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Abstract

This paper is an attempt to add precision to the debate about the black-white price differential in housing. The theoretical literature on this differential is reviewed, and it is shown how the various theories can be tested in a regression of house values on housing characteristics. A properly specified house-value regression leads not only to tests of hypotheses about the black-white price differential but also to measures of this differential. The econometric specification derived in this paper is estimated using data for owner-occupied houses in St. Louis in 1967. These estimates provide support for hypotheses about the effects on the price of housing of racial attitudes and of discrimination against blacks. It is also found that a black-white price differential exists both between neighborhoods and within neighborhoods: The price of equivalent housing is about 25 percent higher in highly integrated and largely black neighborhoods than in all-white neighborhoods and, within any given neighborhood, blacks pay about 15 percent more than whites for equivalent housing.

THE BLACK-WHITE PRICE DIFFERENTIAL IN HOUSING: SOME FURTHER EVIDENCE

I. Introduction

Despite a great deal of literature on the subject, there remains considerable controversy about the black-white price differential in housing. One reason for this controversy is that the many regression studies on the topic, which use a variety of econometric specifications to estimate the price differential, are difficult to compare. In this paper we will attempt to clarify several issues surrounding the estimation of the black-white price differential in housing by showing how the various theories about this differential can be reflected in the econometric specification used to estimate it.

In order to establish whether or not a price differential exists, one must compare the prices blacks and whites pay for equivalent housing. All of the studies to be discussed in this paper make this comparison by regressing the value of housing (a price or rental) on the characteristics of housing and various racial variables. The coefficients of these racial variables allow one to determine whether or not blacks pay more than whites for housing, controlling for housing characteristics, or, equivalently, whether or not blacks pay more than whites per unit of housing services.

Analysis of the black-white price differential in housing requires careful distinctions among several terms. Prejudice is defined to be an inflexible, deeply felt attitude toward a particular group of people, whereas discrimination is behavior that denies one group of people the rights or opportunities given to others.[1] One important type of

discrimination is price discrimination, which exists when a seller charges one group a higher price than another group for the same product; another type of discrimination is exclusion, which is the refusal to sell or rent to some group of people in a given neighborhood.[2] It is important to distinguish discrimination from the purely descriptive terms price differential, which describes a situation in which two groups pay different prices for the same product, and segregation, which is the physical separation of groups. Although logically separate, the phenomena to which these terms refer are all closely related in the structure of American society.

The rest of this paper is organized as follows. Section II is a discussion of theories about the black-white price differential in housing. In section III, two econometric specifications for testing these theories are described and estimated using data from St. Louis. Several additional results about the black-white price differential are presented in section IV, and a summary and some conclusions appear in section V.

II. Theories About the Black-White Price Differential in Housing

This section provides a review of the theoretical literature on the black-white price differential in housing. In this review we will attempt to distinguish carefully among the terms defined earlier. Such distinctions are important, not only to clarify the causes of the black-white price differential but also to separate for policy purposes the effects of racial discrimination on the price differential from the effects of racial attitudes. We will also attempt to distinguish theories that imply a black-white price differential within a neighborhood from theories that imply a price differential between different

types of neighborhoods such as largely black and largely white neighborhoods.[3] This distinction is similar to the distinction between horizontal and vertical equity; a price differential within a neighborhood suggests a lack of horizontal equity, whereas a price differential between largely black and largely white neighborhoods suggests a lack of vertical equity--blacks pay more than whites for equivalent housing on average even though blacks and whites pay the same unit prices in any given neighborhood.

A. Price Discrimination

Price discrimination can affect the black-white price differential in one of two ways. First, if the price elasticity of demand facing a single seller of housing is lower for blacks than for whites (which implies that the seller has some monopoly power in the black submarket), then profit-maximizing sellers will charge a higher price to blacks than to whites. This argument is a straightforward application of a well-known neoclassical result (see Robinson, 1969), but since it depends on the existence of some monopoly power in the black submarket, it is only plausible in neighborhoods where only a few sellers of housing are willing to deal with blacks.

Second, sellers of housing who are prejudiced against blacks may charge a premium in order to deal with blacks. This argument, which is an application of Becker's (1957) approach to discrimination, is found in King and Mieszkowski (1973). The black-white price differential that results from this premium will be smaller the greater the number of unprejudiced sellers; indeed, if there are enough unprejudiced sellers, it will disappear altogether.

Price discrimination leads directly to a black-white price differential within a neighborhood if discriminating sellers deal with both blacks and whites within that neighborhood.[4] Furthermore, price discrimination is the only theory of housing prices and race that leads to a black-white price differential within a neighborhood.[5] The existence of such a differential can therefore be taken as support for the hypothesis that price discrimination exists.

B. Exclusion

Two theories, the Rate of Growth Hypothesis and the Exclusion Hypothesis, describe the relationship between exclusion and the black-white price differential in housing. The Rate of Growth Hypothesis first appeared in Becker (1957) and has been further discussed by Haugen and Heins (1969), Muth (1969), and King and Mieszkowski (1973). The hypothesis is that blacks are trapped in the city center so that increases in the black demand for housing--increases due to migration or natural population growth or increased incomes--will lead to a higher price for housing in the black part of the city. Since there are long lags in the housing market, this differential may persist for a long time; indeed, it may persist indefinitely if black demand continues to grow. Note that this hypothesis depends on the assumption that blacks are excluded from most of the urban area; as Haugen and Heins point out, the black-white price differential will be smaller the greater the opportunity for blacks to buy housing outside the central city.[6]

As stated by Downs (1960), the Exclusion Hypothesis is that the exclusion of blacks from large parts of an urban area leads to "pent-up" black demand and thereby drives up the unit price of housing services in

black and integrated areas. This hypothesis does not depend on growth in the black demand for housing; instead, it implicitly assumes that exclusion is so pervasive that the black area will not expand until the black-white price differential is very large.

These two hypotheses lead to similar predictions about the black-white price differential: The price of housing paid by both blacks and whites will be higher in largely black and integrated areas than in largely white areas. Furthermore, since racial transition--that is, the process of blacks outbidding whites for housing--takes place in integrated areas, prices may, at least in the short run, be higher in integrated areas than in black areas.

C. Exclusion in a Search Model of Housing

The Rate of Growth Hypothesis and the Exclusion Hypothesis depend on strong assumptions about the extent of exclusion. A recent paper by Courant (1975) shows that in the context of a search model of the urban housing market, the main results of these two hypotheses--complete segregation of blacks from whites and a higher unit price for housing in the black submarket than in the white submarket--can be obtained on the basis of substantially weaker assumptions. To be specific, Courant derives these results on the basis of the assumption that some proportion of the sellers in the white submarket refuse to sell to blacks.[7]

There is a powerful intuition behind the mathematics of Courant's model. He argues that people will search for housing as long as the expected gain in utility from searching is greater than the expected utility loss from the costs of searching. If some sellers in the

white submarket will not sell to blacks, then blacks are less likely to find a house that will increase their utility in the white submarket than in the black submarket. Thus blacks' expected utility gain from searching for housing in the white submarket is always less than their expected gain in the black submarket, and they will restrict their search to the black submarket.

Courant also shows that equilbrium can be obtained in his model with a higher unit price for housing in the black submarket than in the white submarket. This result obtains because blacks have an incentive to search in the white submarket only if the price differential between the two submarkets is greater than the difference in expected utility gains; with smaller (but still positive) price differentials, blacks will not have an incentive to search and will therefore be in equilibrium.[8] If the price differential is large enough (because, for example, of an increase in black demand), blacks will have an incentive to search in white areas (as in the Rate of Growth Hypothesis), but the resulting growth in the black area will stop before the black-white price differential is eliminated.

D. Border Models of Racial Attitudes

The best-known theory about the relationship between racial attitudes and the black-white price differential in housing is Bailey's (1959, 1966) "border model." This model is discussed by Muth (1969, 1975) and by King and Mieszkowski (1973), and its main assumptions have been incorporated into a mathematical model of an urban area by Courant (1974) and by Rose-Ackerman (1975). A review and critique of the Bailey model and its extensions can be found in Courant and Yinger (1975).

Bailey's model assumes that blacks and whites are completely segregated with blacks in the city center, that whites prefer to live away from blacks, and that blacks prefer to live near whites.[9] These assumptions imply that whites will pay less for housing at the black-white border than in the white interior and that blacks will pay more for housing at the black-white border than in the black interior. Since competition insures that the black and white prices will be equal at the black-white border, these assumptions also imply that prices will be highest in the white interior, lowest in the black interior, and at some intermediate level near the black-white border.

The Bailey model and its extensions have two weaknesses as equilibrium models of an urban area. First, under perfect competition, blacks who prefer to live with whites would simply move into the white area, thereby contradicting the assumption of complete segregation. In practice, this difficulty is simply assumed away: Muth makes the strong assumption that <u>all</u> whites are willing to pay more than <u>any</u> black to live in all-white areas, and the general equilibrium models of Courant and Rose-Ackerman make the equally strong assumption that blacks are indifferent to the race of their neighbors.

Second, even with these strong assumptions about black preferences, border models do not have an equilibrium solution when there is a range in black incomes. This result is rigorously proved in Courant and Yinger. The basic notion of this proof is that the amount a household is willing to pay for housing in any location is a function of its income as well as of its attitudes. In the Bailey model, a rich black household with only a slight preference for an integrated neighborhood will outbid a poor white household with a strong preference for an all-white neighborhood.

In the context of an urban model, where the higher a household's income the farther from the CBD is its equilibrium location, rich blacks who are indifferent to the race of their neighbors will outbid poor whites for housing outside the central city. Thus in both types of border models, the basic assumption that there is complete segregation with blacks in the city center is contradicted by the logic of the models. This problem reflects a fundamental--and unresolved--simultaneity in border models: The effect of white prejudice on the price of housing depends on the pattern of segregation and the pattern of segregation depends on the effect of white prejudice on the price of housing.[10]

Despite these theoretical difficulties, border models can be used to make predictions about the price of housing if it is assumed that complete segregation is the result of the exclusion of blacks from white neighborhoods. Thus any empirical support for the predictions of border models about the price of housing can also be interpreted as support for the hypothesis that blacks are excluded from white areas.

E. Racial Composition as an Amenity

An alternative view of the effects of racial attitudes on the price of housing has been developed by Yinger (forthcoming). This view is an application of the analysis of neighborhood amenities in a simple urban model. In such a model, the locational equilibrium of households in an urban area is established by the price of housing services; workers who commute a long distance are as well off as workers who commute a short distance because the former pay a lower price per unit of housing services. If a location has amenities,

then the unit price of housing must be higher at that location in order for there to be locational equilibrium. Since the racial composition of a neighborhood can be thought of as an amenity, the theory of locational equilibrium can be used to determine the effect of racial attitudes on the price of housing.

When all employment is in the central business district (CBD), the household maximization problem that is used to derive the equilibrium housing price-distance function is

$$\begin{aligned} &\text{Maximize} && U(Z,H) \\ &\text{Subject to} && Y = P_z Z + P(u)H + T(Y,u) \end{aligned} \tag{1}$$

where Z is a composite consumption good (with price P_z), H is units of housing services, Y is income, P(u) is the price per unit of housing services at a distance of u miles from the CBD, and T(Y,u) is per-mile round-trip commuting costs to location u. The first-order conditions of this problem can be used to solve for the equilibrium P(u) function.

Two observations make it possible to include amenities in this analysis. First, housing services are some function of amenities (A(u)) and other characteristics of housing (X) so that H = H(X,A(u)). Second, in the long run A(u) will not have an implicit price, so X, not H, will appear in the budget constraint of the household's maximization problem (see Hamilton, 1972).

Now under the assumptions that (a) the utility function is Cobb-Douglas, (b) commuting costs are constant (=t), and (c) the H-function is of the form H = Xf(A(u)), we can rewrite problem (1) as

$$\text{Maximize} \qquad U = c_1 \ln(Z) + c_2 \ln(H)$$

$$= c_1 \ln(Z) + c_2 \ln(X) + c_2 \ln(f(A(u))) \qquad (2)$$

$$\text{Subject to} \qquad Y = P_z Z + P(u)X + tu \quad .$$

The first-order conditions of this problem lead to the equilibrium price-distance function[11]

$$P(u) = K(Y-tu)^{1/k}[f(A(u))]^{1/c_2} \qquad (3)$$

where $k = c_2/(c_1+c_2)$ and K is a constant of integration. Making use of the initial condition $P(\bar{u}) = \bar{P}$, where $\bar{u}$ is the outer edge of the city and $\bar{P}$ is the opportunity cost of housing,[12] equation (3) becomes

$$P(u) = \bar{P}[(Y-tu)/(Y-t\bar{u})]^{1/k}[f(A(u))/f(A(\bar{u}))] \quad . \qquad (4)$$

Racial composition can be thought of as an amenity. For prejudiced whites, the number of units of housing services in a house at a given location declines as the proportion of the population at that location that is black increases. One plausible form for the housing-services function for prejudiced whites is

$$H_w = X_w f(r(u)) = X_w e^{-d_w r(u)} \qquad (5)$$

where r(u) is the percentage of the population at location u that is black. This form has the reasonable implications that an additional black neighbor will have a greater impact on housing services (and hence on utility) for the owner of a house yielding many housing services than for the owner of a house yielding few housing services and a smaller impact in a large neighborhood than in a small one. Plugging (5) into (4), we obtain

$$P_w(u) = \bar{P}[(Y-tu)/(Y-t\bar{u})]^{1/k}\, e^{d_w[r(\bar{u})-r(u)]} \qquad (6)$$

Now if the quantity of housing services is a multiplicative function of the characteristics of housing, then the market value of a house (V) is given by

$$V = P(u)H(X_1,\ldots,X_n) = \bar{P}[(Y-tu)/(Y-t\bar{u})]^{1/k}\, e^{d_w[r(\bar{u})-r(u)]}\, X_1^{b_1} X_2^{b_2} \ldots X_n^{b_n}$$

or

$$\ln(V) = a_o + a_1 \ln[(Y-tu)/(Y-t\bar{u})] + a_2 r(u) + \sum_i b_i \ln(X_i) \qquad (7)$$

where $a_o = \ln(\bar{P}) + d_w r(\bar{u})$, $a_1 = 1/k$, and $a_2 = -d_w$. Thus, the effect of white prejudice can be included in a house-value regression by using racial composition as an independent variable. The coefficient of racial composition is an indication of the strength of white prejudice.

Two further complications must be considered in applications of this theory. First, a P(u) function that takes the form given by (6) represents an equilibrium for prejudiced whites, but not for blacks. In fact, it can be shown that if, as surveys indicate, some blacks prefer to live in integrated areas, there exists no combination of a price-distance function (P(u)) and a racial-composition-distance function (r(u)) that leads to a stable locational equilibrium for both blacks and whites (Yinger, forthcoming). Thus if whites value neighborhood stability, they will have an incentive to "purchase" it by restricting the movement of blacks.[13] We will therefore hypothesize that the price-distance function adjusts to keep whites in equilibrium,

so that a_2 is negative, and that discrimination prevents blacks from moving to their preferred locations.

A second complication is that the relationship between racial attitudes and the price-distance function is likely to be different in different types of neighborhoods. As noted earlier, most blacks prefer the racial compositions in integrated areas to the racial compositions in largely white or largely black areas. Thus the hypothesis that a_2 is negative is not consistent with locational equilibrium for blacks in largely white areas unless discrimination prevents blacks in such areas from moving. In largely black areas, a price-distance function that reflects white prejudice may be consistent with locational equilibrium for blacks, since many blacks would rather live in integrated areas than in largely black areas; therefore, a negative a_2 in largely black areas does not imply discrimination against blacks. There is no way to determine which of these explanations is more appropriate for integrated areas: Given our hypothesis that the price of housing adjusts to keep whites in equilibrium, then either blacks prefer the integrated areas with the highest proportion of whites, in which case prices keep blacks in equilibrium, or discrimination prevents blacks from moving. Unfortunately, there is no way to choose one of these explanations on the basis of a house-value regression.[14]

III. Testing Hypotheses About the Black-White Price Differential In Housing

In this section we will describe and estimate two specifications that are designed to test the hypotheses about the black-white price differential discussed in section I.

A. The King-Mieszkowski Specification

An appropriate specification for testing hypotheses based on discrimination and on the Bailey border model is used by King and Mieszkowski (1973). They define a ghetto zone and a boundary zone and use these definitions to create four dummy variables: BOUND-B equals one for black households in the boundary zone; BOUND-W equals one for white households in the boundary zone; GHET-B equals one for black households in the black ghetto; and GHET-W equals one for white households in the ghetto.

The key to the King-Mieszkowski specification lies in the definition of the ghetto and boundary zones. One approach to these definitions is to define the boundary zone as the set of neighborhoods undergoing racial transition, that is, all neighborhoods with significant proportions of both blacks and whites. An approach based on the Bailey model is to assume that there exists a specific boundary in space and to define the boundary zone as the area located between the black and white areas. In practice, these two approaches are highly correlated, and King and Mieszkowski use definitions that draw on both.

They define the black area to be all blocks that are 60 percent or more black and surrounded by blocks that are 60 percent or more black; the white area to be blocks that are 3 percent or less black; and the boundary zone to be everything else. These definitions do not explicitly locate blocks in space, but by tying each block to neighboring blocks they include some spatial information.

Applying this specification to data for rental housing in New Haven, King and Mieszkowski find that the coefficient of GHET-B is significantly positive and the coefficient of BOUND-W is significantly negative. The coefficient of GHET-W has approximately the same magnitude as the coefficient of GHET-B, but it is not significant at the 10 percent level. The coefficient of BOUND-B is approximately equal to zero. King and Mieszkowski interpret the difference between the coefficients of BOUND-B and BOUND-W (equivalent to about 7 percent of average rentals) as evidence of price discrimination against blacks in the boundary zone. They also interpret the large positive coefficients of GHET-B and GHET-W (about 9 percent of average rentals) to be evidence of the effect of exclusion,[15] the large negative sign of the coefficient of BOUND-B (7 percent of average rentals) to be evidence of a white taste for segregation, and the difference between GHET-B and BOUND-B to be evidence of a black taste for segregation.

The present study uses data for owner-occupied houses in St. Louis in 1967. This set of data identifies houses by census tract but not by block; thus, the King-Mieszkowski definitions of zones could not be duplicated. Instead, two different approaches were used: One divided tracts into zones solely according to their racial compositions, and the other combined spatial information with information about racial composition.

Two types of regressions were performed using the first approach. The first type arbitrarily chose 5 percent black as the dividing line between white and integrated areas and 85 percent black as the dividing line between integrated and black areas. The second type defined the racial compositions that separated the three types of neighborhoods to be those that minimized the sum of squared errors (SSE) of the regressions; in all cases these racial compositions were 40 and 80 percent black.[16] The locations of the zones that result from these two sets of dividing lines are shown in Figures 1 and 2.

Two types of regressions were also performed using the second approach. The first makes use of zones defined using spatial information and racial composition. The ghetto consists of all contiguous tracts that are 90 percent or more black, the white area consists of all tracts that are 5 percent or less black plus all tracts surrounded by such tracts, and the boundary zone consists of everything else. The zones that result from these definitions are illustrated in Figure 3. The second type of regression divides the boundary zone into a north and a south segment and includes BOUND-B and BOUND-W variables for both segments. This second type of regression reflects the fact that considerably more racial transition took place in the northern boundary zone than in the southern boundary zone.[17]

Estimates of the King-Mieszkowski specification using these four definitions of the different zones and using both a double log and a linear regression are presented in Table 1.[18] The housing characteristics used as independent variables in these regressions are discussed in the Appendix.

Figure 1. Racial Zones in St. Louis Using 5 and 85 Percent Black as Boundaries.

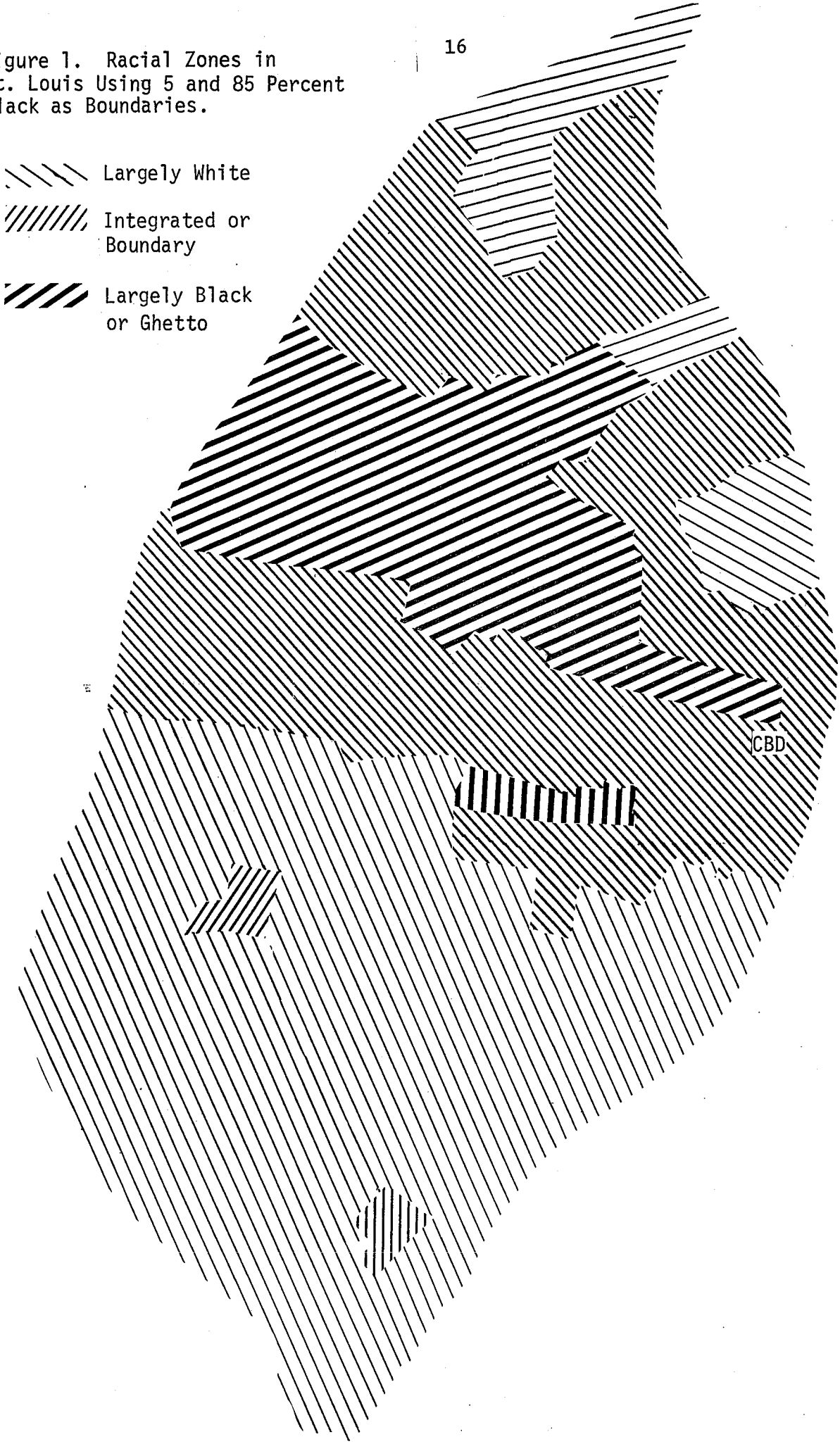


Figure 2. Racial Zones in St. Louis Using 40 and 80 Percent Black as Boundaries.

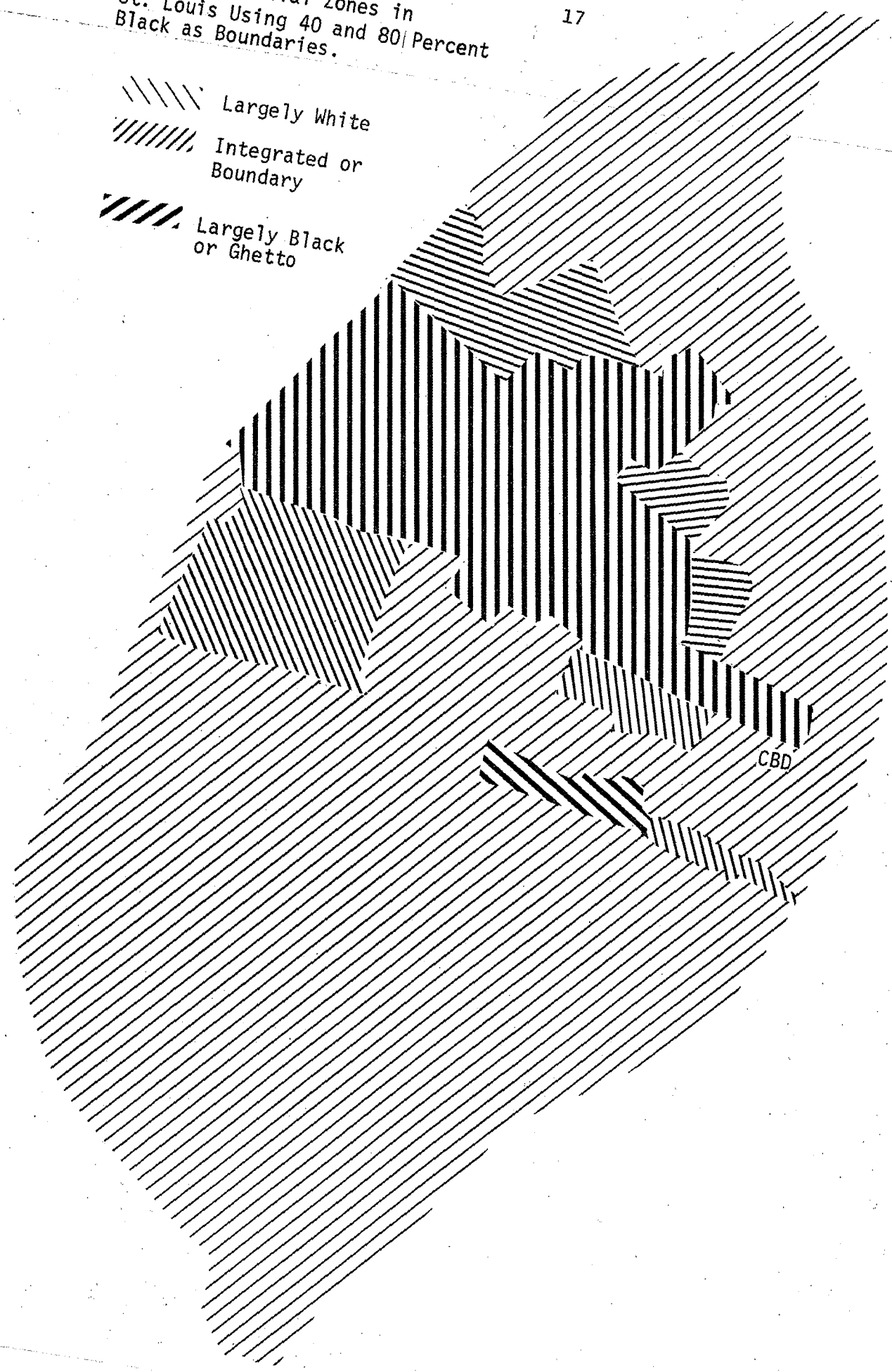


Figure 3. Racial Zones in St. Louis Defined Using Spatial Information.

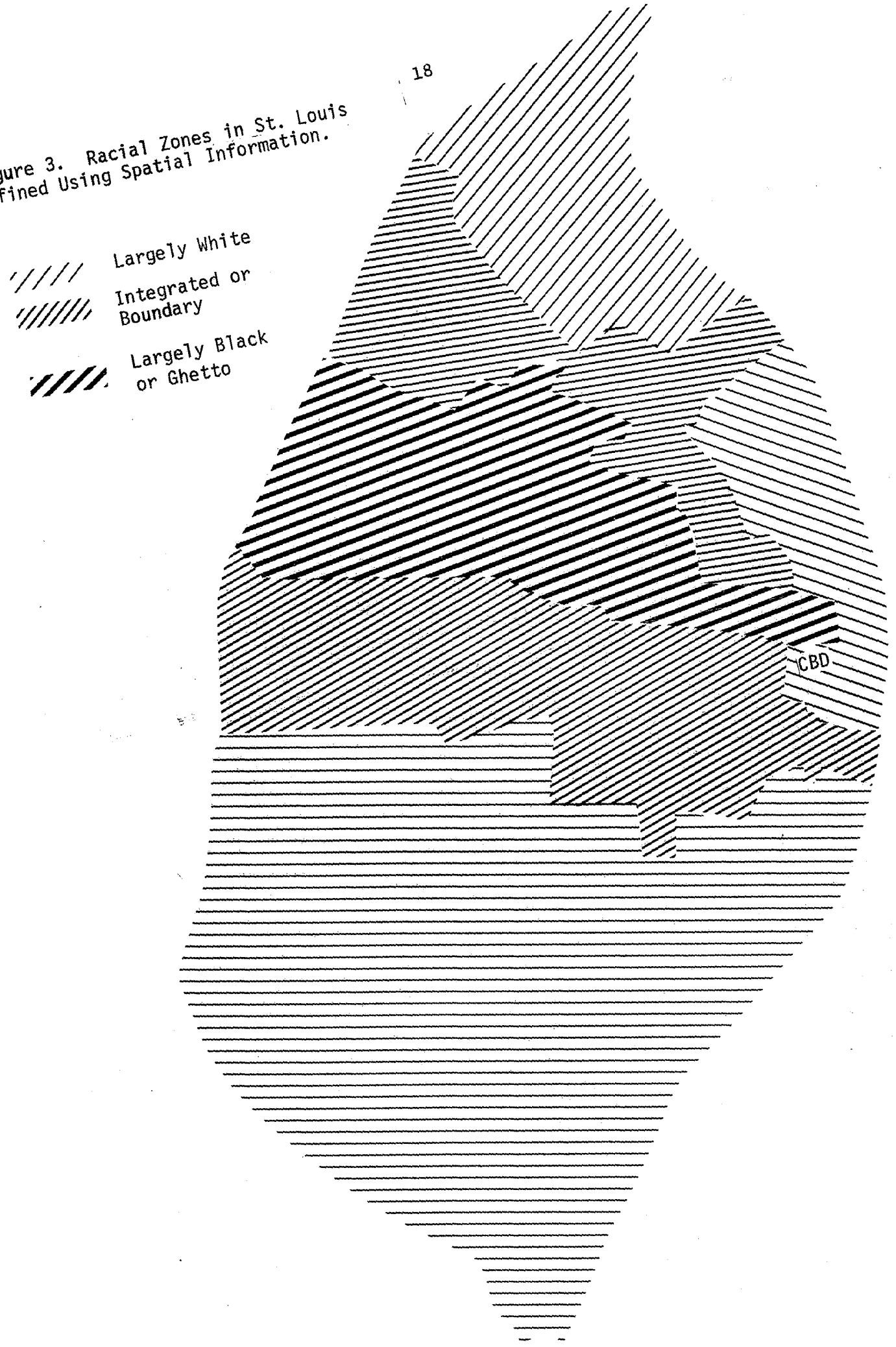


Table 1. Estimates for Racial Variables Using the King-Mieszkowski Specification with Various Neighborhood Definitions

	Neighborhoods Defined by (1) Percentage of the Population that Is Black (0-5, 5-85, 85-100)		(2) (0-40, 40-80, 80-100)		(3) Spatial Information: Combined		(4) Spatial Information: Separate	
	Coef.	t-Stat.	Coef.	t-Stat.	Coef.	t-Stat.	Coef.	t-Stat.
A. Log Model								
GHET-B	.1124	2.23	.1473	2.960	.1037	2.116	.1099	2.298
GHET-W	.0320	.37	.0859	.986	-.0470	-.426	-.0215	-.1997
BOUND-B[a]	.0645	.50	.1536	1.183	.1697	1.987	.2167	2.144
BOUND-W[a]	-.0475	-1.13	.1370	1.576	-.0064	-.139	.2810	3.110
BOUND-B[b]							.0967	.772
BOUND-W[b]							-.0703	-1.469
B. Linear Model								
GHET-B	593.03	.61	1698.17	1.768	524.80	.570	1151.28	1.255
GHET-W	-880.72	-.60	544.93	.372	-2242.72	-1.244	-1520.01	-.863
BOUND-B[a]	-260.24	-.13	1600.69	.781	1946.79	1.337	3834.20	2.156
BOUND-W[a]	-672.28	-.99	1698.17	2.343	30.30	.039	4886.26	3.26
BOUND-B[b]							475.63	.241
BOUND-W[b]							-777.21	-.996

Note: The two-tailed 10 percent (1 percent) significance level is 1.645 (2.576).

[a]Boundary variables for the northern segment in regression (4).

[b]Boundary variables for the southern segment in regression (4).

The results of the first regressions, which use the boundary percentages of 5 and 85, are similar to the King and Mieszkowski results for New Haven. The coefficient of GHET-B is large and positive, the coefficient of BOUND-B is close to zero, and the coefficient of BOUND-W is negative. However, the only coefficient that is significant at the 10 percent level is that of GHET-B in the log regression; this coefficient suggests that blacks in the ghetto pay 11 percent more than residents of the white area for equivalent housing. Since the coefficient of GHET-W is small and not significantly different from zero, the coefficient of GHET-B implies the existence of price discrimination against blacks in the ghetto. The coefficient of BOUND-W suggests that whites in the boundary zone pay less per unit of housing services than whites in the white area, but it is not significant at the 10 percent level in either regression.[19]

The second regressions perform somewhat better than the first. These regressions use 40 and 80 as the racial compositions that divide the different zones. In both the log and the linear regressions, the coefficient of GHET-B is positive and significant at the 5 percent level. In addition, the coefficient of BOUND-W is positive in both regressions and significant at the 5 percent level in the linear regression. These significant coefficients provide evidence that there is price discrimination against blacks in the ghetto and that blacks are excluded from white areas.

The third regressions, which make use of spatial information in defining the zones, have two significant coefficients in the log case (those of GHET-B and BOUND-B) and no significant coefficients in the linear case. The two significant coefficients indicate that blacks pay

considerably more than whites for equivalent housing in both the boundary zone and the ghetto. As shown in the fourth regressions, the separation of the north and south boundary zones improves the performance of this specification. The coefficients for the northern boundary zone are all positive and significant at the 5 percent level, but none of the coefficients for the southern boundary zone are significantly different from zero. These significant coefficients indicate that both blacks and whites pay significantly more in the northern boundary zone than in white areas. In addition, the coefficient of GHET-B is positive and significant at the 5 percent level in the log regression.

In summary, only one hypothesis about the black-white price differential is supported by all of our four neighborhood definitions: that there is price discrimination against blacks in the ghetto. Results based on the second and fourth neighborhood definitions support the hypothesis that prices are higher in integrated neighborhoods, particularly those undergoing rapid racial transition, because of the exclusion of blacks from white neighborhoods. However, no more than half of the coefficients of the racial variables in any of our regressions are significant at the 10 percent level. Furthermore, none of the significant coefficients can be interpreted as an indication of the effects of racial attitudes on house values; if racial attitudes affect house values in St. Louis, the King-Mieszkowski specification fails to capture such effects--or at least to separate such effects from the effects of racial discrimination. We will therefore derive and estimate an alternative specification, one that incorporates the effects of racial attitudes on house values using, instead of Bailey's border model, the theory of racial composition as an amenity.

B. An Alternative Specification

According to our analysis of racial composition as an amenity, the effect of racial composition on the price of housing is different in different types of neighborhoods. The appropriate econometric specification for testing our hypotheses about racial composition and the price of housing therefore includes the following three variables: PBL-WHI, or racial composition in largely white neighborhoods (that is, racial composition times a dummy variable for white neighborhoods); PBL-INT, or racial composition in integrated neighborhoods; and PBL-BLK, or racial composition in largely black neighborhoods. These three variables are designed to capture the effects of racial attitudes on the price of housing.

Price discrimination against blacks may lead to higher unit prices for blacks than for whites within any given type of neighborhood. In our specification, the effects of price discrimination on the unit price of housing are determined by the 0-1 variables INT-B, for nonwhite households in integrated areas, and BLK-B, for nonwhite households in black areas. The exclusion of blacks from large parts of an urban area leads to a higher unit price for housing in black and integrated areas than in white areas. The effects of exclusion are measured by the dummy variables INT, for integrated neighborhoods, and BLK, for largely black neighborhoods.

All the racial variables with their predicted signs are listed in Table 2. Integrated and largely black neighborhoods are defined by their racial compositions. The racial compositions chosen as boundaries between the different types of neighborhoods are those

Table 2. Racial Variables

Variable	Predicted Sign	Definition
INT	+	Dummy variable; = 1 for houses in integrated neighborhoods
BLK	+	Dummy variable; = 1 for houses in largely black neighborhoods
INT-B	+	Dummy variable; = 1 for nonwhite households in integrated neighborhoods
BLK-B	+	Dummy variable; = 1 for nonwhite households in largely black neighborhoods
PBL-WHI	-	Racial composition in largely white neighborhoods = (PBL)x(1-INT-BLK)
PBL-INT	-	Racial composition in integrated neighborhoods = (PBL-40)x(INT)
PBL-BLK	-	Racial composition in largely black neighborhoods = (PBL-80)x(BLK)

Note: PBL is the percentage of the population that is black in the census tract in which an observation is located. Integrated neighborhoods are census tracts in which $40 < PBL \leq 80$. Largely black neighborhoods are census tracts in which $80 < PBL \leq 100$.

that minimize the SSE of the regressions. For both the log and the linear regressions these racial compositions are 40 percent black for the boundary between largely white and integrated areas and 80 percent black for the boundary between integrated and largely black areas.[20] Note that the PBL-, or racial composition terms, in Table 2 are defined to be zero at the smallest percentage black in each type of neighborhood, so that the shift terms, INT and BLK, reflect the deviation of unit prices at 40 and 80 percent black, respectively, from the price in an all-white neighborhood.

This alternative specification is equivalent to the King-Mieszkowski specification with the addition of the racial composition terms. Several previous studies of the black-white price differential have used racial composition terms, but the only study that combines racial composition and shift terms is that of Gillingham (1973). Gillingham's study does not, however, use racial composition terms and shift terms for different types of neighborhoods.

The racial variables in Table 2 have been included in house-value regressions using data for owner-occupied houses in St. Louis in 1967. The housing characteristics included as independent variables in these regressions and the estimated coefficients for these characteristics are described in the Appendix. The coefficients of the racial variables are presented in Table 3. All of the coefficients in both the log and the linear models have the predicted signs. In addition, all of the coefficients that refer to largely white and largely black neighborhoods are significant at the 5 percent level or above. The

Table 3. Estimates for the Racial Variables in Table 2

	Regression (1)		(2)		(3)	
	Coef.	t-Stat.	Coef.	t-Stat.	Coef.	t-Stat.
			A. Log Model			
INT-B	.1589	1.803	.1556	1.747	-	-
BLK-B	.1270	.819	.1262	.813	-	-
RACE	-	-	-	-	.1515	1.941
INT	.2494	1.410	.2477	1.397	.2586	1.528
BLK	.2706	2.122	.2710	2.121	.2739	2.173
PBL-WHI	-.00617	-2.674	-.00617	-2.671	-.00617	-2.680
PBL-INT	-.00824	-1.247	-.00826	-1.247	-.00880	-1.501
PBL-BLK	-.01868	-2.454	-.01861	-2.437	-.0184	-2.465
TENURE	-	-	-.00029	-.288	-	-
			B. Linear Model			
INT-B	2726.24	1.984	2662.33	1.919	-	-
BLK-B	2182.55	.845	2165.39	.837	-	-
RACE	-	-	-	-	2608.40	2.141
INT	8155.46	2.796	8104.95	2.770	8342.90	3.051
BLK	3498.46	1.674	3498.25	1.671	3537.42	1.704
PBL-WHI	-86.84	-2.314	-87.11	-2.317	-86.99	2.323
PBL-INT	-275.67	-2.432	-275.65	-2.427	-287.11	-3.014
PBL-BLK	-317.56	-2.672	-316.21	-2.655	-313.39	-2.690
TENURE	-	-	-5.78	-.371	-	-

Note: The one-tailed 10 percent (1 percent) significance level is 1.282 (2.326).

coefficients that refer to integrated neighborhoods are less significant, but INT is significant at the 10 percent level in the log regression and INT and PBL-INT are significant at the 5 percent level in the linear regression.

The patterns of unit housing prices implied by these estimates for the log regressions and for the linear regressions are shown in Figures 4 and 5, respectively. In the log regression, the coefficient of PBL-WHI implies that the unit price of housing services in largely white neighborhoods declines by 6.2 percent for every increase of 10 percentage points in the black population. Similarly, the coefficients of PBL-INT and PBL-BLK imply that unit prices decline steeply as percent black increases in both integrated and largely black neighborhoods. According to the coefficient of INT, prices are 24.9 percent higher in neighborhoods that are 40 percent black than in all-white neighborhoods, and according to the coefficient of BLK, prices are 27.1 percent higher in neighborhoods that are 80 percent black than in all-white neighborhoods. Finally, the coefficients of INT-B and BLK-B indicate that in a neighborhood with any given racial composition, the price of housing for blacks is about 14 percent higher than the price for whites. The linear regression has similar implications.

Interpretation of these results is complicated by the fact that the dependent variable is an owner-estimated market value instead of an actual sales price.[21] If the dependent variable were actual sales price in a given year, the coefficients of INT-B and BLK-B would be measures of price discrimination against blacks. However, using

Figure 4. Percent Deviations in Unit Price of Housing from the Price in an All-White Neighborhood, by Racial Composition of Neighborhood (Based on Log Regression).

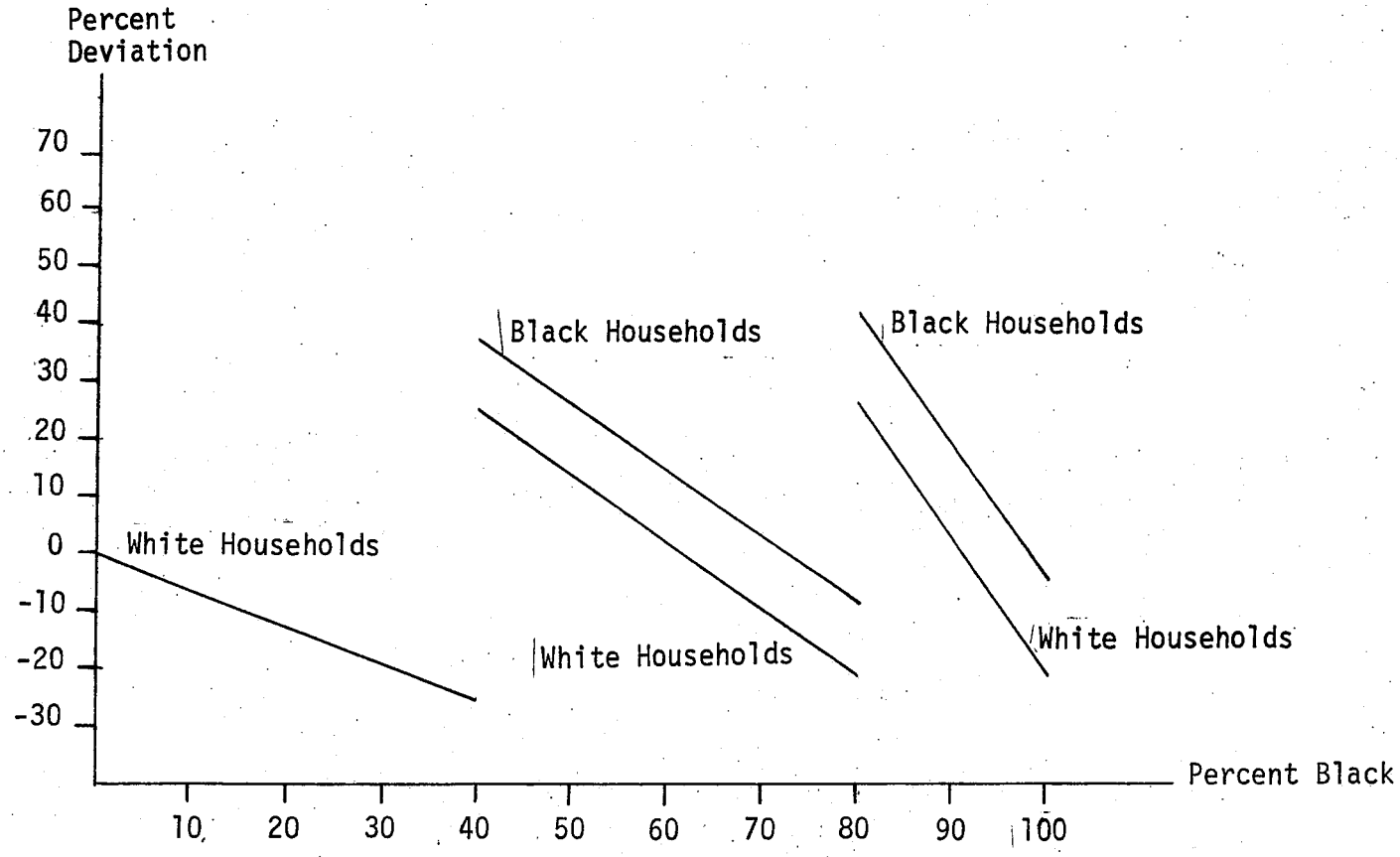
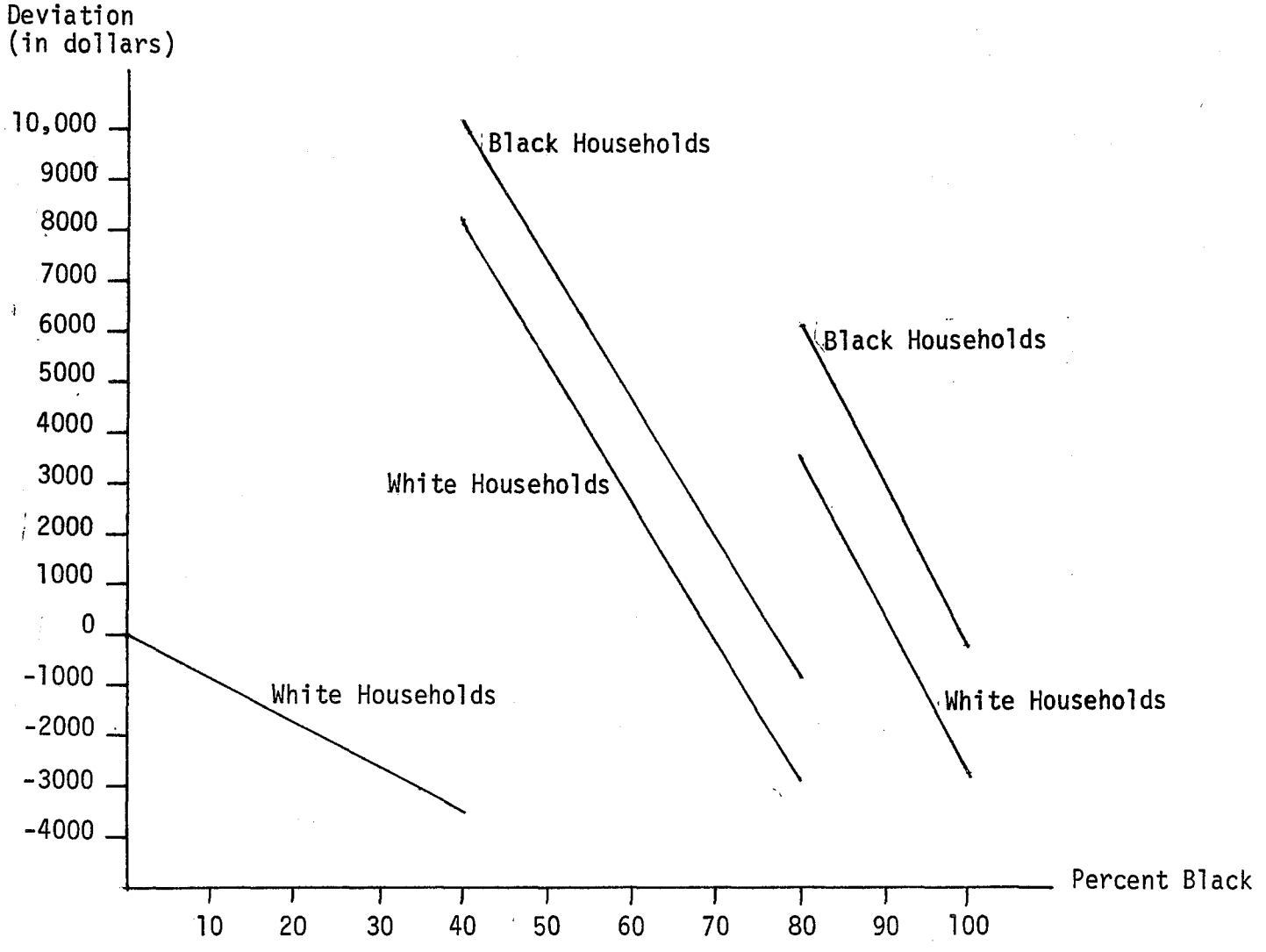


Figure 5. Absolute Deviations in Price of Housing from the Price in an All-White Neighborhood, by Racial Composition of Neighborhood (Based on Linear Regression).



owner estimation introduces the possibility that owner estimates do not keep up with actual price increases in a given neighborhood. In this case the large positive coefficients of INT-B and BLK-B may reflect the fact that blacks are more recent entrants into black and integrated neighborhoods. To test for this possibility, a new variable, years lived at current address (TENURE), was added to the regressions. Regression (2) in Table 3 shows that the coefficients of this variable are small and insignificant, and its inclusion had no significant impact on the coefficients of the racial variables. It is safe to conclude that INT-B and BLK-B are not capturing the effects of tenure.

Two other interpretations of the coefficients of INT-B and BLK-B involve price discrimination against blacks. The first is that price discrimination is carried out by middlemen. In this case, estimates made by white owners, who have not faced price discrimination, will be lower than estimates made by black owners, who have. The second interpretation is that white owners are the source of price discrimination, but that they give estimates of what other whites would have to pay for their houses, not of the price they would charge blacks.

Our estimates also suggest that price discrimination has a similar magnitude in integrated and largely black neighborhoods. (Since our sample contains no observations for black households in largely white neighborhoods, we cannot estimate the extent of price discrimination in such areas.) Indeed, using the appropriate t-test, we cannot reject the hypothesis that the coefficients of INT-B and BLK-B are the same. We have therefore defined a new variable, RACE, which equals one for nonwhite households and zero for other households; it is the sum of INT-B and BLK-B. Log and linear regressions using RACE

are presented in column (3) of Table 3. The coefficients of RACE, which are significant at the 5 percent level in both regressions, indicate that at any given level of racial composition blacks pay about 15 percent more than whites for equivalent housing.

We hypothesized that the unit price of housing would adjust to keep whites in locational equilibrium, so that the signs of the racial composition terms would all be negative. In this situation, locational equilibrium within any given type of neighborhood requires either that blacks, like whites, prefer the neighborhoods of that type with the highest proportion of whites or that blacks cannot respond to price differentials because of discrimination against them. We argued that the first possibility was more likely in largely black neighborhoods and the second was more likely in largely white neighborhoods. Since the estimated coefficients of the racial composition terms (PBL-WHI, PBL-INT, and PBL-BLK) are all negative, the interpretation of these coefficients is a direct application of our earlier arguments.

The coefficients of INT and BLK require careful interpretation. If our dependent variable were actual sales price in a given year, then in the log regression the high positive coefficient of INT combined with the negative coefficient of PBL-WHI would imply that some whites paid 49.6 percent more in neighborhoods that were 41 percent black than they would have had to pay for equivalent houses in neighborhoods that were 39 percent black. The fact that our dependent variable is owner-estimated market value eliminates this possibility; instead, the large gap in unit prices at 40 percent black implies that the owner of a house in a neighborhood that is 41 percent black could sell his house for 49.6 percent more than the owner of an equivalent house in

a neighborhood that is 39 percent black. According to the theory in section II, this large gap persists because blacks are excluded from large parts of the urban area.

It should be pointed out that whites in integrated areas are probably not in equilibrium. They could sell their houses and buy new ones in white areas with a large capital gain and a loss of black neighbors. Moving and search costs presumably have kept them from making the move.[22] To put this argument another way, the price gap at 40 percent black helps to explain the speed and universality of racial transition once blacks start to move into a neighborhood; whites in such a neighborhood have an incentive to leave, both because of their prejudice and because of the large capital gains they can make.

The negative coefficient of PBL-INT is consistent with locational equilibrium for blacks and whites in integrated areas, and the positive coefficient of BLK is consistent with the hypothesis that blacks are excluded from white areas. In combination these coefficients imply, in the log regression, that unit housing prices are 60 percent higher in neighborhoods that are 81 percent black than in neighborhoods that are 79 percent black. This large gap in unit housing prices at 80 percent black is puzzling. The existence of a price gap between neighborhoods with different racial compositions implies that some people cannot bid for housing in the neighborhoods on the low-price side of the gap. The hypothesis that blacks are excluded from white neighborhoods therefore explains why a large price gap may exist at 40 percent black. But no comparable theory exists to explain the price gap at 80 percent black; indeed, one would expect blacks in the ghetto to move into integrated neighborhoods, where unit housing prices

are much lower, and thereby to bid up the price of housing in such neighborhoods.

The following arguments are ex post explanations of the price gap at 80 percent black:

1. Houses in integrated neighborhoods are only sold to blacks whom the sellers consider to be desirable residents or good credit risks in such neighborhoods; other blacks must remain in the ghetto.

2. Some blacks prefer segregation so strongly that they will not move into integrated areas despite a substantial savings in the unit price of housing.[23]

3. Blacks in the ghetto have so few assets that they cannot afford the houses in integrated areas, which, despite their low unit price, contain many more units of housing services than ghetto houses and sell at higher total prices. There is some evidence to support this explanation: Average incomes and average house values are substantially lower in the ghetto than in integrated areas. However, the distributions of incomes and house values in the two types of neighborhoods overlap considerably, so that if incomes accurately reflect assets, some houses that ghetto blacks can afford do exist in integrated areas.[24]

Unfortunately, the data necessary to test these three propositions do not exist, and the price gap at 80 percent black must remain something of a puzzle. Since our sample contains only 13 observations in the integrated area, it is reasonable to be somewhat skeptical about the estimated coefficient of PBL-INT and therefore about the existence of so large a price gap. It is hoped that future studies will help to resolve this puzzle.

IV. Further Results

A. Extrapolations to 1967 Racial Composition

One possible objection to the results in section III is that they make use of 1970 racial composition to explain 1967 house values, thereby implicitly assuming that changes in racial composition between 1967 and 1970 have the same effect on the price of housing as the level of racial composition in 1967. To meet this objection, two procedures were used to extrapolate back to 1967 racial compositions and the third regressions in Table 3 were repeated using the estimated 1967 racial compositions to define the racial variables.

The first procedure is a simple linear extrapolation: Racial composition in 1967 is defined to be racial composition in 1960 plus seven-tenths of the change in racial composition from 1960 to 1970. The estimated coefficients of racial variables defined using this extrapolation are reported in column (1) of Table 4. The signs of all of these coefficients are the same as in Table 3, but the magnitudes and significance levels of the coefficients of all the variables except RACE and PBL-INT are much smaller than before. It can be argued, however, that a linear extrapolation is not appropriate; not only is racial transition influenced by the socioeconomic characteristics of each tract, but the process of racial transition is undoubtedly not linear.

The second extrapolation procedure attempts to capture the effects on racial transition of the socioeconomic characteristics of a neighborhood, within the limits imposed by census-tract data. This

Table 4. Further Results for the Racial Variables in Table 2

	(1) Regressions Based on 1967 Percent Black: Linear Extrapolation Coef.	t-Stat.	(2) Regressions Based on 1967 Percent Black: Mover Extrapolation Coef.	t-Stat.	(3) Regression with Price-Distance Function Coef.	t-Stat.
			A. Log Model			
RACE	.1406	1.686	.1316	1.612	.1603	1.940
BL4080	.0977	.821	.1378	1.086	.2437	1.423
BL8099	.0801	.842	.1489	1.314	.2990	2.189
PBL0040	-.00407	-1.369	-.00623	-2.481	-.00620	-2.589
PBL4080	-.00422	-.850	-.00125	-.241	-.00899	-1.522
PB68099	-.00894	-1.817	-.00809	-1.838	-.0200	-2.291
			B. Linear Model			
RACE	2255.32	1.699	2164.81	1.685		
BL4080	1927.83	.978	4844.97	2.387		
BL8099	187.57	.110	1116.99	.599		
PBL0040	-27.18	-.547	-89.85	-2.182		
PBL4080	-111.71	-1.420	-129.33	-1.576		
PBL8099	-144.90	-1.857	-131.55	-1.912		

procedure is based on a simple model of neighborhood transition, in which the percentage of the population that moves between 1965 and 1970 is a function of the levels of the socioeconomic characteristics (including racial composition) in 1960 and of the changes in those characteristics between 1960 and 1970. Thus if M is the percentage of the population that moves between 1965 and 1970, $S_i(60)$ is the level of the ith socioeconomic characteristic in 1960, and R(60) is the racial composition in 1960, then[25]

$$M = \sum_i a_i S_i(60) + \sum_i b_i S_i(70) + cR(60) + dR(70) \quad .$$

Racial transition is the process of blacks moving into a neighborhood and whites moving out; the percentage of movers that reflects racial transition is given by $M_R = cR(60) + dR(70)$. Thus M_R represents black households moving into a tract, and it follows that

$$R(65) = R(70) - M_R$$

and

$$R(67) = R(70) - (3/5)M_R = R(70) - .6(cR(60) + dR(70))$$
$$= R(70)(1-.6d) - R(60)(.6c) \quad .$$

The results of our regressions using this extrapolation to define the racial variables are given in column (2) of Table 4.[26] Both the magnitudes and the significance levels of the coefficients of the racial variables are higher in this case than in the simple linear extrapolation, but they are still lower than when 1970 racial composition is used. For example, the log regression indicates that the unit

price of housing is about 15 percent higher in neighborhoods that are 80 percent black than in all-white neighborhoods.

There is no way to determine the accuracy of our estimates of 1967 racial compositions, and it is certainly possible that the low magnitudes and significance levels of the coefficients of the racial variables in the first two regressions in Table 4 are due to the inaccuracy of our extrapolations. If our extrapolations are accurate, however, then the superior performance of the variables based on 1970 racial composition suggests that anticipated racial composition has a greater impact on housing prices than does actual racial composition. On the assumption that people's anticipations are based on current trends, this proposition could be tested in future studies by projecting racial composition a few years ahead on the basis of its current rate of change and defining the racial variables in a house-value regression on the basis of projected racial composition.

B. Price-Distance Function Variables

Another possible objection to our specification is that it is not fully consistent with our theoretical model. The variables on the right-hand side of equation (7) include variables from the price-distance function as well as housing characteristics, but only the latter have been used so far as independent variables in our regressions. The omission of the price-distance function is important because the higher unit prices that we have estimated in largely black neighborhoods may be due to the fact that such neighborhoods are located in the central city where the equilibrium price of housing is higher.

It is therefore appropriate to include variables from the price-distance function in our regressions. For a description of these variables, see the Appendix. The coefficients of our racial variables in a regression that includes variables from the price-distance function are given in column (3) of Table 4. Comparison of these results with the results in column (3) of Table 3 shows that the inclusion of the variables from the price-distance function has virtually no effect on the magnitudes or significance levels of the coefficients of the racial variables. It is safe to conclude that the black-white price differential in St. Louis is not due to the centralization of blacks.

C. Racial Differences in Implicit Prices

Finally, several authors (see Lapham (1971) and Daniels (1975)) have argued that the implicit prices for housing characteristics are different for blacks than for whites, so that it is appropriate to run separate house-value regressions for the two groups. According to this approach, a black-white price differential exists if (1) the average bundle of housing characteristics for black households valued at the implicit prices paid by blacks is worth more than the same bundle valued at the implicit prices paid by whites and (2) the average bundle for white households valued at the implicit prices paid by whites is worth less than the same bundle valued at the implicit prices paid by blacks. If these two comparisons are not both true (or both false) then there is an index number problem with no known solution.

To test for racial differences in the set of implicit prices, the St. Louis sample was split into black and white households and

separate house-value regressions were run for each subsample. These regressions included the racial variables described earlier. Then an F-test was carried out to test the null hypothesis that the sets of coefficients in the two regressions are the same. In neither the log nor the linear regression could this null hypothesis be rejected at the 10 percent level of confidence.[27]

These F-tests do not, of course, prove that the two sets of coefficients are the same. Therefore, for the sake of completeness, we will assume that the two sets of coefficients are different and see if this assumption leads to a different picture of the black-white price differential than the one drawn earlier. In both the log and the linear regressions, we calculated (1) how much more the average bundle of housing characteristics for white households would cost if valued at black implicit prices instead of at white implicit prices and (2) how much less the average bundle for black households would cost if valued at white implicit prices instead of at black implicit prices. Each of these calculations was performed for various levels of racial composition, and each resulted in an estimate of the black-white price differential within a neighborhood with a given racial composition.[28] The results are presented in Table 5. The table indicates, for example, that a house with the average bundle of characteristics for white households, in a neighborhood that is 60 percent black, would cost 46.6 percent more if evaluated at black implicit prices rather than at white implicit prices.

Thus the assumption that implicit prices of housing characteristics are different for blacks and whites does not lead to results dramatically different from those in section III. In virtually every type

Table 5. Percentage Changes in the Valuations of Average Bundles of Housing Characteristics for Blacks and Whites When Evaluated at the Implicit Prices for the Other Group, in Neighborhoods with Various Racial Compositions

Percentage of the Population that Is Black	Change in Valuation of White Bundle	Change in Valuation of Black Bundle
	A. Log Model	
40	+87.9	-36.5
60	+46.6	-18.6
80	+14.4	+4.3
80	+66.3	-28.2
99	+35.9	-12.2
	B. Linear Model	
40	+12.8	-.04
60	+24.4	-4.9
80	+34.2	-14.3
80	+42.3	-25.7
99	+41.9	-22.5

Note: The first three rows for each model refer to "integrated" neighborhoods, and the second two rows refer to "largely black" neighborhoods.

of neighborhood, houses are valued much higher at black implicit prices than at white implicit prices.[29]

V. Summary and Conclusions

The existing theory about the black-white price differential in housing suggests a very complex relationship between racial variables and the market value of housing. King and Mieszkowski account for this complexity by using an econometric specification designed to estimate the effects on rentals of price discrimination against blacks, the exclusion of blacks from white neighborhoods, and racial attitudes. Their results for New Haven provide evidence that all three of these factors affect rentals.

We have used the King-Mieszkowski specification to analyze the black-white price differential in St. Louis. Although our results are similar to theirs, two additional points emerge from our results: First, the signs and magnitudes of the coefficients of the racial variables in their specification are sensitive to the definitions of the three zones (white, boundary and black). Second, if racial attitudes and discrimination against blacks both affect house values in St. Louis, their specification does not allow one to adequately distinguish between these two effects.

As an alternative to the King-Mieszkowski specification, we have derived and estimated a specification based on a different view of the effect of racial attitudes on the price of housing. In particular, we

have argued that the effects of racial attitudes can be captured by treating racial composition as a neighborhood amenity. We have estimated this alternative specification using data from St. Louis, and the results indicate that this new specification more adequately captures the complexity of the relationship between racial variables and the price of housing than does the King-Mieszkowski specification. We have found that the unit price of housing declines as percent black increases. This view is consistent with our hypotheses about the effects of attitudes on the price of housing. In addition, we have found that, as predicted by theories based on the exclusion of blacks from white neighborhoods, the price of housing shifts upward in black and integrated areas. Finally, we have found that, within any given neighborhood, blacks pay considerably more than whites, a result that supports the hypothesis that there is price discrimination against blacks. In short, we have found evidence of a large black-white price differential between largely white neighborhoods and both integrated and largely black neighborhoods, and of a large black-white price differential within neighborhoods. One puzzle remains in our results: We cannot adequately explain why there is a large price gap at 80 percent black.

Two general points about estimating the black-white price differential emrge from our discussion. First, it is appropriate to estimate the black-white price differential by using an econometric specification that is explicitly linked to theories about the black-white price differential in housing. Ad hoc specifications that are designed simply to measure this price differential fail to account adequately for the complexity of the relationship between racial variables

and the market value of housing; such specifications, therefore, may lead to misleading results. Second, the econometric specification should be able to distinguish among the various influences on the price of housing; otherwise, the coefficients of the racial variables are difficult to interpret and incorrect inferences about the black-white price differential may be made. We have found that a specification based on an analysis of racial composition as an amenity provides a good way to distinguish between the effects on house values of racial attitudes and the effects on house values of discrimination against blacks.

Appendix. Housing Characteristics

This study makes use of survey data for individual houses in St. Louis in 1967. For a more complete description of this data see Kain and Quigley (1970). The housing characteristics used as independent variables to accompany both the King-Mieszkowski specification and our alternative specification of racial variables are listed in Table A1. All of these variables were included in the linear regressions, and all of them except POVFAM were included in the log regressions.

The variables in Table A1 are taken from a larger set of variables described in Yinger (1975b). The variables included in the regressions are all of the variables in the complete set that (1) have a t-statistic greater than unity or (2) have a strong theoretical connection to house values. The estimated coefficients for the housing characteristics associated with regression (1) in Table 3 are presented in Table A2. These coefficients are extremely robust and do not vary much for any of the regressions reported in sections III and IV.

The estimated coefficients of the variables from the price-distance function included in regression (3) in Table 4 are presented in Table A2. These variables are taken from equation (7), with two changes: First, many income classes are considered. The city is divided into rings one mile wide and the inhabitants in each ring are defined to be in one income class. The outer edge of each ring is defined to be u_j^*, and separate coefficients for the price-distance function variables are estimated for each ring. Second, the estimated value of t (per-mile commuting costs) is that value that minimizes the SSE in the

Table A1. List of Variables

Type	Name	Description
Dependent	VALUE	Owner-estimated market value of house
Structural	ROOMS	Number of rooms
	BATHS	Number of bathrooms plus one
	FIRST	First floor area (hundreds of square feet)
	PARCEL	Parcel area (hundreds of square feet)
	MAQUAL	Material quality (assessor's data; 1=best, 4=worst)
	AGE	Age of house (in years)
	FAC2[a]	Dwelling unit quality (Kain & Quigley's second factor)
Neighborhood (=amenities)	FAC1	Basic residential quality (Kain & Quigley's first factor)
	FAC4	Nonresidential usage (K & Q's fourth factor)
	MATH	Average eighth-grade math achievement score in local public school
	EDUC	Median years of schooling of adult population (1970 Census)
	FINCOM	Median income of families (1970 Census)
	PSAME	Percentage of families in the same house in 1965 (1970 Census)
	POLD	Percentage of population over 65 years old (1970 Census)
	POVFAM	Percentage of families below the poverty line (1970 Census)
Location	CBDDIS	Distance to CBD (in miles)

[a]The variables FAC1, FAC2, and FAC4 are factors determined by factor analysis from a set of 39 structural and neighborhood characteristics, none of which is included separately in this list of variables. For details see Kain and Quigley (1970).

Table A2. Estimates for Housing Characteristics

	Log Model		Linear Model	
	Coefficient	t-Statistic	Coefficient	t-Statistic
Constant*	6.6565	13.141	288.184	.057
CBDDIS*	.00479	.324	202.024	.856
FAC1	.0850	3.333	1112.668	2.606
FAC2	.0483	2.682	726.586	2.532
FAC4	.0476	2.409	502.458	1.591
LROOMS	.1591	3.209	1479.381	1.994
LBATHS	.0998	1.460	1343.122	1.231
LFIRST[a]	.2879	4.887	4.473	4.648
LPARCEL[a]	.1911	4.691	80.668	10.285
AGE	-.00776	-8.215	-110.792	-7.555
MAQUAL[a]	-.2825	-3.167	-1494.456	-3.319
PSAME	-.00324	-1.441	-60.658	-1.744
EDUC	.0106	.719	482.482	1.918
POLD*	.0748	2.695	134.269	3.090
POVFAM*	-	-	91.258	1.829
MATH	.0501	1.686	844.098	1.821
R^2	.7754		.8162	

Notes to Table A2

A first letter "L" indicates that a variable is expressed as a natural logarithm.

The one-tailed 10 percent (1 percent) significance level is 1.282 (2.326). The two-tailed 10 percent (1 percent) significance level is 1.645 (2.576). Variables for which a two-tailed test is appropriate are marked with an asterisk (*).

[a]Expressed in logarithmic form only in Model I.

regression. In principle, the iterative procedure used to determine t should be performed simultaneously with the procedure used to determine the racial compositions that are the boundaries between the various zones. In practice, however, there appeared to be no interaction between the two procedures. The estimate of t is the same regardless of the racial compositions used as neighborhood boundaries, and vice versa. The precise definitions of the variables from the price-distance function are given as notes to Table A3. Note that CBDDIS is not included as an independent variable when the price-distance function is estimated. For more on the derivation and estimation of the price-distance function, see Yinger (1975b).

Table A3. Estimates for Variables from the Price-Distance Function

	Coefficient	t-Statistic
Constant	6.7651	12.893
RING2[a]	.3710	3.002
RING3	.2515	1.953
RING4	.2853	2.214
RING5	.3022	2.264
RING6	.2497	1.737
PRIDIS[b]	4.4996	1.775
PRIDIS2	-5.3353	-1.921
PRIDIS3	-5.2420	-1.876
PRIDIS4	-4.7891	-1.778
PRIDIS5	-5.0154	-1.881
PRIDIS6	-3.9208	-1.450
R^2	.7881	

Note: A two-tailed test is appropriate for all variables. The 10 percent (1 percent) significance level is 1.645 (2.576).

[a] RINGj is the dummy variable for ring j.

[b] The definitions for the PRIDIS variables are

$$PRIDIS = \ln(Y_j - t_j u) - \ln(Y_j - t_j u_j^*)$$

and

$$PRIDISj = (PRIDIS) \times (RINGj).$$

Notes

[1]The distinction between prejudice and discrimination is discussed by Becker (1957). For a more complete discussion, see Simpson and Yinger (1972).

[2]For a discussion of seven types of discrimination of interest to economists, see Thurow (1969).

[3]Throughout this paper we will distinguish among largely white, largely black, and integrated neighborhoods, where integrated neighborhoods are defined to be neighborhoods with significant proportions of both black and white residents. This definition will prove to be more convenient than the more literal one that integrated neighborhoods have at least one black resident and at least one white resident.

[4]Price discrimination can also lead to a black-white price differential between neighborhoods if discriminating sellers of housing deal with blacks in one neighborhood and whites in another. However, since many houses are sold by their owners and since real estate brokers typically do not operate in both the black and white submarkets (see Helper (1969) and Yinger (1975a)), we will assume that this possibility is of little practical importance.

[5]However, price discrimination is not the only explanation of a black-white price differential within a neighborhood. For example, King and Mieszkowski (1973) suggest that blacks often are more recent migrants into a city than whites and therefore have poorer information about the housing market, so that they do not get as much for

their money as do whites. In saying that the existence of a within-neighborhood price differential implies price discrimination, we are assuming that all nonracial explanations of this differential have been controlled for.

[6]The dependence of the Rate of Growth Hypothesis on exclusion is often misunderstood in the literature. Even King and Mieszkowski (1973), who are generally very careful about their definitions of racial variables, are confusing on this point. They argue that the Rate of Growth Hypothesis is a reflection of the "funneling" effect of "segregation," but segregation is a descriptive term and does not explain why blacks are "funneled" into the city center. Instead, both segregation and the black-white price differential are the results of the exclusion of blacks from white neighborhoods.

[7]To be precise, Courant's model depends on the assumption that blacks perceive that some sellers in the white submarket would refuse to sell to them; presumably, such perceptions are based on the experiences of blacks in the white submarket. Courant also points out that the proportion of whites who refuse to sell to blacks may decrease as the black-white price differential increases.

[8]Courant also shows why middlemen will not have an incentive to arbitrate across this price differential until it is very large.

[9]These assumptions about racial attitudes are important, and it is appropriate to review some of the evidence about them. Recent surveys, many of which are summarized in Pettigrew (1973), reveal that most whites prefer to live in all-white areas and that a majority of blacks

prefer to live in integrated areas. However, these surveys cannot separate blacks' attitudes about living with whites from blacks' attitudes about the levels of services in integrated areas, so that it is not appropriate to interpret these surveys as evidence that whites are prejudiced and blacks have "reverse" prejudice.

[10]Note that in principle one could build and solve a border model that made this simultaneity explicit, but the solution to such a model, which would involve rich blacks living farther from the CBD than poor whites, would be very unrealistic. For more on this point see Courant and Yinger (1975).

[11]For more discussion of this result, see Polinsky and Rubenfeld (1975) or Yinger (1975b).

[12]In a simple urban model, the city extends to the point where urban activities outbid agricultural activities for land, that is, until $R(\bar{u}) = \bar{R}$, where $R(u)$ is the rent-distance function and $\bar{R}$ is the agricultural rental rate. Furthermore, there is a relationship between $R(u)$ and $P(u)$ so that the assumption that $P(\bar{u}) = \bar{P}$ is equivalent to the assumption that $R(\bar{u}) = \bar{R}$. See Mills (1972).

[13]Note that "restricting the movement of blacks" is a general concept that may involve several types of discrimination. For example, it may involve the exclusion of all but a few blacks from many neighborhoods or it may involve the "steering" of blacks into certain neighborhoods. For a discussion of the techniques used by some real estate brokers to restrict the movements of blacks, see Yinger (1975a) or Helper (1969). Note further that blacks may also value neighborhood

stability, but it is assumed that they do not have the political or economic power to obtain it through discrimination against whites.

[14]There is also no empirical way to choose one of these two explanations for largely black or largely white areas, but in those areas, unlike in integrated areas, there are theoretical reasons for choosing one explanation or the other. It should be pointed out that these theoretical reasons are not as convincing in largely black areas as in largely white areas, because, to be precise, the price-distance function will only keep both blacks and whites in locational equilibrium in largely black areas if racial composition affects the utility of both groups in exactly the same way. This special case is given more general status in the text on the basis of the assumption that the effect of racial composition on the price-distance function is not as precise as equation (6) implies.

[15]Actually, King and Mieszkowski argue that this differential is evidence of the funneling effect of segregation as stated by the Rate of Growth Hypothesis, but as pointed out in our note 4, the Rate of Growth Hypothesis is based on exclusion, not on segregation.

[16]If the error terms are normal with a zero mean and a constant variance, this procedure results in maximum-likelihood estimates of the boundary percentages. (See Goldfeld and Quandt, 1972, p. 58). These estimates should not be regarded as precise, however, because only multiples of 5 percent were examined in determining the SSE-minimizing boundary percentages and because our sample includes few observations in neighborhoods between, say, 20 and 80 percent black.

[17]PSAME, the percentage of the population in a census tract that lived in the same house in 1965 and 1970, is included as an independent variable in these regressions to control for the effects on house values of general neighborhood transition. The northern and southern boundary zones are separated to see if there is anything special about the process of racial transition.

[18]Both log and linear regressions were used because there is no good theoretical way to choose between them. The log model is somewhat more appealing, in that it allows the marginal valuations of characteristics to decline with the quantity of the characteristics and to depend on the quantity of other characteristics, but the linear model may be more appropriate in the range of values in any given sample. For more on this see Yinger (1975b).

[19]Two factors may explain the differences between our results and King and Mieszkowski's: (1) our data is for owner-occupied housing, theirs is for rental housing, and (2) our dependent variable is owner-estimated house value, theirs is actual rental. The second factor is discussed below. Our regressions use 85 percent instead of 60 percent as the dividing line between the boundary zone and the ghetto because we have no observations for black households in neighborhoods that are less than 60 percent black.

[20]This specification was also estimated using racial variables based on the racial zones defined with spatial information (see Figure 3). The results are similar to those in Table 3, but since the coefficients, particularly the shift terms, are harder to interpret (see text), these results are not reported here.

[21]For a discussion of the accuracy of owner-estimated house values in general and in the sample of houses in St. Louis used in this study, see Kain and Quigley (1972).

[22]It is also possible that whites in integrated and largely black areas remain there because of factors that are not accounted for in our data, such as proximity to employment.

[23]Note that this explanation is somewhat inconsistent with our interpretation of the slope of PBL-BLK; the latter coefficient indicates, we said, that blacks slightly prefer 80 percent black to 81 percent black, but this price gap indicates that they very strongly prefer 80 percent black to 79 percent black.

[24]Average incomes in all tracts in the integrated and largely black areas in 1970 were $7293 and $6443, respectively. The average house values were $11,930 and $10,056. However, one-third of the tracts in the integrated area had average incomes below the ghetto mean, and one-half of the integrated tracts had average house values below the ghetto mean.

[25]The results of this regression for the tracts in our sample are

$$
\begin{aligned}
M = {} & \underset{(-2.68)}{-.0029\ (Y70)} \quad \underset{(-2.41)}{-.0026\ (Y60)} \quad \underset{(-.14)}{-.177\ (E70)} \quad \underset{(2.16)}{+2.857\ (E60)} \\
& \underset{(-.62)}{-.038\ (BLD70)} \quad \underset{(2.16)}{+.450\ (BLD60)} \quad \underset{(-.57)}{-.035\ (POWN70)} \quad \underset{(-1.67)}{-.142\ (POWN60)} \\
& \underset{(1.77)}{+.409\ (POLD70)} \quad \underset{(.26)}{+.088\ (POLD60)} \quad \underset{(4.26)}{+.2246\ (PBL70)} \quad \underset{(-7.67)}{-.434\ (PBL60)} \\
& \underset{(5.24)}{+57.144} \quad , R^2 = .836
\end{aligned}
$$

where Y is family income, E is median education of adults, BLD is the percentage of dwelling units more than 20 years old, POWN is the percentage of dwelling units owner-occupied, and POLD is the percentage of the population more than 65 years old.

[26]One of the housing characteristics used as an independent variable in these regressions is PSAME, the percentage of the population that did not move between 1965 and 1970. In order to avoid double counting, the percentage of movers that was taken out of the racial composition variable to get R(67) was added back into the PSAME variable to get an estimate of the percentage of the population that did not move between 1965 and 1967.

[27]This F-test is described by Johnston (1972, p. 199). The 10 percent significance level for an F-test with 21 and 224 degrees of freedom is 1.42. The values of the Chow test statistic are .6627 for the log regression and .7830 for the linear regression. (The latter test has one more degree of freedom in the numerator and two fewer in the denominator.)

[28]The coefficients of the regressions for the two subsamples also tell us something about the price differential between largely white areas and integrated or largely black areas. For example, the coefficient of BLK in the log regression for the white subsample is equal to .2809 (but is only slightly larger than its standard error) and therefore provides evidence of a price differential between black and white areas.

[29]It is also possible to split the sample into black and white submarkets. This approach was carried out by defining the white submarket to be made up of largely white neighborhoods. The F-tests for the null hypothesis that the coefficients are the same in these two subsamples are not significant at the 10 percent level. Calculations similar to those reported in the text indicate that allowing the two submarkets to have different implicit prices does not change our results--houses cost considerably more when evaluated at black submarket prices than when evaluated at white submarket prices, so that there is a large price differential between submarkets. The regression for the black submarket also provides evidence about the black-white price differential within neighborhoods; the coefficient of RACE in the log regression for the black submarket is .2185 and is significant at the 5 percent level.

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