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CROSS-LENDER VARIATION IN HOME MORTGAGE LENDING

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ABSTRACT

The Community Reinvestment Act of 1977 (CRA) requires depository institutions to help meet the credit needs of their communities, including low- and moderate-income neighborhoods, consistent with safe and sound lending practices. Despite the clear focus of CRA and other fair credit and housing legislation on individual lender responsibilities, consumer finance studies generally do not concede any differences in the mortgage lending activities of individual lenders; they consider variance among either individuals or neighborhoods. Virtually all of the studies draw inferences about the practices of some *prototypical lender* from data pooled across many lenders. Our strategy is to examine differences among *individual* lenders in the rates at which they receive applications from, and originate mortgage loans to, minority and low-income applicants. More specifically, we use the new applicant-level data gathered under the Home Mortgage Disclosure Act of 1975 (HMDA) to examine differences in minority and low-income mortgage loan originations across the more than 8,600 U.S. lenders who received applications for single-family home purchase loans in 1990. We then allocate the variance in lender-specific credit originations into two components: differences among lenders in their application volumes from various population groups, and differences among lenders in the actions taken on applications they receive. Both the applications and their disposition are then examined further for lender differences.

Although our analysis reveals substantial differences in regard to lenders' housing market activities, we do not attempt to draw conclusions regarding discrimination. We emphasize that the HMDA data do not contain enough relevant information about the loan applicants to draw any firm conclusions regarding the reasons for observed variance in denial rates. Instead, we take up the broader issue of whether the substantial differences we observe in lenders' credit flows to minority and low-income households stem fundamentally from differences in the volume of these applications received by lenders, or from differential actions taken on the applications. We conclude that for the United States as a whole, the variance across lenders in minority or low-income loan originations, relative to total originations, is overwhelmingly accounted for by the variance in application rates to those lenders, as opposed to relative differences in the disposition of the applications after they are received. We also find that only a small portion of these differences result from application characteristics that may reflect the type of loan being applied for (loan size, FHA/VA or conventional loan, etc.). In addition, they cannot be accounted for solely by geographic differences in markets served by lenders: Lenders that receive a relatively large proportion of minority applications tend to draw applicants from many neighborhoods within their MSA, not just from a small number of predominantly minority census tracts; lenders that receive a relatively small proportion of minority applications fail to attract as many of the minority residents looking for homes in the neighborhoods they serve.

I. INTRODUCTION

During the 1970s, amid concern about the adequacy of housing credit flows to minority and low-income neighborhoods, Congress passed a pair of laws designed to encourage more lending by depository financial institutions (essentially banks and thrifts). Through the Home Mortgage Disclosure Act of 1975 (HMDA), these firms became obligated to collect and publicly report by census tract the total number of mortgage loans they originate. The Community Reinvestment Act of 1977 (CRA) requires depository institutions to help meet the credit needs of their communities, including low- and moderate-income neighborhoods, consistent with safe and sound lending practices. Amendments to HMDA in 1989 now require most depository institutions (and certain other mortgage lenders) to collect and report information on all individual loan applications taken, whether approved or not. Regulators are charged with collecting and using these data to monitor lenders for compliance with CRA and other lending statutes.

This information garners an unusual amount of attention from the news media. It is not uncommon to find newspaper articles, based on HMDA data, that describe the volume of mortgages flowing into different neighborhoods in a metropolitan area, with inferences drawn about the policies of the prototypical lender.[1] When the 1990 HMDA data were released, enabling for the first time a calculation of application denial rates by race and income, news accounts zeroed in on this aspect of the data. Even the Federal Reserve Board (Canner and Smith [1991]), when providing the first glimpse of the 1990-vintage HMDA data, included a discussion of the rates at which different racial and income groups were denied housing credit by all reporting lenders taken *as a group*.

Our strategy is to examine differences among *individual* lenders in the rates at which they receive applications from, and originate mortgage loans to, minority and low-income applicants. More specifically, we use the new applicant-level HMDA data to examine differences in minority and low-income mortgage loan originations across the more than 8,600 lenders throughout the United States who received applications for single-family home purchase loans in 1990. We then allocate the variance in lender-specific credit originations into two components: differences in

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application volumes from various population groups, and differences in response to actions taken on the applications. Both the applications and their disposition are then examined further for lender differences.

Despite the clear focus of CRA and other fair credit and housing legislation on individual lender responsibilities, consumer finance studies generally do not concede any differences in the mortgage lending activities of individual lenders; they consider variance among either people[2] or neighborhoods.[3] We believe the individual lender vantage point actually can provide important insights into the mortgage credit process. First, with regard to compliance, the lender -- rather than the applicant or neighborhood -- is clearly the appropriate unit of analysis. We would like to understand how and why individual lenders differ in their servicing of specific markets. Second, just as previous research reveals that applicants and geographic areas are heterogeneous with respect to the demographic and financial characteristics that affect mortgage lending decisions, we regard lenders as heterogeneous in the markets they service and in the methods they use to penetrate these markets. By looking at these differences across lenders, we may be able to learn something about what works, and what doesn't work, with regard to servicing minority and low-income communities. Finally, ignoring the heterogeneity of lenders may give an incomplete and misleading picture of mortgage market segmentation. For example, one can imagine a market in which some lenders, by working harder to attract minority or low-income loan applicants, actually receive -- and deny -- a larger fraction of such customers than might some other lenders.

Although our analysis reveals substantial differences among lenders in regard to their housing market activities, we do not attempt to draw conclusions regarding lender discrimination. We emphasize in our discussion that the HMDA data do not contain enough relevant information about loan applicants to draw any firm conclusions regarding the reasons for observed differences in denial rates.[4]

Instead, we take up the broader issue of lender differences in credit flows to minority and low-income households: Does the substantial variance we observe in lenders' credit flows stem fundamentally from differences in the volume of minority and low-income applications received by

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lenders, or from differential actions taken on the applications? We conclude that for the United States as a whole, the variance across lenders in minority or low-income loan originations, relative to total originations, is overwhelmingly accounted for by the variance in application rates to those lenders, as opposed to relative differences in the disposition of the applications after they are received. We also find that only a small portion of these differences are due to divergent application characteristics that may reflect the type of loan being applied for (loan size, FHA/VA or conventional loan, etc.). In addition, they cannot be ascribed solely to geographic differences in markets: Lenders that receive a relatively large proportion of minority applications do so from all tracts they serve; lenders that receive a relatively small proportion of minority applications fail to do so because, on average, they tend to draw disproportionately fewer minority applicants from the tracts they serve.

How low-income and minority populations or neighborhoods fare in the marketplace for consumer and housing finance is an important social concern, and the previous studies on credit availability have advanced our understanding of how the markets function. Based on our research, however, we conclude that those who are interested in understanding differences among lenders in credit flows to minority and low-income applicants should focus somewhat more on applications from, and somewhat less on denials to, those groups. We intend this paper to be the first step of a research program organized around lenders and the application process.

II. DATA DESCRIPTION

The HMDA Data

All commercial banks, savings and loan associations, credit unions, and other mortgage lending institutions (primarily mortgage bankers) that have assets of more than $10 million, make at least one 1-4 family home purchase loan, and have an office in a metropolitan statistical area (MSA) are required to meet HMDA reporting requirements. Such institutions must file a loan application register with the appropriate federal regulatory agency for each calendar year. The

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loan register must give the following information for *each* mortgage application acted upon by the institution during the calendar year:

(1)   the loan amount;

(2)   the location of the property (state, county, and 1980 census tract number);

(3)   whether the property is owner-occupied;

(4)   loan purpose (home purchase, home improvement, or refinancing for 1-4 family or multifamily);

(5)   type of loan (conventional, Federal Housing Administration [FHA], guaranteed by the Department of Veterans Affairs [VA] or Farmers Home Administration [FmHA]);

(6)   action taken by the lender (loan approved and originated, application approved but withdrawn, application denied, application withdrawn before lender action, file closed due to incompleteness, loan purchased from another institution);

(7)   the race and gender of the loan applicant (and co-applicant, if any);

(8)   the income relied upon by the lending institution in making the loan decision.

Information on income, race, and sex of the applicant does not have to be supplied by reporting institutions with assets of less than $30 million.

The data used in this study are those reported for 1990, the first reporting year under the new HMDA. In total, 9,333 financial institutions made HMDA filings in 1990; of these, 8,761 provided information on 2,225,983 1-4 family home purchase loan applications in MSAs in which they had an office.[5] About 10 percent of these applications (241,295) never reached the stage of lender action because they were either withdrawn by the applicant or closed due to incompleteness. This left a total of 1,984,688 loan applications, which constituted the sample for most of the analysis presented in this study. These loans were originated by 8,745 separate lenders operating in 40,008 census tracts in all 340 of the nation's MSAs defined as of 1990.

Not surprisingly, the initial HMDA filings contained many errors and inconsistencies that required extensive editing by the receiving federal agencies. Unfortunately, these procedures do

not appear to have been uniformly applied, requiring additional cleaning and editing for this study. In addition, smaller institutions were not required to report race, income, and gender for loan applicants. It was decided to deal with missing data using a "hot deck" imputation procedure similar to that used by the U.S. Census Bureau. Applications with missing data were statistically matched to applications in the same census tract that came closest to them in reported characteristics (race, loan action, income, and loan amount). Missing values were filled in using the variable value of the matched observation. Applications with implausible reported values were treated as missing and imputed in the same way. Overall, income was imputed for 4.9 percent, loan amount for 1.5 percent, gender for 4.0 percent, and race for 5.6 percent of the study sample applications.

Sample Statistics

Applicant statistics for the study sample are given in table 1.[6] Mortgage applicants are a select sample of American households. Household mean income ($63,357) was substantially higher than that reported for all households in the 1989 Survey of Consumer Finance ($35,700).[7] The racial composition of the study sample also appears to differ from that of all U.S. households. Blacks constituted 6.2 percent of the mortgage applicants, yet were 7.4 percent of the homeowners and headed 11.2 percent of the households in 1990. Similarly, Asians, Native Americans, and others were 5.9 percent of the mortgage applicants, but only 2.1 percent of the homeowners and 3.0 percent of the households. Hispanics were more evenly represented: 6.6 percent of the applicants, 4.1 percent of the homeowners, and 6.4 percent of the households.[8] Mean loan amount requested in 1990 was $97,502.

Sample characteristics are further broken down by type of lender and applicant in tables 2 and 3. Table 2 shows the distribution of applications, and table 3 shows the distribution of loan dollar value. Lender here is defined at the MSA level. Thus, a lender reporting loans for two different MSAs is treated as two different lenders.[9] Lenders are grouped by size and type of institution and by the size and minority population of their MSA. Applicants are grouped into five categories: (1) total; (2) minority (Native American, Black, and Hispanic); (3) low-income

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(family income less than or equal to $25,000, roughly the bottom 15 percent of applicants); (4) residents of minority census tracts (those with more than 30 percent of loan applications from minority applicants, roughly 15 percent of applicants); and (5) residents of low-income census tracts (those with more than 30 percent of loan applications from low-income applicants, again roughly 15 percent of applicants).

There is little evidence that specific types of institutions, such as commercial banks or thrifts, specialize in minority lending, defined either by the race of the applicant or by the racial composition of the census tract. Minority applications followed approximately the same distribution as total applications received, with commercial banks taking a slightly smaller share of all minority applications and independent mortgage banks taking a slightly larger share. There is, however, some indication of specialization by size of institution. Lenders receiving more than 500 home purchase loan applications took in 43 percent of all applications and accounted for 55 percent of all minority applications, and 57 percent of applications from minority tracts. This may reflect the concentration of large lenders in large MSAs, where there is a high concentration of minority applicants and minority tracts. Within MSAs, there is no evidence that the larger institutions (those with market shares exceeding 5 percent) receive a disproportionate share of minority applications.

The picture looks somewhat different for low-income applicants. Commercial banks and their subsidiaries receive a disproportionate share of low-income applications, defined either by the income of the applicant or by the census tract. Within MSAs, the largest lenders (those with 5 percent or more of the market) tend to receive more low-income applications. However, when viewed purely by size, lenders receiving 500 or more applications tend to receive fewer low-income applications. This apparent contradiction can be explained by the fact that these lenders tend to be located in the largest MSAs, which have relatively low concentrations of low-income mortgage applicants.

Finally, we note that the measure of minority or low-income lending has little impact on the distribution of minority and low-income applications across lenders. Minority lending defined

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by number of minority applicants, number of minority-tract applicants, dollar value of applications from minority applicants, or dollar value from minority tracts all reveal the same general pattern. The same is true for the various measures of low-income lending.

Disposition of Loans

We now turn to the disposition of these of loan applications (see tables 4 and 5, where table 5 gives dollar value figures). In our data set, .85 of all loan applications were approved in 1990; this is the *total approval rate*. The approval rate for all minority applicants, the *minority approval rate*, was .75. We define the *relative approval rate* (for minorities) as the ratio of these two rates (that is, .75/.85 =.88). Clearly, whenever minority applicants are approved at a lesser rate than the entire applicant pool, this rate will be less than one. But this rate by itself does not inform us about the minority proportion of mortgage originations. To calculate this, we also need to factor into the equation a term we call the *minority application ratio* (minority applications as a percent of the total). We define the *minority origination ratio* as the product of the *relative approval rate* and the *minority application ratio*. In our national data, for example, the minority origination ratio (.12) equals the relative approval rate (.88) times the minority application ratio (.13).[10] The same arithmetic can be applied to low-income applicants, whose relative approval rate is .85. Their origination ratio of .13 is the product of .85 and their application ratio of .15.

When the relative approval ratio for a group is less than one, it reduces the proportion of group members who become *approved* applicants relative to their proportion in the original pool of all applicants. From this perspective, the relative approval rates shown in table 4, although always less than one by type and size class of lender, do not translate into striking differences in the distribution of approved applicants when compared with the distribution of the applications themselves. On average, we observe that lenders of all types and sizes originate a share of their loans to minority and low-income applicants roughly in proportion to, but quite the same as, the share of applications they receive from those groups. Lurking behind these averages are different combinations of these minority application ratios and relative approval rates, generated by divergent actions on the part of both applicants and lenders.

III. DIFFERENCES IN ORIGINATIONS ACROSS LENDERS

The previous section describes the *average* rates of minority and low-income loan applications, and the *average* treatment of those applications by various types of lending institutions. That discussion concerns the performance of the full mortgage market, not of any individual lender operating in that market, and ignores the variation across these individual lenders. For the market as a whole, about 12 percent of all loans went to minority applicants and 13 percent to low-income applicants; however, there is considerable variation in these percentages across lenders. In this section, we compare two possible sources of variance across lenders in minority and low-income originations: dispersion in application ratios and differences in actions taken on these applications, as measured by relative approval rates.

We are motivated to examine these issues because we recognize that there are undoubtedly many actions on the part of both applicants and lenders that could generate the combinations of application rates, denial rates, and mortgage originations that we observe.[11] For example, take two lenders similar in all respects, except that lender A works hard at marketing products to minority and low-income individuals and lender B does not. Assume further that neither lender discriminates against applicants, and that both follow the same underwriting standards. Our analysis of the HMDA data would show lender A with a higher minority application rate than lender B. Their approval rates may differ, however, if the lenders' strategies result in different mixes of qualified and unqualified applicants. If lender A's program brings in proportionately more marginal applicants, it will end up with higher application rates and lower approval rates for the targeted group. On the other hand, if lender A develops expertise in these markets that improves its ability to identify qualified minority and low-income applicants, we may find that it has both a higher minority application rate and a higher approval rate than lender B.

The same pattern of greater minority and low-income approval rates for institutions with higher application rates is consistent with a process of applicants sorting themselves in the credit

markets. Again, take the case of two lenders. Suppose lender A charges a low interest rate for mortgage loans, but has tough lending standards. Lender B has easier lending standards, but charges a greater interest rate as compensation against the larger risk of default. Suppose lenders approve applicants strictly on economic criteria. Further, suppose that in the population at large, minority or low-income status is correlated with loan risk variables such as credit history, work history, and wealth.[12] If applicants can identify lender types readily, lender A would receive fewer minority and low-income applications than lender B, but might actually have a greater approval rate on these applications. On the other hand, if applicants cannot perfectly identify lenders according to their loan-policy types, we would expect to find that lender A's minority or low-income approval rates are lower than those of lender B.

We want to determine how much diversity exists among lenders in the rates at which they receive applications from different population groups, and how much diversity exists in the disposition of applications. Furthermore, we would like to know the extent to which credit origination differences among lenders stem from the former factor versus the latter. Our inquiry extends to the types and sizes of lenders as well. Do commercial banks differ from independent mortgage banks in regard to the sources of variation in loan origination? Do the largest and most urban lenders differ from the others?

<u>Sample</u>

In shifting our focus to lenders, the sample of applications and lenders changes from the one used in the previous section. The sample used to analyze the variance across lenders in minority lending, defined in terms of the number of minority loans, is described in the first row of table 6. The full sample now includes only 11,598 of the 20,695 HMDA-reporting lenders, and 1,867,211 of the 1,984,688 applications. The sample difference results from the following considerations. About 40 percent of the 20,695 lenders in our sample report no minority loan applications whatsoever. Since the minority approval rate (minority approvals/minority applications) is not defined for these lenders, they are excluded from our analysis. In addition, we

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also exclude the 3 percent of institutions that have no loan originations at all, because relative approval rates (minority approval rate/total approval rate) are not defined for these institutions. Lenders that do not receive minority applications or have no loan originations tend to be small, so eliminating all applications made to these institutions reduces the sample of applications by less than 6 percent. Sample statistics for each of our several measures of minority and low-income lending are presented in table 6. Aside from the average size of the lenders and the percent of minority applications, the restricted samples are much the same as the full sample discussed in the previous section.

Ignoring distinctions across lenders, the mean ratio of minority to total originations (the minority origination ratio) in this adjusted sample is .12, the same as for the full national sample reported in table 4. However, the mean of the individual lender's origination ratios is higher, namely .16, because lenders account for different numbers of applications and differ in their own application ratios and approval rates. For example, 959 (8 percent) of the lenders have no minority originations, and 357 of them have minority originations only. Fifty percent of the lenders have minority origination ratios of .08 or less, while 25 percent have minority origination ratios that exceed .18. The standard deviation of the minority origination ratio is .21, a number larger than the mean. Although the figures are not shown in table 6, the application ratio has a mean and standard deviation of .17 and .20, respectively, whereas comparable statistics for the relative approval rates are .87 and .37.

Model

Because the minority origination ratios are equal to the product of the application ratios and the relative approval rates, the variance of minority origination ratios across lenders, which we wish to decompose, is a nonlinear function of the variance of application ratios, the variance of relative approval rates, and the covariance between the two. While the nonlinearity could be removed (through an appropriate transformation of the data), the covariance between the two

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components cannot. As a result, we can assign only ranges, rather than point estimates, to the contribution of each component. The size of the range reflects the influence of the covariance.

Our estimates of these ranges are based on the following linear regression model:

(1) $ORIGR_l = B_l + B2*APPLYR_l + B3*RAPPR_l + u_l,$

where $ORIGR_l$ is the minority origination ratio for lender l (minority approvals/total approvals), B_l is a separate intercept representing a fixed effect for the metropolitan area in which lender l operates, $APPLYR_l$ is the application ratio for lender l (minority applications/total applications), and $RAPPR_l$ is the relative approval rate for lender l (minority approval rate/total approval rate).

The MSA fixed effects control for differences in the mortgage lending market that are common to all lenders in that market but may vary across markets, such as the size of the minority population or lending practices. The variance associated with MSA is removed from the total before we measure the contributions of APPLYR and RAPPR. Thus, the variance captured by APPLYR and RAPPR together is the incremental reduction in the error sum of squares (SS) when both are added to the model that already includes the MSA fixed effects.

The maximum captured by each variable is the reduction in SS (as a share) that occurs when the variable is added to a model that includes only the MSA fixed effects; the minimum is the reduction when the variable is added to the model that already includes the other variable (along with the MSA fixed effects). The minimum is the marginal contribution of each variable, thus attributing the entire covariance to the other variable. The maximum assigns the full covariance to the variable in question.

Results

The result of this allocation of the variance across lenders in minority lending (defined in terms of the number of minority approvals relative to total approvals) is presented in the first line of table 7. We find that the overwhelming majority of the variance in minority originations across lenders is attributable to differences in minority application ratios. Differential approval rates by race account for a relatively small portion of the variance across lenders. For the full sample of

11,598 lenders, 87-91 percent of the variance in minority originations, after controlling for MSA differences, is captured by lender-specific differences in minority application rates; 9-13 percent stems from different approval rates for these applications. This narrow range suggests the contribution of the covariance is quite small, which greatly enhances our ability to identify the importance of the application ratios.

This dominance of differences in lenders' application ratios as the explanation for lender variance in minority originations holds across all types of lenders and all sizes, measured in terms of both the volume of applications received by the lender and the lender's market share (see table 8). The contribution of the relative approval rate component is strongest for mortgage banks operating as either subsidiaries of depository institutions or independent firms. Even in this case, application rate differences among lenders account for at least three-quarters, and may account for as much as 90 percent, of the variance in minority originations. Furthermore, most of this variance across groups of lenders is due to differences in the size of lenders.[13]

The smallest contribution of minority application ratios to the variance in minority originations occurs among small lenders, regardless of the type of lender. For the largest lenders (those with 500 or more applications), differences in application rates account for 93-99 percent; for lenders with less than 100 applications, they account for 85-89 percent. This is also true when size is measured by market share. Differences in lender minority application rates account for 96-97 percent of the variance across those with 5 percent or more of the market, and for 84-89 percent across lenders with less than 1 percent of the market. When institutions are grouped by size and type, we find that the relative contribution of application ratios to the overall variance for any type of lender differs primarily because of lender size.

As a further check on the robustness of our result, we consider several different measures of minority lending: (1) the dollar value of minority loan applications relative to the total dollar value of loan applications; (2) the number relative to nonminority loans, (3) the number and dollar value of loan applications from minority tracts relative to those from all tracts; and (4) the number

of central-city minority loan applications relative to all central-city loan applications. Similarly defined measures of low-income lending are also analyzed. For each measure, our sample includes all lenders for which the origination ratio, application ratio, and relative approval rates are defined. The samples used in the analysis of each measure, and the pertinent sample statistics, are denoted in table 6. The allocation of variance for these alternative measures of minority lending are presented in rows 2-6 of table 7.[14]

The results are virtually identical when dollar values rather than numbers of applications are used or when minority census tracts rather than minority applicants are examined. We recognize that it has been more common to compare minority relative to nonminority lending, rather than minority relative to total lending, as we have done in this paper. The results presented in table 7 indicate that with the more conventional approach, an even larger portion of the variance is attributable to differences in application rates. We prefer the minority-relative-to-total framework because it tends to put less weight on the lenders with extreme values.

In the above analysis, we have assumed that the relevant market for lenders is the MSA. This may not be true for all lenders. Some may operate on a small scale, in the rural fringe, or in the remote suburbs of an MSA, where the minority population is very small. Including these lenders in our sample may introduce additional variance in applications and approvals, which reflect differences in the market rather than in individual lenders' response to the market. Our findings with regard to large lenders lend some support to our interpretation. It may be reasonable to assume that the MSA is, or should be, the relevant market for any lender that receives more than 500 applications in an MSA or has a market share greater than 5 percent. These are the lenders for which differences in application rates explain the largest portion of the variance in minority approvals. Our conclusions are further supported by an analysis limited to central-city lending (row 6 of table 7). Here we conduct the same decomposition as above, but restrict our attention to loan applications for properties in central-city tracts. As was the case with the MSA-level analysis, the majority of the variance in minority origination ratios across

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lenders is attributable to differences in minority application rates, rather than to actions taken on these applications.

Our results concerning low-income lending are much the same as those for minority lending (rows 7-12 of table 7, with sample statistics in rows 7-12 of table 6). Differences across lenders in low-income applications as a share of total applications account for the lion's share of differences across lenders in low-income originations as a share of total originations. Again, this is true regardless of the type, size, or market share of the institution. The primary difference is that the ranges for low-income lending are larger than those for minority lending, indicating that the covariance between application ratios and relative approval rates contributes more to the variance across lenders in low-income than in minority origination ratios.

From the above analysis, we conclude that differences in the relative approval rates of minority and low-income loans account for only a small portion of the variance across institutions in the share of originations going to minority and low-income applicants. However, applications to lenders and lenders' actions on these applications are almost certainly interrelated. The applicant's decision of where to apply is probably influenced by the action he or she expects from the lender. In our sample, we find a positive correlation across lenders between minority application ratios and relative approval rates. This is consistent with minorities choosing to apply at institutions they perceive will treat them more favorably. A full examination of this issue, however, requires an understanding of the application decision that is beyond the scope of our current paper.

IV. FURTHER EVALUATION OF LENDER DIFFERENCES IN ORIGINATIONS

In section III, we found that the majority of the variance among lenders in minority loan originations is attributable to differences in minority application ratios, although relative differences in the disposition of minority applications also contribute somewhat to the observed variance. The question remains as to what accounts for these lender differences in application

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ratios and relative approval rates. One possible explanation is that lenders specialize in specific markets identified by either loan products or geographic areas. These markets could be distinguished from one another by such application characteristics as loan size, applicant income, loan type (such as FHA/VA or conventional), and property location. To the extent that these characteristics are correlated with race, this specialization will contribute to the observed variance across lenders in the percent of minority applications received. Similarly, to the extent that these characteristics are correlated with creditworthiness, they may also contribute to the observed differences in relative approval rates. In this section, we examine the application characteristics and property location factors to determine their roles in creating the differences we observe among lenders in their minority application ratios and relative approval rates.

Decomposition of Minority Application Rates

For each lender, we partition the minority application ratio into three components: the portion attributable to differences in the application characteristics (for example, loan size, loan type), the portion attributable to the geographic market served by that lender (both MSA and census tract), and the portion attributable to pure lender effects. For each lender, the first two components are measured by the racial mix of applications predicted on the basis of the market served, where the lender's market is defined by the nonracial characteristics of the applications that the lender actually receives, and by the MSA and census tracts from which it draws applications. As an example of the first component, suppose the only relevant application characteristic is loan type (FHA/VA or conventional) and that in one lender's market, minorities comprise half of *all* FHA/VA applicants and one-tenth of *all* conventional loan applicants. If the data show that a lender's applications are split 30 percent FHA/VA and 70 percent conventional, we would predict, based solely on loan type, that 22 percent of this lender's applications would be from minority applicants ($.3*.5 + .7*.1 = .22$). The second component is derived from a similar comparison of the lender's geographic mix of applications and its market's composition of minority applicants. The third component, the pure lender effect, is measured by each lender's

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deviation from what we would predict based on the first two components alone; that is, its propensity to draw a higher or lower percentage of minority applicants than is typical for lenders active in its market.

The procedure we use to construct the three components is by necessity based on characteristics reported under HMDA. The full 1,984,688 loan sample is used to estimate a fixed-effects linear probability model. The dependent variable is coded one if the applicant was a minority (Native American, Black, or Hispanic) and zero otherwise. Independent variables include gender, marital status, occupancy, income, loan amount, income-to-loan-ratio, loan type, and interactions among these variables. In addition, 607,631 separate intercepts for *each* combination of lender and census tract are included as fixed effects.[15] The resulting coefficient estimates are reported in appendix table 12.

Although the regression shown in appendix table 12 separates applicant-specific factors from those representing location and institutions, the effects of lender, MSA, and tract are still intertwined in the fixed-effects dummies. These were separated using an iterative procedure equivalent to regressing values of the 607,631 fixed-effects intercepts against the 340 MSA, 40,008 tract, and 20,695 institution dummies.

The computation of separate applicant, tract, and lender effects for each application allows the average difference in the race of applicants to be assigned to various sources. The predictive model estimated for the race of the applicant has the form

$$(2) \qquad Race_{imcl} = AC_i + MSA_m + T_c + LO_l + e_{imcl},$$

where Race is one if the ith applicant using the lth lender in the mth MSA and c^{th} census tract is a minority and zero otherwise, AC are the applicant's economic characteristics, MSA is the MSA effect, T is the tract effect, LO is the overall lender effect, and e is a residual. Table 9 shows the decomposition of the average difference in the race of applicants using such a model.[16]

Loan application characteristics and the overall lender effect are unhelpful in predicting an applicant's race; the tract and MSA effects are more useful, contributing 22.7 percent and 8.7

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percent, respectively, to the prediction.[17] However, a large portion (63.9 percent) of the race of the applicants cannot be predicted with these variables. This can be interpreted as a within-lender-tract-MSA residual.

So far, we have fully exploited the HMDA data at the application level to assess the connection between both application characteristics and property locations, and race. Now we can recompile these individual applications back into the lenders' portfolios, enabling us to address the question of how much of the *cross-lender variance* in the racial mix of applicant pools can be attributed to differences in the application characteristics and census tracts served by each lender. We can also assess how much of the variance stems from pure lender differences. This decomposition of variance is similar to that conducted in the previous section. The percent of minority applications for each lender is regressed against the percent minority predicted by our model using the lender's application characteristics, census tracts served, and a lender residual. We approximate the effect of each component by regressing it separately against the dependent variable and by computing the reduction in the explanatory power of the full equation when each component is dropped.

Table 10 shows the sources of variation across lenders in the racial composition of their applications.[18] Differences in application characteristics account for 0.8 to 2.6 percent of the within-MSA variance across lenders. Much more surprisingly, differences in the census tracts from which lenders receive applications account for only 21.9 to 28.9 percent of the variation, with 70.8 to 74.8 percent of the variation across lenders unexplained. This means that most of the variation across lenders in the number of minority applications received does not stem from the fact that they serve different neighborhoods, *but from how they draw applicants within neighborhoods*. This result, which is robust to a number of variations, such as ignoring MSA effects or weighting the regression by number of applications received by the lender, runs counter to the conventional wisdom that neighborhood service areas are the major cause of cross-lender variation in the proportion of minority applications received.[19]

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Decomposition of Relative Approval Rates

We now turn to an analysis of institutional differences in the relative approval rates of minority and nonminority loan applicants. This approach is similar to that used to decompose variation in lender minority application rates. We first estimate a model to predict the likelihood that an individual loan application would be denied based on objective characteristics independent of which lender receives the application. We then calculate the extent to which individual lenders deviate systematically from this predicted denial rate.

The sample and methodology used are almost identical to that used to decompose variation in lender application rates. The full 1,984,688 loan sample is used to estimate a fixed-effects linear probability model. The dependent variable is coded zero if the application was approved and one otherwise. Independent variables represent all those used in the minority equation plus dummy variables for six applicant and two co-applicant racial categories. The racial dummies are also interacted with FHA and VA loan dummies. We include separate intercepts for each combination of lender and census tract. Again, there are 607,631 unique combinations of the 40,008 tracts and 20,695 lenders in the sample, and an iterative procedure is used to solve for individual lender, MSA, and tract effects in a second stage of the analysis.

The resulting regression is reported in appendix table 13. A positive coefficient can be interpreted as the expected rise in the probability that an applicant's loan would be denied resulting from a one-unit increase in the independent variable, holding all other variables constant -- specifically, the applicant's MSA, census tract, and lender. Thus, the coefficients on race, for example, represent the expected difference in the probability that a white and black applicant with the same income, gender, FHA/VA status, loan amount, MSA, census tract, and lender will have their loan application denied. Thus interpreted, the estimated black/white (.103) and Hispanic/white (.048) differences for conventional loans are quite significant. Differences are similar for FHA loans (.116 and .030).

The computation of separate applicant, MSA, tract, and lender effects for each application allows the average difference in the denial rate of minority and nonminority applicants to be assigned to various sources. The predictive model estimated for application denial has the form

(3) $\text{Denial}_{imcl} = AC_i + MSA_m + T_c + LO_l + e_{imcl},$

where Denial is one if the ith applicant using the lth lender in the mth MSA and c^{th} census tract is denied, and zero otherwise, AC are the applicant's economic characteristics (as measured with all applicants assumed to be white), T is the tract effect, LO is the overall lender effect, and e is a residual. Table 11 shows the decomposition of the average difference in the denial rates of minority and nonminority applicants using such a model.

On average, 25.2 percent of minority loan applications were denied versus 13.1 percent of nonminority applications. Less than one-seventh of the gross difference in denial rates (12.1 percent) can be attributed to differences in applicants' economic characteristics (as measured by predicted values from the denial regression). MSA, census tract, and overall lender effects, as measured by average differences in the MSA, tract, and institution dummies associated with each type of applicant, account for just over one-quarter of the difference (3.5/12.1). The portion attributable to racial sorting (that is, minorities applying to lenders with higher minority approval rates and nonminorities applying to lenders with lower minority approval rates) is very small (only .2 percent). The major portion of the difference remains unexplained and cannot be attributed to any of these sources. This unexplained race differential may be due to differences in credit histories, employment histories, loan-to-value ratios, or other factors considered in the loan evaluation process that are not included in the HMDA file, or to differential treatment based solely on the race of the applicant.

The predictive equation is used to examine the source of variation in the disposition of applications across lenders. Table 12 shows this decomposition. The ratio of the approval rate of minorities to that of all applicants for each lender is regressed against two variables computed separately for the minority and total applicants of each lender: (1) the portion attributable to

application characteristics as measured by the predicted value from the denial regression (assigning all applicants to the same race); and (2) the portion attributable to property location. Again, because we are looking at a decomposition of variance, the amount charged to each source can only be approximated. These regressions are performed on within-MSA data; between-MSA variations are thus removed.

Between 2.4 and 4.6 percent of the variation in relative approval rates across lenders within MSAs can be attributed to variation in the application characteristics. Location accounts for between 4.0 and 5.9 percent of the variation. The overwhelming majority of variation (91.0 to 92.7 percent) cannot be explained by these factors.

Similar conclusions are reached when we examine sources of variation in the minority approval rate (table 13). Applicant economic and census tract effects are small. The overall credit standard of the institution explains about one-third of the within-MSA variation (that is, minorities tend to apply to institutions with relatively large denial rates for all applicants, ceteris paribus). However, more than half of the variation in minority approval rates cannot be explained by any of these factors. These remaining differences may reflect lender bias or differences in the unobserved characteristics of the loan application. Without additional information, it is impossible to sort out these two possibilities. It appears that this component of largely unexplained variation is consistent with evidence of significant idiosyncratic lender behavior. As shown in table 14, almost 90 percent of the within-MSA variation in total lender approval rates cannot be explained by either applicant characteristics (as we measure them) or by neighborhood.

V. SUMMARY AND CONCLUSIONS

This paper uses recently released HMDA data to examine differences in minority and low-income lending patterns across lending institutions. The new data allow us to identify both the application and the action taken on that application by the lender, thus enabling us to sort out lender behavior from applicant behavior to a greater extent than allowed by previous data. This

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permits us to determine the extent to which the differences across lenders in minority and low-income originations, found in earlier studies, reflect differences in minority (low-income) *application rates* across lenders as opposed to differences across institutions in their minority (low-income) *approval rates* relative to their overall approval rates.

We find that the overwhelming majority of the variance across lenders in both minority and low-income originations is attributable to differences in application ratios. Differences in relative approval rates account for a relatively small portion of the variance across lenders. For the full sample, 87-91 percent of the variance in minority originations is captured by lender-specific differences in minority application rates, while only 10-13 percent stems from differential treatment of these applications. The dominance of variations in lenders' application rates as the explanation for lender differences in minority and low-income originations holds for all types of institutions, for different lender sizes, for different lender market shares, and for various definitions of the relevant market (full MSA and central city only).

The public's interest in examining the relative rates at which lenders in an MSA approve credit applications for one group versus another emanates from a suspicion that some lenders might discriminate. Denying credit to applicants because of their race is illegal, as is refusing to lend strictly on the basis of property location. Regulatory agencies charged with enforcing equal credit laws and CRA can benefit from analyzing lender-specific HMDA data, including relative approval rates, in an effort to spot illegal practices. Our research indicates that lenders vary enormously in terms of their relationships with minority and low-income applicants. These differences may result from illegal practices, or simply from economic factors on both sides of the market. Regulators and the public need to attain a better understanding of the variation in lenders' practices before reaching conclusions about how well or poorly the markets function for all applicants.

ENDNOTES

1. For a taste of the media's approach to the issue, see "The Color of Money," *Atlanta Constitution*, May 1-6, 1988, and "The Race for Money," *Detroit Free Press*, June 24-27, 1988.

2. Canner, Gabriel, and Wooley (1990), Gabriel and Rosenthal (1991), and Duca and Rosenthal (1992) study racial aspects of credit rationing and market performance by using data from the Survey of Consumer Finances, which comprises information collected from a sample of households. These studies attempt to infer from the households' experiences and demographic characteristics whether lenders *as a group* treat people differently as a result of their racial status.

3. Canner (1981), Avery and Buynak (1981), Avery and Canner (1983), and Bradbury, Case, and Dunham (1989) contrast the differences in mortgage credit originations between predominantly white and predominantly minority neighborhoods in various metropolitan statistical areas (MSAs). These studies use either pre-1990 HMDA data or lien title data to infer from the neighborhoods' characteristics whether mortgage lenders *as a group* treat neighborhoods differently depending on their racial composition. Shafer and Ladd (1981) collect information on some lender-specific, individual mortgage loan applications in New York and California, but they aggregate the data over lenders within MSAs to examine the credit denial actions of lenders *as a group* within these markets. Calem (1992) contrasts the experiences of individual lenders participating in a Philadelphia area mortgage-lending plan with those that did not participate. His paper does document the existence of lender differences in the penetration of minority communities, but the primary focus is on the characteristics of the voluntary mortgage plan operated by a *group of lenders*. Avery (1989) notes the differences between studies based on lending in a neighborhood and the lending procedures adopted by individual lenders.

4. These data may be useful when used in conjunction with other data, such as those collected from regulatory audits. In addition, regulators can employ the information as a tool in signaling potential problem lenders. For a thorough discussion of both the issues and data, see Munnell et al. (1992).

5. We decided to restrict the analysis to 1-4 family home purchase loans within MSAs, which were directly acted upon by the reporting institution. Overall, the institutions reported information on 6,595,089 loan applications in 1990. Of these, 3,933,919 (59.6 percent) were originated by the reporting institution within an MSA in which they had an office (of the excluded loans, 1,137,741 were purchased from other institutions and 1,523,429 were outside an MSA). A significant portion of the loans remaining, 1,707,936, were for home improvements, refinancing, or multifamily residences. This left a total of 2,225,983 loan applications that met the study criteria.

6. We examine only 1-4 family home purchase loans in this study. In addition to these loans, a total of 787,952 home improvement loans, 716,595 refinancings of 1-4 family home loans, and 32,176 multifamily home loans met the same criteria used for the study sample (originated by the reporting institution within an MSA where it has an office and where the lender made a decision on the application).

7. Household income of sample applicants may be higher, because this figure represents only the applicant's income used for mortgage qualification.

8. The percent Hispanic in the HMDA sample is slightly higher than that in the overall U.S. population, due in part to the inclusion of Puerto Rico, and the percent black is slightly lower. U.S. figures are taken from the whole 1990 Census, which may differ somewhat from the coverage of the study sample in that rural areas are included.

9. The 8,745 financial institutions filing 1990 HMDA reports that had at least one loan in the study sample operated in an average of 2.4 MSAs. This translated into 20,695 study lenders when lenders were defined at the MSA level.

10. Note that we define the origination ratio in terms of loans approved, even though a small number of loans that are approved are not originated due to withdrawals by the applicants.

11. See ICF, Inc. (1991) for a discussion of how some mortgage lenders regard the lending process as different for members of disadvantaged groups.

12. Avery, Elliehausen, Gustafson, and Canner (1984) and Canner and Luckett (1991) report on these differences.

13. Unreported estimates by type and size of lender indicate that the variance is largest for the smallest lenders, those with fewer than 100 applications. For other lenders, the variance decomposition matches the reported figures.

14. Analyses of variance for each measure by type of lender, size of lender, size of MSA, and size of MSA minority populations are presented in appendix tables 1-11.

15. The model was actually estimated using deviations about the means, which is computationally equivalent to adding intercepts. There were 607,631 unique combinations of the 40,008 tracts

and 20,695 lenders in the sample spread across 340 MSAs; thus, the average tract had about 15 lenders, each of whom served about 30 tracts per MSA.

16. The figures in table 9 (and subsequent tables 10-14) are based only on data from the 11,598 lenders who had at least one minority applicant and at least one loan approval. The decision to use a subsample was made in order to make results in this section more comparable with those of the previous section.

17. It is commonly recognized that a more complete accounting of loan application characteristics would contribute substantially to the explanatory power of this procedure. See Munnell et al. (1992), especially table 6 therein, for evidence of this.

18. The analysis-of-variance figures in tables 10, 12 and 13 are computed from the remaining variance across lenders after MSA effects are removed.

19. The potential contribution of census tracts is larger when the regression is weighted by the number of applications each lender received. Since this decomposition focuses on within-MSA variation and gives most weight to the largest lenders within the MSA, it is difficult to separate the lender effect from the census tract effect. As a result of the covariance between the two, the range of the contribution of each is quite large (27-69 percent for census tracts and 30-63 percent for lender effects). We note that even in this decomposition (the most favorable case for census tract effects), at least 30 percent of the variance across lenders cannot be accounted for by loan application characteristics or by the racial composition of the neighborhood from which the lender draws applications.

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Table 1: Characteristics of Mortgage Applications for the Purchase of 1-4 Family Homes, 1990 HMDA

	Number	Percent of Sample	Percent of Loan $	Percent of Accepts	Percent of Denials
Race of Applicant					
Black	123,029	6.2%	4.8%	5.1%	12.3%
Hispanic	130,324	6.6	6.4	6.0	9.8
Native American	10,976	.6	.6	.5	.7
Asian/Pacific Islander	90,739	4.6	6.8	4.6	4.4
White	1,615,299	81.4	80.5	83.1	71.8
Other	14,321	.7	1.0	.7	1.0
Race of Co-applicant					
No Co-applicant	563,559	28.4	23.4	27.6	33.2
Same Race as Applicant	1,377,108	69.4	74.2	70.2	64.5
Different Race than Applicant	44,021	2.2	2.5	2.2	2.3
Gender					
Male Applicant, Female Co-applicant	1,270,696	64.0	69.1	65.1	57.7
Female Applicant, Male Co-applicant	85,272	4.3	4.1	4.1	5.4
Male Applicant and Co-applicant	40,403	2.0	2.3	2.0	2.3
Female Applicant and Co-applicant	24,758	1.3	1.2	1.2	1.5
Male Applicant, No Co-applicant	336,005	16.9	15.0	16.3	20.4
Female Applicant, No Co-applicant	227,554	11.5	8.4	11.2	12.7
Owner-Occupied	1,857,330	93.6	94.5	96.3	93.8
Loan Type					
Conventional	1,489,584	75.1	82.9	75.0	75.2
FHA	404,361	20.4	13.7	20.5	19.9
VA	90,212	4.5	3.4	4.5	4.9
FmHA	531	.0	.0	.0	.0
Lender Action					
Loan Originated	1,632,623	82.3	83.4	96.6	0
Loan Kept by Originator	733,567	37.0	39.7	43.4	0
Loan Sold to FNMA	236,160	11.9	12.0	14.0	0
Loan Sold to GNMA	171,935	8.7	6.4	10.2	0
Loan Sold To FHLMC	146,191	7.4	7.6	8.6	0
Loan Sold Elsewhere	344,770	17.4	17.7	20.4	0
Loan Accepted and Withdrawn	57,760	2.9	3.5	3.4	0
Loan Denied	294,305	14.8	13.1	0	100.0
Reasons for Denial (of Loans Denied)[1]					
No Reason Given	92,294	32.0	29.5	-	-
Debt-to-income Ratio	47,055	16.0	17.7	-	-
Employment History	12,393	4.2	3.1	-	-
Credit History	76,650	26.1	22.2	-	-
Collateral	24,028	8.2	8.8	-	-
Insufficient Cash	11,781	4.0	4.1	-	-
Unverifiable Information	8,166	2.8	3.8	-	-
Application Incomplete	7,783	2.6	3.6	-	-
Mortgage Insurance Denied	1,909	.6	.6	-	-
Other	43,505	14.7	17.7	-	-

[1] Up to three reasons for denial could be given, and answers were voluntary. Each category row displays the percent of all denied applications listing that particular reason as one of the three.

Source: Authors.

Table 2: Distribution of 1-4 Family Mortgage Applications by Type and Size of Lender, 1990 HMDA

	Number of		Percent of Applications				
	Lenders[1]	Applications	All	Minority Applicants[2]	Low-Income Applicants[3]	Minority Tracts[4]	Low-Income Tracts[5]
Type of Institution							
Commercial Banks	7,043	447,526	22.6%	18.9%	30.9%	19.6%	32.7%
Thrift Institutions	3,975	667,513	33.6	35.0	24.7	35.2	22.6
Credit Unions	1,627	20,839	1.1	.7	1.1	.7	1.2
Bank Subsidiaries	3,532	389,250	19.6	18.7	23.4	18.1	22.4
Thrift Subsidiaries	1,478	154,820	7.8	8.3	8.3	8.2	8.5
Other Mortgage Banks	3,040	304,740	15.4	18.3	12.3	18.2	12.6
Size of Institution							
> 500 Applications	774	853,319	43.0	55.2	34.7	57.0	29.8
100-500 Applications	3,628	795,477	40.1	32.7	45.4	31.1	48.6
< 100 Applications	16,293	335,892	16.9	12.1	19.9	11.9	21.6
Market Share of Institution							
More than 5 Percent	1,916	813,279	41.0	43.6	46.2	42.5	49.2
1-5 Percent	4,441	811,086	40.9	40.5	38.8	40.6	37.9
Less than 1 Percent	14,338	360,323	18.2	15.8	15.0	17.0	12.9
Size of MSA							
> 25,000 Applications	3,545	660,927	33.3	45.3	19.1	49.7	12.3
< 25,000 Applications	17,150	1,323,761	66.7	54.7	80.9	50.3	87.7
Percent Minority Applications in MSA							
More than 22 Percent	2,055	281,863	14.2	33.9	11.2	45.3	11.4
Less than 22 Percent	18,640	1,702,825	85.8	66.1	88.8	54.7	88.6
Total	20,695	1,984,688	100.0	100.0	100.0	100.0	100.0

[1] Lenders operating in multiple MSAs are treated as separate institutions.
[2] Native Americans, Blacks, and Hispanics.
[3] Applicant income less than or equal to $25,000.
[4] Census tracts with 30 percent or more of loan applications from minority applicants.
[5] Census tracts with 30 percent or more of loan applications from low-income applicants.

Source: Authors.

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Table 3: Distribution of Dollar Value of 1-4 Family Mortgage Applications by Type and Size of Lender, 1990 HMDA

	Number of Lenders[1]	Total Loan Amount($1000s)	Percent of Applications				
			All	Minority Applicants[2]	Low-Income Applicants[3]	Minority Tracts[4]	Low-Income Tracts[5]
Type of Institution							
Commercial Banks	7,043	$39,281	20.3%	16.3%	25.6%	17.0%	28.8
Thrift Institutions	3,975	73,349	37.9	42.3	27.2	42.6	23.2
Credit Unions	1,627	1,582	.8	.5	.9	.5	1.1
Bank Subsidiaries	3,532	34,706	17.9	15.5	23.2	14.6	23.0
Thrift Subsidiaries	1,478	14,792	7.6	7.6	8.1	7.5	9.0
Other Mortgage Banks	3,040	29,800	15.4	17.7	15.0	17.8	14.9
Size of Institution							
> 500 Applications	774	93,769	48.5	61.7	39.9	64.4	31.2
100-500 Applications	3,628	70,195	36.3	28.0	43.2	25.9	48.8
< 100 Applications	16,293	29,551	15.3	10.3	16.9	9.6	20.0
Market Share of Institution							
More than 5 Percent	1,916	73,312	37.9	43.0	46.2	42.5	49.4
1-5 Percent	4,441	80,926	41.8	40.4	39.1	40.3	38.1
Less than 1 Percent	14,338	39,272	20.3	16.6	14.7	17.3	12.5
Size of MSA							
> 25,000 Applications	3,545	82,784	42.8	56.3	24.9	61.1	13.8
< 25,000 Applications	17,150	110,727	57.2	43.7	75.1	38.9	86.2
Percent Minority Applications in MSA							
More than 22 Percent	2,055	36,841	19.0	39.6	13.6	53.8	12.5
Less than 22 Percent	18,640	156,670	81.0	60.4	86.4	46.2	87.5
Total	20,695	1,984,688	100.0	100.0	100.0	100.0	100.0

[1] Lenders operating in multiple MSAs are treated as separate institutions.
[2] Native Americans, Blacks, and Hispanics.
[3] Applicant income less than or equal to $25,000.
[4] Census tracts with 30 percent or more of loan applications from minority applicants.
[5] Census tracts with 30 percent or more of loan applications from low-income applicants.

Source: Authors.

Table 4: Minority and Low-Income Lending Relative to Total 1-4 Family Mortage Lending, 1990 HMDA

	Overall Approval Rate	Minority[1] Percent of		Approval Rate	Relative Rate	Low Income[2] Percent of		Approval Rate	Relative Rate
		Appls.	Approvals			Appls.	Approvals		
Type of Institution									
Commercial Banks	.82	11.2%	9.1%	.67	.81	20.5%	17.4%	.69	.85
Thrift Institutions	.87	13.9	12.5	.78	.90	11.0	9.6	.76	.87
Credit Unions	.89	9.0	7.7	.77	.86	15.6	13.4	.77	.86
Bank Subsidiaries	.84	12.7	11.1	.73	.87	17.9	14.5	.68	.81
Thrift Subsidiaries	.86	14.2	12.0	.72	.84	14.5	12.6	.74	.87
Other Mortgage Banks	.87	15.9	14.3	.79	.90	12.0	11.1	.81	.92
Size of Institution									
> 500 Applications	.86	17.1	15.3	.77	.90	12.1	10.4	.74	.86
100-500 Applications	.85	10.9	9.2	.72	.85	17.0	14.5	.73	.85
< 100 Applications	.84	9.5	8.1	.71	.85	17.6	14.7	.70	.83
Market Share of Institutions									
More than 5 Percent	.86	14.2	12.3	.74	.87	16.9	14.5	.73	.86
1-5 Percent	.85	13.2	11.7	.76	.89	14.2	12.0	.72	.85
Less than 1 Percent	.84	11.6	10.1	.73	.87	12.4	10.4	.70	.84
Size of MSA									
> 25,000 Applications	.86	18.1	16.5	.78	.91	8.6	7.4	.74	.86
< 25,000 Applications	.85	10.9	9.2	.72	.85	18.2	15.4	.72	.85
Percent Minority Applications in MSA									
More than 22 Percent	.80	31.8	29.5	.75	.93	12.8	9.6	.66	.82
Less than 22 Percent	.86	10.3	8.9	.75	.87	15.5	13.2	.73	.85
Total	.85	13.3	11.7	.75	.88	15.0	12.7	.72	.85

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Table 4 (Continued)

	Overall Approval Rate	Minority Census Tracts[3]				Low-Income Census Tracts[4]			
		Percent of		Approval Rate	Relative Rate	Percent of		Approval Rate	Relative Rate
		Appls.	Approvals			Appls.	Approvals		
Type of Institution									
Commercial Banks	.82	11.0	9.3	.69	.85	22.5	20.1	.76	.93
Thrift Institutions	.87	13.2	12.1	.80	.92	10.4	9.4	.79	.90
Credit Unions	.89	8.5	7.7	.80	.90	18.0	16.5	.82	.92
Bank Subsidiaries	.84	11.7	10.2	.73	.87	17.7	15.3	.72	.86
Thrift Subsidiaries	.86	13.3	11.3	.73	.85	17.0	14.9	.75	.88
Other Mortgage Banks	.87	14.9	13.6	.80	.91	12.7	11.9	.82	.94
Size of Institution									
> 500 Applications	.86	16.7	15.2	.78	.91	10.8	9.4	.75	.88
100-500 Applications	.85	9.8	8.4	.73	.86	18.8	17.1	.77	.91
< 100 Applications	.84	8.9	7.8	.74	.88	19.8	18.0	.76	.90
Market Share of Institutions									
More than 5 Percent	.86	13.1	11.5	.76	.88	18.7	16.7	.77	.90
1-5 Percent	.85	12.5	11.3	.77	.90	14.4	12.9	.76	.90
Less than 1 Percent	.84	11.8	10.5	.75	.89	11.0	9.9	.75	.89
Size of MSA									
> 25,000 Applications	.86	18.8	17.3	.79	.92	5.7	5.1	.77	.90
< 25,000 Applications	.85	9.5	8.2	.73	.86	20.4	18.4	.76	.90
Percent Minority Applications in MSA									
More than 22 Percent	.80	40.2	38.2	.77	.88	12.5	10.7	.69	.86
Less than 22 Percent	.86	8.0	7.1	.75	.95	16.0	14.4	.77	.90
Total	.85	12.6	11.2	.76	.89	15.5	13.9	.76	.90

1 Native Americans, Blacks, and Hispanics.
2 Applicant income less than or equal to $25,000.
3 Census tracts with 30 percent or more of loan applications from minority applicants.
4 Census tracts with 30 percent or more of loan applications from low-income applicants.

Source: Authors.

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clevelandfed.org/research/workpaper/index.cfm

Table 5: Minority and Low-Income Lending Relative to Total 1-4 Family Mortgage Lending, Dollars of Loans, 1990 HMDA

	Overall Approval Rate	Minority[1] Percent of Appls.	Percent of Approvals	Approval Rate	Relative Rate	Low Income[2] Percent of Appls.	Percent of Approvals	Approval Rate	Relative Rate
Type of Institution									
Commercial Banks	.84	9.5%	7.8%	.69	.82	8.0%	6.8	.71	.85
Thrift Institutions	.88	13.2	12.0	.80	.91	4.5	4.0	.77	.88
Credit Unions	.90	7.5	6.7	.80	.89	7.1	6.1	.77	.86
Bank Subsidiaries	.88	10.2	9.1	.78	.89	8.2	6.9	.74	.85
Thrift Subsidiaries	.87	11.7	10.2	.75	.87	6.7	5.9	.76	.88
Other Mortgage Banks	.87	13.6	12.4	.79	.91	6.2	5.7	.81	.93
Size of Institution									
> 500 Applications	.87	15.1	13.7	.79	.91	5.2	4.6	.76	.87
100-500 Applications	.87	9.1	7.9	.75	.87	7.6	6.6	.76	.87
< 100 Applications	.86	7.7	6.8	.75	.89	7.0	6.0	.73	.85
Market Share of Institutions									
More than 5 Percent	.86	13.4	11.9	.77	.88	7.7	6.7	.76	.87
1-5 Percent	.87	11.4	10.3	.78	.90	5.9	4.0	.75	.86
Less than 1 Percent	.85	9.7	8.6	.75	.89	4.6	5.1	.73	.86
Size of MSA									
> 25,000 Applications	.86	15.5	14.2	.79	.92	8.3	7.2	.75	.87
< 25,000 Applications	.87	9.0	7.8	.76	.87	3.7	3.7	.76	.87
Percent Minority Applications in MSA									
More than 22 Percent	.82	24.6	23.0	.77	.94	4.5	3.9	.70	.85
Less than 22 Percent	.88	8.8	7.8	.78	.89	6.8	5.9	.76	.87
Total	.87	11.8	10.5	.77	.91	6.3	5.5	.75	.88

Table 5 (Continued)

	Overall Approval Rate	Minority Census Tracts[3]				Low-Income Census Tracts[4]			
		Percent of Appls.	Percent of Approvals	Approval Rate	Relative Rate	Percent of Appls.	Percent of Approvals	Approval Rate	Relative Rate
Type of Institution									
Commercial Banks	.84	8.8%	7.5%	.71	.84	9.7%	9.2%	.80	.95
Thrift Institutions	.88	11.9	11.0	.81	.92	4.2	3.9	.82	.93
Credit Unions	.90	6.9	6.3	.82	.91	9.1	8.5	.83	.93
Bank Subsidiaries	.88	8.6	7.7	.78	.89	8.7	7.8	.78	.89
Thrift Subsidiaries	.87	10.3	9.1	.76	.88	8.0	7.3	.79	.91
Other Mortgage Banks	.87	12.2	11.3	.81	.93	6.6	6.3	.83	.95
Size of Institution									
> 500 Applications	.87	14.1	12.9	.80	.92	4.4	3.9	.79	.91
100-500 Applications	.87	7.6	6.6	.77	.87	9.2	8.6	.81	.93
< 100 Applications	.86	6.7	6.0	.78	.90	8.9	8.3	.80	.93
Market Share of Institutions									
More than 5 Percent	.86	11.9	10.6	.78	.89	8.9	8.2	.81	.92
1-5 Percent	.87	9.0	8.1	.77	.90	4.2	3.9	.79	.92
Less than 1 Percent	.85	10.2	9.3	.79	.91	6.2	5.7	.80	.91
Size of MSA									
> 25,000 Applications	.86	15.1	14.0	.80	.92	2.2	2.0	.78	.91
< 25,000 Applications	.87	7.2	6.3	.77	.88	10.3	9.5	.80	.92
Percent Minority Applications in MSA									
More than 22 Percent	.82	29.9	28.6	.79	.96	4.5	4.0	.74	.90
Less than 22 Percent	.88	6.0	5.3	.78	.89	7.4	6.7	.81	.92
Total	.87	10.4	9.6	.78	.90	6.8	6.3	.80	.92

1 Native Americans, Blacks, and Hispanics.
2 Applicant income less than or equal to $25,000.
3 Census tracts with 30 percent or more of loan applications from minority applicants.
4 Census tracts with 30 percent or more of loan applications from low-income applicants.

Source: Authors.

Table 6: Sample Statistics for Analysis of Variance in Origination Ratios across Lenders, 1990 HMDA

	Number of Lenders[1]	Origination Ratio		Mean	Standard Deviation
		Number of Applications	Percent of Total		
Minority					
Number	11,598	1,867,211	14.1%	.16	.21
Dollar Value	11,598	1,867,211	12.4	.14	.21
Number Relative to					
Nonminority	11,241	1,864,856	14.0	.35	2.13
Minority Tracts					
Number	8,846	1,624,207	15.4	.20	.26
Dollar Value	8,846	1,624,207	12.4	.17	.26
Central City Minority					
Number	8,548	745,161	19.1	.23	.26
Low-Income					
Number	13,651	1,918,018	15.5	.21	.21
Dollar Value	13,651	1,918,018	6.7	.16	.21
Number Relative to					
Non-Low-Income	13,259	1,917,075	15.4	.33	.56
Low-Income Tracts					
Number	11,024	1,566,699	19.6	.32	.29
Dollar Value	11,024	1,566,699	10.2	.27	.29
Central City Low-Income					
Number	9,668	764,423	19.8	.26	.24

[1] Lenders operating in multiple MSAs are treated as separate institutions. This includes only those lenders with at least one minority applicant and at least one loan acceptance.

Source: Authors.

Table 7: Summary of Analysis of Origination Ratios across Lenders, 1990 HMDA

	Std. Dev. of Origination Ratio[1]	R-Square[1]	Percent Attributable to to Variance in[2]	
			Application Ratio	Relative Approval Rate
Minority				
Number	.18	.92	86.7-90.7%	9.3-13.3%
Dollar Value (1)	.18	.91	87.4-91.1	8.9-12.6
Number Relative to				
Nonminority (2)	1.59	.94	99.3-99.3	.7-.7
Minority Tracts				
Number (3)	.19	.91	88.7-91.9	8.1-11.3
Dollar Value (4)	.19	.91	89.7-92.2	7.8-10.3
Central City Minority				
Number (5)	.22	.93	82.5-88.5	11.5-17.5
Low-Income				
Number (6)	.19	.91	85.4-87.8	12.2-14.6
Dollar Value (7)	.19	.92	88.4-90.7	9.3-11.6
Number Relative to				
Non-Low-Income (8)	.52	.79	89.2-91.5	8.5-10.8
Low-Income Tracts				
Number (9)	.24	.94	90.2-92.6	7.4-9.8
Dollar Value (10)	.23	.94	93.3-95.3	4.7-6.7
Central City Low-Income				
Number (11)	.23	.93	81.7-85.8	14.2-18.3

Note: Analyses of variance by type of lender, size of lender, size of MSA, and size
      of MSA minority population are reported in appendix tables indicated in parentheses.

[1] Expressed as deviation around MSA means.
[2] Minimum and maximum contributions to variance based on deviations around MSA means.

Source: Authors.

Table 8: Allocation of Variance in Origination Ratios across Lenders: Number of Minority
Originations, 1990 HMDA

| | Number of Lenders[1] | Std. Dev. of Origination Ratio[2] | R-Square[2] | Percent Attributable to Variance in[3] | |
				Minority Applications	Relative Approval Rate
Type of Institution					
Commercial Banks	3,615	.19	.91	86.5-91.1%	8.9-13.5%
Thrift Institutions	2,689	.14	.93	92.0-93.9	6.1-8.0
Credit Unions	551	.29	.97	85.2-93.1	6.9-14.8
Bank Subsidiaries	2,059	.15	.88	80.4-83.4	16.6-19.6
Thrift Subsidiaries	818	.18	.90	74.2-81.7	18.3-25.8
Other Mortgage Banks	1,866	.18	.94	86.5-90.2	9.8-13.5
Size of Institution					
> 500 Applications	774	.09	.99	92.8-98.8	1.2-7.2
100-500 Applications	3,488	.08	.96	96.5-98.0	2.0-3.5
< 100 Applications	7,336	.21	.92	85.0-89.3	10.7-15.0
Market Share of Institution					
More than 5 Percent	1,785	.07	.95	95.7-97.3	2.7-4.3
1-5 Percent	3,619	.09	.93	92.8-94.1	5.9-7.2
Less Than 1 Percent	6,194	.22	.92	84.0-88.7	11.3-16.0
Size of MSA					
> 25,000 Applications	2,225	.20	.94	86.4-91.0	9.0-13.6
< 25,000 Applications	9,373	.17	.91	86.6-90.4	9.6-13.4
Percent Minority Applications					
More than 22 Percent	1,484	.24	.94	76.6-86.8	13.2-23.4
Less than 22 Percent	10,114	.17	.92	87.7-91.0	9.0-12.2
Total	11,598	.18	.92	86.7-90.7	9.3-13.3

Dependent Variable: Number of approved loans to minority applicants as a percent of all approved loans.

[1] Lenders operating in multiple MSAs are treated as separate institutions. This includes only those lenders with at least one minority applicant and at least one loan acceptance.
[2] Expressed as a deviation around MSA means.
[3] Minimum and maximum contributions to variance based on deviations around MSA means.

Source: Authors.

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Table 9: Percentage of Average Applicant Pool--Racial
          Differences Attributable to Various Sources, 1990 HMDA

Applicant Economic	
Characteristics	1.2%
MSA Effect	8.7
Census Tract	22.7
Pure Lender Effect	3.5
Unexplained	63.9
Total Difference	100.0

Table 10: Allocation of Institutional Differences in Minority
           Application Rates, Deviations about MSA Means, 1990 HMDA

Applicant Economic	
Characteristics	0.8-2.6%
Census Tract	21.9-28.9
Unexplained Lender Effect	70.8-74.8

Table 11: Difference in Average Minority and Nonminority Percentage
           Denial Rates Attributable to Various Sources, 1990 HMDA

	Total
Nonminority Applicants	
Percent of Nonminorities	100.0
Actual Denial Rate	13.1
Applicant Economic	
Characteristics	13.6
MSA Effect	-.1
Census Tract Effect	-.3
Overall Lender Effect	-.1
Residual (Unexplained)	.1
Minority Applicants[1]	
Percent of Minorities	100.0
Actual Denial Rate	25.2
Applicant Economic	
Characteristics	15.2
MSA Effect	1.0
Census Tract Effect	1.9
Overall Lender Effect	.1
Residual (Unexplained)	7.1

[1] Native Americans, Blacks, and Hispanics.

Source: Authors.

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Table 12:   Allocation of Institutional Differences in Relative
            Approval Rates, Deviations about MSA Means, 1990 HMDA

Applicant Economic	
Characteristics	2.4-4.6%
Census Tract	4.0-5.9
Unexplained Lender Effect	91.0-92.7

Table 13:   Allocation of Institutional Differences in Minority
            Approval Rates, Deviations about MSA Means, 1990 HMDA

Applicant Economic	
Characteristics	2.5-5.7%
Census Tract	3.6-4.2
Overall Lender Effect	26.4-38.3
Unexplained Lender Effect	53.8-65.9

Table 14:   Allocation of Institutional Differences in Total
            Approval Rates, Deviations about MSA Means, 1990 HMDA

Applicant Economic	
Characteristics	3.4-10.9%
Census Tract	2.0-3.2
Unexplained Lender Effect	88.7-91.1

Source: Authors.

Appendix Table 1: Allocation of Variance in Origination Ratios across Lenders: Dollar Value of Minority Originations, 1990 HMDA

	Number of Lenders[1]	Std. Dev. of Origination Ratio[2]	R-Square[2]	Percent Attributable to Variance in[3]	
				% Minority Applications	Relative Approval Rate
Type of Institution					
Commercial Banks	3,615	.20	.90	88-93%	7-12%
Thrift Institutions	2,689	.14	.91	93-94	6-7
Credit Unions	551	.30	.96	89-92	8-11
Bank Subsidiaries	2,059	.16	.87	81-84	16-19
Thrift Subsidiaries	818	.18	.88	76-83	17-24
Other Mortgage Banks	1,866	.18	.94	85-88	12-15
Size of Institution					
> 500 Applications	774	.09	.99	93-99	1-7
100-500 Applications	3,488	.08	.96	96-98	2-4
< 100 Applications	7,336	.22	.91	86-90	10-14
Market Share of Institution					
More than 5 Percent	1,785	.07	.96	96-98	2-4
1-5 Percent	3,619	.09	.92	92-94	6-8
Less than 1 Percent	6,194	.23	.91	85-89	11-15
Size of MSA					
> 25,000 Applications	2,225	.21	.92	87-91	9-13
< 25,000 Applications	9,373	.18	.91	87-91	9-13
Percent Minority Applications					
More than 22 Percent	1,484	.25	.93	81-87	13-19
Less than 22 Percent	10,114	.17	.91	88-92	8-12
Total	11,598	.18	.91	87-91	9-13

Dependent Variable: Dollar value of approved loans to minority applicants as a percent of all approved loans.

[1] Lenders operating in multiple MSAs are treated as separate institutions. This includes only those lenders with at least one minority applicant and at least one loan acceptance.

[2] Expressed as a deviation around MSA means.

[3] Minimum and maximum contributions to variance based on deviations around MSA means.

Source: Authors.

Appendix Table 2:   Allocation of Variance in Origination Ratios across Lenders: Number of Minority
Tract Originations, 1990 HMDA

	Number of Lenders[1]	Std. Dev. of Origination Ratio[2]	R-Square[2]	Percent Attributable to Variance in[3]	
				% Minority Applications	Relative Approval Rate
Type of Institution					
Commercial Banks	2,676	.22	.92	89-93%	7-11%
Thrift Institutions	2,093	.14	.93	92-95	5-8
Credit Unions	458	.26	.96	88-92	8-12
Bank Subsidiaries	1,566	.15	.86	85-86	14-15
Thrift Subsidiaries	648	.20	.88	73-78	22-27
Other Mortgage Banks	1,405	.19	.93	88-92	8-12
Size of Institution					
> 500 Applications	734	.09	.99	98-100	0-2
100-500 Applications	2,775	.10	.97	98-99	1-2
< 100 Applications	5,337	.23	.91	86-90	10-14
Market Share of Institution					
More than 5 Percent	1,224	.08	.95	97-98	2-3
1-5 Percent	2,753	.11	.95	96-97	3-4
Less than 1 Percent	4,869	.23	.91	86-90	10-14
Size of MSA					
> 25,000 Applications	2,027	.22	.94	89-92	8-11
< 25,000 Applications	6,819	.18	.91	88-91	9-12
Percent Minority Applications					
More than 22 Percent	1,575	.24	.95	83-88	12-17
Less than 22 Percent	7,271	.18	.91	89-92	8-11
Total	8,846	.19	.91	89-92	8-11

Dependent Variable: Number of approved loans for properties in census tracts where 30 percent or
more of the applicants are minorities as a percent of all approved loans.

[1] Lenders operating in multiple MSAs are treated as separate institutions. This includes only
those lenders with at least one minority applicant and at least one loan acceptance.

[2] Expressed as a deviation around MSA means.

[3] Minimum and maximum contributions to variance based on deviations around MSA means.

Source: Authors.

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Appendix Table 3: Allocation of Variance in Origination Ratios across Lenders: Dollar Value of Minority Tract Originations, 1990 HMDA

	Number of Lenders[1]	Std. Dev. of Origination Ratio[2]	R-Square[2]	Percent Attributable to Variance in[3]	
				% Minority Applications	Relative Approval Rate
Type of Institution					
Commercial Banks	2,676	.23	.93	91-94%	6-7%
Thrift Institutions	2,093	.14	.91	93-94	6-9
Credit Unions	458	.27	.94	90-90	10-10
Bank Subsidiaries	1,566	.15	.85	83-84	16-17
Thrift Subsidiaries	648	.20	.87	75-78	22-25
Other Mortgage Banks	1,405	.19	.94	86-91	9-14
Size of Institution					
> 500 Applications	734	.08	.99	98-100	0-2
100-500 Applications	2,775	.09	.97	98-99	1-2
< 100 Applications	5,337	.23	.91	89-91	9-11
Market Share of Institution					
More than 5 Percent	1,224	.08	.96	97-99	1-3
1-5 Percent	2,753	.10	.95	97-98	2-3
Less than 1 Percent	4,869	.24	.91	88-90	10-12
Size of MSA					
> 25,000 Applications	2,027	.22	.94	89-91	9-11
< 25,000 Applications	6,819	.18	.90	90-92	8-10
Percent Minority Applications					
More than 22 Percent	1,575	.26	.95	87-89	11-13
Less than 22 Percent	7,271	.18	.91	90-92	8-10
Total	8,846	.19	.91	90-92	8-10

Dependent Variable: Dollar value of approved loans for properties in census tracts where 30 percent or more of the applicants are minorities as a percent of all approved loans.

[1] Lenders operating in multiple MSAs are treated as separate institutions. This includes only those lenders with at least one minority applicant and at least one loan acceptance.

[2] Expressed as a deviation around MSA means.

[3] Minimum and maximum contributions to variance based on deviations around MSA means.

Source: Authors.

Appendix Table 4: Allocation of Variance in Origination Ratios across Lenders: Number of Minority Originations Relative to Nonminority Originations, 1990 HMDA

	Number of Lenders[1]	Std. Dev. of Origination Ratio[2]	R-Square[2]	Percent Attributable to Variance in[3]	
				% Minority Applications	Relative Approval Rate
Type of Institution					
Commercial Banks	3,467	2.30	.94	100-100%	0-0%
Thrift Institutions	2,642	1.17	.97	100-100	0-0
Credit Unions	493	.48	.88	78-86	14-22
Bank Subsidiaries	2,023	.35	.80	90-90	10-10
Thrift Subsidiaries	794	.63	.70	79-81	19-21
Other Mortgage Banks	1,822	1.29	.90	97-98	2-3
Size of Institution					
> 500 Applications	774	2.81	1.00	100-100	0-0
100-500 Applications	3,484	.55	.80	99-100	0-1
< 100 Applications	6,983	1.74	.93	99-99	1-1
Market Share of Institution					
More than 5 Percent	1,770	2.80	.97	100-100	0-0
1-5 Percent	3,595	.73	.95	100-100	0-0
Less than 1 Percent	5,876	1.57	.92	99-99	1-1
Size of MSA					
> 25,000 Applications	2,159	2.17	.95	99-99	1-1
< 25,000 Applications	9,082	1.41	.93	99-99	1-1
Percent Minority Applications					
More than 22 Percent	1,333	3.55	.93	99-99	1-1
Less than 22 Percent	9,908	1.08	.96	99-99	1-1
Total	11,241	1.59	.94	99-99	1-1

Dependent Variable: Number of approved loans to minority applicants relative to approved loans to nonminority applicants.

[1] Lenders operating in multiple MSAs are treated as separate institutions. This includes only those lenders with at least one minority applicant and at least one loan acceptance.
[2] Expressed as a deviation around MSA means.
[3] Minimum and maximum contributions to variance based on deviations around MSA means.

Source: Authors.

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Appendix Table 5:   Allocation of Variance in Origination Ratios across Lenders: Number of Central
City Minority Originations, 1990 HMDA

	Number of Lenders[1]	Std. Dev. of Origination Ratio[2]	R-Square[2]	Percent Attributable to Variance in[3]	
				% Minority Applications	Relative Approval Rate
Type of Institution					
Commercial Banks	2,441	.23	.92	79-87%	13-21%
Thrift Institutions	2,031	.18	.94	88-93	7-12
Credit Unions	377	.31	.96	85-91	9-15
Bank Subsidiaries	1,597	.20	.89	78-83	7-22
Thrift Subsidiaries	653	.22	.92	71-81	19-29
Other Mortgage Banks	1,446	.24	.96	83-89	11-17
Size of Institution					
> 500 Applications	189	.12	.99	77-99	1-23
100-500 Applications	1,859	.11	.97	96-98	2-4
< 100 Applications	6,500	.24	.93	81-87	13-19
Market Share of Institution					
More than 5 Percent	1,785	.09	.95	94-97	3-6
1-5 Percent	2,820	.13	.92	86-91	9-14
Less than 1 Percent	3,943	.28	.94	78-85	15-22
Size of MSA					
> 25,000 Applications	1,574	.26	.95	82-89	11-18
< 25,000 Applications	6,974	.21	.92	82-88	12-18
Percent Minority Applications					
More than 22 Percent	1,205	.25	.94	75-85	15-25
Less than 22 Percent	7,343	.22	.93	83-89	11-17
Total	8,548	.22	.93	82-88	12-18

Dependent Variable: Number of approved loans to minority applicants in central city census tracts
as a percent of all approved loans to central city census tracts.

[1] Lenders operating in multiple MSAs are treated as separate institutions. This includes only those
lenders with at least one minority applicant and at least one loan acceptance.
[2] Expressed as a deviation around MSA means.
[3] Minimum and maximum contributions to variance based on deviations around MSA means.

Source: Authors.

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Appendix Table 6: Allocation of Variance in Origination Ratios across Lenders: Number of Low-
Income Originations, 1990 HMDA

	Number of Lenders[1]	Std. Dev. of Origination Ratio[2]	R-Square[2]	Percent Attributable to Variance in[3]	
				% Minority Applications	Relative Approval Rate
Type of Institution					
Commercial Banks	5,055	.27	.92	86-90%	10-14%
Thrift Institutions	3,053	.16	.91	88-91	9-12
Credit Unions	728	.39	.95	93-96	4- 7
Bank Subsidiaries	2,223	.25	.87	88-86	14-12
Thrift Subsidiaries	812	.27	.88	85-85	15-15
Other Mortgage Banks	1,780	.23	.93	92-95	5- 8
Size of Institution					
> 500 Applications	774	.10	.98	97-99	1- 3
100-500 Applications	3,551	.13	.96	97-99	1- 3
< 100 Applications	9,326	.29	.91	87-89	11-13
Market Share of Institution					
More than 5 Percent	1,898	.15	.96	95-98	2- 5
1-5 Percent	4,162	.16	.92	94-95	5- 6
Less than 1 Percent	7,591	.30	.91	87-89	11-13
Size of MSA					
> 25,000 Applications	2,236	.21	.91	88-91	9-12
< 25,000 Applications	11,415	.21	.91	88-91	9-12
Percent Minority Applications					
More than 22 Percent	1,238	.28	.91	87-92	8-13
Less than 22 Percent	12,413	.26	.91	89-91	9-11
Total	13,651	.26	.91	88-91	9-12

Dependent Variable: Number of approved loans to applicants with income not greater than $25,000
as a percent of all approved loans.

[1] Lenders operating in multiple MSAs are treated as separate institutions. This includes only
those lenders with at least one minority applicant and at least one loan acceptance.
[2] Expressed as a deviation around MSA means.
[3] Minimum and maximum contributions to variance based on deviations around MSA means.

Source: Authors.

Appendix Table 7: Allocation of Variance in Origination Ratios across Lenders: Dollar Value of Low-Income Originations, 1990 HMDA

	Number of Lenders[1]	Std. Dev. of Origination Ratio[2]	R-Square[2]	Percent Attributable to Variance in[3]	
				% Minority Applications	Relative Approval Rate
Type of Institution					
Commercial Banks	5,055	.26	.93	80-85%	15-20%
Thrift Institutions	3,053	.17	.90	87-90	10-13
Credit Unions	728	.37	.97	86-93	7-14
Bank Subsidiaries	2,223	.25	.89	86-83	17-14
Thrift Subsidiaries	812	.26	.90	80-83	17-20
Other Mortgage Banks	1,780	.23	.93	90-93	7-10
Size of Institution					
> 500 Applications	774	.12	.98	97-99	1- 3
100-500 Applications	3,551	.15	.96	97-98	2- 3
< 100 Applications	9,326	.28	.92	83-86	14-17
Market Share of Institution					
More than 5 Percent	1,898	.16	.96	96-97	3- 4
1-5 Percent	7,591	.29	.91	82-85	15-18
Less than 1 Percent	4,162	.17	.93	92-94	6- 8
Size of MSA					
> 25,000 Applications	2,236	.22	.91	89-91	9-11
< 25,000 Applications	11,415	.26	.92	85-87	13-15
Percent Minority Applications					
More than 22 Percent	1,238	.27	.91	84-90	10-16
Less than 22 Percent	12,413	.25	.92	86-88	12-14
Total	13,651	.25	.92	85-88	12-15

Dependent Variable: Dollar value of approved loans to applicants with income not greater than $25,000 as a percent of all approved loans.

[1] Lenders operating in multiple MSAs are treated as separate institutions. This includes only those lenders with at least one minority applicant and at least one loan acceptance.
[2] Expressed as a deviation around MSA means.
[3] Minimum and maximum contributions to variance based on deviations around MSA means.

Source: Authors.

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Appendix Table 8:   Allocation of Variance in Origination Ratios across Lenders: Number of
Low-Income Tract Originations, 1990 HMDA

	Number of Lenders[1]	Std. Dev. of Origination Ratio[2]	R-Square[2]	Percent Attributable to Variance in[3]	
				% Minority Applications	Relative Approval Rate
Type of Institution					
Commercial Banks	4,003	.27	.96	92-96%	4-8%
Thrift Institutions	2,183	.16	.92	97-98	2-3
Credit Unions	629	.29	.95	94-95	5-6
Bank Subsidiaries	1,964	.21	.92	88-91	9-12
Thrift Subsidiaries	711	.26	.91	88-89	11-12
Other Mortgage Banks	1,534	.20	.94	93-95	5-7
Size of Institution					
> 500 Applications	634	.10	.99	99-100	0-1
100-500 Applications	2,926	.13	.98	99-100	0-1
< 100 Applications	7,464	.27	.93	92-94	6-8
Market Share of Institution					
More than 5 Percent	1,712	.14	.98	97-99	1-3
1-5 Percent	3,428	.17	.97	97-99	1-3
Less than 1 Percent	5,884	.28	.92	92-94	6-8
Size of MSA					
> 25,000 Applications	1,273	.18	.93	94-97	3-6
< 25,000 Applications	9,751	.24	.94	93-95	5-7
Percent Minority Applications					
More than 22 Percent	1,014	.26	.94	90-94	6-10
Less than 22 Percent	10,010	.24	.94	94-95	5-6
Total	11,024	.24	.94	93-95	5-7

Dependent Variable: Number of approved loans for properties in census tracts where 30 percent or
more of the applicants have income not greater than $25,000 as a percent of
all approved loans.

[1] Lenders operating in multiple MSAs are treated as separate institutions.   This includes only
those lenders with at least one minority applicant and at least one loan acceptance.
[2] Expressed as a deviation around MSA means.
[3] Minimum and maximum contributions to variance based on deviations around MSA means.

Source: Authors.

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Appendix Table 9:   Allocation of Variance in Origination Ratios across Lenders: Dollar Value of
Low-Income Tract Originations, 1990 HMDA

	Number of Lenders[1]	Std. Dev. of Origination Ratio[2]	R-Square[2]	Percent Attributable to Variance in[3]	
				% Minority Applications	Relative Approval Rate
Type of Institution					
Commercial Banks	4,003	.25	.96	90-94%	6-10%
Thrift Institutions	2,183	.16	.93	93-95	5-7
Credit Unions	629	.27	.96	89-92	8-11
Bank Subsidiaries	1,964	.21	.91	87-89	11-13
Thrift Subsidiaries	711	.25	.93	83-83	17-17
Other Mortgage Banks	1,534	.20	.94	91-93	7-9
Size of Institution					
> 500 Applications	634	.11	.98	99-100	0-1
100-500 Applications	2,926	.13	.98	99-99	1-1
< 100 Applications	7,464	.26	.94	88-90	10-12
Market Share of Institution					
More than 5 Percent	1,712	.13	.97	97-99	1-3
1-5 Percent	3,428	.17	.96	97-98	2-3
Less than 1 Percent	5,884	.26	.94	87-89	11-13
Size of MSA					
> 25,000 Applications	1,273	.19	.93	94-96	4-6
< 25,000 Applications	9,751	.23	.94	90-92	8-10
Percent Minority Applications					
More than 22 Percent	1,014	.24	.93	86-91	9-14
Less than 22 Percent	10,010	.23	.94	91-93	7-9
Total	11,024	.23	.94	90-93	7-10

Dependent Variable: Dollar value of approved loans for properties in census tracts where 30
percent or more of the applicants have income not greater than $25,000 as a
percent of all approved loans.

[1] Lenders operating in multiple MSAs are treated as separate institutions.   This includes only
those lenders with at least one minority applicant and at least one loan acceptance.
[2] Expressed as a deviation around MSA means.
[3] Minimum and maximum contributions to variance based on deviations around MSA means.

Source: Authors.

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Appendix Table 10: Allocation of Variance in Origination Ratios across Lenders: Number of Low-Income Originations Relative to Non-Low-Income Originations, 1990 HMDA

| | Number of Lenders[1] | Std. Dev. of Origination Ratio[2] | R-Square[2] | Percent Attributable to Variance in[3] | |
				% Minority Applications	Relative Approval Rate
Type of Institution					
Commercial Banks	4,908	.57	.85	89-88	12-11%
Thrift Institutions	3,022	.30	.81	92-93	7-8
Credit Unions	652	.67	.89	94-94	6-6
Bank Subsidiaries	2,167	.65	.67	86-93	7-14
Thrift Subsidiaries	778	.56	.81	84-84	16-16
Other Mortgage Banks	1,732	.32	.83	90-92	8-10
Size of Institution					
> 500 Applications	774	.20	.96	96-99	1-4
100-500 Applications	3,551	.30	.91	98-99	1-2
< 100 Applications	8,934	.60	.77	87-89	11-13
Market Share of Institution					
More than 5 Percent	1,897	.46	.91	97-99	1-3
1-5 Percent	4,156	.60	.79	93-93	7-7
Less than 1 Percent	7,206	.48	.78	83-87	13-17
Size of MSA					
> 25,000 Applications	2,195	.28	.72	85-88	12-15
< 25,000 Applications	11,064	.56	.80	89-91	9-11
Percent Minority Applications					
More than 22 Percent	1,195	.62	.85	93-94	6-7
Less than 22 Percent	12,064	.51	.78	89-91	9-11
Total	13,259	.52	.79	89-92	8-11

Dependent Variable: Number of approved loans to low-income applicants relative to approved loans for non-low-income applicants.

[1] Lenders operating in multiple MSAs are treated as separate institutions. This includes only those lenders with at least one minority applicant and at least one loan acceptance.

[2] Expressed as a deviation around MSA means.

[3] Minimum and maximum contributions to variance based on deviations around MSA means.

Source: Authors.

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Appendix Table 11: Allocation of Variance in Origination Ratios across Lenders: Number of Central
City Low-Income Originations, 1990 HMDA

	Number of Lenders[1]	Std. Dev. of Origination Ratio[2]	R-Square[2]	Percent Attributable to Variance in[3]	
				% Minority Applications	Relative Approval Rate
Type of Institution					
Commercial Banks	3,218	.25	.94	76-83%	17-24%
Thrift Institutions	2,231	.18	.94	84-90	10-16
Credit Unions	473	.30	.98	87-93	7-13
Bank Subsidiaries	1,786	.22	.90	82-82	18-18
Thrift Subsidiaries	635	.23	.91	80-84	16-20
Other Mortgage Banks	1,325	.21	.93	84-91	9-16
Size of Institution					
> 500 Applications	189	.09	.99	96-99	1-4
100-500 Applications	1,884	.11	.96	95-98	2-5
< 100 Applications	7,595	.25	.92	80-85	15-20
Market Share of Institution					
More than 5 Percent	1,934	.12	.96	94-95	5-6
1-5 Percent	3,202	.14	.89	85-86	14-1
Less than 1 Percent	4,532	.28	.93	77-83	17-23
Size of MSA					
> 25,000 Applications	1,394	.22	.93	85-89	11-15
< 25,000 Applications	8,274	.23	.93	81-85	15-19
Percent Minority Applications					
More than 22 Percent	998	.23	.92	83-87	13-17
Less than 22 Percent	8,670	.23	.93	81-86	14-19
Total	9,668	.23	.93	82-86	14-18

Dependent Variable: Number of approved loans to low-income applicants in central city census
tracts as a percent of all approved loans to central city census tracts.

[1] Lenders operating in multiple MSAs are treated as separate institutions. This includes only
those lenders with at least one minority applicant and at least one loan acceptance.
[2] Expressed as a deviation around MSA means.
[3] Minimum and maximum contributions to variance based on deviations around MSA means.

Source: Authors.

Appendix Table 12: Linear Probability Model of Minority (1) or Nonminority (0)

	Parameter Estimate	Standard Error
Owner-occupied (Dummy)	.01034 ***	.00112
Income ($1,000's)		
Income	-.00171 ***	.00028
Income Spline at $20k	.00082 *	.00032
Income Spline at $40k	.00040 **	.00013
Income Spline at $60k	.00008	.00012
Income Spline at $80k	-.00023	.00015
Income Spline at $100k	.00048 ***	.00012
Income Spline at $150k	.00018 *	.00008
Income Spline at $200k	-.00002	.00005
Loan Amount ($1,000's)		
Loan Amount	-.00159 ***	.00017
Loan Amount Spline at $20k	.00180 ***	.00023
Loan Amount Spline at $40k	-.00017	.00015
Loan Amount Spline at $60k	-.00006	.00014
Loan Amount Spline at $80k	.00001	.00014
Loan Amount Spline at $100k	.00052 ***	.00012
Loan Amount Spline at $125k	-.00053 ***	.00007
Loan Amount Spline at $200k	.00004	.00002
Loan-to-Income Ratio (Dummies, Less than 1.5 Is Base Group)		
Ratio of 1.5 to 2.0	-.00301 ***	.00089
Ratio of 2.0 to 2.225	-.00244 *	.00119
Ratio of 2.225 to 2.5	.00093	.00138
Ratio of 2.5 to 2.75	.00068	.00158
Ratio of 2.75 to 3.0	.00455 *	.00192
Ratio over 3.0	.00365	.00175
Applicant Gender (Dummies, Female Applicant, No Co-applicant Is Base Group)		
Male Applicant, Female Co-applicant	-.02765 ***	.00644
Female Applicant, Male Co-applicant	-.01765 **	.00652
Male Applicant and Co-applicant	-.01237	.00664
Female Applicant and Co-applicant	.00225	.00675
Male Applicant, no Co-applicant	-.01565 ***	.00092
Income, Interacted with no Co-applicant		
Income	-.00157 ***	.00036
Income Spline at $20k	.00184 ***	.00042
Income Spline at $40k	-.00028	.00020
Income Spline at $60k	.00036	.00025
Income Spline at $80k	.00012	.00031
Income Spline at $100k	-.00047 **	.00016

	Parameter Estimate	Standard Error
FHA Loan (Dummy)	.12305 ***	.01201
VA Loan (Dummy)	.12368 ***	.01203
Marital Status, Interacted with VA or FHA Loan		
No Co-applicant (VA Loan)	.02287 ***	.00262
No Co-applicant (FHA Loan)	.00166	.00138
Income, Interacted with VA or FHA Loan		
Income	-.00141 **	.00045
Income Spline at $20k	.00096 *	.00049
Income Spline at $40k	.00024	.00020
Income Spline at $60k	-.00001	.00028
Income Spline at $80k	-.00007	.00044
Income Spline at $100k	.00035	.00029
Loan Amount, Interacted with VA or FHA Loan		
Loan Amount	-.00171 ***	.00045
Loan Amount Spline at $20k	.00151 **	.00059
Loan Amount Spline at $40k	-.00025	.00029
Loan Amount Spline at $60k	.00030	.00023
Loan Amount Spline at $80k	.00004	.00023
Loan Amount Spline at $100k	.00048 *	.00023
Loan-to-Income Ratio, Interacted with VA or FHA Loan		
Ratio of 1.5 to 2.0	-.00542 **	.00188
Ratio of 2.0 to 2.25	-.00601 *	.00252
Ratio of 2.25 to 2.5	-.01143 ***	.00293
Ratio of 2.5 to 2.75	-.01058 **	.00335
Ratio of 2.75 to 3.0	-.00848 *	.00401
Ratio over 3.0	-.00967 *	.00415

* Significant at the 5 Percent Level
** Significant at the 1 Percent Level
*** Significant at the .1 Percent Level

Number of Observations	1,984,688
Mean Minority Share of Regression Sample	.133
Number of Tract/Institution Dummies	607,631
R-Squared (Including Tract/Institution Dummies)	.577
R-Squared (Variation around Tract/Institution Means)	.005

Source: Authors.

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Appendix Table 13: Linear Probability Model of Loan Denial (1) or Acceptance (0)

	Parameter Estimate	Standard Error
Race (Dummies, "Other Race" Is Base Group)		
Black Applicant	.07271 ***	.00403
Hispanic Applicant	.01031 **	.00392
Native American Applicant	-.00174	.00569
Asian Applicant	-.02186 ***	.00390
White Applicant	-.02987 ***	.00364
Mixed Race, Minority Co-applicant (Dummy)	.02410 ***	.00337
Mixed Race, Nonminority Co-applicant (Dummy)	-.02690 ***	.00329
Owner-occupied (Dummy)	.00630 ***	.00132
Income ($1,000's)		
Income	-.00985 ***	.00034
Income Spline at $20k	.00606 ***	.00038
Income Spline at $40k	.00282 ***	.00015
Income Spline at $60k	.00063 ***	.00015
Income Spline at $80k	.00016	.00017
Income Spline at $100k	.00011	.00014
Income Spline at $150k	-.00004	.00010
Income Spline at $200k	.00010	.00006
Loan Amount ($1,000's)		
Loan Amount	-.00193 ***	.00020
Loan Amount Spline at $20k	.00028	.00027
Loan Amount Spline at $40k	.00179 ***	.00018
Loan Amount Spline at $60k	-.00018	.00016
Loan Amount Spline at $80k	.00033 *	.00016
Loan Amount Spline at $100k	-.00015	.00014
Loan Amount Spline at $125k	.00012	.00008
Loan Amount Spline at $200k	-.00021 ***	.00003
Loan-to-Income Ratio (Dummies, Less than 1.5 Is Base Group)		
Ratio of 1.5 to 2.0	-.01016 ***	.00105
Ratio of 2.0 to 2.225	-.01168 ***	.00141
Ratio of 2.225 to 2.5	-.01195 ***	.00163
Ratio of 2.5 to 2.75	-.00737 ***	.00187
Ratio of 2.75 to 3.0	.00323	.00227
Ratio over 3.0	.05062 ***	.00207
Applicant Gender (Dummies, Female Applicant, No Co-applicant Is Base Group)		
Male Applicant, Female Co-applicant	-.01886 *	.00763
Female Applicant, Male Co-applicant	-.00766	.00772
Male Applicant and Co-applicant	-.00390	.00787
Female Applicant and Co-applicant	-.01021	.00800
Male Applicant, no Co-applicant	.02834 ***	.00109
Income, Interacted With No Co-applicant		
Income	-.00334 ***	.00042
Income Spline at $20k	.00516 ***	.00049
Income Spline at $40k	-.00051 *	.00024
Income Spline at $60k	-.00137 ***	.00030
Income Spline at $80k	.00048	.00036
Income Spline at $100k	-.00045 *	.00019
Race and Marital Status, Interacted with VA Loan		
Black Applicant	-.00667	.01469
Hispanic Applicant	-.00866	.01548
Native American Applicant	.04929 *	.02208
Asian Applicant	.01699	.01765
White Applicant	-.02033	.01428
Other Race Applicant	.02562	.02726
Single Applicant	-.00619 *	.00311

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Appendix Table 13 (Continued)

	Parameter Estimate	Standard Error
Race and Marital Status, Interacted with FHA Loan		
Black Applicant	-.01967	.01446
Hispanic Applicant	-.04312 **	.01445
Native American Applicant	.00429	.01701
Asian Applicant	-.03294 *	.01489
White Applicant	-.03329 *	.01425
Other Race Applicant	-.02377	.01732
No Co-Applicant	-.01230 ***	.00164
Income, Interacted with VA or FHA Loan		
Income	-.00169 **	.00054
Income Spline at $20k	.00295 ***	.00058
Income Spline at $40k	-.00032	.00024
Income Spline at $60k	-.00129 ***	.00034
Income Spline at $80k	.00195 ***	.00052
Income Spline at $100k	-.00157 ***	.00034
Loan Amount, Interacted with VA or FHA Loan		
Loan Amount	.00366 ***	.00053
Loan Amount Spline at $20k	-.00256 ***	.00069
Loan Amount Spline at $40k	-.00231 ***	.00034
Loan Amount Spline at $60k	.00066 *	.00027
Loan Amount Spline at $80k	-.00038	.00028
Loan Amount Spline at $100k	.00052	.00027
Loan-to-Income Ratio, Interacted with VA or FHA Loan		
Ratio of 1.5 to 2.0	-.00333	.00222
Ratio of 2.0 to 2.25	-.00511	.00299
Ratio of 2.25 to 2.5	-.00612	.00347
Ratio of 2.5 to 2.75	.00029	.00397
Ratio of 2.75 to 3.0	-.00449	.00475
Ratio Over 3.0	-.00681	.00492

* Significant at the 5 Percent Level
** Significant at the 1 Percent Level
***Significant at the .1 Percent Level

Number of Observations	1,984,688
Mean Denial Rate in Regression Sample	.148
Number of Tract/Institution Dummies	607,631
R-Squared (Including Tract/Institution Dummies)	.456
R-Squared (Variation around Tract/Institution Means)	.022

Source: Authors.