UNDERSERVED MORTGAGE MARKETS: EVIDENCE FROM HMDA DATA

by Robert B. Avery, Patricia E. Beeson, and Mark S. Sniderman

Robert B. Avery is a professor in the Department of Consumer Economics and Housing at Cornell University, and Patricia E. Beeson is an associate professor of economics at the University of Pittsburgh; both are research associates of the Federal Reserve Bank of Cleveland. Mark S. Sniderman is senior vice president and director of research at the Federal Reserve Bank of Cleveland. This paper was presented at the Western Economic Association Annual Meeting in Vancouver in July 1994; an earlier version was presented at the 1994 winter meetings of the AREUEA Society.

Abstract

The 1992 Housing and Community Development Act directed the two government-sponsored housing enterprises -- Fannie Mae and Freddie Mac -- to increase their lending in "underserved areas" and where there are "unmet housing needs." Unfortunately, Congress did not specify how unmet mortgage needs were to be measured or how underserved areas were to be identified. To shed light on this issue, we use data collected under the Home Mortgage Disclosure Act to provide a baseline evaluation of the variation in mortgage credit flows from all lenders across different types of neighborhoods. These data represent a virtual census of all mortgage loan applications in metropolitan areas for the years 1990 and 1991. Variations in both loan application and lender denial rates are examined separately, recognizing that loan originations depend on both processes. An attempt is made to isolate the effect of neighborhood characteristics by controlling for other factors, such as the borrower's income and race, market effects, and lender behavior.

After other factors are controlled for, the study concludes that the racial composition of a neighborhood appears to have little impact on either the likelihood that a loan application will be denied or the rate at which applications are made. On the other hand, the race of the applicant appears to have a strong impact on loan denial. Black applicants, in particular, have unexplainably high denial rates. The income of a neighborhood does appear to impact both denial and application rates, with neighborhoods below a median income of $20,000 being particularly disadvantaged. Finally, once other factors are controlled for, the fact that a neighborhood is in a central city appears to have little impact on credit flows. The study cautions that although these data represent the most comprehensive information available, questions remain about both the coverage of the dataset and the impact of many omitted variables, such as applicant credit history and property valuation.

I. INTRODUCTION

When Congress enacted the Housing and Community Development Act (HCDA) in 1992, it added another legislative initiative to a 25-year federal tradition of support for the goal of equal access to credit markets for all segments of the community. The Act directed the two government-sponsored housing enterprises (GSEs) -- Fannie Mae and Freddie Mac -- to increase their lending in "underserved areas" and where there are "unmet housing needs." In the short run, interim targets specify that 30 percent of the GSEs' purchased mortgages must be in central cities, rural areas, or other underserved locations, and 30 percent must be made to borrowers with incomes below their area's median. By 1995, the Department of Housing and Urban Development (HUD) is to replace these targets with permanent ones.

The language and spirit of HCDA are very similar to those of the 1977 Community Reinvestment Act (CRA), which requires depository institutions (mainly commercial banks and savings and loans) to help meet the credit needs of their entire community, including low- and moderate-income neighborhoods, in a manner consistent with safe and sound banking. Initial enforcement of CRA by the federal banking regulatory agencies focused on procedures used to advertise and solicit loan applications (particularly mortgages) from low-income and minority (nonwhite) neighborhoods. Increasingly, however, community groups have pressured regulators to shift enforcement toward quantitative standards.[1] This has raised the same issue about how unmet mortgage needs are measured as HUD will face in devising permanent GSE targets under HCDA. Unfortunately, there is little agreement about how to identify underserved areas. The underlying premise of both HCDA and CRA is that some sort of market breakdown exists under which well-qualified borrowers are willing to pay prevailing mortgage rates but are unable to secure a mortgage. This might occur because of either supply constraints (lenders may discriminate against certain individuals or neighborhoods, or they may incorrectly perceive the risk of such lending) or demand considerations (borrowers might have incorrect perceptions about underwriting standards). Although the premise may be

---

[1] See Neuberger and Schmidt (1994) and Avery (1989).

clear, it is not clear how to identify the occurrence of a market breakdown empirically. Credit flows may vary across individuals or neighborhoods for many reasons other than the presence or absence of a market breakdown. Supply may vary because lending risk differs, and demand may vary for a host of reasons.

The objective of this paper is to provide a baseline evaluation of the variation in mortgage credit flows across different types of neighborhoods. We focus on mortgage credit because of its heavily geographic component and its specific citation in HCDA. In our analysis, we examine variation in loan application and lender denial rates separately, recognizing that the variable of concern -- loan originations -- depends on both processes. The spirit of our inquiry is descriptive; we do not pretend to answer definitively the question of how to identify an underserved area. Hopefully, a better understanding of the reduced-form stylized facts can provide signs about where future research can best be directed.

We use data recently made available under the 1989 amendments to the Home Mortgage Disclosure Act (HMDA). Starting in 1990, the amendments required covered lenders operating in metropolitan areas (MSAs) to report on a census tract basis, among other things, detailed information on individual mortgage loan applicants, including income and race and disposition of the applications. Curiously, despite congressional interest in credit flows to specific types of neighborhoods, most analysts have used post-1989 HMDA data to investigate charges of racial discrimination against individual loan applicants. The role of property location remains largely unexplored with this dataset.[2]

---

[2] 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 MSAs. These studies use either pre-1990 HMDA data or lien title data to infer from the neighborhoods' characteristics whether mortgage lenders treat neighborhoods differently depending on their racial composition. In studies combining individual and neighborhood data, King (1980) and Schafer and Ladd (1981) find little evidence of neighborhood effects, but they do uncover some evidence of higher denial rates for black and Hispanic applicants. While quite informative, these studies are limited in their geographic coverage and in the number and types of lenders surveyed. More recently, Munnell et al. (1992) conducted a special survey of home purchase applications in Boston matched to the 1990 HMDA frame. They determined that once an individual's race is factored in, neighborhood racial composition accounts for little. However, their sample contained a relatively small number of minority neighborhoods. Similarly, Megbolugbe and Cho (1993) and Buist,

We use HMDA data in two ways. Total loan applications for 1990 and 1991 are sorted into census tracts and used to construct application rates by tract, scaled by the number of tract housing units as measured in the 1990 Decennial Census. Application denial rates are also constructed by aggregating actions on individual loan applications into tract averages. Our analysis focuses on how these two variables differ across different types of neighborhoods -- specifically, neighborhoods sorted by median family income and percent minority population. We examine the gross variation in these two measures as well as the variation controlling for 1) individual characteristics of the borrower and loan and 2) demographic characteristics of the tract.

Although HMDA data are by far the most comprehensive available on the geographic distribution of mortgages, they raise several concerns. First, many applicant-level variables used in lenders' credit decisions are not collected. These include the applicant's credit history, work history, debt burdens, and wealth, for example. Second, no information is provided about the physical condition of the individual property securing the mortgage being sought. To the extent that these individual and property characteristics are correlated with neighborhood characteristics, this creates problems in identifying a pure neighborhood effect.

Finally, concern has been expressed about the completeness of HMDA coverage. Evidence suggests that some lenders, particularly mortgage bankers, may not be filing HMDA reports. If such omissions are not random, then this presents a potentially serious drawback to the use of our application rate variable. This is particularly troublesome because we have argued elsewhere (see Avery, Beeson, and

---

Megbolugbe, and Trent (1994) use post-1989 HMDA data to examine geographic variations in mortgage lending, but they restrict themselves to MSA-level aggregates.

Sniderman [1994]) that loan originations are the best measure of lender compliance with CRA. We show that across lenders, and thus potentially across neighborhoods, application rate variation explains a much larger percentage of the variation in origination rates than do denial rates. Because of its importance to the debate over underserved neighborhoods and the lack of a better data source, we present evidence on the distribution of application rates constructed from HMDA data. However, these results should be viewed with caution until we have a better understanding of the potential bias stemming from undercoverage.

By way of preview, we find that once other factors are controlled for, the racial composition of a census tract has little impact on either its application rate or the likelihood that a loan will be denied. On the other hand, tract income appears to be important. Ceteris paribus, low-income tracts, particularly those with median incomes below $20,000, show significantly lower application rates and higher denial rates than other areas. Although the racial composition of a tract doesn't appear to matter, we do find that the race of an individual has a large impact on denial rates. Black applicants, in particular, have unexplainably high denial rates. Finally, although the interim HCDA guidelines set specific targets for central city lending, we find little evidence that central city tracts have either lower application rates or higher denial rates once other tract characteristics are accounted for.

The remainder of the paper is organized as follows. The next section presents the framework for the empirical analysis used to identify neighborhood effects. In section III, we discuss the dataset used in the study, describe the steps used to prepare it, and give simple descriptive statistics. Section IV presents the bulk of the analysis and a discussion of the results. Conclusions are reported in section V.

II. EMPIRICAL FRAMEWORK

The purpose of this paper is to examine variation in mortgage lending patterns -- both application rates and denial rates -- across neighborhoods (i.e., census tracts). Ideally, we would like to isolate true neighborhood differences; that is, differences that stem from characteristics of the neighborhood itself rather than from characteristics of either the individuals who apply for loans in the neighborhood or the lenders that happen to serve them. Unfortunately, since we lack any information on persons who did not apply for loans, analysis of application rates must be conducted at the neighborhood level without controls for any individual or lender characteristics. Information in HMDA filings, however, does allow the potential to control for some borrower and lender characteristics in the analysis of denial rates. This is done through a two-stage procedure. In the first stage, we use the complete 1990/1991 HMDA filings to identify neighborhood differences in denial rates that cannot be explained by characteristics of the application or lender.[3] These neighborhood residuals are then used as dependent variables in second-stage regressions relating them to neighborhood characteristics drawn from the 1980 and 1990 Decennial Censuses. This approach parallels the one we used in two earlier studies designed to isolate individual and lender effects (Avery, Beeson, and Sniderman [1993a, 1993b]).

In the first stage, we assume that each mortgage applicant's risk can be represented as a function of his/her race and economic characteristics (such as income), neighborhood (census tract), market (MSA), and lender. We have no basis with which to select a particular econometric model specification. However, the size of the dataset dictates that in practice we assume a linear-probability model specification.[4] Thus,

---

[3] At the time this paper was written, 1992 HMDA data were also available. However, the geographic taxonomy used for reporting loans changed from 1980 census tracts to 1990 tracts in 1992. Thus, the analysis was restricted to 1990 and 1991 in order to utilize a consistent geographic framework.

[4] As discussed later, a large number of nonlinear transformations and interactions of the independent variables are used. We do this to increase the robustness of the results and to reduce the potential impact of the arbitrary

we estimate a model in which the probability of a random loan application being denied is linear in the following terms:

(1) $\text{DENIAL}_{iMTL} = \beta_A \text{AC}_i + \beta_R \text{RACE}_i + \beta_M \text{MSA}_M + \beta_T \text{TRACT}_T + \beta_L \text{LENDER}_L + e_{iMTL},$

where DENIAL is one if the ith application using the Lth lender in the Mth MSA and Tth census tract is denied, and zero otherwise. MSA, TRACT, and LENDER are dummy variables indicating which MSA, census tract, and lender the application relates to, and e is a residual. AC is a vector of application characteristics, other than race, reported in the HMDA data. It includes gender, marital status, occupancy, income, loan amount, income-to-loan ratio, federal loan guarantee (Federal Housing Administration [FHA] or Department of Veterans Affairs [VA]), and month of the year the application was acted upon.[5,6] RACE is a set of dummy variables indicating the race of the applicant and co-applicant; each is interacted with FHA/VA status as well as income. The model is specified and estimated separately for each of three types

selection of the model form. With more than 2,000,000 observations, the use of either a logistic or probit model form would have been impractical.

[5] To help minimize the possibility that the differences we identify within and across neighborhoods reflect nonlinearities in other effects that are correlated with location, we allow for a considerable degree of nonlinearity in the effects of individual characteristics. Income and loan amount are entered as linear spline functions with seven knots each (dummies are also used for small home improvement loans), and the income-to-loan-amount ratio is entered as a series of six dummy variables. A five-knot linear spline for income is interacted with a dummy variable indicating the presence of a co-applicant, and with dummy variables indicating that the application is for an FHA or VA loan. Similarly, a five-knot linear spline of loan amount, and the six dummy variables indicating ranges of values for the ratio of income to loan amount, are also interacted with a dummy variable indicating applications for FHA or VA loans.

[6] The month of the action date is included as a crude proxy for interest rates and other market conditions. Lenders reported the date of both the application and loan action. The application month would be the ideal choice as a proxy for interest rates, since most mortgage rates are locked in at that point. Unfortunately, the filing year is defined by the action date, which is the date of denial for a denied application, but the closing date for accepted and originated mortgages. Because the closing date is typically a month or two later than the approval date, this creates a systematic bias in the HMDA data in the relationship between the loan action and application dates and the loan's disposition. For example, more than half of the applications made in November or December 1991 and filed for the 1991 calendar year were denials. Closing dates for accepted applications during those months were likely to extend over the first of the year and thus were filed for the 1992 calendar year. Potentially, this problem could be reduced by combining several years of data. However, this raises the issue of changing filing requirements.

of loan applications -- home purchases, refinancings, and home improvements -- and for each of the two sample years, 1990 and 1991.

To reduce the computing requirements, the actual estimation was done in two steps. In the first step, equation (1) was estimated with the individual application characteristics (AC) and separate intercepts for *each* lender/census tract combination included as single-component fixed effects. The MSA, lender, and tract effects are thus intertwined in these intercepts. In the second step, an iterative procedure, equivalent to regressing the fixed-effects intercepts against MSA, census tract, and lender dummies, was used to identify the MSA, tract, and lender effects. Separate lender effects were estimated for each MSA, thus defining lenders operating in multiple MSAs as multiple lenders. By construction, the MSA effects were normalized to have overall sample means of zero, and within each MSA, lender and tract means were normalized to zero. In cases where lender and tract effects were not identified (a lender was the only lender in a tract and did all of its business there), the effect was assigned to the tract.

The parameter estimates from equation (1), together with the characteristics of the applications received (AC, RACE, and LENDER), are used to predict denial rates for each neighborhood. Neighborhood denial residuals are measured as the difference between the neighborhood's predicted and actual denial rates:

(2) $DENIAL\ RESIDUAL_{Tj} = DENIAL_{Tj} - (\beta_{Aj}AC_{Tj} + \beta_{Rj}RACE_{Tj} + \beta_{Lj}LENDER_{Tj})$,

where DENIAL (the actual denial rate), AC, RACE, and LENDER are tract *averages* for the jth loan type (home purchase, refinance, home improvement) and Tth tract. Note that these residuals reflect *relative* treatment, since, by construction, the average residual across all neighborhoods is zero. Also note that the residuals include MSA effects (which are normalized to zero). Thus, the tract residuals reflect both within-

and between-MSA effects. Including the between-MSA effect in the residual is consistent with the view that it is the *absolute* characteristics of a tract, and its absolute denial rate, that matter. This would be the case if the United States were truly one national market, but may not be true if MSA market conditions are important.

Although these residuals are constructed for each of the three types of loans and each-year, our analysis combines 1990 and 1991 data for each loan type using a weighted average. A second set of residuals that factor out the MSA effects, $\beta_{Mj}MSA_{Mj}$, were also constructed. These residuals are deviations about MSA means, indicating that the relevant consideration for a tract is its *relative* position within an MSA.

In the second stage of estimation, these neighborhood residuals are regressed on various neighborhood characteristics. The general form of the estimation is as follows:

(3) $DENIAL\ RESIDUAL_{Tj} = \gamma_j CENSUS_T + u_{Tj}$,

where j indicates loan type, T specifies tract, and CENSUS is a vector of variables drawn from the 1980 and 1990 Decennial Censuses. Regressions are run for the whole sample and separately for center city and suburban (non-central city) tracts. We use both absolute tract residuals, including between-MSA effects, and relative residuals, specified as deviations about MSA means.

Consistent with the qualifications cited earlier, we also examine the relationship between loan application rates and neighborhood characteristics. Applications are summed for each tract over the two years for each loan type and are then deflated by the stock of 1-4 unit residential properties as defined by the 1990 Decennial Census. This variable is regressed against the same set of independent variables as used for the denial rate regressions in equation (3):

(4) APPLICATION RATE$_{Tj}$ = π_jCENSUS$_T$ + v$_{Tj}$,

with j, T, and CENSUS as defined above.

III. DATA

Mortgage Loan Application and Disposition Data

Data on individual loan applications and dispositions for 1990 and 1991, used in the first-stage

estimation for the denial rate and to form the numerator of the application rate, are collected under the 1989

revisions to HMDA. The amended HMDA data form one of the most comprehensive sets of statistics on

mortgage lending available in the United States. Nearly all commercial banks, savings and loan

associations, credit unions, and other mortgage lending institutions (primarily mortgage banks) with assets

of more than $10 million and an office in an MSA are required to report on *each* mortgage loan purchased

and loan application filed during the calendar year. Lenders must report the loan amount, census tract of

the property, whether the property is owner occupied, purpose of the loan (home purchase, home

improvement, or refinancing), loan guarantee (conventional, FHA, or VA), loan disposition (loan approved

and originated, application approved but withdrawn, no lender action taken [incomplete data or application

withdrawn], or application denied), race and gender of the loan applicant (and co-applicant, if any), and

income relied on by the lending institution in making the loan decision.[7,8]

---

[7] See Canner and Smith (1991, 1992) for a comprehensive discussion of the HMDA data.

[8] Institutions with assets of less than $30 million are not required to report race, income, or gender for loan applicants. In addition, the HMDA filings contain many errors and inconsistencies even after extensive editing by the receiving agencies. We dealt with missing and implausible data by using a "hot deck" imputation procedure similar to that used by the U.S. Census Bureau. Applications with missing or implausible data were statistically matched to applications for the same type of loan 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. 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.

In total, 9,333 financial institutions filed HMDA reports for 1990 on 6,595,089 loans. In 1991,

9,365 institutions filed on 7,939,107 loans. Our analysis focuses on the 7,938,438 loan applications in the

two years for 1-4 unit residential properties that were acted upon (denied or accepted) by the lenders.[9] Of

these, 4,072,158 were for home purchase loans, 2,216,810 were to refinance an existing mortgage loan,

and 1,649,470 were for home improvement loans (generally second or third mortgages).[10] These

applications were received by 8,745 separate institutions operating in 40,008 census tracts in all 341 of the

MSAs defined as of 1990. For our analysis, we define lender at the MSA level; thus, an institution

reporting applications for two different MSAs is treated as two different lenders. There are 23,248 such

lenders in our sample.

Descriptive statistics for the applications reported for 1990 and 1991 under HMDA are presented

in table 1. Statistics are given separately for home purchase, refinancing, and home improvement loan

applications. Clearly, housing credit applicants are a select group of American families. Applicants'

median income ($49,000) is substantially higher than the median income of families in MSAs ($37,918) as

---

[9] The following loan filings were omitted from the sample: 1) loans purchased from other institutions (because they did not require an action by the reporting lender and often were missing geographic information) and applications for properties outside the MSAs in which the lender had an office (5,670,768 loans dropped), 2) applications for multifamily homes (55,703 loans dropped), and 3) applications that never reached the stage of lender action because they were either withdrawn by the applicant or closed for incompleteness (869,287 loans dropped). Overall in 1990 (1991), the sample consisted of 1,984,688 (2,087,470) home purchase loan applications, 716,595 (1,500,215) refinancing applications, and 787,952 (861,518) home improvement loan applications. The final sample includes some mobile home loans and condominium loans, since they were treated as 1-4 family units in the HMDA reporting guidelines.

[10] The distinction between loan types may be blurred. Institutions were allowed to report home improvement loans secured by a first lien as either home purchase or home improvement loans. Some home improvement loans may also be reported as refinancings if a new first lien was issued. Some refinancing may not have been reported at all. If a refinancing was undertaken primarily for a purpose other than home purchase or home improvement (such as college expenses or to start a business), then it did not have to be reported. Similarly, unless the borrower specifically noted home improvement as a reason for the loan, lenders did not have to report home equity or second-lien mortgages.

reported in the 1990 Decennial Census.[11] The racial composition of the study sample also appears to differ

from that of all U.S. families. Blacks filed 7.4 percent of the HMDA housing loan applications for the

three loan types, yet headed 11.4 percent of the MSA households and represented 7.7 percent of all

homeowners in the 1990 Decennial Census. Asian loan applicants (5.2 percent), however, were

overrepresented compared with their numbers in the census (2.5 percent of MSA household heads and 2.2

percent of homeowners). The percentage of applicants who were white (81.9 percent) or Hispanic (7.5

percent) is approximately representative of their numbers (78.1 percent of household heads and 84.8

percent of homeowners for whites, and 7.5 percent of household heads and 5.0 percent of homeowners for

Hispanics).[12] It is also apparent that denial rates differ substantially by race for all three types of loans.

Census Data

Data used as explanatory variables in the second stage of the analysis were drawn from the 1980

and 1990 Decennial Censuses. Unfortunately, although most tracts remained the same, some boundary

definitions were changed between 1980 and 1990. In filing 1990 and 1991 HMDA reports, lenders were

required to use 1980 census tract definitions. However, the most relevant census information, that for

1990, is reported by the Census Bureau using 1990 tract definitions. To resolve this problem, we decided

to use 1980 tract definitions as the mode of analysis and to use estimates of 1990 census information. Data

were obtained from Claritas Corporation, which aggregated block-level 1990 census data to 1980-defined

tract totals. Change variables were calculated using 1980 census information and Claritas's 1990

estimates.

---

[11] In the HMDA data, household income may be slightly understated, as it reflects only the portion of an applicant's income needed for mortgage qualification.

[12] These figures exclude Puerto Rico, which is included in the table 1 statistics. If Puerto Rico is included, Hispanics are 8.1 percent of the loan sample.

Census and HMDA data could be aligned using a consistent taxonomy for most areas with the methodology just described. However, for a few outer areas of some MSAs that were not tracted in 1980, loan and census information had to be aggregated to the county level. In a few other instances, tracts had to be dropped for a variety of reasons. We lacked census information on Puerto Rico and thus excluded it from the analysis. We also dropped HMDA loans in tracts that had no residents, in those with insufficient numbers to provide racial breakdowns, and in those with less than 50 dwellings. In total, the sample for the second stage consisted of 38,697 of the original 40,008 HMDA census tracts, with 98.9 percent (7,851,680) of the original HMDA loan applications. Puerto Rico accounted for the majority of the omissions.

Specific census variables selected for the analysis include the following: 1) percent minority population of each tract (defined here as all nonwhites -- Hispanic, black, Asian, native American, and other race), 2) median family income, 3) median owner-occupied house value, 4) age distribution of household heads, 5) distribution of residential dwellings by number of units in the structure, 6) percentage of 1-4 unit residential properties that were vacant and rented, and 7) variables indicating the distribution of the housing stock by vintage. 1990 values were used for each of these variables (except the housing age variables, which used 1980 data) as well as for the change from 1980 to 1990.

The sample distribution of tracts, population, owner-occupied housing units, and total 1990/1991 HMDA loan applications for the three loan classes is reported in table 2. Information is given for the total population and for minorities. Distributions are shown for census tracts sorted by minority population share in 1990, change in minority population share from 1980 to 1990, share of black population, share of

Hispanic population, median owner-occupied housing value in 1990, percentage change in median housing value from 1980 to 1990,[13] median family income in 1990, and center city/suburban and MSA size.

The most interesting comparison in table 2 is between column 4 (the stock of 1-4 unit residential properties as measured by the Decennial Census) and columns 5, 7, and 9 (loan applications for comparable units). Interestingly, those tracts with less than 5 percent minority population are proportionately represented in loan applications, whereas 10 to 50 percent minority tracts have disproportionately more loan applicants, and more than 50 percent minority tracts have disproportionately fewer applicants. It appears that predominantly black tracts are particularly underrepresented. It also appears that tracts with median home values above $100,000 or median incomes above $40,000 have a disproportionately large number of applicants, but that areas with substantial increases in housing value from 1980 to 1990 have less than their share of applicants.

Table 3 reports HMDA denial rates for white, black, and Hispanic applicants by tract using the same taxonomy as in table 2. It appears that differences across racial groups dominate those across neighborhood types. Interestingly, a neighborhood's racial composition seems to affect the treatment of white applicants much more than it does blacks or Hispanics. Tract house value and income appear to impact each racial group in roughly proportional ways. On the other hand, the change in housing value seems to be unrelated to lender treatment. Finally, denial rates are somewhat higher in central cities than in suburban areas, but at least for blacks and Hispanics, MSA size appears to have an even larger effect.

---

[13] Measured in nominal terms. The Consumer Price Index rose about 50 percent over this period.

IV. ESTIMATION AND RESULTS

Parameter estimates for the first-stage regressions predicting the denial of an application are presented in tables 4, 5, and 6.[14,15] In examining these numbers, a positive coefficient can be interpreted as the expected increase in the probability that an applicant's loan will 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, month of action date, MSA, census tract, and lender will have their loan applications denied. Thus interpreted, the estimated black/white (.104 and .106) and Hispanic/white (.038 and .052) differences for conventional home purchase loans are quite significant. Differences are similar for refinance and home improvement loans. This might appear to be tangential to our examination of neighborhood effects. However, since minorities tend to live in segregated communities, if they are underserved as individuals, then a policy of targeting minority neighborhoods may be warranted -- even if the neighborhood racial composition per se does not appear to be related to denial rates.

The second stage of the analysis consists of examining the relationship between neighborhood characteristics and application and denial rates. Instead of gross denial rates, we use adjusted tract residuals computed using the coefficients in tables 4-6 (see equation [2]). These can be thought of as tract

---

[14] The model was actually estimated using deviations about the means, which is computationally equivalent to a single-component fixed-effects model. For 1990 (1991), the home purchase sample had 1,984,688 (2,087,470) observations located in 607,631 (662,571) unique combinations of 40,008 (39,963) tracts and 20,695 (26,508) lenders spread across 340 (341) MSAs; thus, the average tract had about 15 lenders in each year, each of whom served about 30 tracts per MSA. For the refinancing sample in 1990 (1991), the 716,595 (1,500,215) observations were located in 326,535 (563,380) unique combinations of 37,746 (38,912) tracts and 16,159 (23,284) lenders. For the home improvement loan sample in 1990 (1991), the 787,951 (861,518) observations were located in 267,158 (285,605) unique combinations of 39,219 (39,216) tracts and 12,280 (13,276) lenders.

[15] The reported standard errors in tables 4-6 are those from a standard regression program. These may be biased due to heteroskedasticity stemming from the linear probability model specification.

denial rates adjusted for applicant and lender characteristics. Most of our analysis includes the MSA effects in these residuals; however, we also duplicate our analysis using deviations about MSA means. Means for the dependent and independent variables used in the second stage are given in table 7. Figures are reported for all tracts as well as separately for center city and suburban areas. We do not give the adjusted denial-rate means, since they are normalized (to zero) constructs.

Regression results are presented in tables 8-11. Independent variables are identical in each regression. However, the dependent variable and the sample are varied. Regressions were run separately for home purchase, refinance, and home improvement loans. Table 8 presents results for the whole sample using the adjusted denial-rate residuals. In these, and in all regressions using the adjusted denial rates, tracts are weighted by the number of applications of each loan type in the tract. Table 9 gives results of regressions identical to those in table 8, except that all variables are expressed as deviations about MSA means (equivalent to adding a dummy variable for each MSA). Tables 10 and 11 present results of regressions identical to those in tables 8 and 9, except that the dependent variable is the tract application rate, with observations weighted by the number of 1-4 unit residential properties in the tract.

Clearly, the format of the results presented in tables 8-11 makes it difficult to get a good sense of the overall thrust of the data. To put this information into a more easily understood form, we decided to focus on only two neighborhood characteristics -- percent minority population in each tract and tract median family income. We also tried to distill the information in the regressions into a few summary variables. For each tract and loan type, the following were constructed: 1) gross denial rate, 2) denial rate adjusted for lender and individual characteristics (the dependent variable used for the regressions in tables 8 and 9), and 3) gross application rate (the dependent variable in tables 10 and 11).

In addition, predicted values from the regressions presented in tables 8-11 were used to construct

four variables. We subtracted these predicted values from the application and denial rates in each tract to

compute adjusted residuals. These can be thought of as the application (or denial) rate in the tract adjusted

for its demographic and economic characteristics (e.g., age of the housing stock and householders and

house usage) and, in the case of the denial rate, the individual's characteristics as well. Because of the

particular concern with minority population share and tract family income, we constructed two separate

adjusted residuals. To examine the impact of minority population share, we computed residuals using the

coefficients on all variables *except* those for minority population share and the change in minority share.

These residuals are based on the predicted tract application (or denial) rate if the tract were all-white and

had no change in racial composition from 1980 to 1990. The impact of tract income was examined using a

similarly constructed residual that incorporates all variable coefficients except those for median family

income, the change in median income, median house value, and the change in house value. Again, these

residuals can be viewed as deviations from the predicted application (or denial) rate for a tract if it were

assumed to have an average tract income, home value, and average changes from 1980 to 1990.

Tracts were then sorted by minority share and median tract family income. Tract values for each

of these variables were averaged (using applications or 1-4 unit residential properties as weights) for all

tracts with the same income or minority share and were summarized in graph form. In the subsections that

follow, we discuss several issues using these results.

Tract Racial Composition

Loan denial rates arrayed by minority percentage in the tract are presented in figure 1. Panels are

shown for each loan type using the same scale for comparison. In each panel, three separate denial rates

are shown: 1) the gross denial rate controlling for nothing (equivalent to the numbers presented in table 3),

2) the adjusted denial rate controlling for individual and lender characteristics (the dependent variable in the regressions presented in table 8), and 3) the fully adjusted denial rate adjusting for individual and lender characteristics, and for all tract characteristics *except* minority share (the residuals from the regressions presented in table 8). In each case, the denial rates are normalized to have a value of zero in tracts having a minority share of 2 percent or less.

The gap in denial rates between white and minority neighborhoods is huge. Moreover, although much of the difference disappears when individual and other tract characteristics are controlled for, a significant difference remains. The difference between all-white and all-minority tracts for home purchase loan denial rates, for example, falls from .167 when nothing is controlled for, to .084 when individual and lender characteristics are controlled for, to .044 when tract characteristics other than race are controlled for. Similar reductions occur for refinance loans, where the gap narrows from .213 to .118 to .064. Neighborhood effects seem more persistent for home improvement loans, with a comparatively wide gap of .156 remaining even after individual and nonracial neighborhood effects are taken into account.

The data in figure 1 reflect both between- and within-MSA effects, implying that it is the absolute characteristics of a tract that count. In figure 2, we present denial rate differences based only on within-MSA information (the gross denial rate data shown also have between-MSA differences removed). Controlling for MSA appears to virtually eliminate the effect of neighborhood racial composition on denial rates of home purchase and refinance loans, reducing the all-white and all-minority gap to .015 and .016, respectively, when all other factors are controlled for. Thus, any relationship between the racial composition of the tract and denial rates appears to stem from variation across MSAs, not within them. Although reduced from figure 1, the fully adjusted denial rate gap between all-white and all-minority tracts for home improvement loan applications is still a significant .048.

Figures 3 and 4 present similar information for application rates. Since we have no control for individual characteristics, we plot the gross application rate and the rate adjusted for tract characteristics other than race. Although it is necessary to bear in mind our concern about the adequacy of HMDA coverage, several conclusions emerge. The gross difference in home purchase loan application rates between all-white and all-minority tracts presented in figure 3 (.042) is relatively large, especially when compared with the average tract application rate of .071 in the sample. However, this gap narrows to .007 when characteristics other than race are controlled for. Indeed, nearly all differences in application rates across tracts of different racial composition disappear when adjusted rates are used. This is true whether between- and within-MSA data are used or just within-MSA numbers (figure 4).

Tract Median Family Income

Denial rates arrayed by tract median family income (measured in $1,000s) are presented in figure 5. The variables plotted are similar to those used for figure 1 except that the fully adjusted rate represents the denial rate residual controlling for all tract characteristics *except* income, house value, and the change in both variables from 1980 to 1990. Each denial rate is normalized to have a value of zero for all neighborhoods with a median income of $110,000 or more.

Unlike neighborhood racial composition, it appears that neighborhood income has a significant impact on home purchase and refinance denial rates even after other factors are controlled for. This is particularly true for loans in neighborhoods with median incomes below $20,000 (the median income for the average tract is $37,800). Ceteris paribus, home purchase loans in tracts with a median income of $20,000 are .073 more likely to be denied than loans in tracts with a $110,000 median, and .022 more likely than loans in tracts with a $40,000 median. Differences for refinance loans are even more

pronounced, at .165 and .066, respectively. On the other hand, after controlling for other factors, neighborhood income appears to have virtually no effect on home improvement loan denial rates.

Although the magnitudes change somewhat, these findings also hold when only within-MSA differences are plotted (figure 6). The only conclusion with a substantive change is the appearance that neighborhood income may affect home improvement denial rates when MSA is controlled for, even though it has little effect when MSA is not considered.

The income of a tract also appears to have a strong impact on home purchase and refinance (but not home improvement) application rates (figure 7). This is true for both gross and adjusted rate comparisons, when MSA is not controlled for, and when only within-MSA differences are used (figure 8). The effect is monotonic, with the application rate steadily increasing in income up to the $65,000 to $70,000 level.

Center City/Suburban

Interim targets set up under HCDA require the GSEs to meet minimum goals for lending in center cities. This suggests a belief by Congress that central city neighborhoods are more likely to be underserved than are other neighborhoods. HMDA data provide little evidence to support this view. Controlling for other factors, denial rates for home purchase loans are slightly higher (.002) in central city tracts than in other neighborhoods (table 8). However, ceteris paribus, denial rates are actually *lower* for refinance and home improvement loans (table 8). We note, though, that when deviations about MSA means are used, the findings for refinance and home improvement loans reverse (table 9). There also appears to be little evidence that, ceteris paribus, application rates differ significantly between center city and suburban tracts (table 10). Indeed, the regression results suggest that home purchase and home improvement loan application rates are actually higher in central city tracts.

To explore this further, we use the same data as in figures 1, 3, 5, and 7, but graph central city and suburban tracts separately (figures 9-12). It is apparent from the plots that overall, the difference among tracts within central city or suburban areas is much larger than the gap between the two. Moreover, it is not always the case that central city denial rates are larger. For example, among the poorest neighborhoods, suburban home purchase denial rates are actually higher than those for central cities. The only exception to the general conclusion that central city does not matter is the relationship between home purchase and refinance application rates and neighborhood racial composition (figure 10). However, most of this difference disappears when the fully adjusted residuals are compared.[16]

Neighborhood versus Individual

The data presented in figures 1-12 reflect overall neighborhood effects. Clearly, there may be interaction effects; that is, neighborhood effects may be different for different individuals. Moreover, neighborhood characteristics may be important -- not in and of themselves, but because certain types of people tend to live there. The interaction between an individual's race and the racial composition of his/her neighborhood is examined in figures 13 and 14. In figure 13, the gross and adjusted (for individual characteristics other than race) differences between black/white and Hispanic/white applicant denial rates are arrayed by neighborhood racial composition. Unlike data presented in other figures, these are absolute differences and are not normalized. Although a quite noisy series, the gap is generally widest in the predominantly white neighborhoods and lowest in the predominantly minority neighborhoods.

This effect is mirrored in figure 14, which gives the adjusted denial rate residuals (similar to the dependent variables in the table 8 regressions) calculated separately for each racial group. These are *each* normalized to have a value of zero in tracts with a minority share of 2 percent or less. Interestingly, the

---

[16] Although not shown here, similar results emerge when within-MSA data are used.

racial composition of a neighborhood affects the denial rate of *white* applicants much more than that of black or Hispanic applicants. For example, ceteris paribus, a black applicant for a home purchase loan is .037 more likely to have his/her application denied in an all-minority tract than in an all-white tract; a white applicant, however, would be .115 more likely.

Similar data are presented for tracts arrayed by income in figures 15 and 16. Here, tract income appears to affect all racial groups in approximately the same way. Except for home improvement loans -- and here only for middle-income tracts -- there is virtually no difference in tract effects by the individual's race.

V. CONCLUSIONS

We have examined how a neighborhood's racial composition and median family income affect application and denial rates for home mortgage loans. Several findings emerge. We show that controlling for nothing else, the racial composition of a tract appears to be strongly related to the likelihood that a loan application will be denied. However, when other factors, particularly the individual's race and MSA, are controlled for, the difference largely disappears for home purchase and refinance loans (but not for home improvement loans). Similar findings emerge for application rates.

It is important to note that this does not mean that *"race doesn't matter."* Indeed, in our analysis of HMDA data, the most significant and persistent factor in explaining denial rates is the applicant's race (see Avery, Beeson, and Sniderman [1993a]). The current paper attempts to sort out the difference between the effects of an individual's race and the racial composition of the neighborhood. This, however, is an imperfect process, and strong interaction effects may exist. Indeed, the data suggest that the racial composition of a neighborhood strongly affects the denial likelihood of *white* applicants. Moreover, even

if, ceteris paribus, the racial make-up of a neighborhood doesn't matter, neighborhood targeting by race may be a way of helping individual minorities and thus offsetting what appears to be their adverse treatment in the denial process.

We do find evidence that, ceteris paribus, a neighborhood's income does matter. Although many effects are monotonic with no clear-cut breakpoints, tracts with median income below $20,000, in particular, show significantly higher denial rates, even when applicant characteristics (including income) and other tract characteristics are accounted for. Median tract income also appears to have a strong relationship with application rates, particularly for home purchase and refinance loans. These effects remain even when other tract characteristics are controlled for.

Evidence from HMDA data does not appear to support the congressional decision to single out central city tracts in setting targets for the GSEs under HCDA. Although denial rates are marginally higher for home purchase loans in central cities, there is little evidence that central city and suburban tracts differ in either denial or application rates once individual tract characteristics are accounted for. This does not mean that the selection of central city tracts for loan targets is necessarily wrong if, for example, most of these tracts are also low income and/or predominantly minority. However, it would appear to be more effective to set targets according to tract-level characteristics than to use central city as a proxy.

We caution that these results come from reduced-form regressions. Differences in application or denial rates related to the racial composition or income of a neighborhood may stem from either unobserved variables related to risk or demand that we have failed to control for, coverage gaps in our data, inherent differences in mortgage demand, or differences in supply. Only if we eliminated the first three "causes" could we conclude unequivocally that low-income neighborhoods (or minority individuals) are underserved. On the other hand, the results make a prima facie case that neighborhood income and individual race do

matter. Ceteris paribus, persons in low-income tracts are less likely to apply for loans and, if they do, are more likely to be denied. Similarly, loan applications by minorities (particularly blacks) are significantly more likely to be denied than those by whites, even after other factors are controlled for. These are not results that stem from one market or one loan product; rather, they are pervasive and appear to be widespread. Thus, although our results are inconclusive, they are strongly suggestive of the need for further research.

REFERENCES

Avery, Robert B. 1989. Making Judgments about Mortgage Lending Patterns. *Economic Commentary,* Federal Reserve Bank of Cleveland (December 15).

Avery, Robert B., Patricia E. Beeson, and Mark S. Sniderman. 1993a. Accounting for Racial Differences in Housing Credit Markets. *Proceedings of a Conference on Discrimination and Mortgage Lending,* U.S. Department of Housing and Urban Development (forthcoming). Also, Working Paper 9309, Federal Reserve Bank of Cleveland (August).

_____, _____, and _____. 1993b. Lender Consistency in Housing Credit Markets. *Proceedings of the 1993 Conference on Bank Structure,* Federal Reserve Bank of Chicago, pp. 339-358. Also, Working Paper 9310, Federal Reserve Bank of Cleveland (August).

_____, _____, and _____. 1994. Cross-lender Variation in Home Mortgage Lending. *Economic Review,* Federal Reserve Bank of Cleveland, vol. 30, no. 4 (Quarter 4), pp. 15-29.

Avery, Robert B., and Thomas M. Buynak. 1981. Mortgage Redlining: Some New Evidence. *Economic Review,* Federal Reserve Bank of Cleveland (Summer), pp. 18-32.

Avery, Robert B., and Glenn B. Canner. 1983. Mortgage Redlining: A Multicity Cross-Section Analysis. Unpublished working paper, Board of Governors of the Federal Reserve System, Washington, D.C.

Bradbury, Katharine, Karl E. Case, and Constance R. Dunham. 1989. Geographic Patterns of Mortgage Lending in Boston, 1982-1987. *New England Economic Review,* Federal Reserve Bank of Boston (September/October), pp. 3-30.

Buist, Henry, Isaac F. Megbolugbe, and Tina R. Trent. 1994. Racial Homeownership Patterns, the Mortgage Market, and Public Policy. *Journal of Housing Research,* vol. 5, no. 1, pp. 1-27.

Canner, Glenn B. 1981. Redlining and Mortgage Lending Patterns. In *Research in Urban Economics,* edited by J. Vernon Henderson, Greenwich, CT: JAI Press, pp. 67-101.

Canner, Glenn B., and Delores S. Smith. 1991. Home Mortgage Disclosure Act: Expanded Data on Residential Lending. *Federal Reserve Bulletin,* vol. 77 (November), pp. 859-881.

_____, and _____. 1992. Expanded HMDA Data on Residential Lending: One Year Later. *Federal Reserve Bulletin,* vol. 78 (November), pp. 801-824.

King, A. Thomas. 1980. Discrimination in Mortgage Lending: A Study of Three Cities. Working Paper No. 91, Office of Policy and Economic Research, Federal Home Loan Bank Board (February).

Megbolugbe, Isaac F., and Man Cho. 1993. An Empirical Analysis of Metropolitan Housing and Mortgage Markets. *Journal of Housing Research,* vol. 4, no. 2, pp. 191-243.

Munnell, Alicia H., Lynne E. Browne, James McEnearney, and Geoffrey M. B. Tootell. 1992. Mortgage Lending in Boston: Interpreting HMDA Data. Working Paper 9207, Federal Reserve Bank of Boston (October).

Neuberger, Jonathan A., and Ronald H. Schmidt. 1994. A Market-Based Approach to CRA. *FRBSF Weekly Letter*, Federal Reserve Bank of San Francisco (May 27, 1994).

Schafer, Robert, and Helen F. Ladd. 1981. *Discrimination in Mortgage Lending*. Cambridge, MA: MIT Press.

FIGURE 1

DENIAL RATES, MINORITY PERCENTAGE IN TRACT

NEW PURCHASE LOANS

REFINANCE LOANS

HOME IMPROVEMENT LOANS

Minority Percentage in Tract
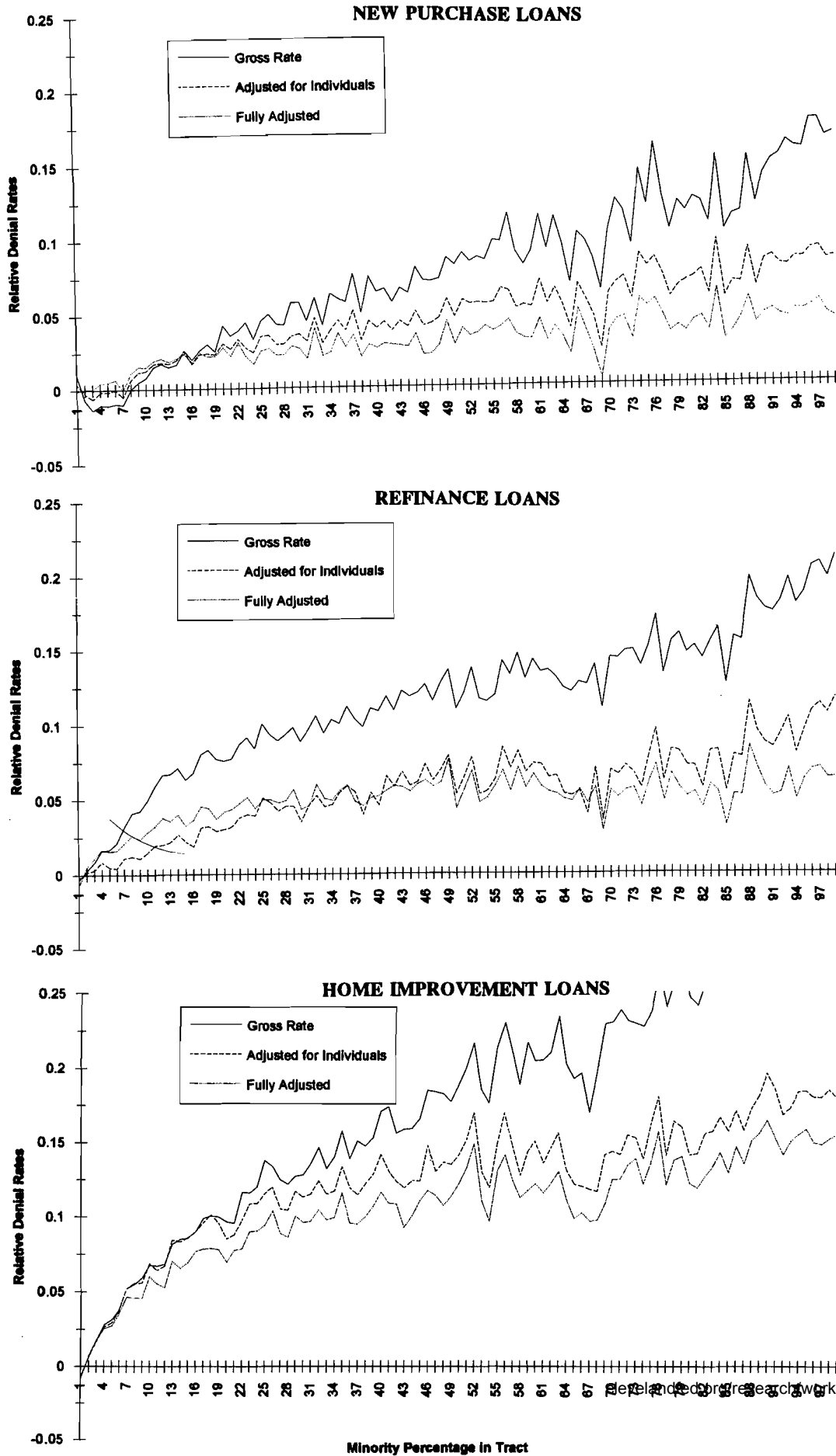
FIGURE 2

DENIAL RATES, DEVIATIONS ABOUT MSA MEANS, MINORITY PERCENTAGE IN TRACT

NEW PURCHASE LOANS

REFINANCE LOANS

HOME IMPROVEMENT LOANS

Minority Percentage in Tract
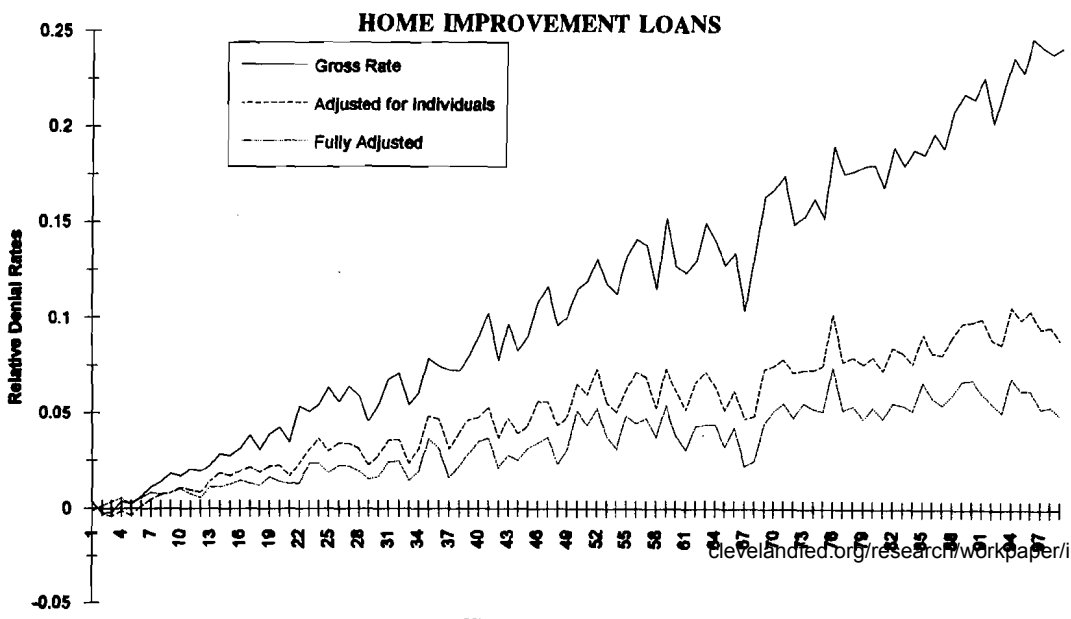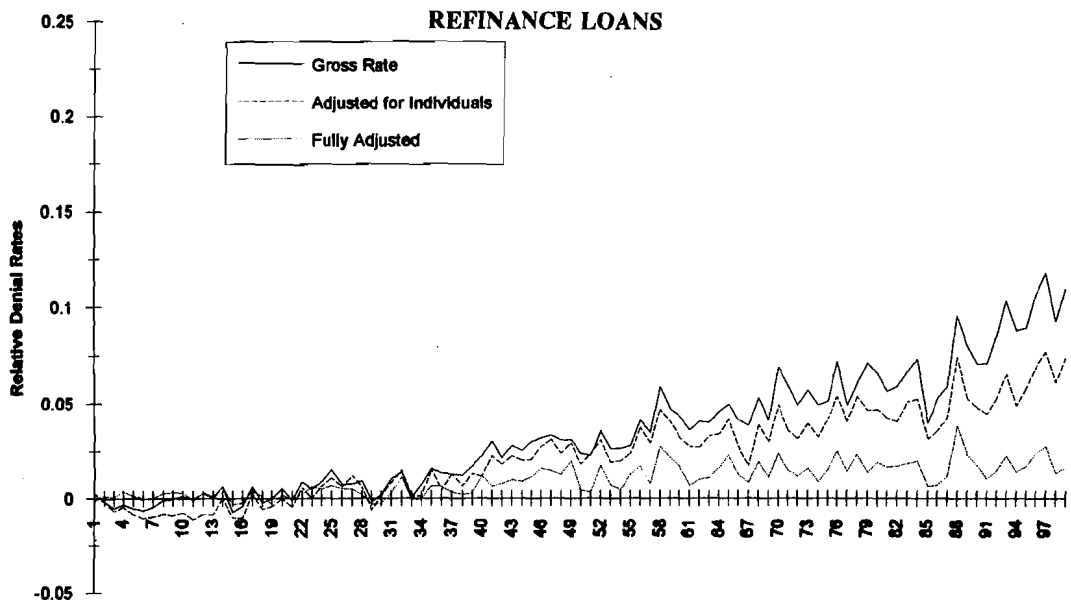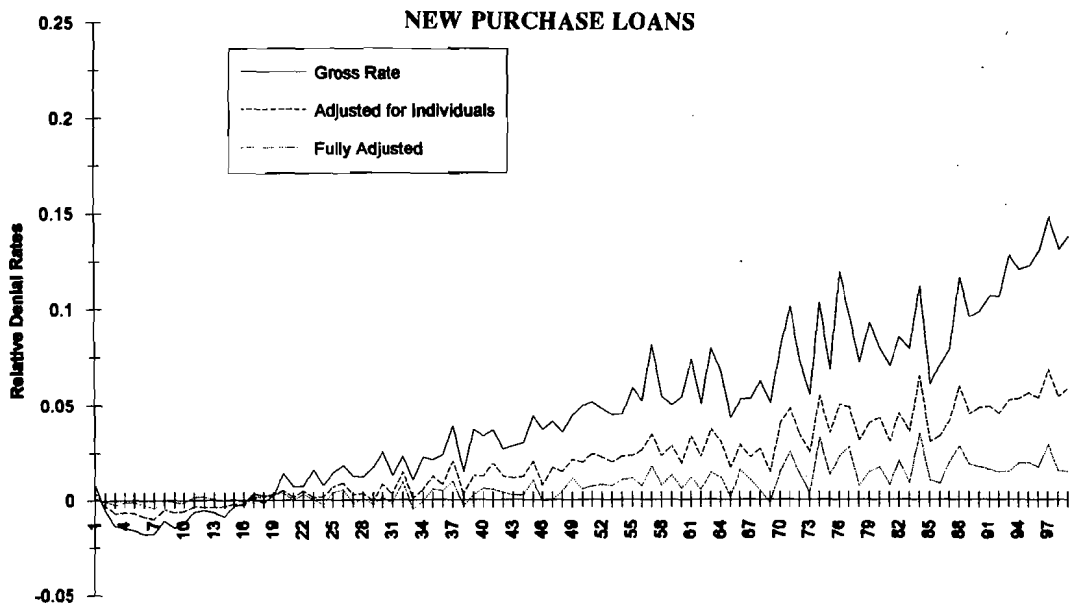
FIGURE 3

APPLICATION RATES, MINORITY PERCENTAGE IN TRACT

NEW PURCHASE LOANS

REFINANCE LOANS

HOME IMPROVEMENT LOANS

clevelandfed.org/research/workpaper/index.cfm

Minority Percentage in Tract
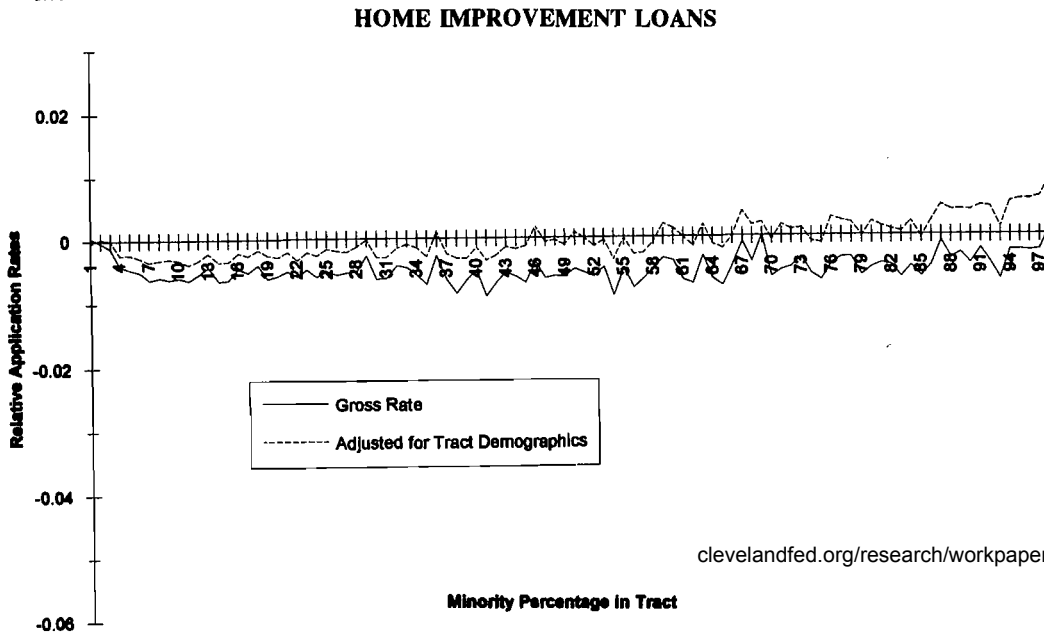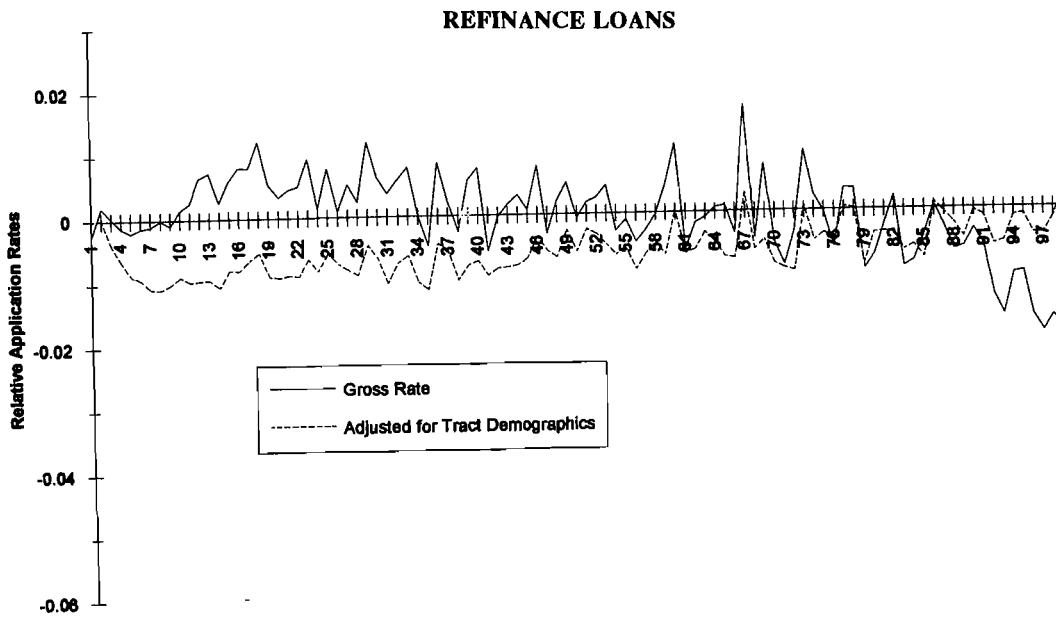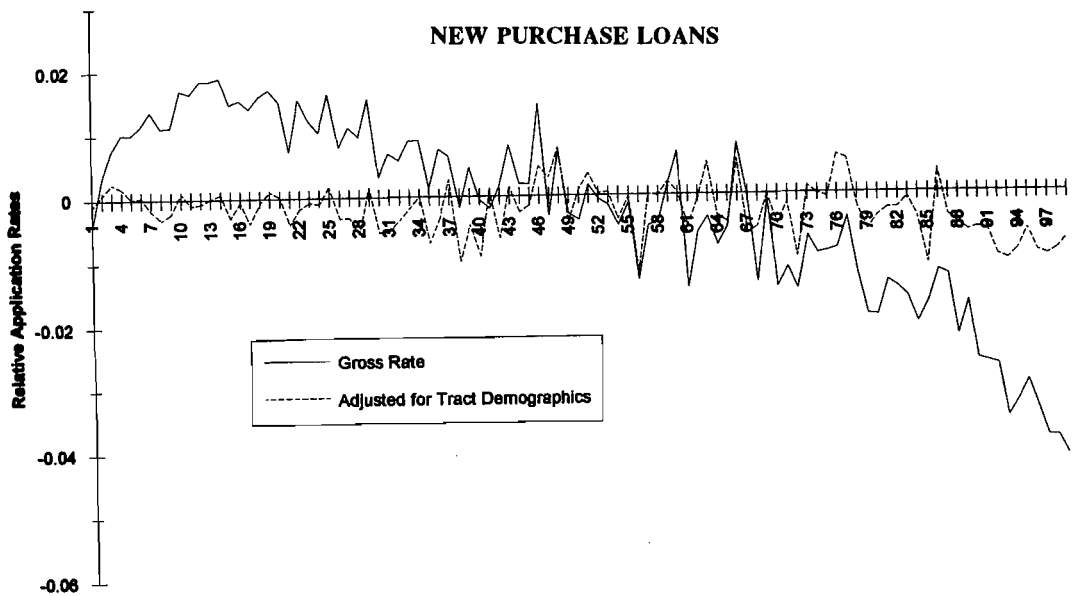
FIGURE 4

APPLICATION RATES, DEVIATIONS ABOUT MSA MEANS, MINORITY PERCENTAGE IN TRACT

NEW PURCHASE LOANS

REFINANCE LOANS

HOME IMPROVEMENT LOANS

clevelandfed.org/research/workpaper/index.cfm

Minority Percentage in Tract
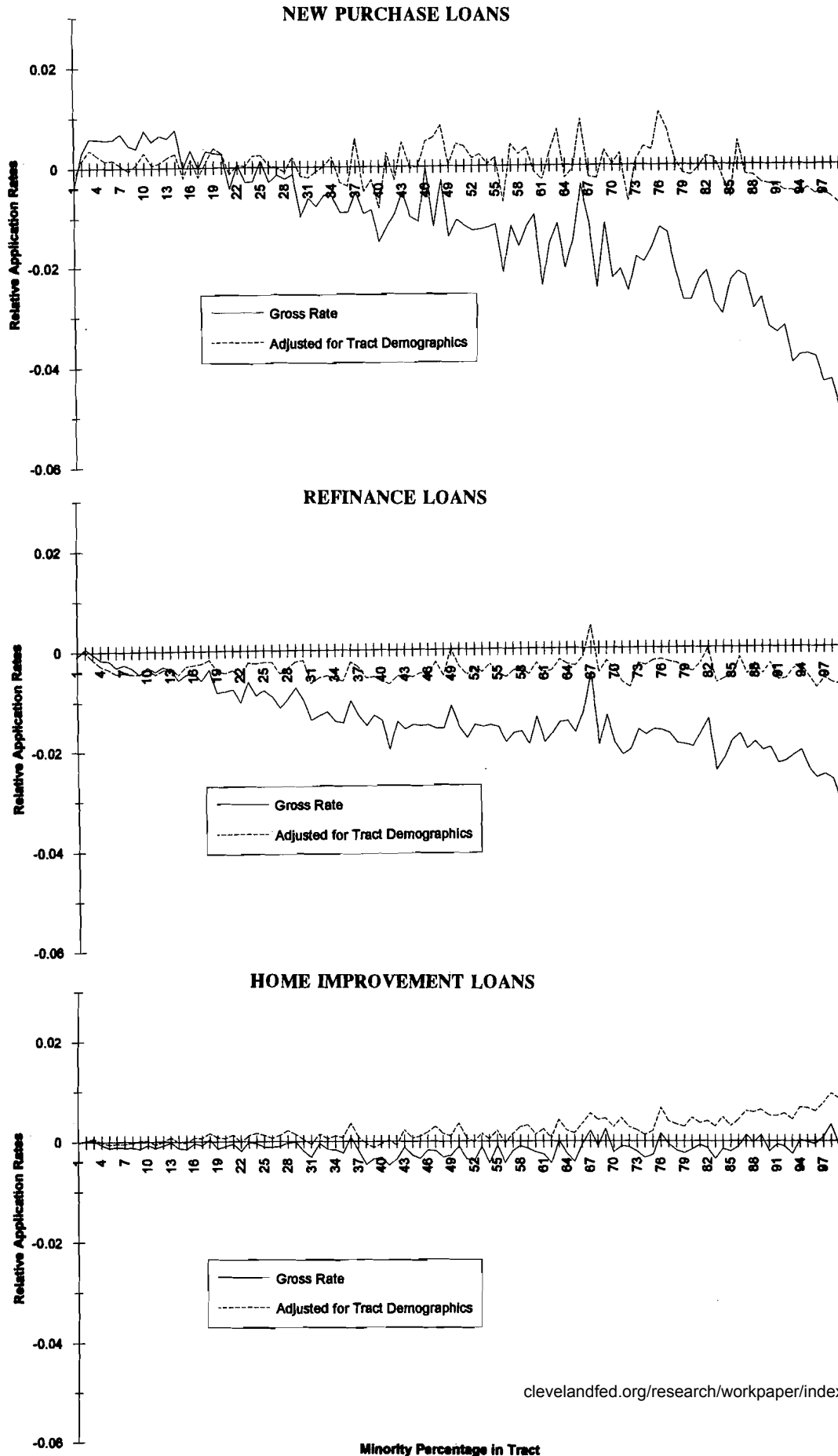
FIGURE 5

DENIAL RATES, TRACT MEDIAN INCOME

NEW PURCHASE LOANS

REFINANCE LOANS

HOME IMPROVEMENT LOANS

clevelandfed.org/research/workpaper/index.cfm
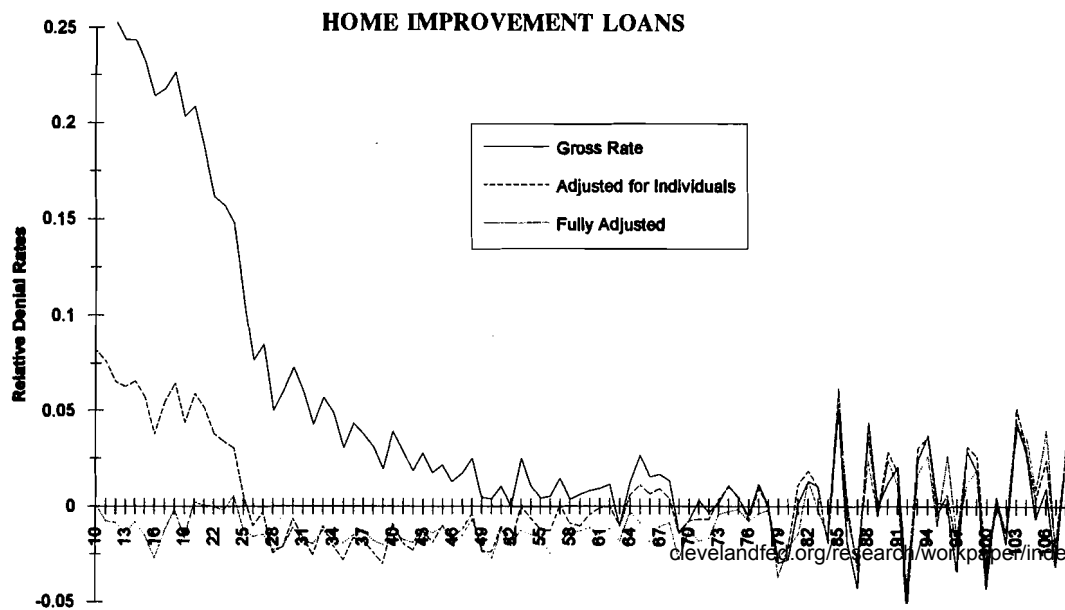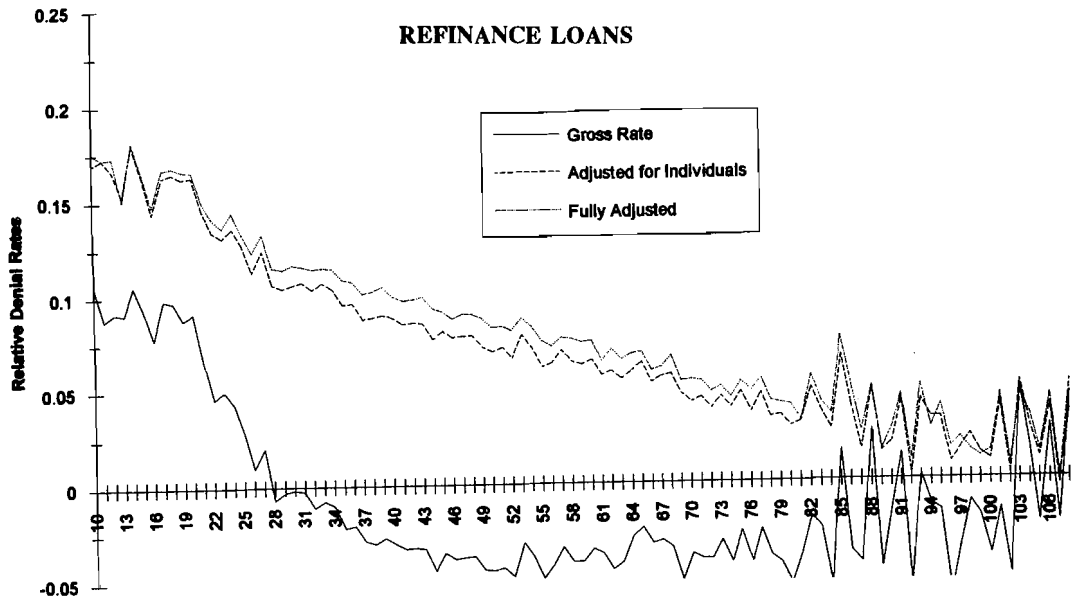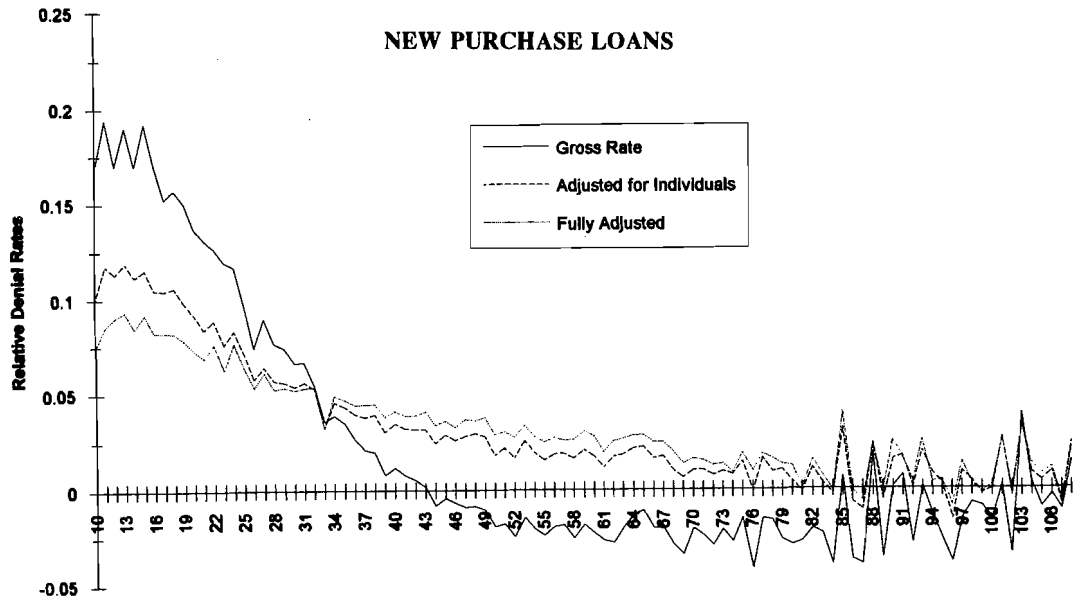
FIGURE 6

DENIAL RATES, DEVIATIONS ABOUT MSA MEANS, TRACT MEDIAN INCOME

NEW PURCHASE LOANS

Legend:
— Gross Rate
---- Adjusted for Individuals
—·— Fully Adjusted

REFINANCE LOANS

Legend:
— Gross Rate
---- Adjusted for Individuals
—·— Fully Adjusted

HOME IMPROVEMENT LOANS

Legend:
— Gross Rate
---- Adjusted for Individuals
— Fully Adjusted

Tract Median Income

FIGURE 7

APPLICATION RATES, TRACT MEDIAN INCOME

NEW PURCHASE LOANS

Relative Application Rates

- Gross Rate
- Adjusted for Tract Demographics

REFINANCE LOANS

Relative Application Rates

- Gross Rate
- Adjusted for Tract Demographics

HOME IMPROVEMENT LOANS

Relative Application Rates

- Gross Rate
- Adjusted for Tract Demographics

clevelandfed.org/research/workpaper/index.cfm

Tract Median Income

FIGURE 8

APPLICATION RATES, DEVIATIONS ABOUT MSA MEANS, TRACT MEDIAN INCOME

NEW PURCHASE LOANS

REFINANCE LOANS

HOME IMPROVEMENT LOANS

clevelandfed.org/research/workpaper/index.cfm

Tract Median Income

FIGURE 9

DENIAL RATES, CENTER CITY/SUBURBAN, MINORITY PERCENTAGE IN TRACT

NEW PURCHASE LOANS

Legend:
- Center City Gross Rate
- Suburban Gross Rate
- Center City Fully Adjusted
- Suburban Fully Adjusted

Y-axis: Relative Denial Rates

REFINANCE LOANS

Legend:
- Center City Gross Rate
- Suburban Gross Rate
- Center City Fully Adjusted
- Suburban Fully Adjusted

Y-axis: Relative Denial Rates

HOME IMPROVEMENT LOANS

Legend:
- Center City Gross Rate
- Suburban Gross Rate
- Center City Fully Adjusted
- Suburban Fully Adjusted

Y-axis: Relative Denial Rates

X-axis: Minority Percentage in Tract

clevelandfed.org/research/workpaper/index.cfm

FIGURE 10

APPLICATION RATES, CENTER CITY/SUBURBAN, MINORITY PERCENTAGE IN TRACT

NEW PURCHASE LOANS

Relative Application Rates

- —— Center City Gross Rate
- ----- Suburban Gross Rates
- —·—· Center City Adjusted for Tract Demographics
- ·········· Suburban Adjusted for Tract Demographics

REFINANCE LOANS

Relative Application Rates

- —— Center City Gross Rate
- ----- Suburban Gross Rate
- —·—· Center City Adjusted for Tract Demographics
- ·········· Suburban Adjusted for Tract Demographics

HOME IMPROVEMENT LOANS

Relative Application Rates

- —— Center City Gross Rate
- ----- Suburban Gross Rates
- —·—· Center City Adjusted for Tract Demographics
- ·········· Suburban Adjusted for Tract Demographics

clevelandfed.org/research/workpaper/index.cfm

Minority Percentage in Tract

FIGURE 11

DENIAL RATES, CENTER CITY/SUBURBAN, TRACT MEDIAN INCOME

NEW PURCHASE LOANS

Legend:
- Center City Gross Rate
- Suburban Gross Rate
- Center City Fully Adjusted
- Suburban Fully Adjusted

Y-axis: Relative Denial Rates

REFINANCE LOANS

Legend:
- Center City Gross Rate
- Suburban Gross Rate
- Center City Fully Adjusted
- Suburban Fully Adjusted

Y-axis: Relative Denial Rates

HOME IMPROVEMENT LOANS

Legend:
- Center City Gross Rate
- Suburban Gross Rate
- Center City Fully Adjusted
- Suburban Fully Adjusted

Y-axis: Relative Denial Rates

clevelandfed.org/research/workpaper/index.cfm

Tract Median Income

FIGURE 12

APPLICATION RATES, CENTER CITY/SUBURBAN, TRACT MEDIAN INCOME

NEW PURCHASE LOANS

Legend:
- Center City Gross Rate
- Suburban Gross Rate
- Center City Adjusted for Tract Demographics
- Suburban Adjusted for Tract Demographics

Y-axis: Relative Application Rates (0.02, 0, -0.02, -0.04, -0.06)

REFINANCE LOANS

Legend:
- Center City Gross Rate
- Suburban Gross Rate
- Center City Adjusted for Tract Demographics
- Suburban Adjusted for Tract Demographics

Y-axis: Relative Application Rates (0.02, 0, -0.02, -0.04, -0.06)

HOME IMPROVEMENT LOANS

Legend:
- Center City Gross Rate
- Suburban Gross Rate
- Center City Adjusted for Tract Demographics
- Suburban Adjusted for Tract Demographics

Y-axis: Relative Application Rates (0.02, 0, -0.02, -0.04, -0.06)

Tract Median Income

FIGURE 13

DENIAL RATE DIFFERENCES BY RACE, MINORITY PERCENTAGE IN TRACT

NEW PURCHASE LOANS

REFINANCE LOANS

HOME IMPROVEMENT LOANS

clevelandfed.org/research/workpaper/index.cfm

Minority Percentage in Tract

FIGURE 14

DENIAL RATES BY RACE, MINORITY PERCENTAGE IN TRACT

NEW PURCHASE LOANS

Legend:
- Black Applicants
- Hispanic Applicants
- White Applicants

Y-axis: Relative Tract Effects Controlling For Individuals

REFINANCE LOANS

Legend:
- Black Applicants
- Hispanic Applicants
- White Applicants

Y-axis: Relative Tract Effects Controlling For Individuals

HOME IMPROVEMENT LOANS

Legend:
- Black Applicants
- Hispanic Applicants
- White Applicants

Y-axis: Relative Tract Effects Controlling For Individuals

clevelandfed.org/research/workpaper/index.cfm

Minority Percentage in Tract

FIGURE 15

DENIAL RATE DIFFERENCES BY RACE, TRACT MEDIAN INCOME

NEW PURCHASE LOANS

REFINANCE LOANS

HOME IMPROVEMENT LOANS

clevelandfed.org/research/workpaper/index.cfm

FIGURE 16

DENIAL RATES BY RACE, TRACT MEDIAN INCOME

NEW PURCHASE LOANS

Legend:
- Black Applicants
- Hispanic Applicants
- White Applicants

REFINANCE LOANS

Legend:
- Black Applicants
- Hispanic Applicants
- White Applicants

HOME IMPROVEMENT LOANS

Legend:
- Black Applicants
- Hispanic Applicants
- White Applicants

Y-axis: Relative Tract Effects Controlling For Individuals

X-axis: Tract Median Income
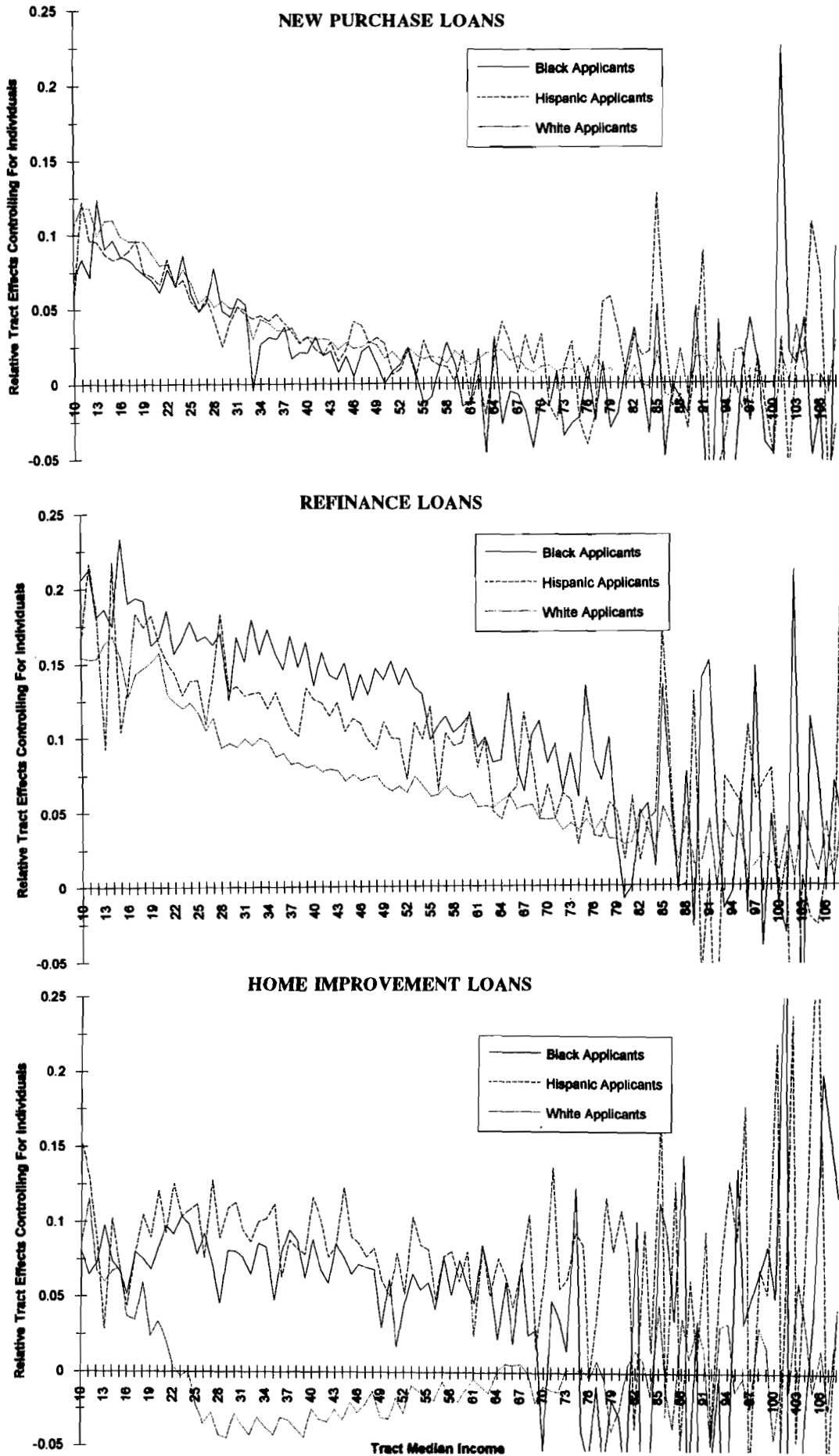
Table 1: Characteristics of Mortgage Applications, National Sample, 1990 and 1991 HMDA

	Home Purchase			Refinance			Home Improvement		
	Percent Sample	Percent Loan$	Denial Rate	Percent Sample	Percent Loan$	Denial Rate	Percent Sample	Percent Loan$	Denial Rate
Race of Applicant									
Native American	.5%	.5%	20.2%	.5%	.5%	23.4%	.8%	.9%	25.8%
Asian (or Pacific Islander)	4.4	6.4	15.5	5.0	7.2	22.5	2.5	5.5	33.1
Black	6.1	4.7	29.2	4.1	3.3	31.6	10.4	5.9	46.1
Hispanic	6.4	6.2	23.2	6.6	6.5	29.1	7.1	6.2	40.0
White	81.9	81.2	13.6	82.9	81.4	16.1	78.4	80.7	22.2
Other	.7	1.0	20.2	.8	1.1	27.9	.7	1.0	36.6
Race of Co-applicant									
No Co-applicant	28.7	24.3	18.1	24.7	23.2	22.3	37.5	28.6	32.2
Same Race as Applicant	69.3	73.4	14.2	73.4	74.6	16.6	60.9	69.2	22.8
Different Race than Applicant	2.0	2.3	15.5	1.9	2.2	20.5	1.6	2.2	23.7
Income of Applicant									
Less than $25,000	13.2	5.4	29.0	8.1	3.2	26.5	24.6	10.5	36.2
$25,000 to $50,000	39.9	28.0	15.0	32.1	19.2	18.1	40.4	28.8	25.9
$50,000 to $75,000	24.5	26.0	11.5	28.2	24.9	15.8	21.0	25.0	20.2
$75,000 to $100,000	10.1	14.1	11.5	13.8	16.0	16.3	7.5	13.1	19.2
More than $100,000	12.3	26.6	12.4	17.8	36.7	19.3	6.5	22.5	15.7
Loan Request									
Less than $50,000[1]	25.0	7.8	23.9	23.3	6.1	17.0	46.0	9.0	28.1
$50,000 to $75,000[1]	21.8	13.7	12.9	18.9	10.0	14.4	29.4	20.0	27.2
$75,000 to $125,000[1]	29.9	29.6	11.0	26.7	22.6	15.8	13.5	19.9	22.1
More than $125,000[1]	23.3	48.9	13.9	31.2	61.2	23.1	11.1	51.1	21.9
Gender									
Male Applicant, Female Co-applicant	64.0	68.3	13.7	69.4	71.0	16.2	55.1	64.6	21.9
Female Applicant, Male Co-applicant	4.3	4.1	18.9	3.6	3.2	21.3	5.8	5.0	29.2
Male Applicant and Co-applicant	1.9	2.1	17.7	1.3	1.6	22.9	.9	1.1	32.2
Female Applicant and Co-applicant	1.3	1.2	19.8	1.0	.9	25.2	.8	.8	34.1
Single Male Applicant	16.9	15.6	18.9	13.4	14.1	23.6	19.6	16.0	31.3
Single Female Applicant	11.8	8.7	16.9	11.3	9.1	20.8	17.9	12.6	33.1
Owner-occupied	93.6	94.6	15.3	92.1	93.0	17.8	96.5	95.4	26.3
Loan Type									
Conventional	74.7	82.3	15.5	96.3	97.9	18.1	94.9	97.1	25.6
FHA	20.1	13.8	14.4	2.7	1.5	17.3	5.0	2.6	41.8
VA	5.1	3.9	16.2	1.0	.6	15.0	.1	.3	16.5
FmHA	.02	.02	28.4	.0	.0	8.7	.0	.0	19.4
Lender Action									
Loan Denied	15.3	14.0		18.1	22.0		26.4	23.6	
Loan Accepted and Withdrawn	2.7	3.2		3.0	4.0		3.6	3.4	
Loan Originated	82.0	82.7		78.9	73.9		70.1	73.0	
Loan Kept by Originator (% of originations)	42.9	45.1		52.4	52.7		92.9	82.5	
Loan Sold to FNMA (% of originations)	15.2	15.2		17.1	15.3		2.1	5.8	
Loan Sold to GNMA (% of originations)	11.0	8.0		2.1	1.4		.2	.4	
Loan Sold to FHLMC (% of originations)	9.4	9.4		14.8	13.4		1.0	3.6	
Loan Sold Elsewhere (% of originations)	21.5	22.4		13.6	17.2		3.8	7.7	

Table 1: (Continued)

	Home Purchase			Refinance			Home Improvement		
	Percent Sample	Percent Loan$	Denial Rate	Percent Sample	Percent Loan$	Denial Rate	Percent Sample	Percent Loan$	Denial Rate
Reasons for Denial (of Loans Denied)[2]									
No Reason Given	31.3	28.7		22.8	21.5		29.9	30.0	
Debt-to-Income Ratio	17.1	19.3		20.8	20.9		23.3	22.5	
Employment History	4.2	3.1		2.3	1.8		2.7	2.1	
Credit History	26.3	21.9		24.8	20.8		33.9	24.1	
Collateral	8.3	9.4		17.3	20.7		10.5	12.9	
Insufficient Cash	4.1	4.5		1.9	2.1		.8	1.3	
Unverifiable Information	2.9	4.2		3.7	4.6		2.2	3.8	
Application Incomplete	3.0	4.3		3.5	4.3		1.1	1.6	
Mortgage Insurance Denied	.9	1.0		.6	.6		.1	.1	
Other	14.5	17.5		17.4	19.0		11.2	17.6	
Memo Items:									
Median Income ($1,000s)	$48			$57			$39		
Median Loan Request ($1,000s)	$78			$86			$10		
Number of Loans	4,072,158			2,216,810			1,649,470		

[1] Loan categories for home improvement loans are 1) under $10,000, 2) $10,000-$25,000, 3) $25,000-$50,000, and 4) over $50,000.
[2] Up to three reasons for denial could be given, and answers were voluntary. Each category gives the percentage of all denials citing that reason as one of the three.

Source for all tables: Authors.

Table 2: Distribution of 1990 Census Population and 1990/1991 HMDA Loan Applications by Tract Characteristics[1]

| | 1990 Census | | | | HMDA Loan Applications | | | | | |
| | Total Tract | Total Pop | Minor Pop | 1-4 Units | Home Purch | | Refinance | | Home Improve | |
					Total	Minor	Total	Minor	Total	Minor
Level & Change in Minority Population Share										
Less than 5 Percent Minority, 1990	24.9%	24.7%	2.5%	27.9%	27.8%	5.1%	27.4%	3.8%	30.6%	4.8%
5 to 10 Percent Minority, 1990	15.6	16.9	4.6	18.2	20.0	8.4	17.6	5.9	17.3	5.8
Rose < 5 Percent from 1980	14.7	15.8	4.2	17.0	18.9	7.7	16.7	5.5	16.3	5.4
Rose > 5 Percent from 1980	1.2	1.1	.4	1.2	1.2	.8	.9	.4	1.0	.4
10 to 50 Percent Minority, 1990	36.0	38.7	34.0	37.5	41.4	47.1	41.8	41.7	35.8	33.0
Rose < 5 Percent from 1980	13.5	14.3	10.3	14.2	16.5	12.2	16.7	11.7	14.3	10.7
Rose 5 to 15 Percent from 1980	17.6	19.2	16.6	18.6	20.3	24.1	20.8	22.3	17.4	16.2
Rose > 15 Percent from 1980	5.0	5.2	7.2	4.7	4.6	10.7	4.3	7.8	4.1	6.2
50 Percent or More Minority, 1990	22.5	19.7	58.8	16.3	10.8	39.4	13.3	48.7	16.3	56.4
Rose < 5 Percent from 1980	10.8	7.8	26.1	6.9	3.3	12.2	4.0	16.3	6.9	26.7
Rose 5 to 15 Percent from 1980	5.5	5.2	15.3	4.3	2.9	10.1	3.9	14.3	4.3	14.2
Rose > 15 Percent from 1980	6.3	6.7	17.4	5.2	4.6	17.2	5.3	18.1	5.2	15.4
Black Population Share, 1990										
Less than 5 Percent	59.0	62.6	35.8	65.1	69.2	48.0	75.6	56.9	67.0	37.0
5 to 10 Percent	10.6	11.9	11.2	11.3	12.5	14.0	10.3	12.9	10.4	9.4
10 to 50 Percent	17.2	17.0	25.1	15.4	14.4	23.0	10.6	17.2	13.5	19.2
50 Percent or More	12.2	8.5	27.9	8.2	4.0	15.0	3.4	13.1	9.1	34.3
Hispanic Population Share, 1990										
Less than 5 Percent	65.0	62.4	39.8	66.9	65.5	39.0	58.2	25.4	68.6	51.4
5 to 10 Percent	12.0	13.0	11.8	12.7	14.5	15.8	15.9	17.0	12.2	11.4
10 to 50 Percent	18.0	19.0	30.9	16.5	17.2	33.8	22.0	41.3	16.0	25.7
50 Percent or More	5.0	5.6	17.5	3.9	2.9	11.4	3.9	16.3	3.2	11.5
Median Owner-occupied House Value, 1990										
Less than $50,000	21.6	15.6	25.5	17.2	9.6	12.5	5.7	4.9	17.5	32.2
$50,000 to $100,000	39.2	42.7	33.2	43.1	44.2	34.4	31.0	17.4	43.4	30.2
$100,000 or More	39.2	41.7	41.3	39.7	46.2	53.0	63.3	77.8	39.1	37.6
Change in House Value, 1980-1990										
Rose Less than 25 Percent	12.6	12.4	10.1	12.7	12.3	9.5	6.8	2.9	12.5	11.0
Rose 25 to 50 Percent	21.5	22.2	16.2	23.1	23.6	16.4	16.7	7.3	23.9	18.5
Rose 50 to 100 Percent	28.4	30.2	31.7	30.7	32.0	30.6	28.0	20.9	31.2	34.5
Rose 100 to 150 Percent	14.1	14.4	16.4	13.9	15.8	20.5	22.7	30.9	16.8	17.8
Rose More than 150 Percent	23.3	20.8	25.5	19.5	16.2	23.1	25.8	38.0	15.6	18.2
Median Family Income, 1990										
Less than $20,000	11.5	7.6	21.2	6.6	2.6	7.1	1.9	5.3	5.3	16.5
$20,000 to $30,000	21.6	19.6	29.4	18.7	13.3	19.4	10.1	16.7	16.7	25.3
$30,000 to $40,000	28.3	29.7	24.7	29.8	29.1	28.1	24.8	24.8	30.8	25.4
$40,000 or More	38.7	43.1	24.7	44.8	55.0	45.3	63.1	53.1	47.2	32.8
Center City, MSA Size, 1990										
Center City										
MSA Less than 1 Million	24.2	21.5	22.2	22.5	20.6	18.3	14.8	10.6	19.6	20.5
MSA 1 to 2 Million	7.5	6.6	9.5	6.7	6.2	8.0	4.8	5.9	6.9	10.5
MSA More than 2 Million	20.2	17.4	32.8	15.0	13.1	24.4	15.7	28.7	15.4	30.8
Non-Center City										
MSA Less than 1 Million	19.4	21.3	10.2	22.6	22.4	10.9	20.7	8.1	22.3	9.3
MSA 1 to 2 Million	7.7	8.8	4.6	9.1	10.0	6.6	8.7	4.9	9.0	4.4
MSA More than 2 Million	21.1	24.3	20.8	24.0	27.7	31.7	35.3	41.8	26.8	24.5

[1] Percentages sum to 100 for each group for each column.

Table 3: Percentage of Applications Denied by Census Tract Characteristics, 1990/1991 HMDA[1]

	Home Purchase			Refinance			Home Improvement		
	White	Black	Hispanic	White	Black	Hispanic	White	Black	Hispanic
Level & Change in Minority Population Share									
Less than 5 Percent Minority, 1990	11.9%	26.5%	19.4%	12.2%	27.6%	25.4%	17.5%	34.8%	27.6%
5 to 10 Percent Minority, 1990	11.8	25.1	19.9	14.4	26.7	26.5	20.6	34.3	34.4
Rose < 5 Percent from 1980	11.8	25.0	20.1	14.4	26.6	26.4	20.5	33.7	33.8
Rose > 5 Percent from 1980	12.6	26.3	18.3	15.7	26.8	27.6	23.1	41.2	40.9
10 to 50 Percent Minority, 1990	15.0	28.0	21.8	18.7	30.7	28.9	25.2	41.0	38.4
Rose < 5 Percent from 1980	14.5	30.7	22.5	17.8	29.8	27.1	23.2	36.1	34.5
Rose 5 to 15 Percent from 1980	14.9	26.9	21.7	19.1	30.6	28.8	25.9	42.2	38.3
Rose > 15 Percent from 1980	17.8	27.0	21.2	21.2	33.0	31.0	30.4	48.8	43.0
50 Percent or More Minority, 1990	21.4	31.0	26.0	24.1	32.6	30.4	37.5	49.2	43.6
Rose < 5 Percent from 1980	21.3	32.5	29.7	24.7	32.6	31.7	41.1	48.0	42.3
Rose 5 to 15 Percent from 1980	21.8	32.3	26.9	24.0	33.7	29.9	35.9	49.5	42.6
Rose > 15 Percent from 1980	21.2	28.7	23.5	23.9	31.7	30.0	36.0	52.5	45.4
Black Population Share, 1990									
Less than 5 Percent	12.8	26.3	23.3	15.7	30.2	28.6	20.7	36.5	37.8
5 to 10 Percent	13.7	25.5	22.5	16.8	30.3	29.6	23.2	37.4	42.2
10 to 50 Percent	16.5	29.5	24.1	17.5	31.1	32.5	25.8	43.5	46.8
50 Percent or More	23.3	31.1	26.4	25.6	32.7	33.6	43.1	49.4	53.4
Hispanic Population Share, 1990									
Less than 5 Percent	12.5	29.1	19.7	13.3	30.5	25.2	19.7	45.9	34.3
5 to 10 Percent	14.6	28.3	21.8	19.7	31.8	28.2	26.9	45.6	38.2
10 to 50 Percent	17.3	29.3	23.0	22.1	33.0	30.1	30.1	47.2	41.3
50 Percent or More	23.0	34.0	26.8	26.1	32.2	30.1	35.4	48.7	42.4
Median Owner-occupied House Value, 1990									
Less than $50,000	20.7	35.8	33.6	16.1	35.9	27.6	26.7	49.7	44.9
$50,000 to $100,000	13.6	28.1	22.8	13.6	32.0	31.3	20.7	44.1	39.9
$100,000 or More	12.1	25.4	21.9	17.5	30.2	29.2	22.3	40.0	39.4
Change in House Value, 1980-1990									
Rose Less than 25 Percent	13.5	30.5	23.4	12.4	31.1	26.2	21.9	48.5	42.0
Rose 25 to 50 Percent	12.9	29.2	24.0	12.5	31.3	28.0	20.8	45.5	38.5
Rose 50 to 100 Percent	13.7	29.1	23.6	15.4	32.4	30.6	21.5	47.1	40.1
Rose 100 to 150 Percent	13.9	27.5	22.1	18.5	30.5	29.9	23.7	44.5	41.9
Rose More than 150 Percent	13.9	29.3	24.3	18.8	31.8	29.1	24.4	42.4	40.9
Median Family Income, 1990									
Less than $20,000	24.6	37.9	32.5	24.9	36.6	34.2	36.7	49.3	44.6
$20,000 to $30,000	20.8	34.8	26.7	19.6	33.0	31.9	26.2	48.4	44.6
$30,000 to $40,000	15.1	28.4	22.8	16.4	32.0	29.3	22.0	45.2	40.6
$40,000 or More	10.9	23.7	19.6	15.3	29.2	27.7	20.4	40.1	35.6
Center City, MSA Size, 1990									
Center City									
MSA Less than 1 Million	14.1	33.7	27.0	14.1	33.2	28.4	19.2	42.7	34.7
MSA 1 to 2 Million	13.8	30.5	26.8	16.2	33.2	28.6	27.0	48.8	47.1
MSA More than 2 Million	15.2	28.7	22.8	21.2	32.4	30.6	32.1	50.6	46.0
Non-Center City									
MSA Less than 1 Million	14.4	31.4	25.7	14.0	29.1	29.2	16.7	34.2	34.5
MSA 1 to 2 Million	12.1	28.8	22.3	15.2	32.2	27.4	22.8	42.5	39.4
MSA More than 2 Million	12.3	23.5	20.9	16.7	30.1	29.3	23.9	45.7	39.8

clevelandfed.org/research/workpaper/index.cfm

[1] Application denial percentage for each category.

Table 4: Linear Probability Model of Loan Denial (1) or Acceptance (0), Home Purchase

	1990		1991	
	Coefficient	Standard Error	Coefficient	Standard Error
Owner-occupied (Dummy)	.00649***	.00132	.00979***	.00136
Race (Dummies, "White" Is Base Group)				
Native American Applicant	.02636***	.00703	.04332***	.00685
Asian Applicant	.00171	.00472	.01180*	.00467
Black Applicant	.10385***	.00478	.10552***	.00474
Hispanic Applicant	.03841***	.00463	.05226***	.00461
Other Race Applicant	.03043***	.00432	.05425***	.00426
Mixed Race, Minority Co-applicant (Dummy)	.00764**	.00268	.00047	.00258
Mixed Race, Non-minority Co-applicant (Dummy)	-.02324***	.00294	-.03102***	.00286
Income, Interacted with Race				
Native American Applicant	-.00983***	.00034	-.01060***	.00037
Asian Applicant	-.00974***	.00034	-.01061***	.00037
Black Applicant	-.00986***	.00034	-.01074***	.00037
Hispanic Applicant	-.00981***	.00034	-.01068***	.00037
White Applicant	-.00983***	.00034	-.01065***	.00037
Other Race Applicant	-.00982***	.00034	-.01073***	.00037
Income Splines ($1,000's)				
Income Spline at $20,000	.00604***	.00038	.00644***	.00042
Income Spline at $40,000	.00283***	.00015	.00305***	.00015
Income Spline at $60,000	.00063***	.00015	.00033*	.00015
Income Spline at $80,000	.00013	.00017	.00062***	.00017
Income Spline at $100,000	.00012	.00014	.00002	.00014
Income Spline at $150,000	-.00003	.00010	.00006	.00010
Income Spline at $200,000	.00011	.00006	.00012*	.00006
Loan Amount ($1,000's)				
Loan Amount	-.00191***	.00020	-.00213***	.00020
Loan Amount Spline at $20,000	.00027	.00027	.00104***	.00027
Loan Amount Spline at $40,000	.00179***	.00018	.00107***	.00018
Loan Amount Spline at $60,000	-.00019	.00016	.00037*	.00016
Loan Amount Spline at $80,000	.00038*	.00016	.00015	.00016
Loan Amount Spline at $100,000	-.00020	.00011	-.00024*	.00010
Loan Amount Spline at $150,000	.00022***	.00006	.00047***	.00006
Loan Amount Spline at $200,000	-.00029***	.00004	-.00059***	.00004
Loan-to-Income Ratio (Dummies, Less than 1.5 Is Base Group)				
Ratio of 1.5 to 2.0	-.01012***	.00105	-.01661***	.00106
Ratio of 2.0 to 2.25	-.01158***	.00141	-.02318***	.00142
Ratio of 2.25 to 2.5	-.01176***	.00163	-.02301***	.00163
Ratio of 2.5 to 2.75	-.00713***	.00187	-.02103***	.00185
Ratio of 2.75 to 3.0	.00362	.00227	-.00979***	.00224
Ratio over 3.0	.05105***	.00207	.05014***	.00210
Applicant Gender (Dummies, Female Applicant, No Co-applicant Is Base Group)				
Male Applicant, Female Co-applicant	-.01875*	.00763	-.02737***	.00811
Female Applicant, Male Co-applicant	-.00726	.00772	-.00902	.00819
Male Applicant and Co-applicant	-.00354	.00787	-.00281	.00838
Female Applicant and Co-applicant	-.00984	.00800	.00750	.00845
Male Applicant, No Co-applicant	.02815***	.00109	.02549***	.00106

Table 4: (Continued)

	1990		1991	
	Coefficient	Standard Error	Coefficient	Standard Error

Income, Interacted with No Co-applicant				
Income	-.00332***	.00042	-.00409***	.00045
Income Spline at $20,000	.00514***	.00049	.00581***	.00052
Income Spline at $40,000	-.00051*	.00024	-.00059*	.00024
Income Spline at $60,000	-.00137***	.00030	-.00052	.00031
Income Spline at $80,000	.00049	.00036	.00028	.00037
Income Spline at $100,000	-.00045*	.00020	-.00093***	.00020
Race and Marital Status, Interacted with VA Loan				
Native American Applicant	.05046*	.02211	-.05608**	.02089
Asian Applicant	.02433	.01766	-.00575	.01671
Black Applicant	-.00559	.01470	-.01431	.01470
Hispanic Applicant	-.00742	.01548	-.02767	.01527
White Applicant	-.01859	.01428	-.03088	.01436
Other Race Applicant	.03077	.02727	.01728*	.02360
No Co-applicant	-.00617*	.00311	-.01267***	.00276
Race and Marital Status, Interacted with FHA Loan				
Native American Applicant	.00605	.01708	-.01909	.01743
Asian Applicant	-.02650	.01490	-.04396	.01502
Black Applicant	-.01816	.01446	-.03974**	.01457
Hispanic Applicant	-.04093**	.01446	-.05980**	.01454
White Applicant	-.03139*	.01424	-.04720**	.01435
Other Race Applicant	-.01913	.01735	-.05510**	.01715
No Co-applicant	-.01235***	.00164	-.01477***	.00162
Income, Interacted with VA or FHA Loan				
Income	-.00171**	.00054	-.00117*	.00056
Income Spline at $20,000	.00297***	.00058	.00243***	.00060
Income Spline at $40,000	-.00033	.00024	-.00059*	.00024
Income Spline at $60,000	-.00130***	.00034	-.00018	.00032
Income Spline at $80,000	.00197***	.00052	.00070	.00048
Income Spline at $100,000	-.00158***	.00034	-.00125***	.00031
Loan Amount, Interacted with VA or FHA Loan				
Loan Amount	.00359***	.00053	.00399***	.00050
Loan Amount Spline at $20,000	-.00249***	.00069	-.00324***	.00068
Loan Amount Spline at $40,000	-.00230***	.00034	-.00156***	.00035
Loan Amount Spline at $60,000	.00067*	.00027	-.00015	.00027
Loan Amount Spline at $80,000	-.00043	.00027	-.00000	.00026
Loan Amount Spline at $100,000	.00058*	.00026	.00078**	.00024
Loan-to-Income Ratio, Interacted with VA or FHA Loan				
Ratio of 1.5 to 2.0	-.00335	.00222	.00305	.00223
Ratio of 2.0 to 2.25	-.00521	.00299	.00351	.00299
Ratio of 2.25 to 2.5	-.00625	.00347	.00089	.00345
Ratio of 2.5 to 2.75	.00011	.00397	.00355	.00392
Ratio of 2.75 to 3.0	-.00476	.00475	-.00044	.00464
Ratio over 3.0	-.00744	.00492	-.00935	.00484

Table 4: (Continued)

	1990		1991	
	Coefficient	Standard Error	Coefficient	Standard Error
Month of Decision (Dummies, December Is Base Group)				
January	.01867***	.00159	.03988***	.00154
February	.02085***	.00155	.03658***	.00152
March	.01328***	.00143	.03091***	.00140
April	.01376***	.00142	.03169***	.00135
May	.00954***	.00139	.01819***	.00131
June	.00382**	.00138	.00538***	.00130
July	.01062***	.00140	.02486***	.00133
August	.00796***	.00137	.01600***	.00132
September	.01078***	.00143	.01816***	.00137
October	.01498***	.00142	.01921***	.00136
November	.00740***	.00146	.00893***	.00140
Memo Items:				
Number of Observations	1,984,688		2,087,470	
Mean Denial Rate in Regression Sample	.148		.157	
Number of Tract/Institution Dummies	607,631		662,571	
R Squared (Including Tract/Institution Dummies)	.457		.478	
R Squared (Variation around Tract/Institution Means)	.022		.025	

* Significant at the 5 percent level.
** Significant at the 1 percent level.
*** Significant at the .1 percent level.

Table 5: Linear Probability Model of Loan Denial (1) or Acceptance (0), Refinance

	1990		1991	
	Coefficient	Standard Error	Coefficient	Standard Error
Owner-occupied (Dummy)	.00012	.00223	-.03180***	.00162
VA Loan (Dummy)	-.01603	.00979	-.00333	.00478
Race (Dummies, "White" Is Base Group)				
Native American Applicant	.02245	.01292	.04939***	.00857
Asian Applicant	.04053***	.00906	.02509***	.00562
Black Applicant	.06370***	.00915	.08023***	.00593
Hispanic Applicant	.04342***	.00879	.06279***	.00552
Other Race Applicant	.03812***	.00831	.07417***	.00520
Mixed Race, Minority Co-applicant (Dummy)	.00340	.00570	.00665	.00354
Mixed Race, Non-minority Co-applicant (Dummy)	-.02737***	.00630	-.03567***	.00381
Income, Interacted with Race				
Native American Applicant	.00131*	.00053	-.00475***	.00053
Asian Applicant	.00128*	.00053	-.00466***	.00053
Black Applicant	.00138**	.00053	-.00469***	.00053
Hispanic Applicant	.00135*	.00053	-.00476***	.00053
White Applicant	.00128*	.00053	-.00474***	.00053
Other Race Applicant	.00129*	.00053	-.00484***	.00053
Income Splines ($1,000's)				
Income Spline at $20,000	-.00419***	.00063	.00250***	.00060
Income Spline at $40,000	.00217***	.00028	.00150***	.00019
Income Spline at $60,000	-.00007	.00027	.00034*	.00016
Income Spline at $80,000	.00115***	.00031	.00020	.00018
Income Spline at $100,000	-.00035	.00024	.00009	.00015
Income Spline at $150,000	.00016	.00016	.00005	.00011
Income Spline at $200,000	-.00016	.00009	.00001	.00006
Loan Amount ($1,000's)				
Loan Amount	-.00338***	.00030	-.00122***	.00026
Loan Amount Spline at $20,000	.00281***	.00042	.00036	.00035
Loan Amount Spline at $40,000	.00080**	.00030	.00122***	.00020
Loan Amount Spline at $60,000	.00014	.00031	-.00021	.00018
Loan Amount Spline at $80,000	-.00009	.00031	.00043*	.00016
Loan Amount Spline at $100,000	.00011	.00021	.00009	.00012
Loan Amount Spline at $150,000	.00040***	.00011	.00125***	.00007
Loan Amount Spline at $200,000	-.00067***	.00006	-.00172***	.00004
Loan-to-Income Ratio (Dummies, Less than 1.5 Is Base Group)				
Ratio of 1.5 to 2.0	-.00241	.00200	.00335**	.00120
Ratio of 2.0 to 2.25	.00433	.00266	.01505***	.00167
Ratio of 2.25 to 2.5	.00667*	.00301	.02254***	.00191
Ratio of 2.5 to 2.75	.01452***	.00324	.03102***	.00209
Ratio of 2.75 to 3.0	.02524***	.00375	.05599***	.00247
Ratio over 3.0	.08519***	.00326	.13278***	.00223
Applicant Gender (Dummies, Female Applicant, No Co-applicant Is Base Group)				
Male Applicant, Female Co-applicant	-.09152***	.01394	-.03405*	.01344
Female Applicant, Male Co-applicant	-.08392***	.01415	-.01847	.01354
Male Applicant and Co-applicant	-.06548***	.01466	.01502	.01384
Female Applicant and Co-applicant	-.08076***	.01512	.03541*	.01392
Male Applicant, No Co-applicant	.02499***	.00251	.03062***	.00163

Table 5: (Continued)

	1990		1991	
	Coefficient	Standard Error	Coefficient	Standard Error
Income, Interacted with No Co-applicant				
Income	-.00493***	.00080	-.00245***	.00074
Income Spline at $20,000	.00492***	.00100	.00253**	.00086
Income Spline at $40,000	.00078	.00055	.00086*	.00035
Income Spline at $60,000	-.00013	.00062	-.00045	.00039
Income Spline at $80,000	-.00059	.00068	.00072	.00045
Income Spline at $100,000	-.00004	.00035	-.00121***	.00024
Interactions with VA or FHA Loan				
Native American Applicant	.06556	.04937	.04740	.02902
Asian Applicant	.02625	.02657	.00366	.01586
Black Applicant	.11632***	.01851	.00897	.01150
Hispanic Applicant	.06928***	.01948	.00757	.01179
White Applicant	.08100***	.01268	.02499***	.00751
Other Race Applicant	.04074	.05014	-.01650	.03068
No Co-Applicant	.00306	.00835	-.02022***	.00481
Income	.00005	.00009	.00017***	.00003
Loan Amount	-.00025	.00015	-.00010	.00009
Month of Decision (Dummies, December Is Base Group)				
January	-.02674***	.00299	.04361***	.00199
February	-.02489***	.00294	.04639***	.00186
March	-.02567***	.00280	.03852***	.00157
April	-.03137***	.00282	.01968***	.00146
May	-.02573***	.00284	.01591***	.00151
June	-.02640***	.00290	.01517***	.00161
July	-.01995***	.00290	.01479***	.00164
August	-.01890***	.00281	.02448***	.00171
September	-.01829***	.00288	.03167***	.00168
October	-.00363	.00282	.02561***	.00148
November	.01590***	.00293	.01167***	.00140
Memo Items:				
Number of Observations	716,595		1,500,215	
Mean Denial Rate in Regression Sample	.181		.181	
Number of Tract/Institution Dummies	326,536		563,380	
R Squared (Including Tract/Institution Dummies)	.552		.512	
R Squared (Variation around Tract/Institution Means)	.021		.039	

* Significant at the 5 percent level.
** Significant at the 1 percent level.
*** Significant at the .1 percent level.

Table 6: Linear Probability Model of Loan Denial (1) or Acceptance (0), Home Improvement

	1990		1991	
	Coefficient	Standard Error	Coefficient	Standard Error
Owner-occupied (Dummy)	-.00311	.00356	-.06323***	.00311
VA Loan (Dummy)	.23181***	.02285	-.11939***	.03181
Race (Dummies, "White" Is Base Group)				
Native American Applicant	.00376	.01285	-.04581**	.01387
Asian Applicant	.06089***	.01073	.09999***	.01071
Black Applicant	.08473***	.01008	.11062***	.01001
Hispanic Applicant	.07295***	.01060	.10532***	.01020
Other Race Applicant	.08060***	.00980	.06489***	.00946
Mixed Race, Minority Co-applicant (Dummy)	-.00124	.00602	-.00220	.00576
Mixed Race, Non-minority Co-applicant (Dummy)	-.04638***	.00701	-.07233***	.00655
Income, Interacted with Race				
Native American Applicant	-.00235***	.00039	-.00749***	.00042
Asian Applicant	-.00256***	.00038	-.00736***	.00039
Black Applicant	-.00258***	.00038	-.00739***	.00039
Hispanic Applicant	-.00274***	.00038	-.00744***	.00039
White Applicant	-.00256***	.00038	-.00728***	.00039
Other Race Applicant	-.00256***	.00040	-.00734***	.00040
Income Splines ($1,000's)				
Income Spline at $20,000	-.00124**	.00046	.00338***	.00047
Income Spline at $40,000	.00109***	.00024	.00121***	.00025
Income Spline at $60,000	.00217***	.00028	.00176***	.00028
Income Spline at $80,000	.00034	.00038	.00098**	.00037
Income Spline at $100,000	.00044	.00033	.00049	.00033
Income Spline at $150,000	-.00027	.00027	-.00076**	.00027
Income Spline at $200,000	.00002	.00016	.00023	.00016
Loan Amount (Dummies or $1,000's)				
$1,000 or $2,000 Loan (Dummy)	-.02452***	.00275	-.02259***	.00276
$3,000 or $4,000 Loan (Dummy)	-.02099***	.00260	-.01357***	.00260
$5,000 or $6,000 Loan (Dummy)	.01104***	.00263	.01179***	.00260
$7,000 or $8,000 Loan (Dummy)	-.00100	.00302	.00873**	.00298
$9,000 or $10,000 Loan (Dummy)	.02937***	.00274	.02719***	.00272
Loan Amount Spline at $10,000	-.00109***	.00021	-.00036	.00022
Loan Amount Spline at $25,000	.00089**	.00029	-.00021	.00030
Loan Amount Spline at $50,000	.00068***	.00018	.00130***	.00020
Loan Amount Spline at $100,000	.00007	.00024	-.00082***	.00023
Loan Amount Spline at $150,000	-.00011	.00038	.00189***	.00035
Loan Amount Spline at $200,000	-.00045	.00024	-.00179***	.00023
Loan-to-Income Ratio (Dummies, Less than 1.5 Is Base Group)				
Ratio of 1.5 to 2.0	.01924***	.00405	.02399***	.00411
Ratio of 2.0 to 2.25	.04139***	.00663	.04586***	.00646
Ratio of 2.25 to 2.5	.02468**	.00921	.03351***	.00832
Ratio of 2.5 to 2.75	.04842***	.00893	.03972***	.00851
Ratio of 2.75 to 3.0	.08086***	.01259	.08290***	.01104
Ratio over 3.0	.03781***	.00620	.07892***	.00667

Table 6: (Continued)

	1990		1991	
	Coefficient	Standard Error	Coefficient	Standard Error

Applicant Gender (Dummies, Female Applicant, No Co-applicant Is Base Group)

Male Applicant, Female Co-applicant	-.11149***	.00815	.01397	.00802
Female Applicant, Male Co-applicant	-.07509***	.00829	.06173***	.00816
Male Applicant and Co-applicant	-.04764***	.01018	.07199***	.00956
Female Applicant and Co-applicant	-.08031***	.01002	.06688***	.00961
Male Applicant, No Co-applicant	.03643***	.00196	.03618***	.00186

Income, Interacted with No Co-applicant

Income	-.00472***	.00048	.00066	.00047
Income Spline at $20,000	.00430***	.00062	-.00111	.00062
Income Spline at $40,000	.00203***	.00045	.00203***	.00045
Income Spline at $60,000	-.00118	.00065	.00001	.00064
Income Spline at $80,000	-.00068	.00084	-.00196*	.00083
Income Spline at $100,000	.00026	.00047	.00033	.00047

Interactions with VA or FHA Loan

Native American Applicant	-.08982*	.03697	.00094	.03303
Asian Applicant	-.11795***	.02371	-.10587***	.01796
Black Applicant	-.17913***	.01179	-.07636***	.00897
Hispanic Applicant	-.12198***	.01368	-.08123***	.01177
White Applicant	-.09718***	.00898	-.00750	.00746
Other Race Applicant	-.05892	.04607	-.08987**	.03262
No Co-applicant	-.01994**	.00704	-.02748***	.00536
Income	.00029*	.00012	.00005	.00009
Loan Amount	.00111***	.00026	.00125***	.00023

Month of Decision (Dummies, December Is Base Group)

January	-.00419***	.00341	.02959***	.00323
February	-.01345***	.00319	.03449***	.00316
March	-.02339***	.00291	.03268***	.00292
April	-.02735***	.00282	.01830***	.00277
May	-.03709***	.00276	.00513	.00276
June	-.03645***	.00278	.00391	.00280
July	-.02804***	.00282	.01010***	.00280
August	-.02454***	.00281	.00025	.00282
September	-.02145***	.00290	.00545	.00290
October	-.01238***	.00284	.01282***	.00285
November	.00227	.00296	.01298***	.00300

Memo Items:

Number of Observations	787,952		861,518	
Mean Denial Rate in Regression Sample	.238		.287	
Number of Tract/Institution Dummies	267,159		285,605	
R Squared (Including Tract/Institution Dummies)	.474		.477	
R Squared (Variation around Tract/Institution Means)	.029		.028	

* Significant at the 5 percent level.
** Significant at the 1 percent level.
*** Significant at the .1 percent level.

Table 7: Variable Means, All Tracts, Center City, and Suburban Tracts[1]

	All Tracts	Center City Tracts	Suburban Tracts
Loan Application Rate (1990/1991 HMDA Applications Divided by Total 1-4 Unit Structures)			
Home Purchase Loans	.07143	.06440	.07701
Refinance Loans	.03930	.03145	.04545
Home Improvement Loans	.02871	.02721	.02989
Minority Population Share, 1990	.20884	.28837	.15739
Change in Minority Share, 1980-1990 (Dummies)			
Change in Share Less than 0	.12162	.09091	.14124
Change in Share between 0 and .05	.54155	.48747	.57561
Change in Share between .05 and .10	.16055	.18806	.14297
Change in Share between .10 and .15	.08302	.10914	.06633
Change in Share More than .15	.09326	.12441	.07336
Median Family Income, 1990 ($100,000's)	.44354	.40118	.47061
Change in Median Family Income, 1980-1990 (Dummies)			
Change in Income Less than 25%	.01803	.03561	.00680
Change in Income between 25% and 50%	.08958	.14402	.05481
Change in Income between 50% and 100%	.62223	.60722	.63200
Change in Income More than 100%	.27004	.21314	.30639
Age of Household Head, 1990			
Share of Household Heads under 25	.04546	.05802.	.03744
Share of Household Heads 25-34	.21743	.22819	.21140
Share of Household Heads 35-44	.24167	.23124	.24833
Share of Household Heads 45-54	.16821	.15464	.17687
Share of Household Heads 55-64	.13395	.12856	.13739
Share of Household Heads 65-74	.11555	.11608	.11520
Share of Household Heads 75 or Older	.07722	.08325	.07337
Median Owner-occupied House Value, 1990 ($100,000's)	1.33740	1.22233	1.41090
Change in Median House Value, 1980-1990 (Dummies)			
Change in Value Less than 25%	.10819	.15640	.07740
Change in Value between 25% and 50%	.21743	.24444	.20180
Change in Value between 50% and 100%	.30740	.28513	.32163
Change in Value between 100% and 150%	.17918	.14498	.19939
Change in Value More than 150%	.18780	.16905	.19978
Structure Variables, 1990			
Share of Structures Single Unit Detached	.64245	.57461	.68579
Share of Structures Single Unit Attached	.06518	.07104	.06144
Share of Structures 2 Units	.04111	.06025	.02889
Share of Structures 3-4 Units	.04215	.05744	.03237
Share of Structures 5 or More Units	.15331	.19550	.12635
Share of Structures Mobile Homes	.05580	.04116	.06515

Table 7: (Continued)

	All Tracts	Center City Tracts	Suburban Tracts
Usage of 1-4 Unit Structures, 1990			
Share of Housing Units Owner Occupied	.73982	.67977	.77671
Share of Housing Units Rented	.20401	.26093	.16764
Share of Housing Units Vacant	.05707	.05930	.05565
Change in House Usage, 1980-1990			
Growth Rate of Total Housing Units	.39907	.33082	.44268
Growth Rate of 1-4 Unit Structures	.35264	.28278	.39727
Change in Share of 1-4 Units Rented	.00955	.01649	.00512
Change in Share of 1-4 Units Vacant	.00313	.00440	.00232
Age of Housing Stock, 1980			
Share of Housing Stock Built 1979-1980	.05772	.05223	.06123
Share of Housing Stock Built 1975-1978	.13494	.11575	.14719
Share of Housing Stock Built 1970-1974	.15202	.13069	.16566
Share of Housing Stock Built 1960-1969	.21341	.19755	.22354
Share of Housing Stock Built 1950-1959	.17373	.17363	.17380
Share of Housing Stock Built 1940-1949	.09193	.11155	.07940
Share of Housing Stock Built Prior to 1940	.17683	.21860	.14918
Number of Tracts	38,697	20,045	18,652

[1] Tracts weighted by the total number of loan applications of all types in 1990 and 1991.

Table 8: All Tracts, 1990/1991 HMDA, Denial Rates

	Home Purchase		Refinance		Home Improvement	
	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error
Intercept	-.04518***	.01186	-.19143***	.01756	-.54140***	.02373
Center City (Dummy)	.00233***	.00063	-.00142	.00082	-.01111***	.00122
Minority Population Share, 1990						
Minority Share	.07100*	.03418	.43291***	.04509	.86152***	.06239
Minority Share Spline at .05	.18832***	.05120	-.18898**	.06832	-.45374***	.09720
Minority Share Spline at .10	-.24255***	.02841	-.17373***	.03824	-.26787***	.05733
Minority Share Spline at .25	-.01885	.01359	-.09782***	.01771	-.16187***	.02678
Minority Share Spline at .50	.05376***	.01038	.06608***	.01303	.17863***	.01873
Change in Minority Share, 1980-1990 (Dummies, Less than 0 Is Base Group)						
Change in Share between .0 and .05	.00363***	.00089	.01698***	.00120	.02028***	.00166
Change in Share between .05 and .10	.01049***	.00113	.02413***	.00151	.03309***	.00218
Change in Share between .10 and .15	.01367***	.00140	.03277***	.00184	.05172***	.00269
Change in Share More than .15	.02115***	.00149	.04528***	.00196	.07564***	.00282
Median Family Income, 1990						
Median Family Income ($100,000's)	-.20070***	.02470	-.47051***	.03644	.10223**	.03744
Median Family Income Spline at $25,000	.01757	.02648	.17271***	.03919	-.21418***	.04025
Median Family Income Spline at $40,000	.00328	.01305	.05235**	.01737	-.09003***	.02508
Median Family Income Spline at $55,000	.08475***	.01004	.15230***	.01183	.15173***	.02054
Change in Median Family Income, 1980-1990 (Dummies, Less than 25% Is Base Group)						
Change in Income between 25% and 50%	.00647**	.00237	.01850***	.00410	.00364	.00343
Change in Income between 50% and 100%	.00601*	.00239	.02021***	.00407	-.00016	.00354
Change in Income More than 100%	.01065***	.00256	.03746***	.00422	.01540***	.00398
Age of Household Head, 1990						
Share of Household Heads 25-34	.06214***	.01402	.28383***	.01994	.64274***	.02972
Share of Household Heads 35-44	.03678**	.01287	.08186***	.01778	.33709***	.02682
Share of Household Heads 45-54	.14615***	.01788	.31139***	.02350	.78143***	.03473
Share of Household Heads 55-64	.19472***	.01906	.33159***	.02519	.30314***	.03623
Share of Household Heads 65-74	-.00325	.01724	.16530***	.02382	.41598***	.03473
Share of Household Heads 75 or Older	.09518***	.01360	.22982***	.01944	.42172***	.02868
Median Owner-occupied House Value, 1990						
Median House Value ($100,000's)	-.02922**	.01026	.06909***	.01701	-.14495***	.01437
Median House Value Spline at $50,000	.04170***	.01115	-.03141	.01842	.21044***	.01598
Median House Value Spline at $100,000	.01039*	.00428	-.02573***	.00586	-.04092***	.00831
Median House Value Spline at $150,000	-.01573***	.00264	-.01903***	.00331	-.00670	.00536
Change in Median House Value, 1980-1990 (Dummies, Less than 25% Is Base Group)						
Change in Value between 25% and 50%	.00303**	.00098	.00620***	.00163	-.00121	.00186
Change in Value between 50% and 100%	.00836***	.00105	.01112***	.00169	-.01328***	.00201
Change in Value between 100% and 150%	.01515***	.00140	.01622***	.00203	-.00576*	.00263
Change in Value More than 150%	.02265***	.00162	.02080***	.00222	-.00736*	.00310

Table 8: (Continued)

	Home Purchase		Refinance		Home Improvement	
	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error
House Usage Variables, 1990						
Share of Structures Single Unit Attached	-.07083***	.00295	-.02372***	.00427	.12167***	.00464
Share of Structures 2 Units	-.05327***	.00610	.06261***	.00824	.10912***	.01025
Share of Structures 3-4 Units	-.00913	.00755	-.00954	.00971	-.06782***	.01425
Share of Structures 5 or More Units	-.02663***	.00250	.00742*	.00336	.05211***	.00530
Share of Structures Mobile Homes	.03588***	.00388	.04115***	.00557	.03624***	.00796
Share of 1-4 Unit Structures Rented	.06775***	.00472	-.03137***	.00629	-.01329	.00970
Share of 1-4 Unit Structures Vacant	.11246***	.00613	.18350***	.00789	.22508***	.01413
Change in House Usage, 1980-1990						
Growth Rate of Total Housing Units	.01263***	.00138	.00997***	.00213	.00851*	.00351
Growth Rate of 1-4 Unit Structures	-.01116***	.00141	-.00443*	.00221	.00397	.00364
Change in Share 1-4 Units Rented	.02363***	.00576	.03885***	.00857	.08400***	.01256
Change in Share 1-4 Units Vacant	-.01609*	.00782	-.10358***	.01085	-.10682***	.01735
Age of Housing Stock, 1980						
Share of Housing Stock Built 1979-1980	.03019***	.00555	.00965	.00799	.06094***	.01287
Share of Housing Stock Built 1975-1978	.01386***	.00361	.01150*	.00491	-.05639***	.00762
Share of Housing Stock Built 1970-1974	.00448	.00331	.00042	.00442	-.02264***	.00664
Share of Housing Stock Built 1960-1969	-.00459	.00286	-.01222***	.00367	-.04009***	.00530
Share of Housing Stock Built 1950-1959	.00121	.00306	.01469***	.00385	.04251***	.00532
Share of Housing Stock Built 1940-1949	-.02036***	.00490	-.02336***	.00614	-.00249	.00830

Memo Items:			
R Squared (Weighted by Loan Applications)	.277	.266	.309
Dependent Variable Mean	.00000	-.00013	.00109
Number of Tracts	38,609	38,064	38,490

* Significant at the 5 percent level.
** Significant at the 1 percent level.
*** Significant at the .1 percent level.

Table 9: All Tracts, 1990/1991 HMDA, Denial Rates, Deviations about MSA Means

	Home Purchase		Refinance		Home Improvement	
	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error
Center City (Dummy)	.00006	.00062	.00393***	.00076	.00619***	.00103
Minority Population Share, 1990						
Minority Share	-.04721	.03264	.11105**	.04186	.35824***	.05071
Minority Share Spline at .05	.13818**	.04704	-.04004	.06092	-.16403*	.07606
Minority Share Spline at .10	-.07636**	.02547	-.05152	.03327	-.11165*	.04392
Minority Share Spline at .25	.00679	.01203	.02101	.01519	-.04065*	.02032
Minority Share Spline at .50	.01236	.00922	-.02240*	.01119	.02792*	.01424
Change in Minority Share, 1980-1990 (Dummies, Less than 0 Is Base Group)						
Change in Share between .0 and .05	-.00064	.00081	.00187	.00105	.00273*	.00128
Change in Share between .05 and .10	.00226*	.00102	.00246	.00131	.00571***	.00167
Change in Share between .10 and .15	.00160	.00126	.00302	.00160	.01294***	.00207
Change in Share More than .15	.00347*	.00138	.00501**	.00174	.02380***	.00221
Median Family Income, 1990						
Median Family Income ($100,000's)	-.14083***	.02207	-.13641***	.03133	.20142***	.02896
Median Family Income Spline at $25,000	.05912*	.02330	.10859**	.03333	-.19950***	.03046
Median Family Income Spline at $40,000	.02711*	.01170	-.02005	.01509	-.09084***	.01940
Median Family Income Spline at $55,000	.02424**	.00913	.01484	.01042	.05631***	.01600
Change in Median Family Income, 1980-1990 (Dummies, Less than 25% Is Base Group)						
Change in Income between 25% and 50%	.00659**	.00210	.00233	.00351	-.00274	.00261
Change in Income between 50% and 100%	.00453*	.00216	-.00324	.00354	-.00665*	.00277
Change in Income More than 100%	.00327	.00233	-.00172	.00368	-.00246	.00314
Age of Household Head, 1990						
Share of Household Heads 25-34	.01780	.01318	.04764**	.01796	.08944***	.02365
Share of Household Heads 35-44	.01515	.01179	.02805	.01555	.13275***	.02084
Share of Household Heads 45-54	.08894***	.01652	.10133***	.02086	.18558***	.02729
Share of Household Heads 55-64	.08581***	.01741	.08441***	.02216	-.04991	.02810
Share of Household Heads 65-74	-.05728***	.01588	-.05359*	.02100	-.03357	.02714
Share of Household Heads 75 or Older	-.01050	.01246	.02377	.01707	.07707***	.02225
Median Owner-occupied House Value, 1990						
Median House Value ($100,000's)	-.08682***	.00947	-.12467***	.01504	-.24168***	.01181
Median House Value Spline at $50,000	.05970***	.01003	.04366**	.01601	.16040***	.01253
Median House Value Spline at $100,000	.01896***	.00399	.03090***	.00532	.03656***	.00672
Median House Value Spline at $150,000	.00025	.00255	.03035***	.00314	.05337***	.00454
Change in Median House Value, 1980-1990 (Dummies, Less than 25% Is Base Group)						
Change in Value between 25% and 50%	.00447***	.00106	.00092	.00169	-.00219	.00170
Change in Value between 50% and 100%	.00825***	.00128	-.00040	.00200	-.00482*	.00212
Change in Value between 100% and 150%	.00730***	.00162	-.00549*	.00232	-.00624*	.00267
Change in Value More than 150%	.00203	.00190	-.01459***	.00255	-.01280***	.00317

Table 9: (Continued)

	Home Purchase		Refinance		Home Improvement	
	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error
House Usage Variables, 1990						
Share of Structures Single Unit Attached	-.05225***	.00307	-.03029***	.00407	-.00788	.00445
Share of Structures 2 Units	-.02634***	.00595	.00588	.00777	-.00108	.00889
Share of Structures 3-4 Units	-.02913***	.00696	-.03536***	.00860	-.06385***	.01129
Share of Structures 5 or More Units	-.00204	.00260	.01755***	.00335	.00431	.00455
Share of Structures Mobile Homes	.02777***	.00358	.07002***	.00493	.08605***	.00626
Share of 1-4 Unit Structures Rented	.05867***	.00453	.02937***	.00579	.04082***	.00802
Share of 1-4 Unit Structures Vacant	.07225***	.00582	.11900***	.00718	.16593***	.01121
Change in House Usage, 1980-1990						
Growth Rate of Total Housing Units	.00185	.00123	.00160	.00184	.00580*	.00268
Growth Rate of 1-4 Unit Structures	-.00263*	.00126	.00188	.00190	.00461	.00277
Change in Share 1-4 Units Rented	-.01693**	.00516	-.04384***	.00739	-.01201	.00964
Change in Share 1-4 Units Vacant	-.01846**	.00711	-.06868***	.00956	-.10427***	.01348
Age of Housing Stock, 1980						
Share of Housing Stock Built 1979-1980	-.02764***	.00506	-.03394***	.00699	-.01133	.00993
Share of Housing Stock Built 1975-1978	-.01397***	.00337	.00539	.00437	-.00465	.00601
Share of Housing Stock Built 1970-1974	-.01409***	.00311	-.00902*	.00398	.00176	.00530
Share of Housing Stock Built 1960-1969	-.01772***	.00266	-.00179	.00328	-.00186	.00420
Share of Housing Stock Built 1950-1959	-.01377***	.00277	-.00084	.00337	.00794	.00415
Share of Housing Stock Built 1940-1949	-.02070***	.00443	.00077	.00535	.00411	.00644

Memo Items:			
R Squared Total (Weighted by Loan Applications)	.464	.490	.624
R Squared about MSA Means	.206	.248	.256
Dependent Variable Mean	.00000	-.00013	.00109
Number of Tracts	38,609	38,064	38,490

* Significant at the 5 percent level.
** Significant at the 1 percent level.
*** Significant at the .1 percent level.

Table 10: All Tracts, 1990/1991 HMDA, Application Rates

	Home Purchase		Refinance		Home Improvement	
	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error
Intercept	-.03029***	.00722	.07144***	.00468	.06057***	.00306
Center City (Dummy)	.00414***	.00044	.00030	.00028	-.00046*	.00019
Minority Population Share, 1990						
Minority Share	-.00352	.02313	-.28203***	.01488	-.08011***	.00972
Minority Share Spline at .05	-.01778	.03553	.27596***	.02286	.06785***	.01493
Minority Share Spline at .10	.00822	.02043	.02191	.01314	.03306***	.00858
Minority Share Spline at .25	.01734	.00939	-.01337*	.00605	-.01503***	.00395
Minority Share Spline at .50	-.01645*	.00654	.00955*	.00423	.00558*	.00275
Change in Minority Share, 1980-1990 (Dummies, Less than 0 Is Base Group)						
Change in Share between .0 and .05	.00089	.00060	.00237***	.00039	.00178***	.00025
Change in Share between .05 and .10	-.00029	.00077	.00214***	.00050	.00022	.00032
Change in Share between .10 and .15	.00110	.00094	.00212***	.00061	-.00112**	.00040
Change in Share More than .15	.00295**	.00098	.00285***	.00064	-.00241***	.00041
Median Family Income, 1990						
Median Family Income ($100,000's)	.04136***	.01249	-.04371***	.00819	.04323***	.00527
Median Family Income Spline at $25,000	-.00826	.01342	-.00010	.00881	-.02556***	.00566
Median Family Income Spline at $40,000	.01790*	.00889	-.05250***	.00573	-.05711***	.00374
Median Family Income Spline at $55,000	-.05958***	.00742	.00157	.00477	-.00293	.00312
Change in Median Family Income, 1980-1990 (Dummies, Less than 25% Is Base Group)						
Change in Income between 25% and 50%	.00277*	.00120	.00073	.00079	-.00191***	.00050
Change in Income between 50% and 100%	.00655***	.00124	.00477***	.00081	-.00249***	.00052
Change in Income More than 100%	.00527***	.00140	.00161	.00091	-.00418***	.00059
Age of Household Head, 1990						
Share of Household Heads 25-34	.11266***	.00923	-.03383***	.00596	-.01468***	.00390
Share of Household Heads 35-44	.07361***	.00863	-.01274*	.00557	.01551***	.00364
Share of Household Heads 45-54	.05945***	.01177	.02128**	.00760	.00983*	.00496
Share of Household Heads 55-64	-.00100	.01228	-.12428***	.00794	-.02342***	.00518
Share of Household Heads 65-74	.00597	.01124	-.05485***	.00726	-.01718***	.00474
Share of Household Heads 75 or Older	.08399***	.00900	-.01269*	.00581	-.03534***	.00380
Median Owner-occupied House Value, 1990						
Median House Value ($100,000's)	.01617**	.00508	.01748***	.00334	-.02773***	.00213
Median House Value Spline at $50,000	.01488**	.00571	.03508***	.00374	.02444***	.00240
Median House Value Spline at $100,000	-.01822***	.00298	.01375***	.00192	.00817***	.00126
Median House Value Spline at $150,000	-.00345	.00195	-.03202***	.00125	.00326***	.00082
Change in Median House Value, 1980-1990 (Dummies, Less than 25% Is Base Group)						
Change in Value between 25% and 50%	-.00115	.00067	.00242***	.00043	.00141***	.00028
Change in Value between 50% and 100%	-.00195**	.00072	.00354***	.00046	.00203***	.00030
Change in Value between 100 and 150%	-.00887***	.00096	.00593***	.00062	.00567***	.00040
Change in Value More than 150%	-.02742***	.00110	-.01706***	.00071	-.00632***	.00046

Table 10: (Continued)

	Home Purchase		Refinance		Home Improvement	
	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error
House Usage Variables, 1990						
Share of Structures Single Unit Attached	-.00616***	.00177	-.01575***	.00114	.00225**	.00074
Share of Structures 2 Units	-.01201***	.00335	-.04539***	.00217	.00201	.00141
Share of Structures 3-4 Units	-.04126***	.00426	-.02871***	.00277	.00041	.00180
Share of Structures 5 or More Units	.05066***	.00181	-.01813***	.00117	.00947***	.00076
Share of Structures Mobile Homes	.08012***	.00291	.00802***	.00188	.00789***	.00122
Share of 1-4 Unit Structures Rented	-.02543***	.00318	-.01758***	.00207	-.04325***	.00135
Share of 1-4 Unit Structures Vacant	-.02312***	.00421	-.02423***	.00272	-.03199***	.00177
Change in House Usage, 1980-1990						
Growth Rate of Total Housing Units	-.00328**	.00118	.00150*	.00077	-.00175***	.00050
Growth Rate of 1-4 Unit Structures	.02777***	.00122	-.00073	.00079	.00098	.00051
Change in Share 1-4 Units Rented	-.04529***	.00411	-.02628***	.00270	.00590***	.00176
Change in Share 1-4 Units Vacant	-.09008***	.00550	-.05852***	.00356	-.01994***	.00232
Age of Housing Stock, 1980						
Share of Housing Stock Built 1979-1980	-.01615***	.00457	-.01842***	.00295	-.01986***	.00192
Share of Housing Stock Built 1975-1978	.02240***	.00277	.01147***	.00179	-.01236***	.00117
Share of Housing Stock Built 1970-1974	.00498*	.00238	-.00849***	.00153	-.01863***	.00100
Share of Housing Stock Built 1960-1969	-.00454*	.00189	.00162	.00122	-.01046***	.00079
Share of Housing Stock Built 1950-1959	.00025	.00194	-.00091	.00125	-.00749***	.00082
Share of Housing Stock Built 1940-1949	.00993***	.00298	-.00743***	.00193	-.01095***	.00125
Memo Items:						
R Squared (Weighted by 1-4 Units)	.424		.582		.220	
Dependent Variable Mean	.07143		.03930		.02871	
Number of Tracts	38,609		38,064		38,490	

* Significant at the 5 percent level.
** Significant at the 1 percent level.
*** Significant at the .1 percent level.

Table 11: All Tracts, 1990/1991 HMDA, Application Rates, Deviations about MSA Means

	Home Purchase		Refinance		Home Improvement	
	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error
Center City (Dummy)	.00251***	.00046	-.00075***	.00023	.00036*	.00017
Minority Population Share, 1990						
Minority Share	.04592	.02366	-.16049***	.01147	.00203	.00855
Minority Share Spline at .05	-.07143*	.03492	.14799***	.01693	.01541	.01262
Minority Share Spline at .10	.01038	.01963	.01131	.00952	.00165	.00710
Minority Share Spline at .25	.02001*	.00895	.00023	.00435	-.01654***	.00324
Minority Share Spline at .50	-.01831**	.00626	-.00357	.00305	.00859***	.00227
Change in Minority Share, 1980-1990 (Dummies, Less than 0 Is Base Group)						
Change in Share between .0 and .05	.00104	.00059	-.00063*	.00029	-.00002	.00021
Change in Share between .05 and .10	.00037	.00075	-.00038	.00036	-.00093***	.00027
Change in Share between .10 and .15	.00178	.00092	-.00069	.00045	-.00175***	.00033
Change in Share More than .15	.00339***	.00097	-.00071	.00047	-.00270***	.00035
Median Family Income, 1990						
Median Family Income ($100,000's)	.05511***	.01227	-.02502***	.00606	.05954***	.00446
Median Family Income Spline at $25,000	.00512	.01282	.03775***	.00634	-.02771***	.00465
Median Family Income Spline at $40,000	.03670***	.00861	.01680***	.00418	-.03537***	.00311
Median Family Income Spline at $55,000	-.06490***	.00724	-.02719***	.00351	-.01551***	.00262
Change in Median Family Income, 1980-1990 (Dummies, Less than 25% Is Base Group)						
Change in Income between 25% and 50%	.00068	.00116	-.00032	.00057	-.00163***	.00042
Change in Income between 50% and 100%	.00065	.00123	-.00018	.00061	-.00216***	.00044
Change in Income More than 100%	.00191	.00140	.00046	.00069	-.00147**	.00051
Age of Household Head, 1990						
Share of Household Heads 25-34	.14284***	.00924	-.01318**	.00450	-.00888**	.00336
Share of Household Heads 35-44	.08264***	.00847	.01436***	.00413	.01184***	.00308
Share of Household Heads 45-54	.06724***	.01161	.05643***	.00565	.02884***	.00421
Share of Household Heads 55-64	.03307**	.01203	-.02508***	.00586	.00881*	.00436
Share of Household Heads 65-74	.01739	.01107	-.02420***	.00539	-.01763***	.00402
Share of Household Heads 75 or Older	.08753***	.00884	-.00363	.00430	-.01853***	.00321
Median Owner-occupied House Value, 1990						
Median House Value ($100,000's)	.00407	.00525	.01217***	.00259	-.02245***	.00190
Median House Value Spline at $50,000	.01616**	.00565	-.00060	.00278	.00540**	.00204
Median House Value Spline at $100,000	-.02455***	.00302	.00835***	.00146	.01528***	.00109
Median House Value Spline at $150,000	.00342	.00203	-.01094***	.00098	.00392***	.00073
Change in Median House Value, 1980-1990 (Dummies, Less than 25% Is Base Group)						
Change in Value between 25% and 50%	-.00012	.00077	.00416***	.00038	.00057*	.00028
Change in Value between 50% and 100%	.00339***	.00095	.00943***	.00046	.00245***	.00034
Change in Value between 100% and 150%	.00398**	.00122	.01411***	.00059	.00364***	.00044
Change in Value More than 150%	-.00062	.00145	.00970***	.00071	.00124*	.00052

Table 11: (Continued)

	Home Purchase		Refinance		Home Improvement	
	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error
House Usage Variables, 1990						
Share of Structures Single Unit Attached	.01279***	.00208	-.00076	.00102	-.00486***	.00076
Share of Structures 2 Units	-.00082	.00362	.00422*	.00177	.00922***	.00131
Share of Structures 3-4 Units	-.02850***	.00427	-.01177***	.00209	.00060	.00155
Share of Structures 5 or More Units	.06037***	.00195	.01742***	.00095	.01394***	.00071
Share of Structures Mobile Homes	.07791***	.00289	.02038***	.00140	.01618***	.00105
Share of 1-4 Unit Structures Rented	-.04608***	.00328	-.03485***	.00161	-.03549***	.00120
Share of 1-4 Unit Structures Vacant	-.02535***	.00428	-.01569***	.00208	-.03498***	.00155
Change in House Usage, 1980-1990						
Growth Rate of Total Housing Units	-.00242*	.00114	-.00104*	.00055	-.00091*	.00041
Growth Rate of 1-4 Unit Structures	.02476***	.00117	.00235***	.00057	.00095*	.00042
Change in Share 1-4 Units Rented	-.03712***	.00398	-.01619***	.00197	.00606***	.00146
Change in Share 1-4 Units Vacant	-.04293***	.00542	-.01421***	.00264	.00464*	.00196
Age of Housing Stock, 1980						
Share of Housing Stock Built 1979-1980	-.00497	.00446	-.00500*	.00216	-.00682***	.00161
Share of Housing Stock Built 1975-1978	.01557***	.00275	.00844***	.00134	-.00436***	.00100
Share of Housing Stock Built 1970-1974	.00124	.00239	-.00405***	.00116	-.00827***	.00086
Share of Housing Stock Built 1960-1969	-.01241***	.00189	-.00746***	.00092	-.00799***	.00068
Share of Housing Stock Built 1950-1959	-.00516**	.00190	-.00554***	.00092	-.00418***	.00069
Share of Housing Stock Built 1940-1949	-.00238	.00291	-.01047***	.00142	-.00461***	.00105

Memo Items:	Home Purchase	Refinance	Home Improvement
R Squared Total (Weighted by 1-4 Units)	.501	.795	.501
R Squared about MSA Means	.398	.460	.188
Dependent Variable Mean	.07143	.03930	.02871
Number of Tracts	38,609	38,064	38,490

* Significant at the 5 percent level.
** Significant at the 1 percent level.
*** Significant at the .1 percent level.