks are equally segregated across all income groups. Finally, they quantified costs of residential segregation in terms of increased probabilities of unemployment, crime, dependence of welfare, and other social pathologies incurred, as a result, to society as a whole. Admittedly, precise quantification of these costs may be difficult. Yet most authors seem to agree that neighborhood segregation by income and race leads to negative externalities in urban neighborhoods, particularly in terms of reduced educational quality, and separation from employment opportunities (Kain, 1992).

The legislative response to the discrimination problem, typically justified with reference to the 1949 Housing Act goal of "a decent home and suitable living environment for all Americans," has focused on institutional factors, i.e., the role of intermediaries in the urban housing market, in perpetuating housing segregation. Statutes to address discrimination include the Fair Housing Act (FH), directed at landlords, agents, and others actors in the housing market; the Equal Credit Opportunity Act (ECOA), directed at commercial lenders; the Home Mortgage Disclosure Act (HMDA),

directed at mortgage lenders; and the Community Reinvestment Act (CRA), directed at regulated depository institutions.

Empirical studies on discrimination in mortgage lending:

In 1974, three separate Fair Housing surveys were conducted in order to detect any discrimination in mortgage lending. The surveys were administered by the Federal Home Loan Bank Board (FHLBB), the Federal Reserve Board jointly with the Federal Deposit Insurance Corporation (FDIC), and The Comptroller of the Currency, to institutions under their supervision in eighteen MSAs. These studies, based on analysis of 105,000 mortgage applications and using simple descriptive statistic methods, found large disparities in rejection rates between white and non-white applicants, and more importantly between females and males applicants.

Additional analysis of the Comptroller of the Currency data, using the variable "creditworthiness" to analyze rejection rates while controlling for other factors (gross annual income, gross assets, indebtedness, monthly debt payments, and job tenure), found that in every instance, rejection rates were higher for minorities than for whites with identical characteristics. Moreover, the rejection rates for whites declined with increased income, while for minorities, higher income brought more rejections. As the value of gross assets increased, rejection rates decreased for whites, but for minorities, rejection rates were the same for those with high assets levels as for those with low ones.

Black, Schweitzer and Mandel (1978) investigated discrimination in lending, using data from a nationwide survey conducted by the Comptroller of the Currency-FDIC. Basing their analysis on a probit model of the mortgage loan decision, their major

findings were that economic variables such as down payment percentage and interest rate were significant in determining the acceptance or rejection of a home mortgage application, but so was the non-economic variable of applicant's race.

Schafer and Ladd (1980), in another HUD study, examined the accessibility of mortgage credit for women and minorities. Using mortgage application data, they focused on institutional lenders' decisions to lend, in order to determine "the extent to which mortgage applicants are discriminated against, because of their sex, race, marital status, or age or because of the neighborhood (its age, racial composition, or geographic location) in which their property is located" (Schaffer and Ladd, 1981). Findings of the study indicated that, as expected, objective factors such as the ratios of the requested loan amount to income and to appraised value, explain the vast majority of lending decisions. Applications are more likely to be denied or modified downward as either of these ratios increase. Similarly, applicants with more income or more net wealth, and properties located in relatively risk-free neighborhoods are more likely to be approved. At the same time, the evidence supports several of the allegations that lenders discriminate on the basis of the race, sex, or age of the applicant, the age or the racial composition of the neighborhood, and the geographic location of the property. However, only limited evidence of discrimination on the basis of variables such as marital status or gender of the applicant was found. In fact, the findings do not support allegations of widespread discrimination against female-only applicants. In contrast, the results support the view that lenders discriminate against male-only applicants and against unmarried or separated applicants.

Canner, Gabriel and Woolley (1991) stated that allegations of discrimination in mortgage lending had been based primarily on analysis of data from the HMDA. After controlling for differences in neighborhood income characteristics, their evidence indicated that commercial banks and thrift institutions have extended substantially fewer home purchase loans per-single-family housing unit in predominantly minority neighborhoods than they had in white neighborhoods.

Munnel, Browne, McEneaney and Tootel (1992) of the Boston Federal Reserve Bank analyzed loan application and rejection rates in Boston. They found that lenders discriminated against minority applicants even when income and other factors such as credit history, debt obligations and property characteristics were taken into account. Munnel et al. concluded that many loan officers made extra arrangements for white borrowers with credit problems, in order to help them overcome these problems. Loan officers, however, were less willing to work with black applicants with similar problems.

Avery, Beeson and Sniderman (1993) used the 1990 HMDA data in a nationwide study of discrimination in mortgage lending. The authors focused on aggregate differences in denial rates, while controlling for differences in applicant characteristics, neighborhood type, MSA, and lender type. They found a persistent difference in the denial rates of white and minority applicants, particularly blacks, even after lender, neighborhood, and applicant characteristics were accounted for. The studies also found that the observed racial differences in denial rates were widespread and could not be attributed to a geographic market, loan type or type of lender.

Berkovec, Canner and Gabriel (1993) had one central hypothesis: that systematic racial discrimination in mortgage lending stems from the lenders holding higher

qualification standards for minority applicants (or applicants from minority neighborhoods) than for their white counterparts (to whom more objective measures of default risk are applied). Their study evaluated the default risk characteristics and the performance of single-family residential mortgages, and indicated a higher likelihood of default on the part of black households compared to White, Hispanic, Asian, and American Indian households. In a 1994 extension of their study, the authors tested the hypothesis that discrimination in the lending process should lead to observed default rates that are lower for minority borrowers than for non-minority borrowers, and attained the result that the former have a higher default rate than the later.

Canner and Passmore (1994,1995) used the 1992 and 1993 HMDA data to study developments in the mortgage market. They employed these data to calculate descriptive statistics, and also to analyze patterns of loan applications and their disposition by income and race of the applicant, and by location of the property involved in the loan. They also described the HMDA data and reviewed how it can be accessible to the public.

As it transpires in this literature review, most studies on discrimination in the mortgage lending market have focussed on issues related to racial discrimination and/or redlining. Race appears to have, in most empirical findings, a significant impact on the outcome of mortgage application, with, in every instance, higher rejection rates for minorities than for non-minorities whites (Black, Schweitzer and Mandel, 1978; Schafer and Ladd, 1980; Canner, Gabriel and Woolley; 1991; Avery, Beeson and Sniderman, 1993; Munnel, Browne, McEneaney and Tootel, 1992; Canner and Passmore, 1994, 1995).

However, there is still a great deal of a debate as to what the sources of these disparities are. Some studies argue that objective lending criteria and the variance in application rates are responsible for the differences (Avery, Beeson and Sniderman, 1993; Gabriel and Rosenthal, 1991). Others argue that the differences are simply based on the race of the applicant and/or redlining, which refers to the discriminatory practice of refusing to extend mortgage credit based on neighborhood racial composition in which the property is located (Yinger, 1995; Munnel et al. 1992).

Studies on gender discrimination in the mortgage market:

Very little research has addressed the specific question of gender bias in credit markets. Moreover, almost all of the research was conducted during the early to mid 1970s, before the enactment of the fair lending laws, therefore leading one to wonder if the disappearance of gender discrimination research from current economic literature was a sign of the problem being resolved.

One of the earliest studies on gender discrimination in access to mortgage credit was the study conducted by The U.S. Commission on Civil Rights in 1974 entitled "Mortgage Money: Who Gets It?" which reveals mortgage-lending discrimination related to gender in Hartford, Connecticut. Another study, "Women and Housing, A Report on Sex Discrimination in Five American Cities" (1975), was prepared for the United States Department of Housing and Urban Development (HUD). It assessed credit barriers for women in New York, Atlanta, Saint Louis, San Antonio, and San Francisco. The researchers conducted local public hearings in each city to evaluate the nature and extent of sex discrimination in the housing market including problems in acquiring mortgage

loans. Finally, a later report, "Women in the Mortgage Market" (1976), also prepared for HUD, developed and presented actuarial tables to project income growth and stability of different family compositions in assessing their ability to pay mortgage loans. All three of these reports ascertained the existence of substantial and consistent disparities between female and male mortgage rejection rates.

Disparity in rejection rates for females versus males was also documented in the 1974 FHLBB survey, discussed in the previous section. Rejection rates for female loan applicants were consistently higher than for males in five of the six MSAs surveyed. The following Table 1.1[6] gives an idea of such disparities.

Table 1.1. 1975 male/female mortgage rejection rates

SMSA	Female Rejection Rate (%)	Male Rejection Rate (%)
Atlanta	5.7	7.6
Buffalo	18.3	16.3
Chicago	10.4	7.6
San Antonio	16.8	12.5
San Diego	9.3	6.1
Washington, D.C.	12.6	9.7

Possible explanations of such differentiation in the outcome of the mortgage lending process raise both objective and subjective issues. Since mortgage loans typically involve a lot of money, lenders are concerned with, among other things, the long-term economic stability of the borrower(s). Underwriting formulas are designed to minimize the incidence of default and limit the lender's loss in the event of foreclosure. Regardless of the objective criteria found in the underwriting guidelines, the lenders' subjective conceptions of the borrower played a significant part in the disposition of the

[6] Adapted from Tables 1 through 3.6, Federal Home Loan Bank Board News, 1975.

application (i.e. statistical and taste discrimination always play a role in the lender's decision).

One consequence of such subjectivity was the way in which lenders approached mortgage applications from women as primary or co-borrowers. Lenders believed that women's incomes, especially the incomes of young and married women, were unstable and could not be counted over a long period of time. Therefore, it was considered prudent banking to discount the earnings of married women when evaluating credit for mortgage loans. According to one banking officer, not to do so would have "increased the risk of default and subsequent foreclosure" (U.S. Commission on Civil Right, 1974). Evidence of discounting a wife's income for mortgage purposes is found in many instances in the literature.

The job status of women also had an influencing effect on lenders' credit decisions insofar as some loan officials counted a woman's professional work income more readily than her non-professional earnings (Hayden, 1973; and Russo, 1973). The rationale behind admitting professional income into the loan portfolio was based on the belief that professional jobs were more stable; professional women had more incentive to work steadily than nonprofessional ones. What represented a "professional occupation" was, however, left to the lender's appreciation. While there may be some merit in these assumptions, they were not applied to male borrowers. In fact, when evaluating the economic stability and growth of a two-wage earning couple, lenders held an optimistic view about the man's income and a pessimistic view about the woman's.

The Pennsylvania Commission (1973) concluded that the fundamental belief among lenders was that women were poor credit risks because their income was

"capricious". Russo (1973) arrived at the same determination, arguing that lenders believed that women worked for personal reasons; they considered women income as "pin money", that their motives for working were unreliable, and that they were casual and occasional participants in the business world. Men, on the other hand, worked for economic purposes and only those purposes were deemed valid and reliable.

In sum, these above mentioned preconceived views about women's earnings value, stability and growth in the mortgage lending market may have been stemmed from the thoroughly discussed and publicized male/female wage and work history differences in the labor market. The literature indicates that wage differentials between men and women have been a subject of public controversy for a long time. Active participants in this controversy are politicians, sociologists, economists, and the public at large. Economists have always been disturbed by the persistence of this wage gap; theorists find it difficult to explain in a competitive environment, and empiricists are hard pressed to isolate the contribution of discrimination to the wage gap.

Oaxaca (1973) used data from the 1967 Survey of Economic Opportunity and found a female/male earnings ratio of 54% for whites and 49% for blacks. He then estimated a human capital wage model, where "the effects of discrimination [were] approximated by the residual left after subtracting the effects of differences in individual characteristics from the overall wage differential" (Oaxaca, 1973). From his findings, discrimination accounts for 50 percent of the logarithm of male/female earnings for both white and blacks (respectively 58.4% and 55.6%).

In a similar study, Blinder (1973) analyzed white male/female and male black/white wage gaps, using data from the University of Michigan's Panel Study of

Income Dynamics. He found a 45.6 percent wage differential for white males over white females, men being particularly favored by factors such as life-cycle income stability, and wage gains through education (p.448). According to Blinder, at least two thirds of the male/female wage differential was due to wage discrimination in the labor market.

Differences in work history patterns accounted for a considerable portion of the wage gaps between [races and] sexes, largely because women acquired less tenure, completed less training, and were more likely to work part-time. Economists traditionally have explained the earning differential in terms of women's weaker commitment to their labor force careers, as reflected in both effort and time inputs[7].

It is also commonly believed that differences in on-the-job training account for a substantial proportion of the wage advantage enjoyed by men. In his discussion of the matter, Gronau (1988) found that if one allows for on-the-job training and the skill intensity for jobs, there are only slight differences between the wage functions of men and women. He argues that on-the-job training and job requirements are the two major variables explaining the wage gap. Moreover, and in support of the traditional view, he found that women's labor force participation decisions are more sensitive to their family environment than men's. Planned changes in their family life, such as additional children, are associated with labor force quits, which in turn, reduced on-the-job investment[8].

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[7] In a contrasting view, Corcoran and Duncan (1979) found that superior qualifications or attachment variables explained very little of the earning differences between men and women, because attachment, as measured in their study, had a negligible impact on wages.

[8] Becker and Lindsay (1994) confirm that men are clearly more likely to remain with a firm. The estimated probability of remaining with a new employer is 14.6% for women and 23.2% for men.

O'Neil and Polacheck (1993) examined the gender wage gap during the 1980's[9] and found that, starting in the early 1980's, the female-to-male earnings ratio began to increase, reaching close to 72% in 1990 (from 60% throughout most of the post-WW II period). This rapid convergence in male-female earnings has been just as surprising to many observers as the earlier lack of convergence. O'Neil and Polacheck (1993) indicate that the observed increase in women's years of experience relative to men's accounts for about 1/4 of the approximately 1% per year narrowing wage gap since 1976, while the relative rise in women's return to a year of experience explains an additional 35%-40% convergence. The relative increases in the level and return to women's schooling also contributed significantly to the convergence. The authors also indicate that declining discrimination toward women in the labor market is another factor that might have had an impact on the gender wage gap. A reduction in discrimination could occur as a direct result of government activities, or it could occur through a complex process in which societal attitudes change. For instance, the steepening of women's age-earnings profiles might in part reflect a greater willingness on the part of employers to train and promote women. However, changes in employer behavior may reflect a reassessment based on observed increases in women's work attachment rather than a decline in pure prejudice.

It is clear that women still earn less than men in the labor market, notwithstanding what the reasons are and how they come into play. Thus, the earning differential appears to be at the kernel of the discounting of women's income in the mortgage market. This discounting of women's income indicates the lenders' concerns not only for women's current earnings, but also the difficult assessment of future income

[9] The authors used data from the current Population Survey and PSID data.

growth and stability for two-income families. Creditors want assurance that the amount of the family income, which they assume sufficient to repay a mortgage debt, would continue for at least the early critical years of the mortgage. Relying on the husband's income alone became the standard practice in an effort to prevent default. However, this practice was not predicated (at least back in the 1970's) on any statistical evidence showing that mortgages granted on the basis of both spouses' incomes had a greater default rate than those granted on the basis of the husband's income alone (HUD, 1975). The 1976 (HUD) study was an attempt to fill in that gap, constructing actuarial tables that appraised and predicted income stability and growth for various categories of women. The model produced two and four year forecasts, since mortgagors are most interested in income stability and growth during the early crucial years of repayment. Findings of this study revealed that single women with a stable income of $6,000 in 1966 experienced the same rate of income growth from 1966-1970 as the industry average, i.e., the income growth of the traditional male headed, one earner family with the same $6,000 in 1966 income. The projected income growth for female family heads with equivalent income characteristics was only 7% below the average. Moreover, the projected 1970 income for families in which the wife's financial contributions to family incomes were 20, 30 and 40 percent was only 5, 7, and 10 percent, respectively, below the industry standard (HUD, 1976).

The findings challenged the lenders' belief that women were poor credit risks because their labor force attachment was tenuous. Furthermore, the popular lender hypothesis that women in nonprofessional occupations have a weaker attachment to the work force was not proven in the study. Income growth was compared between families,

in which the wife did and did not have a high school diploma. While the former category enjoyed a higher income, the income growth gap between the two-earner and one-earner families remained the same in both categories. If women with less education and occupying "blue-collar" jobs were more likely to quit work than their "white-collar" counterparts, the income growth gap would have been larger for the families in which the wife did not have a high school degree. The fact that the gap stayed the same for both types of families either questions the hypothesis that education or job status influences the labor market attachment of women, or otherwise means that it is the men's income (in the blue-collar family setting) that experienced a steady increase.

It appears that there were no studies contemporary to the HUD's 1976 study that presented statistical evidence to justify the practice of discounting women's income for mortgage purposes, or any empirical findings to support other kinds of gender discrimination in the credit market[10]. There was no documentation of women being bad or worse credit risks than men.

Another challenge to lender's assumptions that young married women's income is unstable and should be discounted is found in a report cited in the U.S Commission on Civil Rights' 1974 study. The study maintains that there is "no statistically significant relationship between marital status and loan delinquency or foreclosure". While it is true that many married women do quit their jobs following childbirth, there is no statistical evidence that this practice is typical in families where the lost income jeopardizes the mortgage. In fact ninety percent of mortgage delinquencies and foreclosures are caused by marital difficulties (divorce) – not pregnancy (Pennsylvania Commission, 1973).

Given the absence of empirical evidence to support or oppose the view that women were higher credit risks, it appears that the discriminatory practices of mortgage lenders against women, through the discounting of their income, were possibly based solely on the fact of gender discrimination in the labor market and the associated stereotypical beliefs (statistical discrimination). Efforts to halt such practices emerged in the late 1960's and were in full steam by the early 1970's, and changes in lending policies appeared on the federal, state and local levels, with the support of new fair lending laws.

Fair lending legislation:

The Federal Fair Lending Laws originated as a result of social pressures caused by the private sector not meeting its full responsibility in allocating credit in a manner which did not discriminate against minority borrowers. These Fair Lending laws include the Fair Housing Act, the Equal Credit Opportunity Act and its amendments in 1976, the Home Mortgage Disclosure Act of 1975, and the Community Reinvestment Act.

The Fair Housing Act (FH) of 1968 was a centerpiece of the 1960s civil rights agenda. The legislation grew out of two convictions: first, that residential segregation was undesirable, and second, that institutional forces and intermediaries caused or reinforced it. Thus, it was believed that if the nation could simply rule out discriminatory practices by housing market intermediaries, integrated housing patterns would surely result.

With respect to lenders, the FH was specific:

[10] The previous discussion of studies on women wages, and labor force attachment came later in the

> "Discrimination in the Financing of Housing, Section 805: After December 31, 1968, it shall be unlawful for any bank, building and loan association, insurance company or other corporation, association, firm or enterprise whose business consists in whole or in part in the making of residential or commercial real estate loans, to deny a loan or other financial assistance to a person applying therefore for the purpose of purchasing, constructing, improving, repairing, or maintaining a dwelling, or to discriminate against him in the fixing of the amount, interest rate, duration, or other terms or conditions of such loan or other financial assistance, because of the race, color, religion, sex or national origin of such person or of any person associated with him in connection with such loan or other financial assistance, or of the present or prospective owners, lessees, tenants, or such occupants of the dwelling or dwellings in relation to which such loan or other financial assistance is to be made or given".[11]

While FH outlawed overt discrimination in housing, including mortgage lending, the literature indicates that segregation persisted, although it appears to have declined slightly during the 1970's and the 1980's (Mckinney and Schnare, 1989; Gilmor and Doig, 1992). The FH was able to eliminate some of the most obvious examples of housing market discrimination and increase housing market opportunities for middle income minorities in the suburbs, but the anticipated outcome fell short of expectations. As cities continued to decentralize during the 70's and 80's, with employment suburbanizing as well, the phenomenon of poor minority populations increasingly isolated in central cities, surrounded by predominantly white suburbs grew (Mills and Price, 1986). This trend is viewed as being the result of lenders' practices in extending mortgage credit, which means that the FH had been ineffective in affecting the supply of mortgage loans to minorities from lenders.

The Equal Credit Opportunity Act (ECOA) originated in the work of the National Commission on Consumer Finance (Kaye, 1986) aimed in reinforcing FH. The Commission's 1972 report described many barriers to access to credit, for women in

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literature, but no study actually discusses the case of women as a greater credit risk than men.

general, and married women in particular. As discussed in the preceding sections, it was customary for creditors to discount a wife's earnings in determining household income, inquire about the couple's contraceptive practices in determining her probability of future employment, and maintain credit records in the husband's name only. Consequently, on the death of the husband or divorce, the widow or divorcee would possess neither credit, nor credit history.

To correct these practices, the original legislation passed in 1974 made illegal discrimination by any creditor on the basis of sex or marital status. ECOA was enacted to ensure that when an individual applies for any type of credit, her application will be considered on her "creditworthiness", which reflects both the credit applicant ability and willingness to pay. While the statute was expanded in 1976 to cover additional prohibited cases, sex and marital status remain the most litigated areas (Clontz, 1994). In 1976, ECOA was amended to expand protection categories of race, color and religion, national origin, age, receipt of public assistance, and good faith exercise of rights under the Consumer Credit Protection Act. ECOA also requires creditors to provide declined applicants with specific reasons for their rejection.

The institution of ECOA is thought to have spurred the introduction of automatic credit scoring systems. Since the objective of the credit scoring system is strictly prediction, no economic theory is required to support the statistical model. Accordingly, many credit-scoring models assign points in what appears to be a highly erratic, and

[11] The Fair Housing Act is Title VIII of the Civil Rights Act of 1968 (42 U.S.C. 3601 *et seq*).

unfair[12] fashion, since they certainly contain some degree of statistical discrimination as defined in this study.

The most prominent recent allegation of mortgage discrimination, The Decatur Federal Saving case[13], was based on ECOA. In this instance, the Department of Justice alleged violations of ECOA and FHA by Decatur, a major Atlanta mortgage lender. In the consent decree reached, Decatur agreed to pay $1.0 million to 48 different black loan applicants who had been denied mortgage credit. ECOA remains the principal enforcement tool in cases of mortgage discrimination.

The Home Mortgage Disclosure Act, enacted in 1975, requires that data on home mortgage applications be collected and reported, even when the application is not approved.

> "Lenders, more than anybody else, have the power to determine which communities decline and which stabilize or revive. We permit all kinds of tax breaks for home ownership on the theory that pride of ownership creates stable neighborhoods, promotes proper maintenance of housing and maintains property values. But that premise goes down the drain, and so do some fine old communities when lenders decide a neighborhood is a poor risk. (HMDA will) induce lending institutions to begin contributing to the process of urban rehabilitation rather than decay".[14]

This quote from Senator William Proxmire introduces the HMDA legislation and distills the rationale for the 1975 Act, given that academic research at this same time showed that lender practices were at least as much a result of neighborhood change as a cause (Vandell, Hodas, and Bratt, 1974). Furthermore, the preamble of the Act states that it is the intent of HMDA "to provide citizens and Public officials with sufficient

[12] Capon (1982) provides a detailed review of several actual scoring systems.
[13] U.S. v Decatur Federal Savings and Loan Association, United States District Court, Northern District, Georgia, September 17, 1992.

information to enable them to determine whether depository institutions are fulfilling their obligations to serve the housing needs of the communities and neighborhoods in which they are located"[15].

The original legislation required banks, saving institutions and credit unions with more than $10 million in assets and with a branch in a metropolitan area, to disclose the geographic distribution, by census tract, of home purchase and home improvement loans. HMDA was expanded to include saving and loan service corporations and mortgage bank subsidiaries in 1988, and to independent mortgage companies in 1989. Since depository institution balances were publicly available by branch location already, the notion was that community members could compare institutional lending with deposit taking, in order to insure lenders were not "exporting" credit out of their neighborhoods.

Not long after passage of HMDA, commentators began to note the risks that the availability of these data might create. For example, King (1980), comments: "there is great danger that persons will draw implications about discrimination from the HMDA forms without considering why variation exists..."

The Community Reinvestment Act (CRA) asserts that federally regulated financial institutions have a "continuing and affirmative obligation" to help meet the credit needs of the communities in which they are chartered. Federal regulatory agencies assess the way in which lenders carry out this obligation, and consider the assessment in evaluating creditors' applications for mergers, expansions, and acquisitions. The CRA also enables third party challenges to lenders' applications on the basis of poor CRA performance.

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[14] Senator William Proxmire in *Saving and Loans News*, June 1975.

The 1989 Financial Institutions Reform, Regulation, and Enforcement Act (FIRREA), established the mechanism for dealing with the saving and loan crisis of the late 1980's and contained amendments for both HMDA and CRA. The amendments to CRA focused both on enforcement mechanisms, e.g. new power granted to the Federal Home Loan Bank Board to condition member institution borrowing on adequate CRA ratings, as well as procedural changes. The amendments to HMDA were even more significant in that they now required institutions to begin to collect and report information on all applications for home mortgage secured credit, together with the disposition of those applications. This information was to be prepared on a loan application register (LAR) for each calendar year and submitted to the primary regulator by the following March.

Data required include geographic identifiers (state, county, MSA, and census tract), loan amount, purpose of loan, occupancy category, borrower income, race, gender, and disposition of the loan application. Loan purpose may be purchase, refinance, home improvement, or purchase of investment property; occupancy is owner-occupied or not owner-occupied. Only loans secured by 1-4 family dwelling units must be reported. Second mortgages and home equity lines of credit are included only if the applicant indicates that the loan is for home improvement purposes. Disposition categories include application approved and loan made, loan application approved but rejected by applicant, loan application withdrawn, and loan application rejected. In the case of rejections, the lender is also requested, but not obliged, to report the reason for

[15] Public Law No. 94-200, 89 Stat. 1123 (1975).

decline, choosing among nine categories, such as collateral adequacy, debt burden, credit history, and "others"[16].

The Federal Reserve Board compiles this huge volume of data, generally releasing it in cross-tabulations, in October of the following year. All of the data are made public, with the exception of the loan application number used by each lender. Individual lenders receive their own data from the Federal Reserve, in cross-tabulated format. Since 1990, HMDA has been significantly enhanced in order to provide improved monitoring capabilities for both a concerned public and regulatory agencies charged with controlling the activities of commercial lenders.

For several years following enactment of fair lending and equal opportunity laws, a number of pamphlets and books about women's new credit rights appeared. However, whether or not women's rights have been protected and guaranteed under the law remains an empirical issue that has not been systematically investigated.

Research on women in the mortgage credit market seems to have dropped from the literature in the second half of the 1970s, and the lack of research following the anti-discrimination laws may have led to the conclusion that the legislation has achieved the equality between men and women in accessing credit in general, and mortgage credit in particular. However, the literature indicates that discrimination against women still continues in other economic areas, principally in the labor market (Corcoran and Duncan, 1979; Becker, 1994; Oaxaca, 1973; Schmidt, 1996; Gronau, 1988; Oneill and Polacheck, 1993), despite legal prohibitions against such behavior. If that is the case, then it may be

[16] In practice, lenders use this category to include applications with multiple defects; accordingly, the predominant reason for rejection, when reason is reported (only 25% of lenders report reason of denial) is "other."

an erroneous assumption that gender disparities have disappeared in the mortgage credit market.

Conclusion

The available literature on discrimination in the mortgage lending market asserts the existence of "tastes" and "statistical" based discrimination towards minority applicants, and ample evidence suggests the possibility of intentional discrimination in lending. Brief discussions of the implications of discrimination are also provided in the literature. They include market failure and its resulting costs to welfare, increased search costs for minority mortgagors and the associated reduction in consumer surplus, and finally the overall reinforcement of economic inequalities. However, most studies regarding the problem of discrimination in mortgage credit have principally focused on the race issue, and race appears to have, in most empirical studies, a significant impact on the outcome of mortgage application, with, in every instance, higher rejection rates for minorities than for non-minorities (whites). The issue of gender in mortgage discrimination studies remains a missing link. No recent studies were found that have solely focused on inquiring on any gender discrimination in the mortgage market. The literature search uncovered few empirical studies on mortgage lending concentrating on male/female disparities, and no comprehensive study discussing the discriminatory treatment in relation to gender presented strong allegations of widespread discrimination against female applicants. This study aims to fill in that gap in contributing into the analysis of gender discrimination, if any, in the mortgage market.

Chapter Three

DISCUSSION OF THE THEORETICAL MODEL

Discussion of the theoretical model

It is crucial to any analysis in mortgage lending to realize that a lender's first objective, like any businessperson, is profit maximization. The profit potential of a mortgage to a lender is directly related to the loan quality. Factors affecting the quality of a loan can be classified as the applicant characteristics (income and creditworthiness), the property characteristics (price, location value) and the loan characteristics (interest rate and maturity). Consequently, if profitability from granting a mortgage is a function of loan quality, then loan disposition, as an expression of the supply response to mortgage loan demand, should be related to the factors affecting loan quality.

Theoretically, on the supply side, a lender's offer function should include only risk and return variables, since they would reflect the expected costs associated with making the loan and the expected returns from granting a mortgage. It is customary for lenders to establish loan standards with risk limits (with the level of risk determined by the applicant and the property characteristics) beyond which loans are not granted. Each applicant is compared to this established standard and the loan disposition is determined[17].

[17]It is well possible that these risk limits are set in a discriminatory process (either taste or statistical discrimination), as they may be above standard levels allowing some minority groups to qualify.

In all cases, a lender must evaluate the potential for default by the borrower before making the decision whether or not to grant a mortgage loan. Default risk is the probability that a borrower will default on a financial obligation by failing to pay interest, principal, or both. Default risk can be evaluated using an empirically driven credit scoring system or a judgmental system, which incorporates the institution's summary judgment of an applicant's character.

A borrower's default risk is determined by evaluating her repayment capacity, financial condition, collateral strength and character, along with current and expected economic conditions. The relative weight assigned to the credit factors varies with the circumstances of each individual situation.

Repayment capacity reflects the borrower's ability to repay the loan in accordance with all terms and conditions. A borrower's repayment capacity should be sufficient to meet all obligations. Lower income households are associated with higher monthly payment-to-income ratios, which in turn are associated with higher default risk (Calem, 1989). Several researchers (Bester, 1985, Chan and Kanatas, 1985, Milde and Riley, 1988) asserted that variables measuring repayment capacity, such as the borrower's income or loan size, provide a better signal of default risk than the loan to collateral value ratio. The variables and characteristics discussed next are therefore always analyzed in the review of a mortgage loan application.

Applicant's characteristics

To be granted credit, a prospective mortgagor must possess certain attributes or characteristics that convince loan officers that he or she has both the willingness and the financial ability to repay the loan. Common indices used by lenders to assess the risk

associated with making a loan are the following socio-economic and demographic characteristics of the prospective borrower that provide a measure of financial capabilities: the applicant's income, employment status and occupation; the number of earners in the household; the applicant's net-worth-present debt level; credit history, marital status, and race.

The applicant's income is of particular importance in the lending decision. To mortgage loan officers, income reflects the borrower's financial ability to pay. Income similarly provides the means for repayment of the mortgage debt. The greater the income stream of the prospective mortgagor, the greater the reserves to prevent default, as mortgage payments are normally expected to be paid out of current income (Williams, Bernack and Kenkel, 1974). Normally, higher income households spend a smaller proportion of their income for housing expenses, which increases the reserves available to take care of mortgage payments and other obligations. Higher incomes are also normally associated with greater wealth and liquid asset holdings as well as more favorable occupational status (Herzog and Early, 1970).

The lender not only evaluates current income, but also assesses the probability for continuation of income. The lender examines the income source or type of income in order to determine if there is a positive or negative transitory component[18]. In other words, lenders view a flow of money differently, depending on its source. Income from wages and salaries tends to be viewed differently from transfer payments, or the earning of self-employed persons, due to the possible "ups and downs" of these latter incomes.

[18] From Milton Friedman's Permanent Income Hypothesis.

The applicant's occupation may also be used as a means of assessment of the stability of income stream and level of income and, thus, a measure of the borrower's ability to fulfill the terms of the mortgage obligations. Loan officers viewed seasonal occupations as more risky than occupations that are more stable; e.g., salesmen, farmers, self-employed, and unskilled workers are considered greater risks than professionals and salaried workers.

The number of earners in a household has an obvious influence on its economic level. It seems reasonable to assume that the more earners in the family, the greater the income. If a family's income is insufficient to cope with an increased need for housing service, it may become necessary for another family member to enter the labor force. The lender's perception of risk based on an applicant's financial capabilities according to the number of earners may be either positive or negative.

As indicated in the literature review, prior to the passage of the ECOA in 1975, a female spouse's income was usually either ignored or discounted by lenders, who tended to view her employment as temporary and likely to be replaced eventually by child-rearing responsibilities. Since the enactment of ECOA, the automatic exclusion of income on the basis of income source (transfer payments, self-employment income or wages) or sex of earner is prohibited. Today, 75 percent of all married women are employed in the labor force and future projections are for even higher proportions[19]. Because the cost of home ownership has increased dramatically over the decades, it is not unusual to see loan applications where two incomes are necessary to qualify.

[19] Cable News Network (CNN), "Talk Back Live", September 1999.

For the majority of mortgagors, employment status influences the level of income and consequently to a large extent, determines the ability to repay the mortgage. During periods of unemployment, or in areas of higher unemployment rates, most people tend to have lower reserves and thus dissave, unless other income sources are substituted. Dissaving reduces the amount of present and future income available to repay a mortgage. Thus, an unemployed prospective mortgagor would represent a risk too high for most lenders to accept. In other words, the probability of loss for a lender outweighs any benefits from making the loan, thereby making it an unprofitable business venture.

Race has been identified in numerous studies as a significant factor in mortgage lending. African Americans are consistently denied mortgage loans at higher rate than whites. By controlling for race, its effect in loan approval is statistically removed, allowing for a clearer understanding of the relationship between gender and loan approval.

Applicant's marital status is generally used in credit evaluations as a proxy for stability. Lenders may tend to see married individuals as being more responsible and stable than single individuals. Marital status has not been proven to be an important risk variable. Studies on delinquency and default have excluded, then included this variable, and found it not to be a statistically significant risk variable (William, Beranek and Kenkel, 1974). Therefore, marital status is a possible discriminatory applicant characteristic.

One indicator of good financial management ability of a mortgage applicant is whether she can remain solvent. Individuals or families with more liabilities than assets would have neither reserves to fall back on for emergencies, nor sufficient income to

carry a mortgage in addition to other obligations. Mortgage risk would be increased and might even be so high that it implies denial of the loan, since studies have shown that low and negative net worth tend to increase the incidence of default (William, Beranek and Kenkel, 1974).

Credit history has an obvious relationship to risk. If the mortgage loan applicant has no prior experience with credit or has a bad credit history, a lender will face greater risk if he/she extends credit to such loan applicants vis a vis those with good credit records.

Property characteristics

"Collateral" and "location" are the usual variables used in the literature to portray a mortgaged property's characteristics. Collateral is the security backing up the loan to protect the lender in case of default. The amount of collateral taken should reasonably protect the lender, and provide the necessary control of equity repayment. Therefore, mortgage lenders are particularly concerned about the collateral's worth. The market value of the property gives lenders a safeguard in the event of default. Lenders will require that the collateral (mortgaged house) value be equal, if no greater than the amount of the mortgage. Thus, property and neighborhood characteristics affect the value of the collateral. Neighborhood variables such as rate of decline in housing prices, per capita income, and the unemployment rate are thought to be correlated with foreclosure rates on mortgage loans (Calem, 1989). Risk decreases directly with the appraised value of collateral and/or the sales price, holding the size of mortgage constant (FHA, 1963). Property with a lower appraised value may carry a higher risk since the value of the

property may depreciate further over the life of the mortgage, because mortgages are for long periods.

Studies examining the importance of property location on risk have shown mixed results. Lenders tend to regard inner city property as being less creditworthy because of the large number of older units and the low income of residents in these areas. However, studies have shown that mortgages on suburban properties may be riskier than those on inner city properties[20]. This variable is a possible discriminatory variable (redlining), and regulation governing its use exists.

Loan characteristics

The following variables are generally used in portraying loan characteristics: loan maturity, loan-to-value ratio (down payment), interest rate, economic conditions, and mortgage type. The shorter the mortgage life, the smaller the risk for lenders, ceteris paribus. This is true because shorter term-to-maturity means a shorter period over which loan difficulty might occur, or changes in market conditions such as an inflation shock. Conversely, longer maturity could increase the mortgage risk because the mortgagor's equity (borrower's vested interest) tends to increase slowly and there may be little incentive for the mortgagor to prevent delinquency or default in times of adversity arising from income and/or job interruption.

The down payment has been found to be a significant predictor of risk. Experience has shown that risk of default tends to decline with the mortgagor's equity. Since the down payment is the difference between the purchase price of the property and

[20] United States Savings and Loan League, "Anatomy of the Residential Mortgage", Chicago: 1964.

the size of the loan granted, it represents the borrower's initial equity. The larger the mortgagor's equity in the property, the greater the incentive to protect equity and see the loan through to maturity.

While interest rates represent the cost of credit to the prospective borrower, to a lender they represent the value of an investment and, in part, determine the lender's profit on the loan. The interest rate is also the lender's opportunity cost of capital. Interest rates, in sum, reflect the lender's risk in making the loan. Therefore, high-risk and marginal-risk applicants are charged higher interest rates to compensate for the additional costs of servicing higher risk loans.

The availability of mortgage funds may affect loan disposition. During a period of tight money in local as well as national markets, marginal (higher risk) applicants may face higher probability of rejection than during a period of relatively abundant funds and low demand for mortgage financing. Current and expected economic conditions also have an impact on the ability of borrowers to meet their present and future financial obligations, therefore increasing the risk to default. Default often occurs when a borrower is unable to meet monthly mortgage payments because of a decline or disruption in income. Default risk, therefore, is closely related to the broad measures of economic activity such as gross national product and the unemployment rate. Borrowers that work in more cyclical industries or in more distressed areas are more susceptible to experience disruptions in income, and therefore, more likely to represent larger default risks.

The type of mortgage requested influences the amount of risk the lender must accept in granting a mortgage. The federal government through its mortgage insurance

and loan guarantee programs, including the Federal Housing Administration (FHA) and the Veterans Administration (VA), played an important role in increasing the accessibility to home ownership for high-risk mortgage applicants. Through these two programs (FHA and VA) lenders are protected against losses from default, which may affect the loan outcomes and the setting of loan terms.

Modeling mortgage lending

Depending upon data availability, most of the above-discussed applicant, loan and property characteristics are used in the empirical literature modeling mortgage lending. The available literature gives a number of models discussing supply and demand of mortgage loans. King (1980) argues that the demand for and the supply of mortgage credit are strongly linked to the demand for and supply of housing in a neighborhood. The volume of mortgage loan activity in an area is thus a function of those area characteristics that affect the demand for and supply of general housing.

In his discussion of a simple model of the housing market, King indicates that the demand for mortgage loans in a neighborhood can be identified as the amount of credit necessary to clear the market for housing (King, 1980). As such, it depends primarily on the availability of housing, a function in turn of the turnover rate of existing residents (i.e. their desire to move and the desire of others to purchase) and the amount of new construction. It is also a function of variables such as the price and characteristics of housing in this area relative to elsewhere, the neighborhood's characteristics (e.g. access to jobs and shopping), the income and wealth of purchasers and the credit terms offered, such as interest rate and term structure (King, 1980). Credit terms can be extended to

include demand for particular types of credit (FHA, VA or Conventional loans) and particular lenders.

On the mortgage supply side, King (1980) indicates that mortgage lenders' willingness to lend should depend on credit terms and the risk of loss. There are, he pursues, two identifiable but not independent components to risk: one is risk of default and foreclosure and the other is the risk of loss on the foreclosed property. Of these, the second might seem to be the more important. Even if it were known for certain that a loan would lead to default and foreclosure within some period of time, making the loan would be reasonable if the lender obtained property worth more than the outstanding balance plus foreclosure and resale costs. These resale costs include the legal expenses related to taking re-possession of the collateral, the expenses of maintaining the collateral until it is sold, and the amount by which the unpaid loan balance and interest exceeds the collateral value.

Hence, it appears that the only mortgages likely to go into default are those on which the outstanding balance exceeds the property value. Because of this, applicant's characteristics implying the ability to continue mortgage payments, despite temporary financial problems, and implying an interest in good maintenance, so that the property value is maintained, may be the most important qualifications for approval of an application by a rational lender (King, 1980).

In a comprehensive analysis of the existing literature, LaCour Little (1999) gives a survey of representative formal models used to describe the mortgage lending process. Four types of models are estimated in efforts to test for discrimination in mortgage lending (Rachlis and Yezer, 1993): (1) the mortgage flow models employed in early

aggregate studies of the flow of mortgage credit to urban neighborhoods; (2) the "crowding out" models, which assume that the government-insured segment is non-discriminatory and then estimates mortgage-choice equations; (3) default studies, in which default probabilities are estimated, using ex-post data on loans actually originated; (4) rejection probability models using individual loan applications. The later type of model is the most frequently used in the analysis of discrimination against classes or neighborhoods.

A number of rejection models have been estimated, all of them taking forms similar to the following type of equation.

$$\text{Prob}\,(R=1) = \beta'X + \gamma z + \varepsilon \qquad (3.1)$$

R =1 if the loan application is rejected, and R = 0 if the loan application is accepted, X is a vector of application underwriting characteristics, z =1 if the applicant is a minority, and z = 0 if the applicant is not a minority, and ε is the usual error term. A positive γ is taken as evidence of discrimination by lenders. Munnel et. al (1996), in what has been called the Boston Federal Reserve Bank Study, included loan-to-value ratios, housing and total debt ratios, three measures of applicants credit history, employment status, property type, etc., in such an application.

In a more complex formulation, Maddala and Trost (1982) developed a supply and demand model, which underlies the observed rejection process:

Loan Demand: $$L_D = \beta_1 X_1 + \delta_1 R_M + \gamma_1 z + \varepsilon_1 \qquad (3.2)$$

Loan Supply: $$L_S = \beta_2 X_2 + \delta_2 R_M + \gamma_2 z + \varepsilon_2 \qquad (3.3)$$

where R_M is an exogenously determined set of mortgage interest rate, and X_1 and X_2 are vectors of the independent determinants of demand and supply, such as income and housing demand on the demand side, and credit and debt burden on the supply side; and z is an indicator of the applicant's minority status, z = 1 if minority, z = 0 if white; β, δ, and γ are parameters to be estimated, symbolizing the effect of independent variables including interest rates and minority status on loan supply and loan demand. Loans are granted if Ld < Ls; otherwise they are rejected. The parameter γ_2 measures differential loan supply to minority loan applicants; $_2 = 0$ would indicate that minority status does not result in reduced supply of credit from lenders. Maddala aand Trost then show how an estimation of a rejection probability model can reveal the underlying and unobserved supply function (LaCour-Little, 1999).

Yezer, Phillips, and Trost (YPT) (1994) extend the notion that the lender's rejection function is just one of several simultaneous relationships that must be modeled, emphasizing the role of loan terms, which they proxy by loan-to-value ratio. They set out a three-equation model of the mortgage lending process:

$$L_t = \alpha_0 + \alpha_1 R^*_t + \alpha_D D^*_t + \alpha_C C_t + \alpha_M M_t + \varepsilon_{Lt}, \quad (3.4)$$

$$R_t^* = \beta_0 + \beta_1 L_t + \beta_D D^*_t + \beta_C C_t + \beta_M M_t + \varepsilon_{Rt} \quad (3.5)$$

$$D_t^* = \gamma_0 + \gamma_L L_t + \gamma_C C_t + \gamma_M M_t + \varepsilon_{Dt} \quad (3.6)$$

where Lt = loan terms, R^*_t = rejection probability, D^*_t = default probability, C = creditworthiness, M = minority status, and ε_j are the usual disturbance terms. YPT argue that requested loan terms, e.g. loan-to-value (LTV) ratio, depend both on rejection probability (borrowers increase down payments to avoid rejection) and default probability (borrowers with greater default probabilities prefer high LTV's). They also

argue that since loan terms are both a determinant of, and determined by rejection probability, a reduced form estimation of the rejection equation will suffer from simultaneity bias. Alternatively, LTV is not exogenous in the single-equation rejection probability model. Timing is an implicit assumption here: the lender's rejection function must be known, in some sense, prior to the borrower's application; otherwise, of course, rejection probability could not conceivably affect loan terms. Chronologically, the borrower chooses loan terms prior to submitting the loan application so, in that sense, loan terms cannot be endogenous to the rejection equation. Both D* and R* are unobservable. We observe D = 1 (default) when D>D* and R = 1 (loan rejection) when R>R*.

YPT implicitly assume a form of negotiation with respect to the application process. However, they also indicate that this negotiation probably represents a very small fraction of the transactions in the residential home mortgage market. Lenders usually make their decision based on requested loan amount and terms.

Yinger (1993), in perhaps the most general description developed to date, begins his analysis of the mortgage lending model with the notion that lenders' rejection decision depends on the expected return on the loan.

$$R = f(r), \tag{3.7}$$

where R is the rejection probability, r is the expected return on the loan, and f( ) is some function. If lenders discriminate, either against minority applicants, M, or particular neighborhoods, N, then the previous equation should be augmented as follows:

$$R = g(r, M, N), \tag{3.8}$$

where g( ) is another function and discrimination is evidenced by a positive partial derivative of R with respect to either M or N.

The problem, of course, is that expected returns, r, are difficult to observe, so it could be modeled as:

$$r = h(D, C, T), \tag{3.9}$$

where D = default probability, C = cost of default (i.e., loss severity), and T = a vector of loan terms, implicitly including contract interest rate, and h( ) is some function. Since D and C are not readily observable either, they can be modeled as follows:

$$D = v(A, P, T), \tag{3.10}$$

and

$$C = w(P, T) \tag{3.11}$$

where A = a vector of applicant characteristics, implicitly including indicators of creditworthiness, P a vector of property characteristics, T a vector of loan terms, and v( ) and w( ) are additional functions.

By substitution, we have:

$$r = h[v(A, P, T), w(P, T), T], \tag{3.12}$$

which may be simplified to:

$$r = h^*(A, P, T) \tag{3.13}$$

and

$$R = g\{h[v(A, P, T), w(P, T), M, N\}, \tag{3.14}$$

or

$$R = g^*(A, P, T, M, N). \tag{3.15}$$

Most studies seeking to identify mortgage discrimination or redlining have estimated equations similar to the preceding equation. The essential problem, however, is that M, the indicator of minority status, and N, the indicator of neighborhood racial composition, are often negatively correlated with important elements of A, the vector of applicant characteristics, and P, the vector of property characteristics. For instance, applicant income and net worth may be negatively correlated with minority status or racial composition of the neighborhood. Moreover, D, default probability, and C, cost of default may be related to M and N as well. Minority status may be negatively related to indicators of creditworthiness or positively related to default probability (LaCour Little, 1999).

In the present study, where the main focus is about inquiring on the existence of any gender discrimination in mortgage lending, the models used will be similar to equation (3.1) portraying rejection probability as a function of various variables.

$$\text{Prob}\,(R=1) = \beta'X + \gamma z + \varepsilon\,,$$

where, again, R=1 when the loan is rejected, and R=0 when the loan is accepted.

However, due to the limited amount of the information collected through HMDA, principally the non existence of underwriting criteria such as loan-to-value ratios, credit history, employment history, etc., in the present study, the vector X is composed of a number of selected variables representing: (1) default risk (income and loan amount requested), (2) mortgage type (Conventional loans, FHA, VA), (3) mortgage purpose (home purchase, refinance or remodeling) and (4) economic conditions (unemployment rate and population size) of the selected MSAs. The variable z is equal to one if the applicant is a female, and zero if the applicant is a male. A positive γ is considered an

evidence of gender discrimination. A comparative analysis of two sets of data, a randomized sample of raw unmatched HMDA data and a matched-pairs sample data, is used to assess the existence and the magnitude of any gender disparities in mortgage lending.

Chapter Four

DISCUSSION OF THE EMPIRICAL MODEL

In this chapter, the formal empirical model used to answer the questions regarding gender discrimination is developed, the methodology is justified and summarized, the predicted relationships of the variables are addressed, and the data used in the application are discussed. Using a model of mortgage lending incorporating applicant and loan characteristics available in HMDA data, the major objective of this research is to identify any gender disparities, which may be indicative of gender discrimination in the mortgage lending market. The study will undertake both an MSA and a cross regional comparison (South-North), in order to account for socio-economic and cultural differences across MSAs and across regions.

The empirical questions:

In this study, the following empirical questions are addressed:

1. Does *sex* of the applicant impact the likelihood of loan approval?
2. When controlling for applicant's *race*, does gender of the applicant impact the likelihood of loan approval?
3. When *loan amount* requested, *income* of the applicant, *purpose* of the loan and *type* of loan are controlled for, does *sex* of the applicant impact the likelihood of loan approval?

4. To what extent does the applicant's residence (MSA or region of residence) impact the likelihood of loan approval?

A comparative analysis of two sets of data, a randomized sample of raw unmatched HMDA data, and a matched-pairs sample data, is used to test the empirical questions. Each sample is subdivided in income groups: a low-income group for incomes up to $35,000; a median-income group for incomes between $35,000 and $75,000; and a high-income group for incomes over $75,000.

The model

The regressions in this study use the mortgage loan decision (or *action*) as dependent variable, and selected independent variables representing fair lending requirement (gender), default risk (applicants' *income* and loan *amount* requested, mortgage *type* and *purpose* of the loan), and economic conditions (*unemployment* rate and *population* size). *Race* is considered here a control variable. As discussed in Chapter Three, race has been identified in numerous studies as a significant factor in mortgage lending. By controlling for race, its effect in loan approval is statistically removed allowing for a clearer understanding of the relationship between gender and loan approval.

The following models are used in the empirical testing of discrimination in mortgage lending at the MSA level:

Model 1: Action = F (Sex) 4.1

Model 2: Action = F (Sex, Race, Sexrace) 4.2

Model 3: Action = F (Sex, Race, Income, Amount, Type, Purpose) 4.3

where *sex* and *race* represents the mortgage applicant's gender and race, *purpose* and *type* the type of mortgage loan and the purpose of the loan, and *sexrace* an interaction term for applicant gender and race. Each of these variables is discussed more fully below.

At the regional level: the model 3 for the MSA level analysis was augmented by the economic variables (*unemployment rate* and *population* size).

Model 4: Action = F (Sex, Race, Income, Amount, Type, Purpose, Unempl, Pop) (4.4)

Given the nature of the dependent variable, and following the discussion of Chapter 3, the probit model has been chosen as the method of statistical analysis in this study. The choice of probit over other econometric models was justified by the qualitative nature of the dependent variable, the mortgage loan decision (*action*), as well as previous applications to the question of discrimination. Maddala (1983), for example, suggested that probit analysis provide an appropriate estimation procedure for a model of mortgage lending. This methodology is also consistent with investigations into the mortgage lending decision by Black, Schweitzer and Mandell (1978), King (1980), Chafer and Ladd (1981) Maddala and Trost (1982), Gabriel and Rosenthal (1991) and Munnel et al. (1992, 1996).

More generally, several authors have evaluated the results of probit models (as opposed to logit models and related techniques analyzing qualitative data), and the literature indicates that economists tend to use probit more widely than logit. An important reason for this choice is that the probit model is assumed to be based on a multivariate cumulative normal distribution, unless some specific evidence to the contrary is given (Crown, 1998).

From the probit analysis, the statistical significance of the coefficients can be obtained in the traditional fashion, and the differences in the marginal contribution of the coefficients can be determined. The probit model uses the following general functional form:

$$\text{Prob}\,[Y\text{-}0] = 1 - P(\ _0 + \ _1X_1 + \ _2X_2 + \ldots + \ _nX_n)$$

where P(X) is the cumulative normal distribution.

This specification makes the probability depend on observed explanatory variables, $X_1, X_2, \ldots X_n$ reflecting borrower/lender/loan characteristics. In the present study, a positive coefficient for an explanatory variable implies that as the value of the explanatory variable increases, the odds of loan rejection increases, and conversely, a negative sign indicates a reduction in the odds of rejection or a increase in the odds of approval[21].

Estimation of the probit model is achieved by maximizing the log likelihood function. The degree of significance for a probit model is determined by -2 x (log likelihood ratio). This summary statistic of goodness of fit has a chi-square distribution. The statistical significance of coefficient estimates generated by the probit model is evaluated with t-statistics (Black, Schweitzer and Mandell, 1978).

Independent variables

Race is considered here a control variable in order to remove its effect on loan approval, thus allowing for a clearer understanding of the relationship between gender and loan approval. Thus, in this study, the race variable will be coded as zero white

applicants, and one for non-white applicants. The coefficient estimate of the variable *race* is presumed to be positive, as minorities are more likely to be discriminated against than whites, ceteris paribus.

Default risk is the probability that a borrower will default on a financial obligation by failing to pay interest, principal or both. Default risk is captured using independent variables representing repayment capacity and property type, including *income*, loan request and loan guaranty. Unfortunately, no information is available as the applicants credit history

Loan request is the *amount* of the mortgage loan requested by the borrower. Black, Schweitzer and Mandell (1978) included the loan amount requested as a determinant of acceptance in their model of mortgage lending. As the loan request increases, the risk to an institution of having the borrower default rises, ceteris paribus, increasing the probability of rejection. This relationship suggests that the *loan request* variable should have a positive coefficient.

The *income* variable is a proxy for a borrower's repayment capacity as it provides an indication of the income available for loan repayment. It is postulated to have a negative sign, as higher income levels indicate increased repayment capacity. The repayment capacity variables are consistent with Bester (1985), Chan and Kanatas (1985) and Milde and Riley (1988). These authors concluded that variable measuring repayment capacity, such as the borrower's income, loan size, and debt-to-income ratio, provide a better signal of default risk than the loan-to-collateral value ratio.

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[21] The estimated probit coefficients give the percentage change in the odds of an event occurring (loan rejection) given a one unit change in a given independent variable, ceteris paribus

Loan type is a dummy variable coded *one* if the loan application is for a conventional loan and *zero* if the application is for a guaranteed loan (FHA or VA).

Purpose (of the loan) could also help in measuring any differential treatment in the mortgage decision process. Variables such as credit history are assumed to be more of a focus in cases of first home purchase, than for refinance and remodeling. *Purpose* is here a dummy variable, coded one for home purchase and zero for refinance and remodeling.

Economic conditions have an impact on the ability of the borrowers to meet their obligation. Economic conditions are also related the cost of the property and the amount of credit available. The following variables are included in the model, portraying economic conditions: MSA unemployment rate (*unempl*) and MSA population (*pop*). The MSA *unempl* and *pop* variables provide information on local economic conditions. Gabriel and Rosenthal (1991) noted that lenders presumably apply more stringent credit standards to individuals who are at greater risk of becoming unemployed, since they are more likely to loose their jobs and default. The MSA *unempl* is therefore included in the model, and represented by a dummy variable, coded *one* for MSA with high unemployment rate (unemployment rate greater than 4%). The variable is postulated to have a positive sign as a result of lenders applying stricter credit standards in higher unemployment areas. The *pop* variable provides a proxy of MSAs income and price levels. In MSAs with higher populations, the demand for housing is assumed to be larger, ceteris paribus, than MSAs with smaller population. This relationship leads to higher housing prices and higher median loan requests in the more densely populated MSAs. As discussed in the preceding section related to the *loan* request variable, the

larger the loan amount, the greater the risk to an institution from default. Therefore, the higher the MSA population the higher the probability of a mortgage loan application to be rejected. The MSA population is represented in the present study by a dummy variable, coded *one* for highly populated MSAs (where MSA population is equal or greater than 3 million people), and *zero* otherwise.

A grouping of the six MSAs into two regions was done in order to assess any regional differences in home mortgage decision in relation to gender, given that market demand and supply factors as well as cultural and historical factors could be subject to regional influences. Atlanta, Austin and Memphis are MSAs located in the South, where more conservative socio-cultural influences may leave women with less work opportunities and/or rewards than in the North (Boston, Chicago and New York).

The following two tables 4.1 and 4.2 indicate respectively the definitions for the variables used in the model and the predicted relationships between the dependent and the independent variables.

Data set

Data pertaining to the examination of women and mortgage credit is made available by the factors contained in the data collected for the 1996 HMDA. The 1975 HMDA Act requires that financial institutions engaged in mortgage lending record, on a yearly basis, various information regarding home loan applicants and their applications. Social scientists have used HMDA data to calculate and compare the number of applications received and loans extended across geographic, race and income lines.

Table 4.1. Definition for variables used in the probit regression analysis:

Variable Name	Definition	Unit of Analysis
Dependent Variable		
ACTION	Loan action or disposition	Dummy: 1 = Reject 0 = Approved
Explanatory Variables:		
SEX	Applicants GENDER	Dummy: 1 = Female 0 = Male
RACE	Applicants' RACE	Dummy: 1 = White 0 = otherwise
AMT	Loan AMOUNT requested	Thousands of dollars
INCOME	Applicant INCOME	Thousands of dollars
TYPE	Loan Guaranty	Dichotomous dummy variable
CONV	CONVENTIONAL Mortgage	Dummy: 1 = CONV 0 = FHA, VA
PURPOSE	PURPOSE of the Loan	Dummy: 1 = Home Purchase 0 =Refinan, Remodeling
POP	MSA POPULATION size	Dummy: 1= highly populated MSA 0 = otherwise
UNEMPLOY	MSA UNEMPLOYMENT rate	Dummy: 1= high unemployment MSA 0 = otherwise

Table 4.2. Summary of predicted relationships of variables to the mortgage loan decision in the probit analysis

DEPENDENT VARIABLE: LOAN DENIAL (1) or ACCEPTANCE (0)	
INDEPENDENT VARIABLES	EXPECTED SIGN
FAIR LENDING REQUIREMENTS	
GENDER	POSITIVE/NEGATIVE
RACE	POSITIVE
DEFAULT RISK	
LOAN REQUEST	POSITIVE
INCOME	NEGATIVE
CONVENTIONAL MORTGAGE	POSITIVE
FHA, VA MORTGAGE	NEGATIVE
HOME PURCHASE	POSITIVE
REFINANCE/REMODELING	NEGATIVE
ECONOMIC CONDITIONS	
UNEMPLOYMENT RATE	POSITIVE
POPULATION	POSITIVE

The fact of racial disparities in mortgage application acceptance or rejection rates based on HMDA data is thoroughly documented in the academic literature, the popular press and in government funded studies, as briefly described in Chapter One.

However, the HMDA data have some limitations worth indicating. These limitations are mainly related to HMDA's utility in race-related research. However some of the limitations are also pertinent to studies on gender, including the current study. While the data make clear that credit extension disparities exist, the data alone are insufficient to confirm that the disparities are a result of unlawful practices. For example, HMDA does not reveal the applicant's employment history, assets, and credit record, debt obligation and several other factors, discussed above, which determine applicant creditworthiness. In addition, the data do not provide any characteristics of the property other than the census tract in which it is located, nor does it provide information about the loan characteristics such as interest rate or loan maturity.

Another constraint of HMDA data is the limited information provided about the loan demand. Applications alone may be an inaccurate measure for loan demand, since there is no pre-application information available. It is possible that creditworthy applicants, especially racial minorities and women, are discouraged in the screening process from filing a formal application.

In an attempt to assess the possible effects of these limitations (particularly the unavailability of information about the applicant's credit history, and the ones related to the omitted-variables bias issue), and to better evaluate any significant gender disparities in lenders' response to mortgage loan demand, a comparative analysis of two sets of data was undertaken. The first data set was obtained through a random sampling of the

population of raw HMDA data related to the six chosen MSAs. As for the second set, it was obtained through a thorough statistical matching of all male and female applications within the same MSA, by income and loan amount requested. The analysis was then completed with the observance of randomized samples of denied applications, with the objective to detect any trend for females vs. males in terms of "reason for denial."

The matched pair sampling

The statistical sampling method used in this study is similar but somewhat different from the one used by the Federal Reserve System in recent years and allowing for a much better use of HMDA data as an instrument for fair lending regulation screenings (Avery, Beeson and Calem, 1997). The main goal of the Federal Reserve System's sampling method was to determine which institutions, and which loan products or markets served by a given institution, show statistically significant evidence of disparities in the disposition of loan applications by race (or some other protected characteristic) that cannot be explained with the limited set of explanatory variables available in HMDA.

Essentially, this method first sorts an institution's mortgage loan applications by product type (conventional home purchase, FHA or VA home purchase, conventional refinance, FHA or VA refinance, and home improvement), number of applicants (one or more-than-one), the market or MSA, action date, and applicant race. Each minority application is then matched to all non-minority applications filed for the same product, same market, same calendar quarter of action date, with the same number of applicants (single or joint), and similar income and loan amount. Ideally, similar would mean

identical. However, the study in practice considered income and loan similar as long as the average of the absolute amounts differences is less than 8%. The disposition (denial or acceptance) of the minority application is then compared to the average disposition of all non-minority applications matched to it. This comparison is averaged over all minority applications in the institution. Minority applications that cannot be matched to any non-minority ones are not included in the analysis (Avery, Beeson, and Calem, 1997). Finally, examiners use the statistics generated to determine whether a full-blown logistic analysis appears warranted and to help select a product category and market area on which to focus if it is.

The matching process used in the present study is borrowed from the Federal Reserve's. However it is slightly different from the Federal Reserve's study. The difference resides at first, in the objectives of the two studies: while the Fed's study is designed to identify institutions showing discrimination patterns, the present study aims to identify overall discrimination patterns within MSAs or regions. Consequently, the following changes in the data sampling process: statistical evaluations were performed on aggregated mortgage loan applications within an MSA for a whole calendar year, with no banks and/or financial institutions, product or quarter distinction. The actual matching process was performed as follows: all mortgage loans applicants within an MSA are sorted by gender. Each gender group is then sorted by income and loan amount requested. Each female applicant is then matched to the entire sub-sample of male applicants, and a perfect male match is found, with the exact same income and loan amount. Because female applicants represent a much smaller percentage of the whole population of mortgage applicants than their male counterparts, for most of them a

perfect match was found in the male sub-sample. Each final sample in each MSA is therefore made of pairs of male/female applicants, with "perfectly matched" income and loan amount[22].

Simple statistics of the data

A sample of unmatched data was chosen from the population of mortgage loan applicants for each MSA, each of which having the following number of observations: Atlanta, 8499; Austin, 7200; Memphis, 1362; Boston, 8947; Chicago, 5791; and New York, 1675.

The number of observations obtained through the statistical matched pair sampling process for the six chosen MSAs are respectively: 6,062 for Atlanta; 6,720 for Austin; 6,788 for Memphis; 4,630 for Boston; 3,188 for Chicago; and 2,862 for New York. Each data set was subdivided in (3) income groups: (1) a low *income* (low. inc) group for yearly earnings up to $35,000; (2) a median *income* group (med. inc) for earnings between $35,000 and $75,000; and (3) a high *income* group for earnings higher than $75,000. The objective of this subdivision is to better assess the impact of mortgage applicants' income on lender's action, ceteris paribus. Two MSAs in the North, Chicago and Boston, present in both data sets, the highest number of applicants in the high-income group. Similarly, low and median income applicants appear to be dominant in the Southern MSAs.

[22] This sampling procedure may change the weight of the gender variable in the empirical analysis. However there should be no statistical bias (i.e. selection bias), given that the matching process was not based on the endogenous variable of the model.

As a consequence, for both data sets (matched and unmatched) and for all income groups, MSAs in the North present higher means and standard deviation for applicants' income as well as loan amount requested. Means for *income* and *loan amount requested* for the two data sets, aggregated for all three-income groups, are presented respectively in Tables 4.3 and 4.4.

Table 4.3. Unmatched data: simple statistics for income and loan amount requested (all income groups) (amounts in thousands)

	Variable	Observations	Mean	Std Dev	Minimum	Maximum
Atlanta						
	amt	8499	81	55	1	950
	income	8499	55	40	1	97
Austin						
	amt	7103	61	63	1	910
	income	7103	53	42	0	836
Memphis						
	amt	1362	50	45	1	485
	income	1362	54	71	0	840
Boston						
	amt	8947	129	82	2	980
	income	8947	74	53	0	972
Chicago						
	amt	5791	164	119	2	970
	income	5791	111	101	0	981
New York						
	amt	1633	138	99	1	955
	income	1633	77	62	0	770

Table 4.4. Matched data: simple statistics for income and loan amount requested (all income groups)

(amounts in thousands)

	Variable	Observations	Mean	Std Dev	Minimum	Maximum
Atlanta						
	amt	6062	55	32	1	180
	income	6062	32	15	0	131
Austin						
	amt	6720	39	26	1	207
	income	6720	31	16	0	250
Memphis						
	amt	6788	40	26	1	172
	income	6788	26	13	0	263
Boston						
	amt	4630	96	43	2	320
	income	4630	47	18	0	180
Chicago						
	amt	3188	92	53	1	350
	income	3188	51	23	0	237
New York						
	amt	2862	104	63	3	300
	income	2862	45	26	0	178

For both unmatched and matched data sets, Chicago presents the highest means for income (respectively $111,000 and $51,000). The highest means for loan amount are indicated for New York for the matched data ($102,000) and Chicago for the unmatched data sets ($164,000). Similarly, the lowest mean income for the matched data and mean amount for the unmatched data are shown for Memphis (respectively $26,000 and $50,000), while the Austin MSA presents the lowest mean amount for the matched-pair samples and the lowest mean income for the unmatched data ($31,000 and $52,000).

Table 4.5 presents the percentage of female applicants for the unmatched data set. New York presents the highest female application rate, while the lowest is found in Boston.

Table 4.5. Unmatched data: percentage female applications

	Female Applicants	Total applicants	Percentage females
Atlanta	1327	8499	16
Austin	1836	7200	26
Memphis	354	1362	26
Boston	840	8947	9
Chicago	865	5791	11
New York	664	1675	40

For the matched data set, the same numbers of male and females applicant were obtained through the statistical matching process.

Table 4.6 and 4.7 present, for the matched and unmatched data sets and for each MSA and each income group, data on loan type and purpose. Within each sample, for all three income groups and for both males and females, the most common mortgage loan *type* and *purpose* are, respectively, *conventional* (as opposed to *FHA/VA*) and *home purchase* (as opposed to *refinance* and *remodeling*).

Table 4.6. Unmatched data: percentage *purpose* and *type*

Inc. Cat.	MSAs	Type				Total	Purpose				Total
		Conv	%	FHA/ VA	%		Purch.	%	R/Rm.	%	
Hgh-inc.	Atlanta	1245	92	102	8	1347	777	58	570	42	1347
	Austin	1029	88	143	12	1172	651	56	521	44	1172
	Boston	3078	98	68	2	3146	1431	45	1715	55	3146
	Chicag	3330	99	49	1	3379	1883	56	1496	44	3379
	Memp.	115	69	51	31	166	110	66	56	34	166
	N.Y	579	96	24	4	603	359	60	244	40	603
Med-inc.	Atlanta	3711	86	621	14	4332	2467	57	1865	43	4332
	Austin	2882	82	646	18	3528	2576	73	952	27	3528
	Boston	4566	92	414	8	4980	2270	46	2710	54	4980
	Chicag	1801	92	153	8	1954	1059	54	895	46	1954
	Memp.	487	77	144	23	631	311	49	320	51	631
	N.Y	785	89	96	11	881	538	61	343	39	881
Low inc.	Atlanta	2456	87	364	13	2820	1889	67	931	33	2820
	Austin	2169	87	331	13	2500	2120	85	380	15	2500
	Boston	696	85	125	15	821	294	36	527	64	821
	Chicag	402	88	56	12	458	212	46	246	54	458
	Memp.	429	76	136	24	565	269	48	296	52	565
	N.Y	183	96	8	4	191	76	40	115		191

Table 4.7. Matched data: percentage, *purpose* and *type*

Inc. Cat.	MSAs	Type				Total	Purpose				Total
		Conv.	%	FHA/ VA	%		Purch.	%	R/Rm.	%	
High-inc	Atlanta	64	71	26	29	90	66	73	24	27	90
	Austin	97	97	3	3	100	46	46	54	54	100
	Boston	324	97	10	3	334	144	43	190	57	334
	Chicag	413	99	1	1	414	253	61	161	39	414
	Memp.	28	78	8	22	36	22	61	14	39	36
	N.Y	261	93	19	7	280	177	63	103	37	280
Med inc	Atlanta	1765	83	355	17	2120	1335	63	785	37	2120
	Austin	1760	88	234	12	1994	1310	66	684	34	1994
	Boston	2983	92	259	8	3242	1617	50	1625	50	3242
	Chicago	1972	96	78	4	2050	1274	62	776	38	2050
	Memp.	917	69	403	31	1320	703	53	617	47	1320
	N.Y	1536	90	180	10	1716	1031	60	685	40	1716
Low inc.	Atlanta	3244	84	608	16	3852	2452	64	1400	36	3852
	Austin	4293	93	333	7	4626	4004	87	622	13	4626
	Boston	951	90	103	10	1054	497	47	557	53	1054
	Chicago	699	97	25	3	724	490	68	234	32	724
	Memp.	3283	60	2149	40	5432	2981	55	2451	45	5432
	N.Y	836	97	30	3	866	258	30	608	70	866

Table 4.8 and 4.9 present, for the matched and unmatched data sets, the applicants' distribution per race (and gender). In both data sets, and for all income groups, the common mortgage loan applicant is *white*.

Tables 4.10 and 4.11 indicate overall denial and approval rates, in total and by gender, for the two data sets. For the unmatched data, denial rates are the highest for all income groups, and for both sexes, in New York and Atlanta.

They appear to be generally lower for females in the high and low-income groups in most MSAs. For the median and low-income groups, female applicants tend to have higher denial rates than their male counterparts. Moreover, most high female denial rates are found in Southern MSAs (Atlanta, Austin, and Memphis).

Table 4.8. Unmatched data: percentage, *sex* and *race*[23]

Inc. Cat.	MSAs	Male (M)				Total M	%	Female (F)				Total F	%	M+F)
		White	%	Nwhite	%			white	%	nwhite	%			
H inc.	Atlanta	1176	96	52	4	1228	91	115	97	4	3	119	9	1347
	Austin	587	86	97	14	684	58	419	86	69	14	488	42	1172
	Boston	2825	98	62	2	2887	92	251	97	8	3	259	8	3146
	Chicag	2649	91	267	9	2916	86	421	91	42	9	463	14	3379
	Memp.	99	86	16	14	115	69	45	88	6	12	51	31	166
	N.Y	198	58	141	42	339	56	161	61	103	39	264	44	603
M-inc	Atlanta	3441	90	362	10	3803	88	429	81	100	19	529	12	4332
	Austin	1577	61	1010	39	2587	73	691	73	250	27	941	27	3528
	Boston	4322	96	173	4	4495	90	455	94	30	6	485	10	4980
	Chicag	1115	68	519	32	1634	84	209	65	111	35	320	16	1954
	Memp.	331	68	155	32	486	77	103	71	42	29	145	23	631
	N.Y	177	33	355	67	532	60	120	34	229	66	349	40	881
L. inc.	Atlanta	1870	87	271	13	2141	76	524	77	155	23	679	24	2820
	Austin	984	47	1109	53	2093	84	217	53	190	47	407	16	2500
	Boston	674	93	51	7	725	88	86	90	10	10	96	12	821
	Chicag	282	75	94	25	376	82	63	77	19	23	82	18	458
	Memp.	230	57	177	43	407	72	50	32	108	68	158	28	565
	N.Y.	66	47	74	53	140	73	14	27	37	73	51	27	191

[23] Nwhite = non white;

Table 4.9. Matched data: percentage, *sex* and *race*

Inc. Cat.	MSAs	Male (M)				Female (F)				(M=F)	M+F
		White	%	Nwhite	%	white	%	nwhite	%		
High-inc	Atlanta	39	87	6	13	41	91	4	9	45	90
	Austin	47	94	3	6	44	88	6	12	50	100
	Boston	164	98	3	2	163	98	4	2	167	334
	Chicago	189	91	18	9	182	88	25	12	207	414
	Memp.	16	89	2	11	13	72	5	28	18	36
	N.Y	78	56	62	44	79	56	61	44	140	280
Med inc	Atlanta	977	92	83	8	906	85	154	15	1060	2120
	Austin	705	71	292	29	733	74	264	26	997	1994
	Boston	1551	96	70	4	1537	95	84	5	1621	3242
	Chicago	749	73	276	27	854	83	171	17	1025	2050
	Memp.	530	80	130	20	445	67	215	33	660	1320
	N.Y.	383	45	475	55	330	38	528	62	858	1716
Low inc.	Atlanta	1657	86	269	14	1546	80	380	20	1926	3852
	Austin	1161	50	1152	50	1202	52	1111	48	2313	4626
	Boston	487	92	40	8	502	95	25	5	527	1054
	Chicago	243	67	119	33	259	72	103	28	362	724
	Memp.	1451	53	1265	47	1221	45	1495	55	2716	5432
	N.Y.	197	45	236	55	155	36	278	64	433	866

Table 4.10. Unmatched Data: percentage, *action* per *gender*.

Inc. Cat.	MSAs	Male (M)				Total M		Female (F)				Total F		M+F
		Appro	%	Denie	%	N	%	Appro	%	Denie	%	N	%	
High inc.	Atlanta	1099	89	129	11	1228	91	87	73	32	27	119	9	1347
	Austin	562	82	122	18	684	58	482	99	6	1	488	42	1172
	Boston	2679	93	208	7	2887	92	256	99	3	1	259	8	3146
	Chicag	2717	93	199	7	2916	86	423	91	40	9	463	14	3379
	Memp	77	67	38	33	115	69	48	94	3	6	51	31	166
	N.Y	115	34	224	66	339	56	238	90	26	10	264	44	603
Med-inc.	Atlanta	2960	78	843	22	3803	88	311	59	218	41	529	12	4332
.	Austin	2437	94	150	6	2587	73	847	90	94	10	941	27	3528
	Boston	4040	90	455	10	4495	90	477	98	8	2	485	10	4980
	Chicag	1387	85	247	15	1634	84	273	85	47	15	320	16	1954
	Memp.	440	91	46	9	486	77	132	91	13	9	145	23	631
	N.Y	120	23	412	77	532	60	296	85	53	15	349	40	881
Low inc.	Atlanta	1051	49	1090	51	2141	76	535	79	144	21	679	24	2820
	Austin	1981	95	112	5	2093	84	270	66	137	34	407	16	2500
	Boston	596	82	129	18	725	88	92	96	4	4	96	12	821
	Chicag	282	75	94	25	376	82	63	77	19	23	82	18	458
	Memp.	380	95	18	5	398	70	110	66	57	34	167	30	565
	N.Y	66	47	74	53	140	73	37	73	14	27	51	27	191

Table 4.11. Matched Data: percentage, *action* per *gender*

Inc. Cat.	MSAs	Male				Female				M=F
		Approv	%	Denied	%	Approv	%	Denied	%	
High-inc.	Atlanta	42	93	3	7	40	89	5	11	45
	Austin	42	84	8	16	43	86	7	14	50
	Boston	154	92	13	8	148	89	19	11	167
	Chicago	195	94	12	6	193	93	14	7	207
	Memphis	17	94	1	6	14	78	4	22	18
	New York	116	83	24	17	115	82	25	18	140
Med-inc.	Atlanta	884	83	176	17	870	82	190	18	1060
	Austin	586	59	411	41	645	65	352	35	997
	Boston	1449	89	172	11	1462	90	159	10	1621
	Chicago	878	86	147	14	922	90	103	10	1025
	Memphis	524	79	136	21	488	74	172	26	660
	New York	643	75	215	25	673	78	185	22	858
Low inc.	Atlanta	1657	86	269	14	1546	80	380	20	1926
	Austin	711	31	1602	69	703	30	1610	70	2313
	Boston	442	84	85	16	469	89	58	11	527
	Chicago	288	80	74	20	306	85	56	15	362
	Memphis	1946	72	770	28	1938	71	778	29	2716
	New York	286	66	147	34	291	67	142	33	433

For the matched data, denial rates are also slightly higher for females than for males in the high-income group, and for all MSAs (but New York). For the median income group, only two MSAs (Austin and New York) present higher denial rates for males than for females. The low-income group indicates very similar denial rates for males and females. Boston presents the lowest denial rates for both males and females applicants, in the income median and low-income groups. In contrast, Memphis presents the highest or next to highest denial rates for both genders, for all income groups. Overall denial rates appear to be, once again, much higher in southern MSAs than in northern ones.

Applications reported in each of the six MSAs have been sorted by applicant gender, loan amount requested, income category, mortgage type and purpose (conventional home purchase or refinance; government [FHA- or VA- insured] home purchase or refinance; and home improvement).

Individual mortgage loan application information (mortgage loan decision, loan request, income, gender, race, loan type and purpose) were obtained from the 1996 HMDA raw data released by the Federal Financial Examination Council. Economic condition data for each MSA in 1996 were obtained from the U.S census data. As for the United States population gender distribution for 1996, it was indicated in the literature (U.S. Census 1996) to be 35.3% females for 33.5% males.

Table 4.12. 1996 Population size, unemployment and average annual pay

	Pop.	Unempl.	Average Annual pay
Atlanta	3, 532, 675	3.8	$31,354
Austin	1, 038, 660	3.0	$28,707
Boston	5, 554, 431	4.2	$34,383
Chicago	8, 693, 964	5.0	$33,405
Memphis	1, 074, 558	4.4	$27,912
New York	8, 621, 121	6.5	$40,089

Table 4.12 indicates, for each MSA, the data related to population size, unemployment rate, and average annual pay. Population size and unemployment rate for 1996 were both the highest in New York, and their lowest in Austin. Average annual pay was also highest in New York, but lowest in Memphis. All three variables portray higher numbers in northern MSAs than in southern ones.

In this study, the following limitations have been set while proceeding to the data sampling. To assure both validity and reliability, only those applications that met certain

criteria are included in the analysis. First, applications with missing information regarding sex and income were omitted, as both variables are necessary to this study. Secondly, only owner-occupied types of mortgage loans applications were considered. No loan applications for multi-family dwellings were included. One reason is that they present a slightly different risk factor owing to the commercial element of renting out individual units. In addition, income information is not provided for this kind of loan request. Thus, loan applications included in the analysis are conventional and government insured owner-occupied home purchase, home improvement, and refinance applications in which sex, income, and race are known and which result is either loan origination or denial.

Chapter Five

EMPIRICAL RESULTS

Four models were estimated to test the study's empirical questions. The following sections discuss the results of the empirical tests.

Analysis of mortgage lenders' decision relies on both sets of data (the matched and unmatched HMDA data) in an attempt to verify that matching males and females by income and loan amount improves the use of HMDA data as an instrument for fair lending regulations screenings. A probit model is employed to analyze mortgage lenders' decision on both unmatched random samples and matched-pair samples, obtained for six Metropolitan Statistical Areas: Atlanta GA, Austin TX, Memphis TN, Boston MA, Chicago IL, and New York, NY. As the dependent variable (mortgage loan *action*) is a binary variable coded one for "denied" and zero for "approved", a positive coefficient in the model implies that as the value of the independent variable increases, the value of the dependent variable approaches one, or denial of the application. The models for the probit regression use female as the reference category for gender (*sex*), "non-white" for *race*, "home purchase" for loan *purpose*, and "conventional loan" for mortgage *type*.

On both data sets, the analysis starts with a probit regression of *action* on *sex* alone as an explanatory variable. Then the remaining independent variables as well as possible interaction variables, such as *sexrace* (representing the interaction of race with gender of the applicant) are added to the model. The variables representing income of the applicants and the amount of loan requested have been used as independent variables in

the modeling of both unmatched and matched data. Moreover, each data set has been subdivided in three income groups (low, median, and high) in an attempt to better evaluate the impact of income on mortgage lenders' decision.

Model one: regressing *action* on *sex*

Table 5.1 shows the probit results for both the unmatched and the matched data in the regression of the loan *action* (denial or approval) on the *sex* variable.

Table 5.1. Model 1: probit regression of mortgage action on gender

		Unmatched data			Matched data		
MSA	Var.	Low inc.	Med. inc.	High inc.	Low inc.	Med. inc.	High inc.
Atlanta	intcp	-0.0228	0.8408*	1.2533*	0.4037*	0.9699*	1.5011
	sex	-0.7764*	-0.5431*	-0.6372*	0.0951*	-0.5170	-0.2804
		2820	**4332**	**1347**	**3852**	**2120**	**90**
Austin	intcp.	-1.6117*	-1.5531*	-0.9216*	-0.5032*	0.2218*	0.9994
	sex	2.0334*	2.8463*	3.1694*	-0.0098	0.1553*	0.0858
		2500	**3528**	**1172**	**4626**	**1994**	**100**
Boston	intcp.	0.9233*	1.2746*	1.4607*	0.9892*	1.2475*	1.4197
	sex	0.8084*	0.8576*	0.8099*	0.2371*	0.0450	-0.2130
		821	**4980**	**3146**	**1054**	**3242**	**334**
Chicago	intcp.	0.6445*	1.0314*	1.4899*	0.8259*	1.0651*	1.5720
	sex	0.0587	0.0185	-0.1256	0.1905	0.2136*	-0.0783
		458	**1954**	**3379**	**724**	**2050**	**414**
Memphis	intcp.	-1.7036*	-1.3126*	-0.4387*	0.5724*	0.8202**	1.5932
	sex	2.2171*	2.6555*	2.0034*	-0.0086	-0.1790	-0.8285
		565	**631**	**166**	**5432**	**1320**	**36**
New York	intcp.	-1.3233*	-0.7032*	-0.4145	0.4138*	0.6726*	0.9485
	sex	1.7007*	1.8204*	1.7048*	0.0317	0.1144	-0.2771
		191	**881**	**603**	**866**	**1716**	**280**

* Significant at the 1% level
** Signifiant at the 5% level
Numbers in bold represent the number of observations.

The results indicate statistically significant coefficient estimates for all but one MSA (Chicago), and for all income groups, implying an increasing probability of denial for female applicants. Only in Atlanta is the coefficient estimate for gender negative, indicating decreasing denial rates (i.e. increasing approval rates) for females.

The same regression used on the matched-pair sample presents quite different results. The statistical significance for "sex" is present now only in two MSAs for the low-income category (Atlanta and Boston), two MSAs for the median-income category (Austin, and Chicago), and none of the MSAs for the high-income categories. Here the lack of statistical significance of the majority of the coefficient estimates, despite their positive sign, suggests that, when income and loan amount are closely matched, gender of the applicants alone may in fact not be a good predictor of the likelihood of mortgage loan approval or denial.

Model two: regressing action on sex, race, and the interaction variable for gender and race

Table 5.2 presents the results for the probit regression of action on the gender variable (sex), but also the race variable, and the interaction term between the two variables. In the unmatched data set, *sex* remains significant in all MSAs (but Chicago) and for all income categories; it shows a positive sign for the coefficient estimates (thus unfavorable to female applicants) everywhere but in Atlanta.

Table 5.2. Model 2: probit regression of mortgage action on gender and race, and the interaction of gender-race.

		Unmatched data			Matched data		
MSA	Variabl.	Low inc.	Med. Inc.	High inc.	Low inc.	Med. inc.	High inc.
Atlanta	Intcp.	0.0134	0.8852*	1.2748*	0.4246*	0.9919*	1.4260*
	Sex	-0.7618*	-0.4926*	-0.6341*	0.1541*	0.0256	-0.2608
	Race	-0.2897*	-0.5308*	-0.4053	-0.1462	-0.2492	5.4294
	Sexrace	0.0490	-0.0807	-0.2353	-0.2334	-0.3134	0.2608
		(2232.04)	(1979.34)	(357.43)	(1883.80)	(595.02)	(9.96)
		2820	**4332**	**1347**	**3852**	**2120**	**90**
Austin	Intcp.	-1.5551*	-1.5017*	-0.9002*	-0.2654*	0.5264*	1.0410*
	Sex	2.1902*	2.9602*	3.2440*	0.0893	0.1118	0.0558
	Race	-0.1115	-0.1511	-0.1601	-0.5110*	-1.0080*	-0.6102
	Sexrace	-0.3244	-0.3506*	-0.2870	-0.2733*	0.1086	0.4809
		(1088.10)	(1417.07)	(479.56)	(3093.01)	(1133.49)	(25.2)
		2500	**3528**	**1172**	**4626**	**1994**	**100**
Boston	Intcp.	0.9343*	1.2991*	1.4751*	1.0022*	1.2746	1.4979*
	Sex	0.8791*	0.8073*	0.9352*	0.2591*	0.0284	-0.2058
	Race	-0.1475	-0.4861*	-0.4859**	-0.1606	-0.4829	-1.9287
	Sexrace	-.3844	4.7771	-0.7740	-0.3944	0.3019	-0.0379
		(238.51)	(869.04)	(375.92)	(130.81)	(355.86)	(17.92)
		821	**4980**	**3146**	**1054**	**3242**	**334**
Chicago	Intcp.	0.7124*	1.1052*	1.5267*	1.0094*	1.1609*	1.5700*
	Sex	-0.0033	0.0026	-0.0425	0.2921	0.2626	0.0286
	Race	-0.0846	-0.2158**	-0.3320	-0.4923*	-0.3167	0.0231
	Sexrace	0.1402	0.0575	-0.5146	-0.2877	-0.3223	-0.6274
		(511.26)	(1646.89)	(1702.9)	(346.90)	(722.41)	(72.61)
		458	**1954**	**3379**	**724**	**2050**	**414**
Memp.	Intcp.	-1.5847*	-1.2331*	-0.2954**	0.6870*	0.8968*	1.5341
	Sex	2.2280*	2.7243*	2.3053*	0.0299	0.0367	-0.1080
	Race	-0.3225	-0.2848	-6.4109	-0.2374*	-0.3502	5.1722
	Sexrace	0.1355	-0.1388	4.8318	-0.0316	-0.42528	-6.8517
		(252.24)	(249.47)	(59.36)	(3319.7)	(612.13)	(11.43)
		565	**631**	**166**	**5432**	**1320**	**36**
New York	Intcp.	-1.3352*	-1.0019*	-0.40311*	0.4825*	0.8194*	0.8234
	Sex	2.8004*	2.5030*	1.94039*	0.3363	0.1240	0.0549
	Race	0.0222	0.4386*	-0.02762	-0.1245	-0.2552	0.3075
	Sexrace	-1.3856**	-0.9753*	-0.4959	-0.4297	0.0103	-0.2075
		(86.80)	(522.43)	(439.01)	(598.55)	(969.63)	(126.04)
		191	**881**	**603**	**866**	**1716**	**280**

* Significant at the 1% level
** Significant at the 5% level
The numbers in parentheses represent LR Chi-square values and indicate a good fit for the models.
The numbers in bold represent the number of observations.

The matched data set shows the gender variable losing statistical significance in most MSAs in the median-income and high-income categories (i.e. for these income groups, gender doesn't matter in mortgage loan acceptance or denial). The variable remains statistically significant in only two MSAs (Atlanta and Boston) in the low-income category (where it still shows an increasing probability of denial for female applicants).

Race, in the unmatched data set, indicates statistical significance (and low probabilities for denial for minorities) in one MSA (Atlanta) for the low-income group, one MSA (Boston) for the high-income category, and four MSAs (Atlanta, Boston, Chicago, and New York) for the median-income group. In the matched data set, the *race* variable remains statistically significant in two southern MSAs (Austin and Memphis) for the low-income category, all but one MSA (Atlanta) for the median-income category, and none of the MSAs for the high-income category.

As for the interaction variable *sexrace*, it shows no statistical significance in most MSAs. However, when it does (in Austin for median income group, and New York for low-income group), the coefficient estimate is favorable to minority female.

Model three: regressing action on gender, race, loan amount, income, type and purpose

When the variables *race*, *type* and *purpose*, *income* and *amount* are added to the model for the unmatched data, as reported in Table 5.3, the coefficients for *sex* are positive as well as statistically significant for all MSAs but Chicago, and for all income groups .

Table 5.3. Model 3: probit regression of mortgage action on gender, race, loan amount, income, type and purpose

		Unmatched data			Matched data		
MSA	Var.	Low inc.	Med. Inc	High inc.	Low inc.	Med. inc.	High inc.
Atlanta	Intcp	0.1408*	0.4046*	1.2068*	0.6101*	0.4352	1.6680
	sex	-0.6292*	-0.4167*	-0.6517*	0.1124	-0.0153	-0.3348
	race	-0.2480*	-0.5008*	-0.4663	-0.3222*	-0.3865*	6.3681
	amt	0.0134*	0.0073*	-0.0000	0.0135*	0.0130*	-0.0036
	income	0.0175*	0.0117*	-0.0009	0.0182*	0.0073	-0.0096
	type	-0.7981*	-0.5659*	0.0264	-0.7943*	-0.3916*	0.4847
	purpose	-0.7500*	-0.2677*	0.3027	-0.7079	-0.4113*	1.0085
		(3454.54)	(3989.01)	(945.53)	(3601.94)	(1585.46)	(43.49)
		2820	**4332**	**1347**	**3852**	**2120**	90
Austin	intcp	-0.6942*	-1.8951*	-0.5969	0.8749*	1.1978*	-1.3429
	sex	2.0576*	2.8589*	3.2946*	-0.0596	0.1300	0.1811
	race	-0.2308*	-0.2183*	-0.3278	-0.5225*	-0.7456*	-0.2005
	amt	0.0011	0.0033*	-0.0019	0.0132*	0.0139*	0.0055
	income	-0.0061	0.0158*	0.0012	0.0164*	-0.0011	0.0064
	type	-0.8790*	-0.6018*	-0.7366	-1.0312*	-0.7552*	1.2588
	purpose	0.0050	-0.1763	0.7085*	-1.2007*	-0.9819*	0.4740
		(1288.19)	(1598.69)	(630.46)	(3909.70)	(1864.21)	(72.91)
		2500	**3528**	**1172**	**4626**	**1994**	**100**
Boston	intcp	1.4376	0.3520**	1.1916*	1.0213*	0.4796	8.3991
	sex	0.8201*	0.8670*	0.8239*	0.2312**	0.0204	-0.3049
	race	-0.2616	-0.4435*	-0.5706*	-0.3684	-0.2901	-2.3627
	amt	-0.0017	0.0003	-0.0003	-0.0017	0.0029*	0.0027
	income	0.0196*	0.0129*	0.0005	0.0131	0.0038	-0.0025
	type	-0.9212*	0.1064	0.2058	-0.2707	0.2102	-7.0937
	purpose	-0.0604	0.2819*	0.1945*	0.0013	0.3019	0.2500
		(674.43)	(2951.15)	(1508.89)	(717.26)	(1855.62)	(176.79)
		821	**4980**	**3146**	**1054**	**3242**	**334**
Chicago	intcp	1.1499*	0.5944	1.5523*	0.6523	0.5996	6.8789
	sex	0.0651	0.0042	-0.1341	0.1641	0.1697	-0.0467
	race	-0.0667	-0.1591**	-0.3756*	-0.5843*	-0.3904*	-0.4071
	amt	0.0001	0.0004	0.0001	0.0021	0.0034*	-7.9287
	income	-0.0066	0.0095*	0.0004	0.0126	0.0030	-0.0005
	type	-0.4471*	-0.2345	-0.2292	-0.3502	0.0041	-5.2013
	purpose	0.2059	0.2876	0.2379	0.4563*	0.3019*	-0.0377
		(503.84)	(1614.03)	(1690.83)	(579.05)	(1374.76)	(180.86)
		458	**1954**	**3379**	**724**	**2050**	**414**
Memphis	intcp	-1.0076*	-1.3036	-0.2970	0.7687*	1.1418*	4.3878
	sex	2.3469*	2.7992*	2.6348*	-0.0043	-0.0705	17.0253
	race	-0.2947	-0.2204	-2.0999*	-0.2021*	-0.4615*	-34.6688
	amt	0.0069*	-0.0030	-0.0003	0.0098*	0.0090*	3.7927
	income	-0.0132	0.0164	-0.0004	0.0015	-0.0046	0.1930
	type	-0.5785	-0.9452*	-0.6156	-0.5570*	-0.5161*	-69.0479
	purpose	-0.3140	0.0350	0.7490	-0.1947*	-0.1673	-212.4230
		(315.34)	(351.37)	(132.67)	(5195.69)	(1166.33)	(133.55)
		565	**631**	**166**	**5432**	**1320**	**36**

Table 5.3 (continued)

New York	intcp	-2.6629*	-0.8376	-0.5304	-0.1992	0.2507	0.7580
	sex	1.6240*	1.8723*	1.7782*	0.0641	0.1314	0.0020
	race	-0.5006	-0.0493	-0.1948	-0.2969	-0.3547*	0.1799
	amt	0.0009	0.0020	-0.0015	0.0041*	0.0049*	-0.0011
	income	0.0350*	0.0006	0.0018	-0.0074*	0.0003	0.0030
	type	0.7548	-0.5047	-0.2692	0.5040	-0.1099	-0.2525
	purpose	0.1088	0.4969	0.7815	0.2677	0.3020*	0.39531
		(137.68)	(263.91)	(556.32)	(903.72)	(1587.27)	(234.07)
		191	**881**	**603**	**866**	**1716**	**280**

The numbers in bold represent the number of observations.

This clearly implies that when controlling for other relevant variables, such as income, loan *amount* requested, race, etc., *sex* is a predictor for the probability of loan denial or acceptance. The results for the matched data, on the other hand, contrasting with the ones for the unmatched data, no longer present statistical significance for the gender variable.

Race was used in the analysis as a control variable and appears to be statistically significant in most MSAs, in the unmatched data (for the all income groups) as well as the matched data (for all but the high-income group). Contrasting with most findings in the literature, the race variable in this study presents a consistently negative sign for its coefficient, therefore implying increasing probability of approval for minority applicants (nonwhite). It is possible that the "nonwhite" and "white" distinction in this study, as opposed to the usual "black"/ "white" distinction in the literature, is an explanation of the findings for the *race* variable here. The increasing probability for acceptance of Asian

and Hispanic applicants could possibly be offsetting the unfavorable trend of black applicants.

Amount (loan amount requested) is statistically significant in most MSAs in both data sets, but for the first two income groups only (low and median). The variable does not seem to be a predictor of loan action for the high-income group.

Income is statistically significant in most MSAs for the first two income groups in the unmatched data set. For the matched data set, only the low-income category shows statistical significance for income. Neither the median, nor the high-income groups indicate any role for income as predictor of loan action. In sum, *income* and loan *amount* do not present strong coefficient estimates attesting a significant role in predicting loan outcome. Most coefficients for *amount* indicate a positive sign as postulated, even when statistically insignificant. However, the positive signs for income, implying increasing probabilities of denial as income increases, indicates odd results because denial odds are, in contrast, assumed to be decreasing with higher income levels. But again, HMDA data give no information about debt/income ratios and other factors that may influence lending.

Loan *type* yields similar results for both regressions on the matched and unmatched data sets. For the unmatched data, the coefficient estimates are statistically significant in most MSAs for either one of the first two income groups (low and median) or for both. Moreover, they present the postulated negative sign indicative of increasing chances of loan approval for FHA/VA loans and decreasing chances for conventional loans.

Matched and unmatched data present similar results for *purpose* as they did for *type* in the probit analysis. For both data sets, the variable *purpose* is statistically significant in two MSAs of the South (Atlanta and Austin) and in all three MSAs of the North (Boston, Chicago, and New York). In all five MSAs, the variable *purpose* is mostly significant in the low and median income groups only. Moreover, the signs of the coefficient estimates indicate a clear regional difference. In fact, while the probability for approval appears to be higher for first mortgage (*home purchase*) in the South, the inverse seems to be the case in the North, where probabilities for approval are much higher for *refinance* or *remodeling*.

Model four: regional analysis

Two variables have been added to Model 3 with the objective of assessing regional differences in mortgage loan response in relation with economic conditions. These two variables, *unemploy* and *pop* represent, for each MSA, unemployment rate and population size, and are postulated to yield positive coefficient estimates, implying higher probabilities for denial for MSAs and regions with higher unemployment rates and larger population size. This is the broadest set of models estimated in terms of explanatory variables.

Table 5.4 presents the coefficients estimates for the probit regressions used for regional comparison for the unmatched and the matched data sets. The six MSAs have been grouped into two regions, South, and North, the purpose of which being to identify gender differences, if any, in the mortgage loan distribution, across vastly different regions with unique historical and demographic patterns.

Table 5.4. Model 4: regional analysis

		Unmatched data			Matched data		
Region	Var.	Low Inc.	Med. Inc	High inc.	Low inc.	Med. Inc.	High inc.
North	Intcp	3.3577*	2.9470*	2.7379*	1.3469*	0.9672*	1.4191*
	Sex	0.7018*	0.9372*	0.6812*	0.1526	0.0963	-0.1078
	Race	-0.1867	-0.1711*	-0.3218*	-0.4208*	-0.3410*	-0.1648
	Amt	-0.0005	0.0008**	-0.0001	0.0033*	0.0041*	0.0003
	Income	0.0105*	0.0100*	0.0006	-0.0012	0.0024	0.0011
	Type	-0.6051*	-0.0768	-0.0110	0.0393	0.0470	-0.5490
	Purpose	0.0737	0.2899*	0.2800*	0.2231*	0.3009*	0.2064
	Unempl	0.0541*	0.3105*	0.8121*	0.3442*	0.0914*	0.0199
	Popul.	0.2734*	0.2331*	0.5325*	1.5949	0.9189*	1.0515*
		(1373.65)	(7337.30)	(3927.52)	(12956.3)	(4834.82)	(618.56)
		1470	**7815**	**2685**	**2644**	**7008**	**1028**
South	Intcp	-0.8598	-1.9925*	-1.1756	-1.2880*	0.2024	0.3151
	Sex	0.5656*	1.4653*	1.8195*	0.0173	0.0535	-0.1776
	Race	-0.2263	-0.3674*	-0.3858	-0.3585*	-0.6272*	-0.1975
	Amt	0.0069*	0.0061*	-0.0007	0.0120*	0.0121*	0.0048
	Income	0.0139*	0.0134*	-0.0002	0.0112*	0.0027	0.0024
	Type	-0.8592*	-0.5485*	-0.4110	-0.8404*	-0.6192*	0.1556
	Purpose	-0.5680*	-0.2557*	0.3876	-0.6554*	-0.5930*	0.4010
	Unempl	0.9026	0.0848	0.0242	0.4986*	0.3034*	0.2046
	Popul.	1.8556*	1.2078*	1.1231*	0.6276*	0.9264*	1.0143
		(5747.05)	(5519.50)	(2145.11)	(12882.2)	(4690.53)	(150.75)
		5885	**8491**	**2685**	**13910**	**5434**	**226**

The results indicate some regional differences across unmatched and matched data sets, and in terms of the role and importance of the variable *sex* in predicting mortgage lenders' response.

The results for the unmatched data indicate for all income groups, positive and statistically significant coefficient estimates for *sex* in determining *action* both in the South and in the North, but the magnitude of the coefficient estimate appears to be much stronger in the South (for median and high income groups), meaning that the probability for a female applicant to be denied a mortgage loan is much higher in that region than in the North.

As for the results for the matched data set, they appear quite different. *Sex* is no longer statistically significant in the North (expected) or in the South (unexpected), for any of the income groups. This seems to imply that with similar incomes and loan amounts requested, gender of mortgage loan applicants plays little role in lenders decision in any region of residence.

Race remains statistically significant for both data sets in both regions, for the low and median income groups. With its consistent negative signs, the variable still indicates lower probabilities of denial for nonwhite applicants with low or median income.

The variables *unemploy* and *pop* have been added to the modeling of regional analysis of mortgage loan outcome. These two variables represent MSA economic conditions in the model, and portray the postulated positive sign for both matched and unmatched data sets and in both regions, implying increasing probability for denial in more populated areas, and areas of high unemployment rate.

Analysis of denied applications

In an attempt to identify the reasons for denial often indicated for female applicants, a random sample of denied applications was chosen and frequencies for male/female denial reasons observed.

The following random sample sizes of denied applications were respectively obtained for the six Metropolitan Statistical Areas: 1,826 observations for Atlanta; 2,485 for Austin; 1,653 for Memphis; 1,773 for Boston; 1,567 for Chicago; and 1,750 for New York.

Table 5.5 and 5.6 present, respectively, the mean income ($61,000) and loan amount ($91,000) for denied applications, and the male female distribution, per MSA and per denial reason.

What transpires clearly from these simple statistics is that "credit history" and "work history" reasons for denial are indicated for female applicants sensibly more frequently than they are for male applicants. This implies that female applicants are viewed as higher risks than male applicants are, ceteris paribus.

As indicated in previous chapters of this study, HMDA data do not reveal the applicant's employment history and credit record, two crucial factors determining applicant creditworthiness. For the majority of mortgagors, employment status and stability influence the level of income and consequently to a large extent, determine the continuous ability to repay the mortgage. During periods of unemployment, most people tend to have lower reserves and thus dissave, unless other income sources are substituted. Dissaving reduces the amount of present and future income available to repay a mortgage. Moreover, and in support of the traditional view, women's labor force participation decisions were found to be more sensitive to their family environment than men's. Planned changes in their family life, such as additional children, are associated with labor force quits. Thus, a female prospective mortgagor with a succession of relatively short "work histories", explained either by divorce or periods of childbearing, would represent a risk too high for most lenders to accept. In other words, the probability of loss for a lender outweighs any benefits from making the loan, thereby making it an unprofitable business venture to approve a prospective female mortgagor's loan application.

Table 5.5. Denied applications: mean *income* and loan *amount*:

(Amounts in thousands)

Variable	N	Mean	Std Dev	Minimum	Maximum
amount	11054	90	89	1	980
income	11054	60	57	0	981

Table 5.6. Denied applications: percentage, *sex* and *reason* for denial

MSA	Debt to Income				Employ. History				Credit History				Collateral			
	Female(F)		Male (M)		Female		Male		Female		Male		Female		Male	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Atlanta	62	21	341	22	9	3	53	3	189	65	983	64	33	11	156	10
Austin	86	20	509	25	24	24	95	5	303	70	1307	64	17	4	144	7
Memphis	77	25	343	25	8	3	54	4	196	64	830	62	26	8	119	9
Boston	90	37	619	40	16	7	45	3	99	41	649	42	39	16	216	14
Chicago	95	38	603	46	11	4	36	3	116	46	521	40	30	12	155	12
New York	192	40	525	41	15	3	34	3	184	38	410	32	87	18	303	24
North	377	39	1747	42	42	4	115	3	399	41	1580	38	156	16	674	16
South	225	22	1193	24	41	4	202	4	688	67	3120	63	76	7	419	8

Similarly, credit history has an obvious relationship with risk. If the female mortgage loan applicant has no prior experience with credit[24] or has a bad credit history[25], a lender will face greater risk if he/she extends credit to these applicants than to applicants with good credit records.

Given the absence of empirical evidence in contemporary social science literature to support or oppose the view that women were higher credit risks, it is quite difficult, despite the results of the present study, to totally reject the null hypothesis of no differential treatment of mortgage lenders based solely on gender of the applicant.

Summary

Findings in this chapter suggest that no significant disparities exist in mortgage lender decisions based on applicants' gender. The comparative analysis of unmatched data raw with data closely matched in terms of male/female income and loan amount requested establish that gender ceases to be a meaningful determinant of the mortgage loan decision as soon as the data set is changed from unmatched to matched data. It therefore appears that the close matching of male and female applicants, with regard to their income and the amount of loan they requested, makes a difference in the gender variable's ability to predict mortgage lenders' action. The empirical results indicate that for any income group, once male and female applicants' earnings and loan amount are matched, little differentiation in the outcome of their mortgage loan application would be linked to gender.

[24] Most household credit applications are usually made under the husband's name.
[25] Most often married (or divorced) females' credit histories are thought to be contaminated by their (current or previous) spouse's.

The other explanatory variables (*race*, loan *amount*, *income*, mortgage *type* and *purpose*) could be predictors of mortgage action only for low and median income applicants. Once income is higher than $75,000, none of these variables seems to play any significant role into predicting lenders action. Most importantly, an applicant nonwhite status does no longer represent a deterrent to obtaining a mortgage loan.

The grouping of the observed Metropolitan Statistical Areas into regions uncovers no significant regional differences in mortgage decision. However, applicants' gender seems to weigh more in lenders' decision in the South than in the North.

Chapter Six

CONCLUSION

The available literature to date on mortgage credit discrimination has been primarily focussed on *race*, and the variable appears to have, in most empirical studies, a significant impact on the outcome of mortgage application, with, in every instance, higher rejection rates for minorities than for non-minorities (whites). Numerous studies asserts the existence of "tastes" and "statistical" base discrimination towards minority applicants, and ample evidence suggests the possibility of intentional discrimination in lending. Brief discussions of the implications of discrimination are also provided in the literature. They include market failure and its resulting costs to welfare, the increased search costs for minority mortgagors and the associated reduction in consumer surplus, and finally the overall reinforcement of economic inequalities.

The possibility of *gender* discrimination seems to have been largely ignored in the economics literature, ever since the enactment of Fair Lending legislation in the early seventies. Consequently, HMDA data have been underutilized in the analysis of lending patterns with regard to gender.

Credit flow research has been a major use of HMDA data to identify the existence of possible redlining and to target which lenders are practicing geographic selection in the granting of loans. Obviously there is no *gender* analog to redlining since women are not residentially segregated and therefore cannot be denied mortgage credit due to residential location.

The present study is one of the few in attempting to use HMDA data in inquiring on the existence of gender discrimination in the mortgage lending market. HMDA data may be thought to be limited in allowing serious analysis of overt discrimination in mortgage lending, given that they contain no indication about applicants credit history, a major factor in the assessing creditworthiness. However, recent studies (e.g. Avery et. al, 1997) suggested the possibility of using HMDA data to not only evaluate credit extension to women (or other groups discriminated against), but also to calculate and compare the probabilities of approval and denial of female v. males mortgage loan applications, controlling for a number of variables, thus determining whether there are any irregularities based on gender.

The matching method used in this study is similar, but slightly different from the one used by the Federal Reserve System. The Federal Reserve's method first sorts an institution's mortgage loan applications by product type (conventional home purchase, FHA or VA home purchase, conventional refinance, FHA or VA refinance, and home improvement), number of applicants (one or more-than-one), the market or MSA, action date, and applicant race, then matches each minority application to all non-minority applications filed for the same product, same market, same calendar quarter of action date (for large institutions), with the same number of applicants (single or joint), and similar income and loan amount. Examiners use the statistics generated by the step-one program to determine whether a full-blown logistic analysis appears warranted and to help select a product category and market area on which to focus if it is.

In this study, the data are aggregated per MSA and per year. Consequently, there are no bank and/or financial institution or "per quarter" distinction. The main objective

of the data aggregation is related to the purpose of the current study not to undertake lender-to-lender or quarter-to-quarter analysis, but to analyze the overall aspect of lenders action within an MSA, or a region, within a given calendar year. Moreover, the statistical sampling method used in this study allowed the obtaining of exact matches of male and female applicants in terms of income levels and loan amounts requested. Each sample in each MSA is made of pairs of male/female applicants, with "perfectly matched" income and loan amount. Only the principal mortgage loan applicant is observed in this study.

The comparative analysis of the empirical results coming from using probit regressions on both matched and unmatched data sets was an attempt to overcome some aspect of the data limitations[26], thus allowing a better use of HMDA data as an instrument for fair lending regulations screenings. It appears that the matching process does make a difference in the *gender* variable's ability to predict mortgage lenders' action. Findings of the study suggest that, once male and female applicants are exactly matched (in terms of income and loan amount requested), for any income group, little differentiation in the outcome of their mortgage loan application could be linked to gender.

The other explanatory variables (race, loan amount, income, mortgage type and purpose) could be predictors of mortgage action only for low and median income applicants. In contrast with several findings in the literature discussing racial discrimination in mortgage lending, the results of this study assert that an applicant's nonwhite status is not a deterrent to obtaining a mortgage loan. Finally, the grouping of the observed Metropolitan Statistical Areas into regions uncovers little geographical differences in mortgage decision. Once an applicant is in the high-income bracket

(income higher than $75,000), none of the explanatory variables seems to play any significant role into predicting lenders action.

It is nevertheless worth indicating that until publicly available data contain variables representing the true creditworthiness of mortgage loan applicants, no study or sampling method will give a clear view of the existence or not of gender discrimination in the mortgage lending market. However, it is possible that the findings of the present study take researchers a step closer to the truth about gender discrimination in economics.

[26] One of which being the non-availability of any information about applicants credit history in HMDA data.

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