John Carroll University

The Journal of Economics and Politics

Volume 8 | Issue 1 Article 5

1993

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Recommended Citation

Premus, Robert and Blair, John P. (1993) "DETERMINANTS OF MORTGAGE LENDING FLOWS AMONG NEIGHBORHOODS: SOME EMPIRICAL EVIDENCE," *The Journal of Economics and Politics*: Vol. 8: Iss. 1, Article 5.
DOI: https://doi.org/10.59604/1046-2309.1099
Available at: https://collected.jcu.edu/jep/vol8/iss1/5

The Ohio Journal of Economics and Politics, V. 8, No. 1.

DETERMINANTS OF MORTGAGE LENDING FLOWS AMONG NEIGHBORHOODS: SOME EMPIRICAL EVIDENCE

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ABSTRACT

THE LITERATURE ON MORTGAGE LENDING SUGGESTS THAT DISCRIMINATION OCCURS IN SOME AREAS AND NOT IN OTHERS. HENCE, THERE IS A NEED TO EXAMINE THE EXTENT OF MORTGAGE DISCRIMINATION IN PARTICULAR REGIONS RATHER THAN RELYING ON GENERALIZATIONS FOR ALL REGIONS. THIS PAPER TESTS MORTGAGE LENDING DISCRIMINATION IN MINORITY AREAS IN THE DAYTON MSA.

DIFFERENT FORMS OF POOLED TIME SERIES AND CROSS SECTION MODELS ARE DEVELOPED. THE DEPENDENT VARIABLE IS TOTAL LOAN VOLUME PER RESIDENTIAL HOUSING UNIT BY CENSUS TRACT. WE FOUND EVIDENCE OF A NEGATIVE RELATIONSHIP BETWEEN THE PERCENTAGE OF MINORITY POPULATION AND LENDING VOLUME HOLDING CONSTANT THE AGE OF THE HOUSING STOCK, INCOME, AND CITY/SUBURBAN LOCATION.

I. INTRODUCTION

An important issue in the urban policy literature is the extent to which racial discrimination in residential mortgage markets may be contributing--directly or indirectly--to the decline of older, more racially mixed neighborhoods. One reason this might occur is if institutional lenders held biases against minority and older neighborhoods when they make mortgage loans.

Findings on mortgage discrimination are diverse and controversial in terms of statistical methods and empirical findings. However, the literature appears to indicate that discrimination in mortgage lending occurs in some areas and not in others.[1] Hence, the need to examine the issue for specific regions. For this paper, we test for the presence of lending discrimination in Dayton, Ohio.

Our study focuses on the determinants of mortgage credit flows among census tract neighborhoods in the Dayton metropolitan region. Data for the analysis comes from HMDA reports on the lending activities of Dayton regional mortgage lenders provided by the Federal Reserve System. We chose to use "census aggregation reports" so we could focus our analysis on differences in

mortgage credit flows among neighborhoods within a metropolitan region. Neighborhoods in our study refer to the 246 census tracts in the four county Dayton metropolitan statistical area. The study period for our analysis includes pooled time series and cross sectional data on annual mortgage credit flows among census tracts from 1985-1990. Use test nonlinear model specifications against the result of a linear regression model. Also, rather than estimating separate city and suburban equations, we account for suburbanization directly through the use of a dummy variable.

We begin our analysis with a discussion of the theory of discrimination in financial institutions and how their loan decisions can be influenced by neighborhood characteristics, such as income and race. This theory draws upon the work of Arrow and Becker on labor market discrimination.[2] To a significant degree, both labor and housing are regional markets and are therefore both subject to the influence of racial prejudices within the regions. From this theory, an econometric model is developed and used to test the null hypothesis that racial discrimination is absent in institutional loan policies. The model is tested in the Dayton metropolitan region where the null hypothesis is rejected. A discussion of the implications of our research results concludes the paper.

II. Theory of Financial Institutions

Financial institutions are concerned with the total liquidity and profitability of their respective organizations. The balancing act of executives of financial institutions is to choose the optimum trade-off between profitability and liquidity. If an institution can enhance the quality of its assets without reducing profitability, stockholders, federal and state regulators and the larger financial community will view it as "less risky" and deserving of their confidence and continued financial support. Creating a public image of a well managed, low risk institution is an important "reputation good" financial institutions relish.

The general view of financial institutions as being concerned with total liquidity and profitability has important implications for their individual and collective behavior in the mortgage market. Mortgage credit is the second largest use of funds of commercial banks and the largest loan asset component of savings and loan associations. As a result, these institutions can be expected to place a great deal of emphasis on the "quality" of their mortgage loans.

As stated, for most mortgage lenders, the majority of mortgage loans will be confined to the primary region in which the loans are originated. Thus, local lending organizations will have an enormous influence on the spatial flow of mortgage credit within their housing market area.

What neighborhood characteristics are likely to influence institutional lending behavior? Asset management theory would suggest that institutional lenders consider income characteristics of potential borrowers when processing loan applications. The ability of the borrowers to meet payment schedules

https://collected.jcu.edu/jep/vol8/iss1/5
DOI: 10.59604/1046-2309.1099

The Ohio Journal of Economics and Politics, V. 8, No. 1.

is a key factor in the financial market's perceptions of "quality loans." Thus, one would expect that communities with a larger percent of high income residents applying for mortgage credit would receive a higher volume of mortgage loan activity, other things equal.

In cases of foreclosure, financial institutions receive protection by liquidating their problem investments. Obviously, their expectations of future sales opportunities and trends in housing values are key factors in judging the future liquidity of mortgage loans. In general, loans originating in older, declining neighborhoods would be considered a higher risk than loans originating from otherwise identical individuals residing in more stable and growing communities. For this reason, the flow of mortgage credit to stagnant and declining neighborhoods would be expected to be lower than it would be to more stable and expanding neighborhoods, other things equal.

Race could be a factor in accounting for interneighborhood differences in residential mortgage credit flows. This would occur if racial prejudice enters the utility functions of lenders or home buyers. If lenders are prejudiced, their personal preferences could be expected to influence mortgage credit loans at the margin. Thus, other things equal, neighborhoods that have a disproportionally large number of minority home loan applicants would be expected to receive a lower proportion of the mortgage credit.

If home buyers are prejudiced, it is conceivable that home values in racially mixed neighborhoods would negatively reflect the value white home owners place on their dislike for minorities. In this case, lenders, even if not prejudiced themselves, would nonetheless tend to discriminate against racially mixed communities. Racial mix would detract from the perceived quality of mortgage loans to the extent that the liquidity of mortgage loans would be affected. Also, the "tipping" literature suggests that after a community reaches a certain critical mass of minority residents, perhaps 30 percent, white flight from the neighborhood might occur. If this occurred, housing values in the neighborhood would become problematic, making the neighborhood even less attractive to mortgage lenders. In any case, we would expect that in the presence of discrimination, the relative mortgage loan volume would be lower in racially mixed neighborhoods.

Finally, the growth of new communities tends to be located in the more spacious suburban communities. To a significant degree, the historical movement of people from the central city to the suburbs has been driven by economic factors, such as innovations in transportation that lowered commuting costs and rising overall affluence. The lower cost of land in undeveloped suburban areas has historically served as a powerful lure for the urban citizens as their economic prospects improved. The desire of mortgage lenders to protect the liquidity of their loan assets would be expected to result in a larger share of total mortgage loans going to suburban applicants, other things equal.

III. The Model

The theory of institutional behavior in regional mortgage markets can be expressed more formally as follows:

Y = F(MINCP, MINOP, COMMUNITY AGE, SUBURBS/CENTRAL CITY)

where:

Y = total mortgage loans received by residents of a neighborhood over a specified period of time, adjusted for neighborhood size;

MINCP = the median income of the neighborhood residents as a percent of metropolitan income;
MINOP = the racial make-up of the neighborhood as measured by percent of minority population residing in the neighborhood;
AGE = the age of the community. In our study, we use dummy variables to represent ten year increments in median age of housing in each census tract;
CENTRAL = A dummy variable, CENTRAL CITY = 1 for census tracts located in the central city and SUBURB = 0 for suburban census tract neighborhoods; and e = an error term reflecting random disturbances.

The dependent variable, Y, in our model is constructed by aggregating total VHA/FA and conventional mortgage loans received by residents of each census tract over the 1985-90 period. The total volume of mortgage credit is divided by total residential units in each census tract to account for size differences among the neighborhoods. These data are obtained from the Census Aggregation Reports and are based on actual number and amount of mortgage loans extended by Dayton area financial institutions.

The racial mix of a neighborhood is measured as the percent of minority residents residing in the neighborhood (MINOP). In a world without racial prejudice, the coefficient for MINOP would not be expected to be statistically significant. A negative coefficient would be expected if racial prejudice enters as a significant factor in mortgage loan decisions.

The age of the community in our model is captured by a series of dummy variables as follows:

MHOUS1 = 1 if the median age of homes was 1940 or earlier and 0 otherwise;
MHOUS2 = 1 if the median age of homes was between 1940 and 1950, and 0 otherwise;
MHOUS3 = 1 if the median age of homes was between 1950 and 1960, and 0 otherwise;
MHOUS4 = 1 if the median age of homes was between 1960-1970, and 0 otherwise; and
MHOUS5 = 1 if the median age of homes was 1970 or above and 0 otherwise.

Other things equal, the older the neighborhood the larger the negative influence it is expected

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The Ohio Journal of Economics and Politics, V. 8, No. 1.

to have on mortgage loan behavior. Younger communities, as measured by the median age of their housing stock, are expected to be a positive attraction to mortgage credit from the lender's perspective. Thus, in our model MHOUS5 would be expected to have a positive influence whereas MHOUS1 or MHOUS2 would be expected to have negative coefficients. The coefficients for MHOUS3 and MHOUS4 are likely to be indeterminant, a priori.

Next, a dummy variable is used to capture the influence of any decentralization trends in the region on mortgage lending behavior. For this purpose, Central City = 1 if the neighborhood is located in the central city and SUBURB = 0 if the neighborhood is located within the Dayton MSA but outside the central city. Since the decentralization trend has been from the central city to the suburbs, the sign of the coefficient for the central city is expected to be negative.

Finally, a log linear form of the regression was chosen to capture the expected nonlinearities in the relationship. This form of the equation has the advantage that the estimated regression coefficients can be interpreted as elasticity measures. Semilog and linear regressions are also estimated for comparison.

A pooled time series and cross section approach is used for each of the regressions. This procedure was used to improve the efficiency of our regression estimates by increasing the number of observations from 246 census tracts to 1,180 observations. This technique helped to successfully overcome estimation problems that arose because of the comparatively small size of the Dayton SMA market. The ordinary least squares method was used to estimate coefficients for each of the equations.

IV. The Results

The results are presented in Table 1 for three versions of the model. Column 1 presents the results of the log linear regression. Column 2 presents the regression estimates for the semilog version, of the form $LnY = B_1X_1 + B_2X_2 \ldots B_nX_2$. The last column presents the results of estimating a linear version of the model. The dependent variable in each of the regressions is total loan volume per residential housing unit in each census tract for the year 1985 through 1990.

TABLE 1
REGRESSION RESULTS

Y	(1)	(2)	(3)
INTERCEPT	-6.179 (11.04)*	0.077 (0.27)	1.200 (1.48)
MHOUS2	-0.456 (4.76)*	-0.254 (2.79)*	-2.870 (4.29)*
MHOUS3	-0.512 (6.35)*	-0.302 (4.03)*	-3.112 (5.13)*
MHOUS4	-0.537 (6.23)*	-0.302 (4.03)*	-3.112 (5.13)*
MHOUS5	-0.302 (2.54)**	0.427 (3.80)*	0.194 (0.29)
MINOP	-0.115 *4.88)*	-0.012 (7.83)*	-0.004 (0.43)
MINCP	1.748 (16.43)*	0.015 (17.01)*	0.046 (5.80)*
CITY	-0.809 (3.03)*	-0.797 (3.02)*	-1.241 (2.56)*
$\bar{R}^2$	44%	45%	6%

The t-values are in parentheses below the respective regression coefficients. A single asterisk indicates significance at the 99 percent confidence level or above. A double asterisk indicates a 95 percent or better level of confidence.

The overall statistical properties of the regression models in columns 1 and 2 are quite impressive. All of the regression coefficients in both nonlinear models are of the expected signs and

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The Ohio Journal of Economics and Politics, V. 8, No. 1.

they are statistically significant at or above the 5 percent level. The regression results are also quite robust and exhibit no serious signs of multicolinearity problems. The adjusted R^2 is 44 percent for the column 1 and 45 percent for the column 2 regressions, respectively.

As expected, there is a strong negative relationship between the age of neighborhoods, as measured by the median age of its housing stock, and the mortgage loan volume a neighborhood can expect to attract, other things equal. The coefficients for MHOUS2--median housing age 1940-50, MHOUS3--median housing age 1950-1960, and MHOUS4--median housing age 1960-1970 are negative in both of the nonlinear equations. In the equations, each ten years of difference in community median age beyond 1970 contributed to a net reduction in mortgage loan activity in that neighborhood. In contrast, the coefficient for new communities (MHOUS5), defined as neighborhoods with a median housing age of 1970 or later, was positive and statistically significant. Our results suggest that, other things equal, mortgage lenders tend to favor new communities over older communities, contrary to Shlay.[3] New communities apparently provide greater assurances of more stable and predictable housing values over the life of loans. As discussed, financial institutions would view prospective asset values as a positive factor in evaluating loan quality, an important factor in total liquidity management of their companies.

The racial mix (MINOP) of the population was found to be a determining factor in mortgage loan volume flow among neighborhoods. The negative coefficient for MINOP (-0.115), in column 1, suggests that a one percentage point increase in the minority composition of a neighborhood will result in a 0.115 percent reduction in loan volume to that neighborhood, other things equal. The coefficient for MINOP (-.012) in column 2 suggests that the **growth** of loan volume will be cut .012 percent for each percentage point increase in the minority racial mix of communities. Both coefficients are statistically significant at the 1 percent level.

Several observations can be made about the influence of race on institutional mortgage lending behavior. First, the evidence in our study is consistent with the Arrow-Becker hypothesis on racial discrimination as we applied it to mortgage lending behavior. The Dayton area mortgage market exhibits the same pattern of lending bias against older, minority communities that was found by other studies in other cities.

A second observation is that the size of the regression coefficients for race--elasticity coefficient in column 1--is quite small. This was also the case in other metropolitan area housing market studies but it is more pronounced in our study. This suggests that while race is a negative factor in institutional lending behavior, its overall impact is not large. Thus, it would appear that remedial actions to correct the problem should not be a major financial burden to regional mortgage

lenders.

Third, Hula, in his extensive review of the literature, has pointed out that race tends to enter significantly in nonlinear regressions but insignificantly in linear regressions. We test this hypothesis by regressing loan volume per housing unit (Y) on a linear form of the equation. The results, in column 3, show that the coefficient for race becomes statistically insignificant, at a reasonable level of confidence, when this procedure is tried. The low explanatory power of the linear model raise questions about the validity of previous research that used the technique. Thus, our results support the hypothesis that nonlinearity plays an important role in detecting the influence of racial discrimination in housing market lending patterns.[4]

Fourth, while the nonlinear relationship between race and institutional mortgage lending behavior is consistent with the tipping literature, we were unable to find direct evidence of the tipping phenomenon. As stated, the tipping hypothesis implies that the transition of a neighborhood from a predominantly white community to a predominantly minority community will accelerate after a certain "critical mass" of minority residents is reached. If this occurred, it should create a discontinuity in the relationship between mortgage loan volume in the community at the point of the critical mass of minority residents. We tested for the tipping point by using a dummy variable for various levels of percent minority residents, such as 5 and 10 percent, in each neighborhood. Our technique failed to reveal a particular tipping point when a census tract neighborhood would transition more quickly to minority status.

The relative affluence of a neighborhood (MINCP), a market factor, was found to be the single most important determinant of institutional lending behavior. The coefficient for MINCP in column 1 implies that each percentage point increase in median income of a neighborhood, above the median income in the region, will attract a 1.75 percent increase in mortgage loans, other things equal. The results in column 2 suggest that a one percent increase in the growth of the MINCP will result in a 0.17 percentage point increase in mortgage loan volume to the community. As expected, extending mortgage loans to high income borrowers is considered a superior good by mortgage credit institutions.

Also, the coefficient for the dummy variable for a central city location (Central city = 1) is statistically significant and negative in columns 1 and 2. The hypothesized negative coefficient for central city locations and positive coefficient for suburban locations was intended to capture the general shift of metropolitan area housing activities from the central city to the suburbs. The results of our regressions suggest that the decentralization trend, although minor in the short run, can be a contributing factor in long-term housing market lending patterns within metropolitan regions.

Finally, a technical note is in order. The overall explanatory power of our model (adjusted R^2 = .45) is less than that reported in a number of other studies. The reason is that other studies tend to include a larger number of explanatory variables. However, we found that the addition of other

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The Ohio Journal of Economics and Politics, V. 8, No. 1.

explanatory variables introduced multicolinearity problems and reduced the efficiency of our parameters' estimates. Of course, one could argue that our model may suffer from an "omitted variable" problem. We raise this point because the issue of model size--especially in cross section studies that incorporate a large number of explanatory variables--has not received much attention in the housing market studies that focus on racial bias.

V. Summary and Conclusions

The log linear and semilog equations were found to perform better than linear regressions in predicting institutional mortgage lending patterns within metropolitan regions. Applying the nonlinear equations to HMDA data in the Dayton metropolitan region revealed evidence that the racial mix of a community exerted a negative influence on the total number of loans per housing unit a neighborhood could attract, other things equal. This result is consistent with other studies that also used a log linear functional form in their regression equations. Our model is simpler than the others in the literature because it used fewer explanatory variables, but some may consider this a virtue of our approach.

As stated, a significant number of other studies have also found evidence that the racial mix of a community exerts an influence on how institutional lenders evaluate mortgage loan applications originating from within that community. The evidence indicates that the severity of the problem varied considerably across the metropolitan regions of the country. This suggests that resolving these biases should probably be addressed at the metropolitan level, on an area-by-area basis. The disparate findings also raise an interesting issue for further study.

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DOI: 10.59604/1046-2309.1099