

Discrimination, Lending Practices and Housing Values: Preliminary Evidence from the Houston Market

Andrew Holmes*
Joe F. James*

Abstract. At the center of the debate on racially induced price differentials in housing is the issue of discrimination. This research studies the impact that ethnic as well as racial composition in a neighborhood exerts on value. In an attempt to extend previous efforts, aggregate data is used to study the effects of discrimination and lending bias on residential real estate in Houston, Texas. The data do not support allegations of systematic bias in the mortgage lending process.

Introduction

The economic forces that influence the value of housing have received much attention in the literature (among others, see Anderson and Funderburk, 1989, and Greaves, 1984). Further, the effect that noneconomic factors such as race exert on housing prices has also been studied. Inspection of this aspect of the literature leaves the student of the capital markets particularly confused. Straszheim (1974, 1975), Olsen (1974), and Daniels (1975) all conclude that the value of homes in minority (usually Black) areas is lower than should otherwise be expected. Lapham (1971), Schnare (1976) and Smith (1981) present evidence that neighborhood racial composition has no significant impact on housing values. Finally, Kain and Quigley (1970, 1975), Yinger (1978) and Vaughan (1975) conclude that home values in Black areas are higher than in similar White areas. With conclusions that differ in magnitude and sign, the issue of the impact of race on housing prices is obviously still open.

At the center of the debate on racially induced price differentials in housing is the issue of discrimination. Current research divides the sources of discrimination into two categories: discrimination against individuals which will henceforth be referred to as discrimination, and discrimination against neighborhoods which is commonly called redlining. Discrimination from these two sources is related but separable.

Discrimination against individual market participants impacts value one transaction at a time. For instance, discriminatory behavior on the part of a real estate broker is likely to be based on the individuals involved in a specific transaction. That is, due to the personal nature of the search facilitation process the bias of an individual agent could affect the outcome of a specific transaction without having a measurable effect on the value of other homes in the area. Likewise, it is also possible that bigotry on the part of one of the principals involved in the transaction could have a similar localized effect.

**College of Business Administration, P.O. Box 2056, Sam Houston State University, Huntsville, Texas 77341. Date Revised—May 1995; Accepted—June 1995.

On the other hand, discrimination against minority neighborhoods will affect the value of all homes in an area simultaneously. Specifically, allegations have been put forth that lenders refuse to lend in minority areas on the same beneficial terms that are available in non-minority areas. This phenomenon, known as redlining, would reduce the liquidity of homes in minority areas. Reduced liquidity, of course, would lead to lower prices (for a more complete discussion of the effect of liquidity on value, see Hasbrouck, 1991, Kluger and Miller, 1990, and Moore, 1987).

Previous studies employ unit-specific data; either transaction or appraisal data. This creates the possibility that the racial distribution of recent transactions or changing neighborhood demographics could create the appearance of redlining when, in fact, it does not exist. This is particularly worrisome given the small sample size employed in much of the existing literature.

For example, suppose redlining does not exist. Given the powerful statistical techniques employed, a study based on transaction data may still give the appearance of systematic bias (i.e., redlining) where the actual result is caused by individual bias (i.e., discrimination). Confounding the results could be a small number of observations executed by bigoted market participants that involve high deviation transactions. In such a case, the individual bias present in these transactions might well be interpreted as redlining.

Recognizing this possibility, this study departs from the standard transactions data analysis and examines median home value by neighborhood. When combined with previous studies, this will shed additional light on two issues: (1) are home values affected by racial bias, and (2) if so, what is the source of this bias.

The outcome of this research would also affect the literature that examines the flow of mortgage credit directly. Several recent studies show that after economic criteria such as income, education and home values are accounted for, neighborhood racial composition does not affect the flow of mortgage credit (e.g., Holmes and Horvitz, 1994; Schill and Wachter, 1994). However, if value is systematically lower in areas with high minority concentration, it is possible that correlation between value and minority would have a confounding effect and make rejection of the null hypothesis more difficult. This would call into question the results from these studies.

This article advances the literature in four ways. First, an improved analysis of how the forces of supply and demand affect housing prices is provided. Second, the city selected for this study, Houston, Texas, provides a unique opportunity to assess the risks involved in investing in housing due to the wide price swings experienced in recent years. Third, ethnic (i.e., Hispanic) as well as racial (i.e., Black) minority status is considered. Finally, the authors expand the existing knowledge base on the effect of racial composition in housing by employing a methodology designed to examine the effects of both discrimination and redlining.

The paper will proceed in the following order. The following section discusses the methodology. The next section provides a description of the data used. This is followed by the results and conclusions sections.

Methodology

This paper studies the impact of neighborhood racial composition on home values in Houston. The dependent variable is the median home value in each census tract as

reported in the 1990 Census of Housing and Population. Census tracts were chosen for this study because they are large enough to allow for meaningful summary analysis, yet small enough to be reasonably uniform economic units. Obviously, this is not a perfect match between neighborhood and census tracts. But, with an average of approximately 1500 residents per tract, this should be acceptable in most cases. Larger units, such as zip codes, lack internal consistency. Data availability and reliability problems preclude the use of smaller units.

When selecting independent variables, the authors have tried to synthesize economic determinants from the existing literature in order to maintain comparability. This effort is, of course, limited by data constraints and statistical problems that arise from the use of cross-sectional demographic data.

In properly functioning capital markets, value is determined solely by the interaction of supply and demand. For the purposes of this research, race is considered to be exogenous to the model. Assume the functional forms of the supply and demand equations are as follows:

$$q^D = f(So, Ph, Mi, R, F, V) \quad (1)$$

$$q^S = f(So, Ph, R, Me, V), \quad (2)$$

and the equilibrium condition:

$$q^S = q^D = q, \quad (3)$$

where:

- q^S = Quantity supplied,
- q^D = Quantity demanded,
- So = A matrix describing socioeconomic characteristics,
- Ph = A matrix describing physical characteristics,
- Me = Emigrant mobility (the propensity of residents to move out of an area),
- Mi = Immigrant mobility (the propensity of residents to move into an area),
- R = Risk associated with investing in housing,
- V = Value of homes,
- F = Financing terms available.

In structural form, the functional equations become:

$$q^D = \beta_1 So + \beta_2 Ph + \beta_3 Mi + \beta_4 R + \beta_5 F + \beta_6 V + \epsilon^D \quad (4)$$

$$q^S = \delta_1 So + \delta_2 Ph + \delta_3 Me + \delta_4 R + \delta_5 V + \epsilon^S. \quad (5)$$

Given the equilibrium equation (3), this can be rearranged as:

$$\begin{aligned} & \beta_1 So + \beta_2 Ph + \beta_3 Mi + \beta_4 R + \beta_5 F + \beta_6 V + \epsilon^D \\ & = \delta_1 So + \delta_2 Ph + \delta_3 Me + \delta_4 R + \delta_5 V + \epsilon^S. \end{aligned} \quad (6)$$

Solving equation (6) for our variable of interest, V , yields the following reduced-form equation:

$$\begin{aligned}
 V = & [(\delta_1 - \beta_1)/(\beta_6 - \delta_5)]S_o + [(\delta_2 - \beta_2)/(\beta_6 - \delta_5)]Ph \\
 & - [\beta_3/(\beta_6 - \delta_5)]Mi + [\delta_3/(\beta_6 - \delta_5)]Me + [(\delta_4 - \beta_4)/(\delta_6 - \delta_5)]R \\
 & - [\beta_5/(\beta_6 - \delta_5)]F + [(\epsilon^S - \epsilon^D)/(\beta_6 - \delta_5)] .
 \end{aligned} \tag{7}$$

The terms in brackets in equation (7) are strictly functions of the structural coefficients. As such, they can be relabeled to show that they are merely single-valued coefficients. This yields the testable reduced-form model:

$$V = \pi_1 S_o + \pi_2 Ph + \pi_3 Mi + \pi_4 Me + \pi_5 R + \pi_6 F + \tau, \tag{8}$$

where:

- τ = the additive error term
- π = the single-valued coefficients .

Equation (8) represents the valid economic determinants of value. In order to test for any effect from racial composition, variables that measure race must be added. The idea in this approach is to isolate a racial effect, if one indeed exists, from what would otherwise be found due to the basic socioeconomic structure. It should be noted that due to the interrelatedness of race with some of the other variables, this is accomplished in a less than perfect manner. Some empirical findings on the extent of this problem are provided below. Thus the final model to be tested is:

$$V = \pi_1 S_o + \pi_2 Ph + \pi_3 Mi + \pi_4 Me + \pi_5 R + \pi_6 F + \pi_7 Race + \tau, \tag{9}$$

where *Race* is a set of variables describing neighborhood racial composition.

Operationally, the factors included in equation (9) must be converted to relevant proxies. In this study, socioeconomic characteristics are proxied by three variables. These include the median household income (*INCOME*), the percentage of residents between 25 and 34 years of age (*AGE*), and the percentage of adult residents with at least some post-high school formal education (*COLLEGE*). *INCOME* and *COLLEGE* are expected to have a positive impact on value. The *AGE* variable is structured to measure what percentage of the area residents are young homebuyers. Since younger buyers usually buy less expensive homes, the expectation is that *AGE* will be negatively related to value. The physical characteristics are proxied by the median age of the housing stock (*HOUSAGE*), the percent of units that are vacant (*VACANT*) and the percentage of single-family homes that are rental units (*SFRENT*). The a priori effect of *HOUSAGE* on value cannot be anticipated. *HOUSAGE* could have a positive relationship with value because of the enhanced stability of seasoned neighborhoods, while the increased physical deterioration present in older neighborhoods may manifest itself with a negative coefficient. *SFRENT* and *VACANT* should have a negative impact because they can be viewed as decreasing stability.

Financing terms available are considered through the use of two variables. First, the average loan-to-median-value ratio (*LTV*) is used to gauge the equity component in mortgage lending. High values of this ratio can be interpreted as an indication of a high level of lender confidence in the price stability of the neighborhood and should be positively related to price. Second, the percentage of households whose mortgage

payment to income ratio exceeds 30% (*MORTRAT*) is included as a measure of household leverage. All else equal, higher leverage may imply that prices in an area have been bid up and thus a positive sign is expected.

Two related mobility proxies are used. The first is the propensity of area residents to move out of an area, referred to as emigrant mobility. To account for this, the percentage of current residents who are new to the area is used. Assuming a constant housing stock, a greater percentage of new residents can be interpreted as evidence of the departure of previous residents. The variable is calculated as the percentage of 1990 residents who have lived in the area for less than five years (*Me*). The effect of emigration on value is ambiguous. Emigration to other areas may be viewed as causing increased supply which would result in an inverse relationship with value. On the other hand, the departure of residents from minority neighborhoods may signify a transition or “gentrification” effect as higher income families push out current residents. The gentrification effect could also explain the significant positive correlation between the two mobility proxies.

However, since the housing stock is not constant, changing total demand for property must be considered. The propensity of people to move into an area, or immigrant mobility (*Mi*), is proxied by the percentage change in owner-occupants between 1980 and 1990. (*Me* and *Mi* are measured over different time periods because of data constraints.) Net increases in the number of owner-occupants should represent increased demand which would bid up prices. Therefore, *Mi* should have a positive sign.

Risk differences also affect value. Two related but separable types of risk need to be considered. These are default risk and depreciation risk. A measure of default risk must allow for the possibility of past discrimination in the mortgage lending process. In other words, if minority groups have been subjected to different credit standards in the past, the default rate measures will be biased.

To minimize this problem, defaults only on government-insured mortgages (*DEFAULTS*) are considered on the premise that the government is less likely to discriminate in the allocation of mortgage credit. This is accomplished by calculating a ratio of insured defaults to insured loans. The numerator in the equation is the number of FHA and VA loan defaults in each census tract. Ideally, the denominator would be the number of loans outstanding; however, this information is not available by census tract. The denominator in the default rate variable is the number of insured loans granted between 1988 and 1990. This is appropriate as long as the distribution of recent activity is similar to the distribution of total loans outstanding. Increased default rates imply greater risk and should, therefore, have a negative relationship with value.

The default risk variables also point to the problem of determining causation, an inherent difficulty when doing empirical research using cross-sectional demographic data. Due to the focus of this study, no direct attempt has been made to determine whether causality runs from default risk to value or vice versa. This limitation is intended to be addressed as the subject for subsequent research in this area and, therefore, some caution is necessary when interpreting the coefficients in this study.

Depreciation risk is proxied by the change in home values between 1980 and 1990 (*HVCHANGE*). This variable is calculated as the change in the median home value between 1980 and 1990 divided by the value in 1980. During the 1980s, Houston real estate experienced dramatic but geographically uneven price swings. This provides a unique opportunity to assess the risk of falling home prices (which erode the equity of the owner and the collateral of the lender) in different geographical areas. Higher values of

HVCHANGE imply lower actual depreciation rates during the turbulent 1980s. Assuming the structural factors that caused such wide disparity in price changes during the mid-1980s still exist, this can be considered a measure of the current depreciation risk inherent in a neighborhood. Thus, higher values of *HVCHANGE* should imply lower depreciation risk and would therefore be positively related to value.

All of the above are appropriate economic variables that could affect value. In order to determine the impact of noneconomic factors, racial characteristics must also be included. Three variables are employed. The first is the percentage of the population that is Black (*BLK*) and the second, the percentage that is Hispanic (*HISP*). In addition to a static view, the change in percentage minority (*CHGMINOR*) between 1980 and 1990 is also included. This third variable is used to test whether changing racial composition affects value. The racial variables are the true variables of interest. If the allegations of racial bias in the mortgage lending process are true, these variables will have a negative effect on the dependent variable.

It is possible that, in sufficient numbers, transactions biased by the bigotry of individuals could reduce the median home value in a neighborhood. If the data analyzed show median values to be lower in minority neighborhoods after controlling for economic factors, the conclusion will be that either discrimination or redlining exists. The methodology employed will not allow us to disentangle the effects of redlining and discrimination if indeed housing values are lower in minority areas. However, since redlining would affect the value of all homes in the area, if the data show that median home values are not affected by neighborhood racial composition, the conclusion is that the redlining allegations are false.

The actual regression equation to be estimated is:

$$\begin{aligned}
 V = & \alpha_0 + \alpha_1 BLK + \alpha_2 HISP + \alpha_3 CHGMINOR + \alpha_4 INCOME + \alpha_5 AGE \\
 & + \alpha_6 COLLEGE + \alpha_7 SFRENT + \alpha_8 HOUSAGE + \alpha_9 VACANT + \alpha_{10} LTV \\
 & + \alpha_{11} MORTRAT + \alpha_{12} Me + \alpha_{13} Mi \\
 & + \alpha_{14} DEFAULT + \alpha_{15} HVCHANGE + E .
 \end{aligned}$$

The variables are summarized in Exhibit 1.

The use of cross-sectional demographic data induces into the regression the possibility of nonconstant variance. To correct for this problem, the Generalized Least Squares (GLS) model is selected. Additionally, examination of the variance inflation factors indicates there is a minor problem with multicollinearity (*INCOME*). See Exhibit 2 for results. This deviation is considered acceptable given that cross-sectional demographic data is employed and that the socioeconomic variables were selected for comparability with the existing literature.

Data

The data come from three sources. In all cases, the data are collected for an individual census tract in aggregate form (i.e., no transaction data). The data used describe either the percentage of some variable of interest, the median value of some attribute, or the absolute number of occurrences of some event within a particular tract. The data is unique to each tract.

Exhibit 1 Variables List

<i>VALUE</i>	=	Median home value in 1990 (in \$1,000)
<i>BLK</i>	=	Percentage of total population that is Black
<i>HISPANIC</i>	=	Percentage of total population that is Hispanic
<i>CHGMINOR</i>	=	Change in percentage minority between 1980 and 1990
<i>INCOME</i>	=	Median household income in 1990 (\$1,000)
<i>AGE</i>	=	Percentage of total population between 25 and 34
<i>COLLEGE</i>	=	Percentage of adult residents with some post-high school formal education
<i>SFRENT</i>	=	Percentage of single-family homes that are renter occupied
<i>HOUSAGE</i>	=	Median age of housing stock in the census tract
<i>VACANT</i>	=	Percentage of single-family homes that are vacant
<i>LTV</i>	=	Loan-to-value ratio
<i>MORTRAT</i>	=	Percentage of owner-occupants with a mortgage ratio greater than .3
<i>Me</i>	=	Percentage of current owner-occupants who moved in between 1985 and 1990 (emigrant mobility)
<i>Mi</i>	=	Percentage change in the number of owner-occupants between 1980 and 1990 (immigrant mobility)
<i>DEFAULTS</i>	=	Natural log of default rate in insured mortgages
<i>HVCHANGE</i>	=	Percentage change in median home value

Exhibit 2 Variance Inflation Factors

Variable	VIF
<i>BLK</i>	3.9440
<i>HISP</i>	3.9367
<i>CHGMINOR</i>	1.7625
<i>INCOME</i>	7.4399
<i>AGE</i>	2.3919
<i>COLLEGE</i>	4.2244
<i>SFRENT</i>	1.8176
<i>HOUSAGE</i>	2.8042
<i>VACANT</i>	1.6930
<i>LTV</i>	1.2691
<i>MORTRAT</i>	1.7299
<i>Me</i>	2.8456
<i>Mi</i>	1.3256
<i>Ln DEFAULT</i>	1.2735
<i>HVCHANGE</i>	4.2694
<i>CONSTANT</i>	.0000

VALUE (the median home value) is the dependent variable. *BLK* is the percentage of residents that are Black and *HISP* is the percentage that are Hispanic. *CHGMINOR* is the change in percentage minority between 1980 and 1990. *INCOME* is the median household income. *AGE* is the percentage of adult residents between the ages of 25 and 34. *COLLEGE* is the percentage of adult residents who have at least one year of formal education after high school. *SFRENT* is the percentage of single-family homes that are rental units. *HOUSAGE* is the median age of the housing units in the tract. *VACANT* is the percentage of single-family homes that are vacant. *LTV* is the ratio of average loan-to-average value. *MORTRAT* is the percentage of owner-occupants whose mortgage payment-to-gross income ratio is greater than 30%. *Me*, emigrant mobility, is the percentage of area residents who have moved in since 1985. *Mi*, immigrant mobility, is the percentage change in the number of owner-occupants between 1980 and 1990. *DEFAULTS* is the natural log of the insured defaults-to-mortgages-granted ratio. *HVCHANGE* is the change in median home values between 1980 and 1990.

There are 525 census tracts in the 1990 census map for the Houston MSA. Of these, forty-one were eliminated either because they were not on land or because they had fewer than twenty-five housing units. One additional tract was omitted because it was an extreme outlier. Examination of the partial residual plots indicated that this one observation was very influential. However, had it been included it would not have significantly changed the interpretation of the racial variables.

The default data come from the Harris County Clerk's Deed file. The small number of foreclosures during the 1960s and 1970s would not provide a meaningful measure of risk in most metropolitan areas. However, the number of defaults in Houston during the sample period is large enough to allow for the calculation of meaningful default rates. In 1990, there were 1800 foreclosures distributed over 525 census tracts.

The demographic and socioeconomic data are from the 1980 and 1990 census records. Data on insured mortgages granted used as the denominator in the default rate calculation are obtained from the aggregation report of the filings required by the Home Mortgage Disclosure Act (HMDA).

The census data and the HMDA reports are publicly available at Federal Depository libraries. The default data was obtained from Real-Comp, a private firm that collects data for the real estate industry. The data are summarized in Exhibits 3 and 4 which provide information on distribution and correlations.

Exhibit 3 Summary Statistics

Variable	Mean	Minimum	Maximum
<i>VALUE</i>	79.775	18.800	506.900
<i>BLK</i>	22.846	.129	99.482
<i>HISP</i>	25.200	.288	95.985
<i>CHGMINOR</i>	12.088	-19.428	55.945
<i>INCOME</i>	35.340	4.999	207.014
<i>AGE</i>	19.100	5.986	45.356
<i>COLLEGE</i>	43.443	5.763	97.804
<i>SFRENT</i>	21.857	.000	79.167
<i>HOUSAGE</i>	24.858	5.279	47.690
<i>VACANT</i>	13.159	2.057	67.535
<i>LTV</i>	.877	.000	5.342
<i>MORTRAT</i>	16.312	.000	38.715
<i>Me</i>	28.321	.000	76.926
<i>Mi</i>	8.582	-76.144	2132.569
<i>Ln DEFAULT</i>	-4.614	-9.210	1.386
<i>HVCHANGE</i>	33.758	-40.000	378.618

VALUE (the median home value) is the dependent variable. *BLK* is the percentage of residents that are Black and *HISP* is the percentage that are Hispanic. *CHGMINOR* is the change in percentage minority between 1980 and 1990. *INCOME* is the median household income. *AGE* is the percentage of adult residents between the ages of 25 and 34. *COLLEGE* is the percentage of adult residents who have at least one year of formal education after high school. *SFRENT* is the percentage of single-family homes that are rental units. *HOUSAGE* is the median age of the housing units in the tract. *VACANT* is the percentage of single-family homes that are vacant. *LTV* is the ratio of average loan-to-average value. *MORTRAT* is the percentage of owner-occupants whose mortgage payment-to-gross income ratio is greater than 30%. *Me*, emigrant mobility, is the percentage of area residents who have moved in since 1985. *Mi*, immigrant mobility, is the percentage change in the number of owner-occupants between 1980 and 1990. *DEFAULTS* is the natural log of the insured defaults-to-mortgage-granted ratio. *HVCHANGE* is the change in median home values between 1980 and 1990.

Exhibit 4
Correlation Coefficients

	VALUE	BLK	HISP	CHGMINOR	INCOME	AGE	COLLEGE	SFRENT	
VALUE									
BLK	-.30582								
HISP	-.33213	-.31028							
CHGMINOR	-.13551	-.23441	.37644						
INCOME	.80676	-.34030	-.34034	-.09465					
AGE	.04477	-.29689	.10201	.32080	-.00646				
COLLEGE	.70424	-.36445	-.54703	-.11761	.62246	.30652			
SFRENT	-.37244	.14245	.40772	-.00092	.38964	.22580	-.40948		
HOUSAGE	-.29070	.21425	.38917	-.25670	-.47109	-.33619	-.45825	.34039	
VACANT	-.26575	.38761	.22988	.12787	-.41219	.09451	-.38569	.41980	
LTV	-.29460	.03924	.18712	-.10382	-.33570	-.06233	-.26705	.19998	
MORTRAT	-.08467	.57414	-.09134	-.22710	-.13240	-.26959	-.22942	.06804	
Me	.39446	-.47933	-.19557	.13633	.50232	.45816	.54064	-.15898	
Mi	.11049	-.10200	-.15202	-.02827	.22929	.17185	.21808	-.12598	
Ln DEFAULT	-.25413	.20233	.10322	.11900	-.04223	.14423	-.27427	.02903	
HVCHANGE	.69562	-.08018	-.18024	-.20640	.76525	.00239	.35011	-.10722	
		HOUSAGE	VACANT	LTV	MORTRAT	Me	Mi	Ln DEFAULT	HVCHANGE
VALUE									
BLK									
HISP									
CHGMINOR									
INCOME									
AGE									
COLLEGE									
SFRENT									
HOUSAGE									
VACANT	.23808								
LTV	.31856	1.5276							
MORTRAT	.25691	.14497	-.02654						
Me	-.63547	-.29451	-.20847	-.29887					
Mi	-.34253	-.17552	-.08547	-.02856	.44393				
Ln DEFAULT	.00580	.00446	-.07593	.25017	-.06358	.07952			
HVCHANGE	-.11593	-.13090	-.28224	.08281	.25328	.09995	-.04060		

VALUE (the median home value) is the dependent variable. BLK is the percentage of residents that are Black and HISP is the percentage that are Hispanic. CHGMINOR is the change in percentage minority between 1980 and 1990. INCOME is the median household income. AGE is the percentage of adult residents between the ages of 25 and 34. COLLEGE is the percentage of adult residents who have at least one year of formal education after high school. SFRENT is the percentage of single-family homes that are rental units. HOUSAGE is the median age of the housing units in the tract. VACANT is the percentage of single-family homes that are vacant. LTV is the ratio of average loan-to-average value. MORTRAT is the percentage of owner-occupants whose mortgage payment-to-gross income ratio is greater than 30%. Me, emigrant mobility, is the percentage of area residents who have moved in since 1985. Mi, immigrant mobility, is the percentage change in the number of owner-occupants between 1980 and 1990. DEFAULTS is the natural log of the insured defaults-to-mortgage-granted ratio. HVCHANGE is the change in median home values between 1980 and 1990.

Results

Median home values in areas with high minority concentrations are lower than median values in non-minority areas. As shown in Exhibit 5, areas in which more than 80% of the population is Black have an average home value of \$22,460. Areas where Blacks comprise less than 20% of the population have a median home value of \$117,760. Obviously, there is a significant simple correlation between race and value. The question examined here is whether the relationship between race and value can be explained in terms of lending bias.

The equation estimated does a good job of explaining cross-sectional differences in value as is evidenced by an R^2 of .80. The regression results are summarized in Exhibit 6. The major result of this study is that racial composition does not adversely affect home values after accounting for economic factors. The coefficients for both *BLK* and *CHGMINOR* are not statistically significant. *HISP* is significant, but has a positive sign as opposed to concerns about lending bias which would induce a negative sign. This could result from lender outreach programs that are intended to increase lending in minority areas in response to the Community Reinvestment Act. Smith (1981) hypothesized that this could also be the result of bigotry towards Hispanics by housing services providers. If the providers of housing services restrict supply to Hispanics, then the value of homes in Hispanic areas will be bid up. Still another possible explanation could be the number of Hispanics employed as live-in domestics in the more affluent neighborhoods. This appears to be plausible considering that when observations with *VALUE* greater than \$200,000 are not included (approximately the top 10%), the coefficient is no longer significant. Regardless of the explanation, there is no evidence to support the allegations of lender bias against minority neighborhoods.

A test of the combined effect of all the racial variables using a standard F -test for a full and reduced model indicates that, collectively, the three racial variables do have a statistically significant impact (F -statistic=3.53). However, omitting the racial variables decreases the R^2 by only .0045, indicating that there is little economic significance in the explanatory power of the racial variables. Additionally, the combined statistical significance is due to the positive *HISP* coefficient. The data demonstrate that value is not adversely affected by racial composition after reasonable economic factors are included.

One anomaly in the results is the effect of vacancy. The expectation is for vacancy to have a negative impact on value because it represents excess supply. However, the data indicate that vacancy rates have a direct relationship with home values. Although this

Exhibit 5
Housing Value in Thousands by Concentration of Minorities

Percentage by Minority in Census Tract	Black	Hispanic
0-20	\$117.76	\$104.62
21-40	107.00	128.80
41-60	82.20	80.53
61-80	65.80	56.12
81-100	22.46	30.14

Exhibit 6**Regression Results**

Dependent Variable=Median Home Value
(483 Observations, R-Square .8010)

Variable	Coefficient	T-Statistic
<i>BLK</i>	-.0843	-.86
<i>HISP</i>	.2674*	2.01
<i>CHGMINOR</i>	.1422	.81
<i>INCOME</i>	1.1012**	7.36
<i>AGE</i>	-1.0594*	-2.52
<i>COLLEGE</i>	1.3840**	10.46
<i>SFRENT</i>	-.5777**	-3.24
<i>HOUSAGE</i>	.5827*	2.08
<i>VACANT</i>	1.1376**	4.36
<i>LTV</i>	-3.3176	-.87
<i>MORTRAT</i>	.7495*	2.56
<i>Me</i>	.0862	.46
<i>Mi</i>	-.0266	-1.77
Ln <i>DEFAULT</i>	-2.6315**	-5.84
<i>HVCHANGE</i>	.3519**	5.58
<i>CONSTANT</i>	-57.9586**	-3.71

*significant for $\alpha \leq .05$ for a two-tailed test; ** significant for $\alpha \leq .01$ for a two-tailed test

VALUE (the median home value) is the dependent variable. *BLK* is the percentage of residents that are Black and *HISP* is the percentage that are Hispanic. *CHGMINOR* is the change in percentage minority between 1980 and 1990. *INCOME* is the median household income. *AGE* is the percentage of adult residents between the ages of 25 and 34. *COLLEGE* is the percentage of adult residents who have at least one year of formal education after high school. *SFRENT* is the percentage of single-family homes that are rental units. *HOUSAGE* is the median age of the housing units in the tract. *VACANT* is the percentage of single-family homes that are vacant. *LTV* is the ratio of average loan-to-average value. *MORTRAT* is the percentage of owner-occupants whose mortgage payment-to-gross income ratio is greater than 30%. *Me*, emigrant mobility, is the percentage of area residents who have moved in since 1985. *Mi*, immigrant mobility, is the percentage change in the number of owner-occupants between 1980 and 1990. *DEFAULTS* is the natural log of the insured defaults-to-mortgages-granted ratio. *HVCHANGE* is the change in median home values between 1980 and 1990.

could be a statistical anomaly, it could also be explained in economic terms. High vacancy rates may indicate a propensity on the part of area homeowners to maintain higher reservation prices. That is, high vacancy rates may be indicative of the ability of homeowners in an area to forego current income (in the form of rents or low sale price) for future income. The capacity to forego current income may imply greater wealth. The positive relationship between value and wealth may explain the positive sign on *VACANT*.

Value does respond to reasonable economic criteria. Of the physical and socioeconomic variables other than the vacancy rate, *INCOME*, *AGE*, *COLLEGE*, *SFRENT*, and *HOUSAGE* are significant with the hypothesized sign. Higher levels of income and education can reasonably be expected to be associated with higher values.

However, the negative correlation between *INCOME* and *BLK* or *COLLEGE* and *BLK* gives rise to questions of whether the socioeconomic variables are a substitute for

race. To test this, a regression equation with *BLK* as the dependent variable and all the economic characteristics as independent variables was estimated yielding an R^2 of .58. This indicates that, taken together, the economic variables in the model do not serve as a proxy for race. Income and education data proxy for reasonable economic characteristics such as neighborhood stability and desirability for which direct data is not available.

MORTRAT is significant and positive. All else constant, higher household leverage is directly related to higher home values. This may also imply higher lender confidence in an area. Making loans with higher mortgage ratios may be indicative of a greater willingness to lend in a particular area. This increase in liquidity could possibly be manifested in an increase in demand and a corresponding increase in home values.

Risk also impacts value. Less depreciation risk (as evidenced by higher values of *HVCHANGE*) has the expected positive impact on value. Likewise, high default rates imply neighborhood instability and therefore have a statistically significant negative effect on value. Investment in housing is not immune from the risk/return parameters of other investments.

It is interesting to note that if the risk variables are omitted from the model, the Black variable does become negative and significant. Risk must be included in any analysis of value.

Conclusions

Bias on the part of lenders would have far-reaching effects. If these allegations are correct, the flow of credit into minority areas would be restricted causing home values to fall. This paper examines whether neighborhood racial composition affects home values after economic determinants are considered. For Houston, the data clearly demonstrates that it does not.

The reduced liquidity caused by lender bias against minority neighborhoods would cause a decrease in value for all properties simultaneously. On the other hand, discrimination against individuals would affect value one property at a time. If this individual bias had a uniformly negative effect in sufficient numbers, it could certainly lower median value as well.

If the results of this analysis had shown that home values were lower in minority areas than could reasonably be explained by economic factors, the methodology employed would not have allowed distinction between discrimination and redlining. However, the data show that median value is not affected by racial composition. Hence, it can be concluded that there is no systematic lender bias against minority neighborhoods that is negatively affecting home values.

The reader is cautioned against extending these findings to discrimination on an individual basis. The methodology used certainly does not provide grounds for such an extension. Additionally, the unique nature of the Houston market during the study period makes generalization of these results to other areas difficult. More empirical evidence from other areas is required before generalized conclusions can be formed. This is left for future research.

Value is sensitive to reasonable economic criteria. Increased desirability increases value while increased risk reduces value. Standard risk and return parameters determine value whether the asset involved is financial or real.

If the flow of mortgage credit were restricted based on noneconomic factors, it would

constitute a violation of even the weakest economic man argument. This paper has examined the potential effects of this alleged redlining by analyzing property values by neighborhood. The data do not support allegations of redlining.

References

- Anderson, F. B. and D. R. Funderburk, Real Estate Valuation: A Pedagogical Approach, *Appraisal Journal*, April 1989, 221–32.
- Daniels, C., The Influence of Racial Segregation on Housing Prices, *Journal of Urban Economics*, 1975, 105–22.
- Greaves, M., The Determinants of Residential Values: The Hierarchical and Statistical Approaches, *Journal of Valuation*, 1984, 3:1, 5–23.
- Hasbrouck, J., Security Markets, Information and Liquidity, *Financial Practice and Education*, Fall/Winter 1991, 7–16.
- Holmes, A. L. and P. Horvitz, Mortgage Redlining: Race, Risk, and Demand, *Journal of Finance*, March 1994, 49:1, 81–99.
- Kain, J. and J. Quigley, Measuring the Value of Housing Quality, *Journal of the American Statistical Association*, June 1970, 532–48.
- , *Housing Markets and Racial Discrimination, A Micro-Economic Analysis*, New York: National Bureau of Economic Research, 1975.
- Kluger, B. D. and N. G. Miller, Measuring Residential Real Estate Liquidity, *AREUEA Journal*, 1990, 18:2, 145–59.
- Lapham, V., Do Blacks Pay More for Housing?, *Journal of Political Economy*, 1971, 79, 1244–57.
- Moore, J. S., An Investigation of the Major Influences of Residential Liquidity: A Multivariate Approach, *AREUEA Journal*, 1987, 15:1, 684–703.
- Olsen, E. O., Do the Poor or the Black Pay More for Housing?, in H. B. von Furstenberg and A. Horowitz, editors, *Patterns of Racial Discrimination*, Vol. 1, *Housing*, Lexington, Mass.: Lexington Books, 1974.
- Schill, M. H. and S. M. Wachter, A Tale of Two Cities: Racial and Ethnic Geographic Disparities In Home Mortgage Lending in Boston and Philadelphia, *Journal of Housing Research*, 1994.
- Schnare, A., Racial and Ethnic Price Differentials in Urban Housing Market, *Urban Studies*, 1976, 13, 107–20.
- Smith, B. A., A Study of Racial Discrimination in Housing, in J. V. Henderson, editor, *Research in Urban Economics*, Vol. 1, 131–99, Greenwich, Conn.: JAI Press, 1981.
- Straszheim, M. R., Racial Discrimination in the Urban Housing Market and its Effects on Black Housing Consumption, in H. B. von Furstenberg and A. Horowitz, editors, *Patterns of Racial Discrimination*, Lexington, Mass.: Lexington Books, 1974.
- , *An Econometric Model of the Urban Housing Market*, New York: National Bureau of Economic Research, 1975.
- Vaughan, G. A., Some Recent Evidence on the Supply of Urban Housing to Non-Whites from Neighborhoods Undergoing Racial Change, *Journal of Economics and Business*, 1975.
- Yinger, J., The Black-White Price Differential in Housing: Some Further Evidence, *Land Economics*, 1978, 185–206.

The authors gratefully acknowledge the contributions of the editors and reviewers of this special edition of The Journal of Real Estate Research. In addition the comments provided by Paul Horvitz, Don Bumpass, and Lary Cowart and the formatting help provided by Debbie Jordy are appreciated.
