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Role of Bank Branch Locations
in Minority Lending

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Abstract

Past studies on discrimination in home mortgage lending have focused on the loan approval process, yet results show that most of the variation in minority lending across banks is due to the variation in the volume of minority applications and not the variation in the minority approval rate. This paper focuses instead on the application stage and the impact of branch locations on minority applications and lending. The presence of branches in minority areas significantly increases a bank's volume of minority applications and hence its minority lending; however, branch locations do not appear to affect the minority approval rate. These findings refute the argument that banks take in deposits but do not lend in minority areas, and the view that technological innovations such as telephone banking have made branches obsolete. They suggest that the current policy of emphasizing branches in minority areas may be effective in increasing minority lending at individual banks, but not necessarily the overall lending in a minority area.

1   Introduction

In a landmark study, the Federal Reserve Bank of Boston examined mortgage loan approvals in the Boston area and concluded that minority applicants were more likely to be denied loans than comparable white applicants (Munnell et al. 1996). It led to a flurry of articles in the popular press and in academic journals. Most of these articles, like the Boston Fed study, focus only on the loan approval process which is but one aspect of the mortgage process. They do not tell us about possible discrimination in other aspects of mortgage lending, in particular the application stage. Yet, most of the variation in minority lending across banks is due to differences in the volume of minority applications and not the minority approval rate, as this paper shows.

One area that has been the subject of much controversy is the effect of branch locations on the volume of minority loan applications and minority lending. Bank regulators act on the assumption that the presence of branch offices in minority areas increase a bank's volume of minority applications and minority lending. For example, the Justice Department compelled Chevy Chase Federal Savings Bank to open a branch in a minority area near Washington, D.C. in 1994 (Banking Policy Report 1994).[1] On the other hand, bankers argue that branches are becoming obsolete, with consumers doing more transactions via PC (Kutler 1997), phone, mail, and ATMs (Radecki et al. 1996).[2] Branches play a diminishing role in lending, with mortgage loans increasingly originated at central locations by mortgage banks and by mortgage subsidiaries of large bank holding companies. Community groups also believe branches do not matter, but for a very different reason. They charge that branches take in deposits but do not lend in minority areas.

This is the first paper to examine the role of branches in mortgage lending,[3] and one objective is to evaluate the validity of the differing views about the importance of branches in minority lending. A second goal is to offer insights into whether the current policy of emphasizing branch presence in minority areas is effective. The analysis is based on 146 commercial banks and savings banks that received mortgage loan applications for one-to-four family owner-occupied properties located in the Metropolitan Statistical Areas (MSAs) of New York State in 1993,[4] as identified from the Home Mortgage Disclosure Act of 1975 (HMDA) Loan-Application Register (LAR) CD-ROMs. The banks had a total of 3,381 branches in the MSAs of New York,[5] as identified from the June 30, 1993 Summary of Deposits.[6]

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[1]No law requires banks to have branches in minority areas. The Community Reinvestment Act (CRA) of 1977 encourages banks to meet the credit needs of the communities where they operate, including low- and moderate-income areas.

[2]Prima facie evidence against the importance of branch offices comes from the predominance of mortgage companies, which typically operate few or no offices. Mortgage companies originated 60% of home purchase, and 54% of home refinancing loans in 1993 (Canner and Passmore 1995).

[3]Laderman et al. (1991) and Levonian (1996) examine the importance of branch locations in farm lending.

[4]MSAs typically encompass a city of 50,000 in population or an urbanized area. In 1993, the MSAs in New York included 36 counties, the remaining 26 counties were not in MSAs. For a list of MSA and non-MSA counties, see: *Getting It Right*, Appendix.

[5]For the purposes of this paper, a branch is defined as a bank office that accepts FDIC-insured deposits.

[6]The sample includes 49% of all FDIC-insured institutions and 73% of all FDIC-insured branches in New York.

The results show that branch presence in minority areas significantly increases a bank's volume of minority[7] lending by raising the volume of minority applications. In fact, a one-to-one relationship between the percent of minority population in a bank's market, defined as Census tracts where its branches are located, and the percent of minority applications is estimated for home purchase and refinancing loans. However, branch locations do not appear to affect a bank's minority approval rate, or the percent of minority applications that are approved.

To set the stage for the empirical analysis, the next section describes the data sources. Section 3 presents tabulations on the two variables of interest: racial composition of banks' markets and the volume of minority lending across banks. It will also discuss the wide variation in the relative amount of minority lending across banks and present ANOVA results, which show that most of the variation in minority lending is due to the variation in the volume of minority applications. Section 4 describes the econometric framework. Section 5 presents the results, and Section 6 discusses their implications. Section 7 concludes the paper.

2 Description of Data

The primary data source is the HMDA dataset for 1993. HMDA requires most major mortgage lenders[8] to report the number of applications received for home purchase, refinancing, and home improvement loans, the actions taken on the applications (e.g., approved, denied), and characteristics of applicants such as income, race, gender, and marital status. Applications and loans for conventional home purchase, home refinancing, and home improvement (i.e., loans that are not insured by government) are considered.

Only applications and loan originations for properties located in the MSAs of New York are considered, since banks are not required under HMDA to report any geographic information for applications involving properties in non-MSA counties.[9] The omission of geographic information for non-MSA applications poses difficulties in distinguishing banks that received applications only from the non-MSA counties in New York from those that received applications from non-MSA counties of other States. Mortgage applications for MSAs probably represent most of the applications for New York,[10] since about 91% of the population in New York lived in MSA counties as of the 1990 Census.[11]

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[7]Under HMDA, minority groups include: American Indian, Alaskan native, Asian, Pacific Islander, Black, and Hispanic. For the purposes of this study, applications with race reported as "Other" or "Joint" (i.e., either the applicant or the co-applicant is minority) are also considered minority.

[8]Banks with less than $10 million in total assets or with no home or branch offices in an MSA are exempt from HMDA (FFEIC 1993, p. 4-5).

[9]Institutions are also not required to report geographic information for properties located in MSAs where they do not have any branch offices. See: *Getting It Right*, p. 20.

[10]Based on tabulations of applications for which geographic information is missing in the HMDA dataset, about 9% of home purchase applications, 3% of refinancing applications, and 8% of home improvement applications may be from non-MSA counties in New York.

[11]The racial composition of applications from non-MSA counties may be quite different from those from MSA coun-

The street addresses of bank branches in the MSAs of New York are from the June 30, 1993 Summary of Deposits. These addresses are mapped into the corresponding 1990 Census tracts.[12] The market of a bank is delineated as the set of Census tracts where the bank's branch offices are located. Racial composition and other characteristics of the tracts are based on the 1990 Census.

3 Background

3.1 Racial Composition of Banks' Markets

Two measures of the racial composition of banks' markets are considered: the fraction of minority population in a bank's market and the fraction of a bank's branches in mostly minority areas (MMAs), which as are defined as Census tracts with at least 50% minority population. The distribution of minority residents across banks' markets reflects that of the minority population across New York; however, minority areas have relatively fewer bank branches than white areas. About 43% of tracts have less than 10% minority population, and comparable percent of banks (46%) operate in MSA markets with less than 10% minority population (Table 1). By contrast, 28.3% of tracts are MMAs, yet only 10% of banks operate in markets with at least 50% minority population. The average fraction of minority population in banks' markets in 1993 was 21%, which is lower than the average fraction of minority population across the Census tracts of New York in 1990 (32 percent).

Table 1. Percent of Minority Population in Banks' Markets

Percent of Minority Population	Number of Banks	Percent of Banks	Average Number of Branches
Less than 10%	67	46.2%	11.7
10-19%	26	17.9	46.8
20-49%	37	25.5	36.5
50-79%	6	4.1	2.7
80% or more	9	6.2	1.6
All banks	145	100	23.3
Average percent of minority population in market:		20.5%	

ties. In 1990, the MSA counties in New York on average had 34.8% minority population, while the non-MSA counties had 5.5% minority population.

[12]Census tracts are defined to be relatively homogeneous in population and economic characteristics, and living conditions. Their physical size depends on population density, since Census tracts are defined to have typically between 2,500 and 8,000 persons. Census tracts never cross county boundaries (Census Bureau 1993).

The clustering of banks at the low and high end of the percent of minority population reflects the size distribution of banks. Larger banks are less likely to operate in markets with very low or very high percent of minority population. Thus, the average size of banks (in terms of the number of branches) tends to be smaller at the two extremes than the size of those with 10 to 50 percent minority population in their markets.

Another way to measure the racial composition of banks' market is to consider the distribution of branches in minority areas. Over half of the banks have no branches in MMAs, while about 8% have all of their branches in MMAs (Table 2). Again, the distribution of banks according to the percent of their branches in MMAs reflects their size distribution. Banks with no branches in MMAs on average have six branches, while those with 1-49% of their branches in MMAs have over 50 branches. Eight of the eleven institutions with all of their branches in MMAs are unit banks.

Table 2. Percent of Branches in Mostly Minority Areas Across Banks

Percent of Branches in MMAs	Number of Banks	Percent of Banks	Average Number of Branches
None	81	55.9%	4.7
Less than 10%	14	9.7	72.3
10-19%	18	12.4	56.1
20-49%	17	11.7	55.9
50-79%	4	2.8	3.0
80-99%	—	—	—
100%	11	7.6	1.4
Average percent of branches in MMAs:		14.9%	

Notes: None of the banks in the sample had 80-99% of branches in mostly minority areas.

3.2   Variation in Minority Lending

Not only is there a wide variation across banks in branch concentration in minority areas, but also in the volume of minority lending (Table 3) While the fraction of approved home purchase loans.[13] for minority applicants is less than 10% at 46% of banks, about 11% of banks grant all of their loans to minority applicants. Similar patterns are observed for refinancing and home improvement loans.

As seen with the distribution of branches in minority areas, the clustering of banks at the low and high end of the percent of minority loans is due to differences in size. Larger banks originate between 10 and 50 percent of their loans to minority consumers; whereas, banks with less than 10%

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[13]Loan approvals differ from originations, since applicants can reject the bank's offer. The results based on loan originations are similar to those presented, since only about 5.6% of approved loans are rejected by the applicants.

minority loans and those with more than half have on average fewer branches.[14]

Table 3. Percent of Approved Loans to Minority Applicants

(# Minority Approvals) (Total # Approvals)	Purchase		Refinancing		Improvement	
	# banks	% loans	# banks	% loans	# banks	% loans
Less than 10%	50	46.4%	65	67.0%	34	52.9%
10-19%	23	21.8	16	17.5	16	21.4
20-49%	22	19.1	8	8.3	12	17.1
50-79%	2	1.8	1	1.0	2	2.9
80-99%	—		—		—	
100%	11	10.9	5	6.2	4	5.7
Avg. percent of minority lending	22.6		14.3		17.4	

Notes: Banks without any minority applications are excluded from the tabulation. None of the banks in the sample had 80-99% minority approvals for home purchase or refinancing. The percent of banks does not total 100 due to rounding.

Figure 1 serves as a quick check of whether the volume of minority lending is related to the racial composition of banks' markets. It shows that minority lending tends to rise with the percent of minority population in a bank's market. Results from Tobit equations, which control for other bank and market characteristics, lead to the same conclusion of a positive relationship between minority population in the market and minority lending.

Figure 1. Branch Locations and Minority Lending
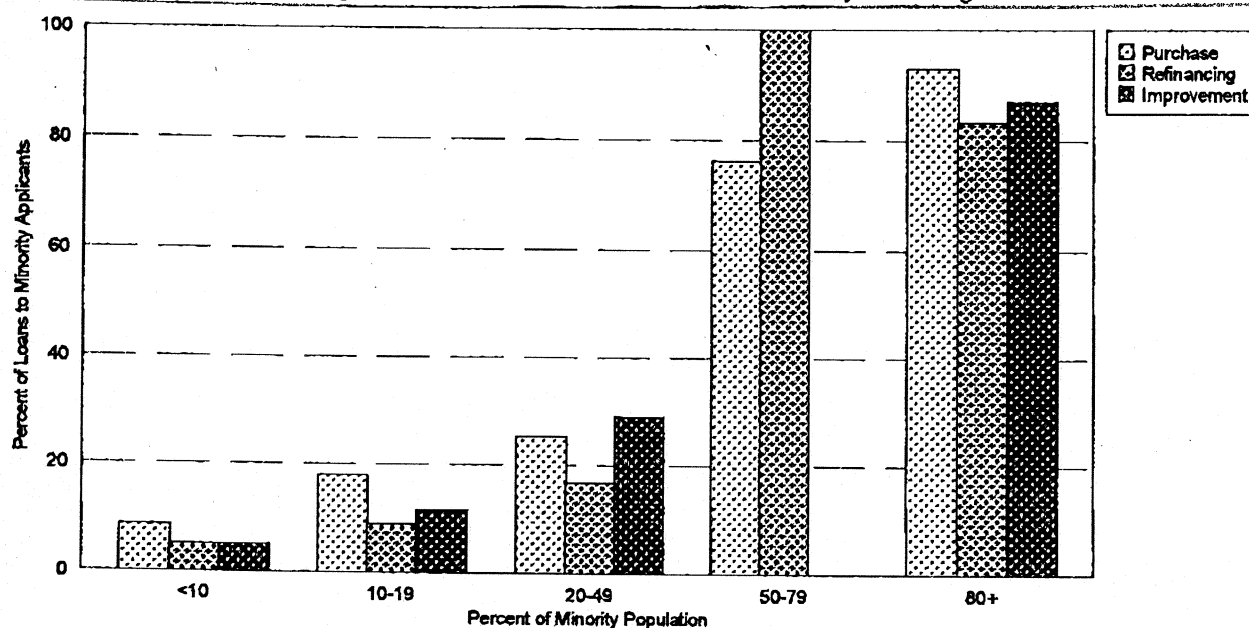
[14]For example, the average number of branches among banks with at least 50% minority loans was less than 5.

Branch locations may affect minority lending either by influencing the volume of minority applications or the minority approval rate. We now consider the channel via which branch locations impact on minority loans. A natural question is whether the wide variation in minority lending is due to differences in the volume of minority applications or differences in the minority approval rate. Analysis of variance (ANOVA) is used to decompose the variance in the minority lending into the two components based on the R^2 statistics of the following OLS equations:

$$frmapr_i = \alpha + \beta_1 frmappl_i \tag{1}$$

$$frmapr_i = \alpha + \beta_2 mnallrate_i \tag{2}$$

$$frmapr_i = \alpha + \beta_1 frmappl_i + \beta_2 mnallrate_i \tag{3}$$

where

- $frmapr$ is the fraction of approved loans for minority applicants at bank i,

- $frmappl$ is the fraction of minority applications, and

- $mnallrate$ is the ratio of the minority approval rate to the overall approval rate.

A brief description of the ANOVA methodology may help illustrate the logic behind using the R^2 statistic. The R^2 from Equation 2 measures the portion of the variance in the fraction of loans for minority applicants due to differences in the minority-overall approval rate across banks. Once we add the fraction of minority applications to get Equation 3, the increase in R^2 gives us a <u>lower</u> bound on the variation due to the fraction of minority applications. It is a lower bound, since it reflects the increase in the explanatory power coming from only the component of the fraction of minority applications that is orthogonal to the minority-overall approval rate, rather than the entire effect of the fraction of minority applications.[15] Similarly, the increase in R^2 going from Equation 1 to Equation 3 gives us the lower bound on the explanatory power of the variation in the relative minority approval rate.

Most of the variance in the fraction of minority loans is due to the variance in the fraction of minority applications, ranging from 74% for home improvement to 97% for purchase and 98 percent for refinancing (Table 4).[16] Very little of the variance is due to the minority-overall approval rate. The F statistics are significant at the 1% level for the fraction of minority applications and the

[15]For a discussion of using R^2 for ANOVA, see Groshen (1991) and Avery et al. (1994).

[16]ANOVA results that adjust for the percent of minority population in a bank's market and the percent of branches in MMAs are available from the author. The qualitative result is the same: substantially more of the variation in minority lending is due to the variation in minority applications than the variation in the minority approval rate.

minority-overall approval rate, indicating that both variables are statistically significant explanatory variables of the variation in minority lending. Nonetheless, the variation in the fraction of minority applications across banks explains more of the variance in minority lending than the variation in the minority approval rates. This underlines the importance of the volume of minority applications for a bank's minority lending.

Table 4. Analysis of Variance of Minority Lending

Loan Product	Percent Attributed to Variance in	
	Minority Applications	Minority Approval Rate
Purchase	96.8%	0.4%
	[13484.7]	[62.8]
Refinancing	97.8	0.6
	[4809.9]	[34.3]
Home Improvement	73.6	4.7
	[353.3]	[34.1]

Notes: Lower bounds are presented for the decomposition of the variance in the relative minority lending for each product. F statistics for the significance of the fraction of minority applications and minority approval rate are presented in brackets. All of the presented F statistics are significant at the one percent level.

The estimates are similar to those in Avery et al. (1994), who find that 80% of the variation in minority home purchase loans can be attributed to the variation in the volume of minority applications across banks. A major difference between this study and Avery et al. is the definition of banks' markets. Avery et al. define a bank's market as the MSAs from which the banks receive home purchase applications. The definition of banks' markets at the MSA level is more problematic for this study, since the MSAs in New York cover wide areas. For example, the New York City MSA encompasses not only the five boroughs but also Long Island, several counties north of Manhattan, and counties in Connecticut and New Jersey. Also, the focus of this study is on the importance of branch locations in minority lending, which is not addressed by the previous study.

4 Methodology

For each loan product, we are interested in the effect of the racial composition of a bank's market on the following dependent variables:

- the fraction of minority loan approvals,

- the fraction of minority applications, and

- the minority approval rate.

Since the dependent variables are bounded between zero and one by construction,[17] OLS estimates are inconsistent. One approach is to do a logistic transformation of the dependent variables and obtain OLS estimates. This approach cannot work in the present setting, because the dependent variables equal 0 for a substantial number of banks (i.e., no minority applications or loans). Tobit analysis is more appropriate than OLS, where the observed value of each dependent variable (y) for bank i is assumed to be the outcome of an unobservable process (y^*):

$$y_i = \begin{cases} 0 & \text{if } y_i^* \leq 0 \\ y_i^* & \text{if } 0 < y_i^* < 1 \\ 1 & \text{if } y_i^* \geq 1 \end{cases} \tag{4}$$

where

$$y_i^* = \beta' min_i + \gamma' x_i + \delta' z_i + \varepsilon_i \tag{5}$$

$$y_i^* \sim N[\mu, \sigma^2]$$

Each dependent variable is a function of the racial composition of banks' markets (min), bank characteristics (x), and economic characteristics of their markets (z). The dependent variables are based on the 1993 HMDA data. As mentioned before, two measures of racial composition of banks' markets are considered: the fraction of minority population in the market and the fraction of a bank's branches in mostly minority areas (MMAs). The following bank, market, and applicant characteristics may affect the volume of minority lending and have been included in the analysis:

Bank Characteristics

- total assets of the bank,

- fraction of the bank's assets that are mortgage loans,[18]

- the total number of mortgage loan applications as reported under HMDA,

- whether the institution is a savings bank,

- whether it is a money center bank,[19]

Market Characteristics

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[17]There are both left- and right-censored observations for the fraction of minority applications and the minority approval rate for all three products. There are no right-censored observations for the fraction of home purchase and refinancing loans granted to minority applicants; there are right-censored observations for the fraction of home improvement loans for minority applicants.

[18]Results are similar with the variable for the fraction of mortgage lending in brackets. Only the results with the continuous variable are presented for brevity.

[19]For 1993, the money center banks in New York State were: Chemical, Chase Manhattan, Citibank, J.P. Morgan, Bankers Trust, Bank of New York, and Republic National Bank of New York.

- fraction of minority-owned housing units

- average income of minority households relative to that of white households

Applicant Characteristics

- average income of the minority applicants relative to that of white applicants, and

- loan-to-income ratio (i.e., amount of loan request divided by the applicant's annual income) of minority applicants relative to that of white applicants.

The first three variables test whether larger banks or those that specialize in mortgage lending have more expertise in attracting and/or approving more minority applications. The dummy variable for savings banks controls for differences in minority lending between commercial and savings banks, and the second binary variable tests whether money center banks behave differently as regards mortgage lending versus other banks. Data on total assets and mortgage lending as a share of total assets are from the 1993 Report of Condition and Income for Commercial Banks (also known as the Call Reports) and the Report of Condition and Income for Savings Banks (also known as the Thrift Financial Reports). The total number of application is from the 1993 HMDA dataset.

Economic characteristics of banks' markets are also considered, such as the fraction of owner-occupied housing units that are minority-owned, and the ratio of the average income of minority households to that of white households. These economic variables may reflect the demand for mortgage loans by minority consumers. For example, the demand may be higher in areas with a higher fraction of minority owner-occupied housing units, or in areas with a higher ratio of average minority income to the average non-minority income. Data on the racial composition and economic characteristics of Census tracts are from the 1990 Census.

The last two variables control for differences in the quality of applicants to some degree. Lenders typically consider applicants' incomes, credit history, debt-to-income ratio, loan-to-value ratio (i.e., down payment), and stability of income (e.g., length of employment) as key variables when making lending decisions. Unfortunately, most of these variables are not reported under HMDA, except income and loan amount. Though not directly used by lenders, the loan-to-income ratio is a proxy of the debt-to-income ratio.

Summary statistics for each loan product are presented in Table 5. Banks receive a much higher fraction of minority applications for home purchase than for refinancing and home improvement. In 1993, the average number of applications was much higher for refinancing than for home improvement or home purchase. These differences suggest that the three products cannot be treated as homogeneous. The lending criteria also differ among the products; purchase and refinancing loans are secured while home improvement loans are often unsecured — another argument for separate analysis of the products.

Table 5. Summary Statistics

Variables	Purchase	Refinancing	Improvement
Fraction of minority loans	0.23 (0.29)	0.14 (0.22)	0.17 (0.24)
Fraction of minority applications	0.20 (0.29)	0.11 (0.21)	0.13 (0.21)
Minority approval rate	0.73 (0.29)	0.74 (0.24)	0.59 (0.33)
Fraction of minority population in the bank's market	0.20 (0.22)	0.17 (0.19)	0.16 (0.18)
Fraction of branches in MMAs	0.14 (0.27)	0.11 (0.22)	0.10 (0.19)
Fraction of minority owner-occupied housing units in the bank's market	0.11 (0.16)	0.08 (0.10)	0.08 (0.14)
Minority to white residents' income in the bank's market	0.87 (0.38)	0.88 (0.39)	0.89 (0.39)
Number of applications	289.8 (836.7)	707.8 (1781.9)	332.6 (1035.9)
Minority to white applicants' income	0.98 (0.61)	1.13 (0.76)	0.87 (0.35)
Minority to white applicants' loan-to-income ratio	1.02 (0.40)	1.12 (0.89)	1.05 (0.59)
Total assets of the bank (in $millions)	3,096.4 (10,414.4)	3,564.1 (11,144.0)	3,325.0 (10,979.3)
Mortgage lending as a share of total assets	0.28 (0.18)	0.29 (0.17)	0.30 (0.17)
Whether a savings bank	0.39 (0.49)	0.39 (0.49)	0.41 (0.49)
Whether a money center bank	0.04 (0.21)	0.06 (0.23)	0.04 (0.20)
Number of banks	135	127	117
Total number of applications	39,126	89,893	38,913

Notes: Standard deviations are in parentheses.

5 Tobit Results

5.1 Volume of Minority Lending

The Tobit results indicate a significant positive relationship between branch presence in minority areas and minority lending (Table 6). The fraction of minority loans significantly increases with the fraction of minority population in a bank's market and with the fraction of its branches in MMAs.[20] In terms of marginal effects,[21] the Tobit coefficients imply that a one percentage-point increase in the fraction of minority population in a bank's market raises the fraction of minority approvals by 0.8 percentage point for home purchase, by 0.5 percentage point for refinancing, and by 0.3 percentage point for home improvement.

A significantly positive relationship is also observed between the fraction of a bank's branches in MMAs and the fraction of minority approvals for refinancing and home improvement loans. For refinancing, a one percentage-point increase in the fraction of branches in MMAs raises the fraction of minority approvals by 0.4 percentage point; and for home improvement, the marginal effect is 0.5. The presence of branches in MMAs does not appear to affect the fraction of minority approvals for home purchase loans.

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[20]For the Tobit equations, banks that did not receive any minority or any white applications were deleted, since the incomes and loan-to-income ratios of minority and white applicants cannot be computed for such institutions. The results are similar if banks that received no white applications are included in the sample, and the explanatory variables that compare the incomes and loan-to-income ratios of minority and white applicants are dropped from the equations.

[21]There are no right-censored observations for home purchase or refinancing in Table 6, such that the marginal effect equals

$$\frac{\partial E(y|x)}{\partial x} = \beta \Phi(\frac{\beta' x}{\sigma})$$

where y is the fraction of minority applications, x is an explanatory variable, β is the Tobit coefficient of x on the latent variable y^*, Φ is the standard cumulative distribution, and σ is the standard deviation of the unconditional error term. Φ is evaluated at the means of the explanatory variables. For home improvement, there are both right- and left-censored observations, and the marginal effect equals:

$$\frac{\partial E(y|x)}{\partial x} = \beta(\Phi_U(\frac{U - \beta' x}{\sigma}) - (\Phi_L(\frac{L - \beta' x}{\sigma})))$$

where U is the upper limit of the observed dependent variable and L is the lower limit of the observed dependent variable.

Table 6. Tobit Results: Volume of Minority Lending

	Purchase		Refinancing		Improvement	
Fraction of minority population in bank's market	0.87** (0.18) [0.81]	—	0.53** (0.11) [0.51]	—	0.80** (0.15) [0.29]	—
Fraction of bank's branches in mostly minority areas	—	0.18 (0.14) [0.16]	—	0.45** (0.07) [0.44]	—	0.58** (0.13) [0.46]
Number of mortgage applications for the loan product (thousands)	0.006 (0.01) [0.006]	0.01 (0.01) [0.01]	0.008* (0.004) [0.007]	0.007* (0.004) [0.007]	-0.01 (0.01) [-0.004]	-0.01 (0.01) [-0.01]
Log of total assets	0.01* (0.008) [0.01]	0.02** (0.009) [0.02]	0.002 (0.005) [0.002]	0.001 (0.005) [0.001]	0.03** (0.01) [0.01]	0.03** (0.01) [0.02]
Mortgage loans as a share of total assets	0.16** (0.07) [0.15]	0.17** (0.08) [0.15]	0.04 (0.04) [0.04]	0.04 (0.04) [0.04]	0.06 (0.15) [0.02]	0.03 (0.16) [0.02]
Fraction of minority owner-occupied housing units in bank's market	-0.44 (0.31) [-0.41]	0.67** (0.26) [0.62]	0.003 (0.18) [0.002]	0.14 (0.13) [0.14]	−0.97** (0.29) [-0.35]	-0.69** (0.28) [-0.54]
Avg. income of minority applicants relative to that of white applicants	-0.02 (0.02) [-0.02]	-0.02 (0.02) [-0.02]	0.0001 (0.007) [0.0001]	-0.003 (0.007) [-0.003]	0.13** (0.06) [0.04]	0.12** (0.06) [0.10]
Avg. loan-to-income ratio of minority applicants relative to that of white applicants	0.01 (0.03) [0.01]	0.01 (0.03) [0.01]	0.02** (0.006) [0.02]	0.02** (0.006) [0.02]	0.05 (0.03) [0.02]	0.05 (0.04) [0.04]
Constant	-0.09 (0.07) [-0.09]	-0.10 (0.08) [-0.09]	-0.05 (0.04) [-0.05]	-0.02 (0.04) [-0.02]	-0.30** (0.12) [-0.11]	-0.26** (0.13) [-0.20]
σ	0.08 (0.006)	0.09 (0.007)	0.05 (0.004)	0.04 (0.003)	0.14 (0.01)	0.15 (0.01)
Number of observations	95	95	91	91	72	72

*   Significant at the 10% level

**   Significant at the 5% level

Notes: Standard errors are in parentheses. The marginal effects are in brackets. The dependent variable is the number of minority approved loans relative to the total number of approvals. The equations also include dummy variables for savings banks and money center banks.

The income of minority applicants relative to that of non-minority applicants is not a significant factor in the volume of minority approvals for home purchase and refinancing; however, it is significant for home improvement minority approvals. The loan-to-income ratio of minority applicants relative to that of non-minority applicants is significant only for refinancing loans. These results should be interpreted cautiously, since income and the loan-to-income ratio may reflect the positive effect of other omitted measures of creditworthiness such as sound credit history or stability of income. For example, if minority applicants with better credit history or stability of income apply for and are approved for larger loans, then the estimated coefficient for loan-to-income ratio might be positive though the ratio in itself exerts a negative impact on the volume of minority approvals.

The fraction of loans for minority applicants may be higher at banks that operate in minority areas either because they receive more minority applications or because they approve more of their minority applications. We now examine the channel via which branches in minority areas affect minority lending.

5.2 Minority Applications and Approval Rates

Banks operating primarily in minority areas receive a significantly higher fraction of applications from minority consumers (Table 7). The marginal effects implied by the Tobit coefficients indicate that a one percentage-point increase in the minority population in a bank's market increases the share of minority applications for home purchase loans by 1.1 percentage points, for refinancing loans by 1.0 percentage point, and for home improvement loans by 0.6 percentage point. In fact, a one-to-one relationship between the fraction of minority population in a bank's market and minority applications cannot be rejected for home purchase and refinancing.[22]

The coefficients for the fraction of branches in MMAs are also highly significant. A one percentage-point increase in the fraction of branches in MMAs increases the fraction of minority applications by 0.9 percentage points for home purchase, 0.8 for refinancing, and 0.6 for home improvement. Again, a one-to-one relationship cannot be rejected for home purchase and refinancing.[23] None of the other explanatory variables are consistently significant. The results indicate that banks operating in minority areas do receive a higher fraction of their applications from minority consumers. This conclusion, in conjunction with earlier ANOVA results show that branch locations have an economically significant, as well as a statistically significant, impact on minority lending through their impact on the volume of minority applications.

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[22]The standard errors for the marginal effect of the fraction of minority population in a bank's market are 0.18 for home purchase, 0.16 for refinancing, and 0.11 for home improvement. They are computed as: $var_j = \nabla g_j' \Sigma \nabla g_j$, where g_j is the continuous function equal to the marginal effect of variable j on the dependent variable and Σ is the variance-covariance matrix of the estimated coefficients (Greene 1990).

[23]The standard errors for the marginal effect of the fraction of branches in MMAs are 0.12 for home purchase, 0.09 for refinancing, and 0.09 for home improvement.

Table 7. Tobit Results: Volume of Minority Applications

	Purchase		Refinancing		Improvement	
Fraction of minority population in bank's market	1.30** (0.22) [1.08]	—	1.11** (0.20) [1.00]	—	0.84** (0.17) [0.61]	—
Fraction of bank's branches in mostly minority areas	—	1.02** (0.14) [0.88]	—	0.89** (0.11) [0.82]	—	0.82** (0.13) [0.62]
Number of mortgage applications for the loan product (thousands)	-0.006 (0.03) [-0.005]	-0.02 (0.02) [-0.01]	0.002 (0.007) [0.002]	0.001 (0.007) [0.001]	0.01 (0.02) [0.01]	0.01 (0.02) [0.01]
Log of total assets	0.02 (0.02) [0.02]	0.03** (0.01) [0.03]	-0.003 (0.009) [-0.003]	-0.003 (-0.008) [-0.003]	0.007 (0.02) [0.005]	0.007 (0.01) [0.005]
Mortgage loans as a share of total assets	0.06 (0.15) [0.05]	0.14 (0.14) [0.12]	0.07 (0.09) [0.06]	0.08 (0.08) [0.08]	-0.08 (0.16) [-0.06]	-0.08 (0.15) [-0.06]
Fraction of minority owner-occupied housing units in bank's market	0.05 (0.30) [0.04]	0.31 (0.23) [0.27]	0.08 (0.34) [0.07]	0.33 (0.22) [0.31]	0.19 (0.22) [0.14]	0.20 (0.20) [0.16]
Ratio of average minority income to average white income in bank's market	0.03 (0.05) [0.03]	-0.02 (0.05) [-0.01]	0.01 (0.03) [0.01]	-0.02 (0.03) [-0.02]	-0.09 (0.06) [-0.06]	-0.10* (0.06) [-0.08]
Constant	-0.25** (0.12) [-0.21]	-0.17 (0.11) [-0.15]	-0.11 (0.08) [-0.10]	-0.008 (0.07) [-0.007]	-0.06 (0.13) [-0.04]	0.02 (0.12) [0.01]
σ	0.20 (0.01)	0.18 (0.01)	0.11 (0.009)	0.10 (0.008)	0.19 (0.02)	0.18 (0.02)
Number of observations	131	131	124	124	116	116

*   Significant at the 10% level
** Significant at the 5% level
Notes: Standard errors are in parentheses. The marginal effects are in brackets. For each product, the dependent variable is the fraction of minority applications. The equations also include dummy variables for savings banks and money center banks.

By contrast, minority approval rates[24] do not vary systematically with the racial composition of bank's markets (Table 8).[25] In fact, the hypothesis that all of the coefficients are zero cannot be rejected at the 5% level for the three products, based on the likelihood ratio test.[26] The results in Table 8 should be interpreted cautiously, since the equations include few measures of applicants' creditworthiness. It is possible that if more precise measures of applicants' credit quality were considered, a significant relationship is observed between the racial composition of banks' markets and their minority approval rates. Also, the impact may show up in the default rate on minority loans and not in the minority approval rate. Banks with branches in minority areas may approve the same percent of minority applications as banks that operate in white areas, but may have a lower percent of minority defaults if they are able to select the better qualified borrowers.

The low explanatory power of the Tobit equations suggest that approval rates probably do not explain the wide variation in the number of minority approvals across banks.[27] This is confirmed by the earlier ANOVA results.

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[24]The findings are similar with the ratio of the minority approval rate to the white approval rate at each bank as the dependent variable.

[25]The conclusions are similar when the insignificant variables are dropped from the equations. The statistical significance of the racial composition variables increases; however, they are still not significant at the 5% level. The conclusions also do not change when the banks in the sample are split into two groups, by whether they operate primarily in minority or non-minority areas. The presence of branches in minority areas does not significantly affect the minority approval rate for either group of banks. The results are similar when the total number of a bank's branches is included in the equations as the measure of bank size.

[26]There are both left- and right-censored observations in the Tobit equations in Table 8, and the marginal effect is computed as described in footnote 21.

[27]The results presented are based on the sample of banks that received both minority and white applications. The results are similar if banks that received no white applications are included in the sample, and the variables for the incomes and the loan-to-income ratios of minority to white applications are dropped from the equations.

Table 8. Tobit Results: Minority Approval Rates

	Purchase		Refinancing		Improvement	
Fraction of minority population in bank's market	0.09 (0.58) [0.05]	—	-0.23 (0.63) [-0.11]	—	0.03 (0.43) [0.008]	—
Fraction of bank's branches in mostly minority areas	—	-0.60 (0.39) [-0.31]	—	0.27 (0.34) [0.12]	—	-0.27 (0.36) [-0.07]
Number of mortgage applications for the loan product (thousands)	-0.002 (0.06) [-0.001]	0.01 (0.06) [0.007]	-0.005 (0.03) [-0.002]	-0.008 (0.03) [-0.003]	0.002 (0.04) [0.0005]	0.001 (0.04) [0.0003]
Log of total assets	-0.02 (0.04) [-0.01]	-0.02 (0.04) [-0.01]	0.01 (0.03) [0.005]	0.005 (0.03) [0.002]	-0.08* (0.04) [-0.02]	-0.08* (0.04) [-0.02]
Mortgage lending as a share of total assets	0.61 (0.34) [0.32]	0.53 (0.34) [0.28]	0.37 (0.26) [0.18]	0.36 (0.25) [0.16]	-1.04** (0.45) [-0.27]	-1.05** (0.45) [-0.27]
Fraction of minority owner-occupied housing units in bank's market	0.59 (0.86) [0.31]	1.66** (0.77) [0.87]	-0.11 (1.10) [-0.05]	-1.00 (0.70) [-0.44]	-0.35 (0.55) [-0.09]	-0.04 (0.53) [-0.01]
Average income of minority applicants ($ thousands)	0.001 (0.0008) [0.0005]	0.0009 (0.0008) [0.0005]	-0.0001 (0.0007) [-0.00006]	-0.0002 (0.0007) [-0.00009]	0.001 (0.002) [0.0003]	0.001 (0.002) [0.0003]
Average loan-to-income ratio of minority applicants	0.02 (0.05) [0.01]	0.02 (0.05) [0.01]	-0.009 (0.03) [-0.004]	-0.02 (0.03) [-0.007]	-0.31* (0.20) [-0.09]	-0.37** (0.20) [-0.10]
Constant	0.62** (0.27) [0.33]	0.62** (0.27) [0.33]	0.74** (0.25) [0.35]	0.80** (0.24) [0.36]	1.49** (0.30) [0.39]	1.50** (0.30) [0.39]
σ	0.43 (0.04)	0.42 (0.04)	0.29 (0.03)	0.29 (0.03)	0.43 (0.05)	0.43 (0.05)
Number of observations	106	106	96	96	75	75

* Significant at the 10% level

** Significant at the 5% level

Notes: Standard errors are in parentheses. The marginal effects are in brackets. For each product, the dependent variable is the fraction of the minority applications that are approved. The equations also include dummy variables for savings banks and money center banks.

5.3 Robustness Tests

The results were tested for robustness in several ways, two of which are discussed in this section. First, the Tobit equations were re-estimated without the smaller banks (defined as those with fewer than ten branches in MSAs) to test whether the results are driven by the smaller banks. Smaller banks are more likely to experience wide fluctuations in the fraction of minority applications and lending across years than the larger banks. Thus, it is possible that the results above may reflect the activities of smaller banks for a particular year. The findings based the 38 largest banks are qualitatively similar to those based on all banks. The fraction of minority population in a bank's market and the fraction of branches in MMAs significantly increase the volume of minority applications and minority lending, but not the minority approval rate. Hence, the results do not appear to be driven by the smaller banks.

Second, a possible simultaneity bias was considered. If banks locate branches in areas where they expect a high volume of minority applications and lending, then there could be a positive feedback between the racial composition of a bank's market and its volume of minority lending, and the racial composition variables could be correlated with the error term in the Tobit equations. The presence of simultaneity bias is not clear a priori, since a bank's decision to open and close branches prior to and in 1993 are most likely based on their past volume of mortgage transactions and thus not contemporaneous with the 1993 transactions.

Furthermore, if the potential for mortgage lending in an area attracts bank branches, then this actually strengthens the argument that branches are important for mortgage lending. Branch offices are expensive to open[28] and close such that banks would prefer other means of attracting creditworthy applicants (e.g., advertising) if such methods were as effective. Thus, if a bank turns to branching to attain mortgage lending in a minority area, it underlines the unique and important role of branch locations.

Nevertheless, to test the presence of a simultaneity bias, I re-estimated the Tobit equations with two-stage least square (2SLS). The instruments include the population and economic characteristics of counties where each bank did not have branches as of 1993. The characteristics of the out-market counties affect the banks' past decisions on branch locations and are correlated with the explanatory variables that reflect the racial composition of banks' markets. On the other hand, characteristics of counties where a bank does not have branches presumably does not impact the volume of the bank's minority mortgage transactions. Whereas characteristics of nearby Census tracts outside a bank's market may impact its mortgage activities due to spillover effects (i.e., bank's customers living in out-market tracts apply at the nearest branch), it is less likely across counties.[29]

The 2SLS results show that the percent of minority population in a bank's market significantly increases the bank's minority lending and volume of minority applications, but not its approval rate.[30] They confirm the conclusions of the Tobit equations. In addition, the 2SLS coefficients are

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[28]A recent estimate of the opening cost of a branch is $1 million (Radecki et al. 1996).

[29]The details of the 2SLS estimation, as well as the results, are available from the author.

[30]Results are similar with the fraction of branches in mostly minority areas as the measure of the racial composition.

similar in magnitude to the marginal effects computed for the Tobit coefficients. Thus, they do not suggest a severe simultaneity bias that invalidates the Tobit findings.

6   Discussion of Results

The findings in this study provide insights in the mechanism via which bank branch locations impact minority lending. The presence of branches in minority areas increases a bank's volume of minority applications and hence its minority lending; however, branch locations do not appear to affect a bank's minority approval rate. These results are robust for home purchase, refinancing, and home improvement loans. The consistency across the loan products is noteworthy, since they have very different lending criteria.[31]

Community activists argue that banks take in deposits but do not lend in minority areas, and some even charge that branches in minority areas discriminate by discouraging minority consumers from even applying. The results in Tables 6 and 7 clearly invalidate these charges. The degree to which a bank operates in minority areas has a direct effect on its volume of minority applications and minority loans.

On the other hand, the hypothesis that consumers simply apply at the nearest branch cannot be ruled out. If they view branch offices as homogeneous except in distance, then we would observe banks with branches in minority areas receive a higher fraction of minority applications but not necessarily approve a higher fraction of minority applications. One evidence that consumers view branches as homogeneous is the very low correlation between the fraction of minority applications at a bank and its minority approval rate (0.07); this suggests that minority consumers do not strategically select where they apply based on the bank's overall minority approval rate.

The evidence is also consistent with the idea that banks do not develop specialized skills in attracting and approving minority loans. For example, none of the bank characteristics considered in the Tobit analysis have a consistent, significant effect on minority mortgage transactions. The results thus suggest that any bank that has branches in minority areas will receive more minority applications and originate relatively more minority loans.

The findings support the regulators' view that branch presence in minority areas can raise a bank's volume of minority lending. However, the ultimate goal is to increase the total minority lending and just not at individual banks. In other words, does the minority lending at a bank increase because it discovers "hidden," well-qualified minority borrowers as a result of opening branches in minority areas, or because it diverts business from other banks with existing branches in the same or nearby areas?

To consider the impact of branches on minority lending in an area, I regressed the total num-

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[31]For example, home purchase and refinancing loans are secured, while home improvement loans are typically unsecured.

ber of loans and the number of minority loans by Census tract on the number of bank branches, controlling for other tract characteristics.[32] The results show the total number of loans rises with the number of branches in a tract, but the number of minority loans stays constant. This is consistent with the notion that there is no large pool of hidden, well-qualified minority borrowers. Unless there is discrimination in the loan approval process throughout New York, these findings suggest that the current policy may be a "beggar-thy-neighbor," whereby banks that open branches in minority areas increase their minority applications and minority loans at the expense of other banks with existing branches in those areas. In this case, the policy of compelling banks to open branches in minority areas will fail to increase total minority lending in those areas.

7 Conclusion

This study presents the first estimates of the impact of bank branch locations on mortgage lending, particularly to minority consumers. Based on 1993 HMDA data for 146 commercial and savings banks in New York State, the analysis shows that banks operating in minority areas receive a higher fraction of their mortgage applications from minority consumers. In fact, a one-to-one relationship between the percent of minority population in a bank's market and the percent of minority applications cannot be rejected for home purchase and refinancing loans. Furthermore, ANOVA results show that most of the variation in the volume of minority lending across banks is attributable to differences in the volume of minority applications and not to differences in the minority approval rate. This suggests that branch locations have an economically significant, as well as a statistically significant, impact on minority lending through their effect on the volume of minority applications.

The strong relationship between branch presence in minority areas and a bank's volume of minority applications contradicts the claim that banks discriminate by discouraging minority consumers from applying for mortgage loans. They also counter the argument that technological innovations have made branch offices obsolete for mortgage lending. The results are consistent with the hypothesis that consumers apply for mortgage loans at nearby branches.[33] They suggest that the current policy of emphasizing branch presence in minority area may succeed in increasing minority applications and minority lending at individual banks. However, it may be a "beggar-thy-neighbor" policy whereby the increase in minority lending at institutions that open branches in minority areas comes at the expense of other banks with existing branches in the same or nearby areas. Further research on the impact of bank branches for the total minority lending in an area may shed more light on the effectiveness of the regulatory emphasis on branch locations.

Banks that operate primarily in minority areas do not necessarily approve a higher percentage of minority applications than banks that operate in non-minority areas. This suggests that, at least

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[32]The following tract characteristics are included in the equations: population, total number of owner-occupied housing units, median value of housing, average income of households, and percent of minority population.

[33]Evidence on mortgage rates (Rhoades 1992) also suggests that mortgage markets are localized. The impact of branch locations on mortgage rates is not yet known.

in mortgage lending, the presence of branches may not help banks learn about consumers and vice versa. The impact of branch locations on minority applications and lending, but not on minority approval rates, is robust and is observed for home purchase, refinancing, and home improvement loans.

Most of the past studies on discrimination in mortgage lending have focused on the loan approval process, yet this paper clearly indicates that it is the volume of minority applications and not minority approval rates that matter in explaining the variation in minority lending across banks. This paper also shows the positive impact of a bank's branches in minority areas on its volume of minority applications and thereby on its minority lending. Further research on factors that affect minority applications may provide as valuable insights as the past studies on minority approval rates.

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