Does Race Affect Mortgage Application Approval?

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Introduction

Consumers expect mortgage lending decisions to be impartial about an applicant's race, based solely on mathematical criteria that evaluate the likelihood an individual will be able to repay the loan. However, early analyses of mortgage approval rates in Boston in 1990 indicate that minorities are more than twice as likely as whites to be denied. These initial findings are not conclusive since they did not take into account whether the difference in loan approval were due to racial bias or other factors such as credit worthiness.

If approval rates are being affected by the race of applicants, it is a serious example of how racial bias can contribute to social and economic inequality. Home ownership is an important means of building wealth and also has numerous intangible benefits. We expect homeowners to remain longer in their neighborhoods, build strong social ties, and contribute to local initiatives that create social welfare. Taken as a whole, bias in mortgage lending could have a cascading effect that depresses minority communities on multiple fronts, making economic and social mobility exponentially more difficult for them.

Our analysis includes variables for the debt to income and loan to value ratios of applicants as well as whether or not they meet the bank's credit guidelines. We find that after taking account of these variables, Whites are more likely than Blacks or Hispanics in our sample to be approved for mortgages.

Econometric Model and Estimation Method

We utilize Logit and Probit regression models to evaluate the effect of race on lending decisions. Logit and Probit models are appropriate where the outcome being evaluated is binary, in this case whether a loan was approved or not approved.

We control for three variables: debt to income ratio, loan to value ratio, and whether applicants meet the bank's credit guidelines.

Data

Our data was gathered in 1990 from lending institutions in Boston, Massachusetts. The full data set contained 1,989 observations of Whites, Blacks, and Hispanics. Given the small number of minority mortgage applications in the measurement period, all Black and Hispanic applications were included in the data set. A random sample of White applicants were added to complete the

data. In addition to applicant race, the data includes whether or not a loan was approved, if the applicant's credit history met the loan guidelines, the applicant's overall debt obligations compared to their income, whether or not the applicant was male or married, and the loan to value ratio of the desired home.

We filtered out records with missing loan to guideline data which we believe to be a key variable. We also filtered out applicants with a loan to value percentage higher than 100, which we believed would not be approved except in circumstances where the applicants were outliers in terms of wealth or credit-worthiness. This leaves us with a total of 1,888 records.

The descriptive statistics in Table 1 show that non-Hispanic whites have the lowest median loan to purchase price percentage (74% versus 82% for Blacks and 84% for Hispanics). Whites also had lower median debt obligations as a percentage of their income (32% versus 35% for Blacks and 33.4% for Hispanics). It should be noted that in terms of debt obligations, the averages for all three groups fall under the guidelines (maximum debt to income of 36%) that are recommended for mortgages being sold on the secondary market.[1]

Table 1: Descriptive Statistics

Variable	Overall	Non-Hispanic White	Hispanic	Non-Hispanic Black
Loan Amount To Value (in %)				
Mean (SD)	75.44 (16.51)	74.08 (16.87)	83.78 (10.81)	82.43 (12.48)
Min - Max	2.00 – 100.00	2.00 – 100.00	40.00 - 96.00	28.99 - 99.76
Other Obligations (in %)				
Mean (SD)	32.36 (8.06)	31.99 (7.98)	33.41 (8.52)	34.95 (7.98)
Min - Max	0.00 – 95.00	0.00 - 95.00	14.60 - 62.00	5.60 - 63.00
Approve (%)	88%	91%	78%	66%
Credit Guidelines (%)	91%	94%	87%	72%
Sample Size (n)	1,888	1,597	104	187

[1] Munnell et al., "Mortgage Lending in Boston: Interpreting HDMA Data," Federal Reserve Bank of Boston, 1992.

Overall, we see that 94% of Whites met the loan guidelines and 91% were approved, 72% of Blacks met the loan guidelines and 66% were approved, and 87% of Hispanics met the loan guidelines and 78% were approved. Not only are Whites the least leveraged group when applying for mortgages, they are also putting more money down (indicated by their lower Loan to Value). When we consider the standard deviations of Loan to Value we see that a full 16% of Whites financed only 58% of their homes, while only approximately 2% of Hispanics and Blacks did the same. Highly leveraged individuals are more likely to default since smaller changes in their financial position can make them unable to meet their obligations.

Results

Logit Model

Our null hypothesis for both models is that all probabilities of loan approval among races are the same, and the alternative is that all probabilities of loan approval among races are not the same.

Our Logit model of estimated lending decisions (shown below as Table 2) illustrates that Loan to Value (LOANPRC) and Other Obligations (OBRAT) have a negative relationship with estimated loan approval based on the estimated parameters, which indicates that higher values (in percentages) of LOANPRC and OBRAT would lower the probability of loan approval. Also, Credit Guidelines (GDLIN) has a positive relationship with loan approval, which makes sense given that the probability of loan approval for an applicant who meets the credit guidelines is higher than the probability of loan approval for an applicant who doesn't meet them. All of these variables are statistically significant at the 1% level. Furthermore, Whites have a higher probability of loan approval on average compared to Blacks (significant at the 1% level) and Hispanics (significant at the 1% level) respectively after controlling for ORRAT, LOANPRC and GDLIN.

Odds ratios are correlated with estimated coefficients. Variables with an odds ratio less than 1 usually have a negative estimated coefficient, indicating a decrease in the odds of loan approval and vice versa. Thus, an increase of 1 percentage point in LOANPRC causes an estimated decrease of 1.7% in the odds of approval after controlling for other variables. Similarly, an

increase of 1 percentage point in OBRAT causes an estimated decrease of 3.1% in the odds of approval after controlling for other variables.

Holding other variables the same, applicants who meet the credit guidelines are estimated to have 41.96 times higher odds of loan approval than applicants who do not meet the credit guidelines. We also find that holding all other variables constant, odds of loan approval for White applicants are 2.5 times and 2.28 times greater compared to Blacks and Hispanics respectively.

Table 2: Estimated Logit Model

	Dependent Variable: Approve	
	Estimated Coefficient	**Odds Ratio**
(Intercept)	1.533** (0.699)	4.631
Other Obligations (OBRAT)	-0.031*** (0.011)	0.969
Loan to Value (LOANPRC)	-0.017** (0.007)	0.983
Credit Guidelines (GDLIN)	3.737*** (0.221)	41.961
Non-Hispanic Black	-0.917*** (0.246)	0.400
Hispanic	-0.827** (0.324)	0.438
No. of Observations	1,888	
Log-Likelihood	-451.261	

Notes: *Standard Errors are parenthesis.*

*** significant at 1%, ** significant at 5%, * significant at 10%*

Reference category is Non-Hispanic *White.*

Predicted probability of loan approval using the logit model (Table 3) shows scenarios of predicted probabilities when applicants who meet credit guidelines and do not meet credit guidelines vary by different races with average other obligations and loan to value. The predicted probability of loan approval from the logit model for Whites is generally higher than other races (Hispanic and Black). For example, a White applicant who meets credit guidelines is 5 percentage points higher in predicted probability

than a Hispanic applicant with OBRAT (= 32.4%) and LOANPRC (= 75.4%) at the mean of the entire valid data set. The gap is wider for White applicants who meet credit guidelines; the are approximately 15 percentage points higher than Hispanics with OBRAT and LOANPRC at the mean of the entire valid data set.

With the data presented in tables 2 and 3 using the logit model, we can conclude that there is strong evidence to reject the null hypothesis that all probabilities of loan approval among races are the same. Hence, there is discrimination among races.

Table 3: Predicted Probability of Loan Approval (Logit Model)

	Race		
	White	Hispanic	Black
Meeting Credit Guidelines	0.953	0.898	0.889
Not Meeting Credit Guidelines	0.324	0.173	0.160

Note: Mean OBRAT: 32.4%, Mean LOANPRC: 75.4%

OBRAT and LOANPRC are evaluated at the mean of the entire valid data set

Probit Model

Estimated parameters from the probit model are shown in Table 4. The coefficient estimates in the probit model have the same patterns as the logit model in terms of signs and statistical significances. Hence, we can conclude that our estimates from both models are robust.

Table 4: Estimated Probit Model

	Dependent Variable: Approve
	Estimated Co-efficient
(Intercept)	0.583* (0.341)
Other Obligations (OBRAT)	-0.015*** (0.006)
Loan to Value (LOANPRC)	-0.008** (0.003)
Credit Guidelines (GDLIN)	2.162*** (0.124)

Non-Hispanic Black	-0.473*** (0.129)
Hispanic	-0.422** (0.169)
No. of Observations	1,888
Log-Likelihood	-451.182
Notes: *Standard Errors are in parenthesis.* *** significant at 0.1%, * significant at 5%, . significant at 10% *Reference category is* Non-Hispanic *White.*	

Predicted probability of loan approval using the probit model (Table 5) shows scenarios of predicted probabilities when applicants who meet credit guidelines and do not meet credit guidelines vary by race (using the mean of the entire valid data set of other obligations and loan to value). The predicted probability of loan approval for Whites is generally higher than other races (Hispanic and Black). For example, a White applicant who met credit guidelines is 6 percentage points higher in predicted probability than a Hispanic applicant with OBRAT (= 32.4%) and LOANPRC (= 75.4%) at the mean of the entire valid data set. The gap is wider for White applicants who met credit guidelines by approximately 13 percentage points compared to Hispanic applicants with OBRAT and LOANPRC at the mean of the entire valid data set.

Similar to the logit model, with data presented in both table 4 and 5 using the probit model, we can conclude that there is strong evidence to reject the null hypothesis that all probabilities of loan approval among races are the same. Hence, there is discrimination among races.

Table 5: Predicted Probability of Loan Approval (Probit Model)

	Race		
	White	Hispanic	Black
Meeting Credit Guidelines	0.953	0.894	0.885
Not Meeting Credit Guidelines	0.312	0.181	0.168
Note: Mean OBRAT: 32.4%, Mean LOANPRC: 75.4% OBRAT and LOANPRC are evaluated at the mean of the entire valid data set			

Conclusions

Our expanded analysis of loan approval which controls for credit history, debt to income ratio, and whether applicants met credit guidelines suggests that Whites are given preferential treatment over Blacks and Hispanics. However, while our models are robust and the coefficients of our variables are highly statistically significant, there are other variables that could help explain the gap in approval rates between races.

One possible variable could be an applicant's level of education which could factor into both their income but also their ability to navigate the lending process. Another variable could be the location of the desired homes. If some groups of people are seeking to buy in less desirable neighborhoods that lenders believe may decrease in value over time, this could cause higher rejections.

While we would recommend further study of the above issues, we also believe there is already strong evidence indicating that racial discrimination is present in the mortgage lending process.