Volume Title: Residential Location and Urban Housing Markets

Volume Author/Editor: Gregory K. Ingram

Volume Publisher: NBER

Volume URL: http://www.nber.org/books/ingr77-1

Publication Date: 1977

Chapter Title: Housing Discrimination and Job Search

Chapter Author: Susan C. Nelson

Chapter URL: http://www.nber.org/chapters/c4314

Chapter pages in book: (p. 329 - 348)

Chapter Nine

Housing Discrimination and Job Search

Susan C. Nelson

INTRODUCTION

The effect of housing discrimination on the employment opportunities of urban blacks has been the subject of much debate since John Kain's influential article in 1968. Kain's conclusion that the elimination of housing segregation would produce a substantial number of additional jobs for blacks has been challenged on several grounds: on his methodology, by the observation that there still is an adequate supply of jobs in the inner cities despite decentralization, and by the assertion that other factors, such as the strength of local aggregate demand and employment discrimination, seem more important.[1]

Distinguishing the empirical effects of the various issues involved is a complex process. By simplifying and abstracting from considerations that are empirically problematical but theoretically unimportant (such as the extent of employment discrimination), however, the model of job search in a spatial context presented here examines the ways that constraints on blacks' residential mobility might affect their employment situation. I do not try to determine whether or not housing discrimination exists; that has been frequently and extensively examined elsewhere.[2] Rather, if blacks who initially live in the inner city are victims of housing discrimination, the model predicts, not surprisingly, that their average wage is lower in central-city jobs and higher in suburban areas than it would be in the absence of a locational constraint. In addition, their employment will be more concentrated near the center of the city. The impact of housing discrimination on the duration of unemployment, however, cannot be determined.

The analysis proceeds as follows: The urban setting is described. A model of random, sequential job search is applied to two job hunters, a black and a white, who begin searching from residences in the center of the city. It is assumed that housing discrimination prevents the black from changing his residential location. By using the concept of stochastic dominance, implications may be drawn on the impact of housing discrimination on black employment opportunities. These conclusions are modified when a less extreme and more realistic version of discrimination is assumed.

THE CITY

The setting for the model is a circular city[3] much like that described in Mills (1972). The following assumptions are made: (1) There are two main sectors—production-employment and housing—which compete for land in the city and determine locational patterns there. (2) Some housing and some employment occur in all areas of the city. All parcels of land the same distance from the center contain the same economic activities. (3) Land in the very center of the city is valued most highly because of agglomeration economies or proximity to transportation facilities. (4) If production functions permit substitution between inputs, then because proximity to the CBD has value, land rents as a function of distance from the CBD decline at a decreasing rate (for proof, see Mills 1972, Chap. 5). The ratio of capital and labor to land will be highest in the CBD, thereby economizing on the scarce resource of central land; hence, employment density $[D(k)]$ will also decline with k, the number of miles from the CBD: $D'(k) < 0$.[4]

An equilibrium distribution of housing services occurs when no household can increase its utility by moving. It is assumed that households have no preference for either city or suburban living per se. Then, since employment density decreases with distance from the CBD, a given quantity of housing services can command a higher price if it is nearer, rather than farther from, the CBD. People will pay more for a location that requires lower transportation costs. This reinforces the pattern of land rents decreasing with distance from the center of the city, and implies that housing prices $[P(k)]$ also will be lower at more distant locations: $P'(k) < 0$.

Let the quantity of housing services (H) demanded be a function of permanent income, price, and tastes. A person with a given permanent income and employed at any distance k_1 from the CBD, such that $k_1 \leqslant k_2$, will find his utility is maximized (i.e., he lives at an equilibrium location) if he resides at a distance k_2 from the CBD, where moving further out would increase transportation costs more than it would save on housing expenditures, and moving further in would increase housing costs more than it would lower commuting costs.[5] If the transportation function is linear of the form $T = m + t$ u, where u is the straight line distance between home and work, the equilibrium location occurs where $P'(k)_2 H(k_2) = -t$. If by chance a person's employment is situated farther from the CBD than k_2, he would choose to live at or as near as possible to his work, since the optimal amount of commuting for him is zero.

THE SEARCH

In this setting, two workers, B and W, living in the center of the city at $k = 0$ begin looking for work in occupation Z. Both employment and vacancies occur as fixed proportions of total employment at all locations in the city. Employment in Z/total employment = a; total vacancies/total employment = c. Thus the density of openings in this job category equals $\alpha D(k)$, where $\alpha = a\ c$. B and W are identical in all respects except race: they possess the same amount and quality of human capital and the same preferences, face the same employment opportunities at the same wages (no employment discrimination exists), have access to the same employment information systems, share the same commuting and search cost functions, and have the same permanent income. B experiences discrimination in the housing market, however, while W does not. In this section, discrimination takes an extreme form: B is unable to move from his[6] initial location while W is free to locate his residence in an optimal relation to any job he accepts.[7] Another, more realistic form of discrimination is assumed: the costs to B associated with moving from the CBD are high but noninfinite.

In the first instance, any nominal wage offer Y at a distance k_1 will be worth more to W than to B in utility terms if a noncentral residence is optimal, because of the declining housing price function. The difference in the value of $Y(k_1)$ to B and W can be approximated by comparing the "real wages" that this implies for each worker, where the real wage equals the wage from the employer minus housing expenditures, transportation costs, and moving expenses (if relevant) for the worker's residential location if he accepts the offer.

$$y_b(k_1) = Y(k_1) - P(0)H + T(k_1 - 0) \qquad (9\text{-}1a)$$

$$y_w(k_1) = Y(k_1) - \min[P(0)H + T(k_1 - 0); P(k_1)H + M^*; \quad (9\text{-}1b)$$
$$P(k_2)H + T(k_2 - k_1) + M^*]$$

where

y_b and y_w = real wages of B and W, respectively, for an offer of Y at k_1;

$T(k_i - k_j)$ = commuting costs, which are some function of the difference between the distances indicated within the parentheses;

H = quantity of housing demanded at $P(0)$;

M^* = moving costs discounted over the expected length of employment; if M = total moving costs incurred in period 0, M^* is defined by:

$$M = \sum_{i=1}^{n+1} \frac{M^*}{(1+p)^i}$$

where p is the discount factor; and n, the expected number of periods of employment;

0 = initial residential distance from the CBD;

k_1 = distance of employment from the CBD;

k_2 = equilibrium residential distance from the CBD for jobs at $k_1 \leqslant k_2$, where $T' = -P'(k_2)H$.

So that these real wages will represent at least monotonic transformations of levels of utility for B and W, W's housing consumption is held equal to B's. Otherwise, if housing demand were quite price-elastic, W's housing expenditures might exceed B's (in spite of the lower price facing W) causing y_w to be less than y_b even though W's utility could be the higher. Analyzing W's behavior with the implicit assumption of a price elasticity of zero results in a lower bound to the amount by which W's utility exceeds B's.

The costs of moving include the costs of finding a new home, any psychological costs, and the actual expenses of packing, hiring a van, etc. M^* is taken as a constant, although costs probably do increase to some extent with distance moved even within the metropolitan area.

The decision whether or not to move, given employment at k_1, is made by comparing the costs of living at the initial location with the costs at k_1 and k_2. Thus W will choose to move if:

$$P(0)H + T(k_1 - 0) > \min\,[P(k_1)H + M^*; P(k_2)H + T(k_2 - k_1) + M^*] \tag{9-2a}$$

The circle of radius $\bar{k}_1$ such that at $\bar{k}_1$,

$$P(0)H + T(\bar{k}_1 - 0) = \min\,[P(\bar{k}_1)H + M^*; P(k_2)H + T(k_2 - \bar{k}_1) + M^*] \tag{9-2b}$$

forms the boundary between the region in which employment could be located and the worker would not benefit from moving either to k_1 or k_2 ($k_1 \leqslant \bar{k}_1$ in the no-move region) and the area for which moving would be beneficial ($k_1 > \bar{k}_1$ for the move region). If the no-move area is small, the worker will be considered very mobile. As can be seen from Equation (9-2b), the tendency to move depends on three factors. Ceteris paribus, if transportation costs are high, the worker is more apt to move, and $\bar{k}_1$ will be small. If the housing price function is very steep (i.e., the gradient is large), moving will be beneficial more often than if the gradient is small. And clearly the lower M^*, the smaller is the worker's no-move region. In this context, housing discrimination could be viewed as raising B's costs of moving so high that nowhere in the metropolitan area would the benefits of moving exceed the costs.

Assume that nominal wage offers in occupation Z at each k_1 ($0 \leqslant k_1 \leqslant k^*$), where k^* equals the distance from the CBD to the edge of the city, are distributed according to the set of non-single-valued functions $[Y|k_1]D$. Such distributions can persist if, for example, the cost of maintaining vacancies is higher for some firms than for others; then the former would offer higher wages to raise the probability of filling their openings more quickly. B and W are aware of these densities and hence of the distribution of real wages each faces in the city: $f(y_b)$ and $g(y_w)$, with $F(y_b)$ and $G(y_w)$ the respective cumulative distributions. Since the real value to B of any nominal wage offer is less than or equal to the value to W, it may be said that $g(y_w)$ is larger than $f(y_b)$ in the sense of first-degree stochastic dominance (FSD) as defined in Hadar and Russell (1969, p. 27):

$$G(y_w) \leqslant F(y_b) \tag{9-3}$$

for all y in the interval $[0, L]$, where L is the maximum possible wage offer. $g(y_w)$ may be considered to strictly dominate $f(y_b)$ if (9-3) holds and if for some y in $[0,L]$, $G(y_w) < F(y_b)$. This will occur if for employment located at some k_1 within the boundary of the metropolitan area the inequality in Equation (9-2) holds and if it is optimal for W to move outside the center of the city. Strict FSD also implies strict second-degree stochastic dominance (SSD), which is defined as:

$$\int_q^L G(y)dy < \int_q^L F(y)dy \tag{9-4}$$

for all lower bounds q in the interval $[0, L]$ (from Hadar and Russell 1969). The domination of the distribution of real wage opportunities facing W over that available to B will be used in determining the relation between B's and W's expected wages.

Job search occurs as a random sample drawn from $f(y_b)$ and $g(y_w)$; one draw is allotted per period, as if each worker went to the employment service and was given one randomly selected firm to check each day.[8] The worker must decide whether to accept or reject the offer in the same period in which it is made. (If no offer is made, the search can be considered as having found a nominal wage of zero.) It has been shown (McCall 1970, Nelson 1970, and Kohn and Shavell 1974) that the optimal strategy, the one that maximizes the present value of expected wealth, is to reject if the discounted expected benefits of searching outweigh the costs of another search, and to accept if the reverse is true. This produces a critical value called the acceptance wage, or reservation wage: if the offer exceeds the acceptance wage, accept it; if not, reject and search again (see among others, McCall 1970, Rothschild 1973, and Mortensen 1970).

This can be represented as:

$$S = \sum_{i=1}^{n+1} \frac{\int_{\overline{y}_b}^{L} (y_b - \overline{y}_b) f(y_b) dy_b}{(1+p)^i} = \sum_{i=1}^{n+1} \frac{\int_{\overline{y}_w}^{L} (y_w - \overline{y}_w) g(y_w) dy_w}{(1+p)^i} \tag{9-5}$$

$\overline{y}_b$ = real acceptance wage for B;
$\overline{y}_w$ = real acceptance wage for W;
n = expected number of periods of employment;
p = discount factor; and
S = cost of the next search.

Simplifying (9-5), we obtain at the limit, as n approaches infinity,

$$S = \frac{1}{p} \int_{\overline{y}_b}^{L} (y_b - \overline{y}_b) f(y_b) dy_b = \frac{1}{p} \int_{\overline{y}_w}^{L} (y_w - \overline{y}_w) g(y_w) dy_w \tag{9-6}$$

Search costs include such factors as out-of-pocket costs of transportation to the job site; time costs of the trip and the interview, valued at the minimum wage or whatever other value the worker places on his leisure[9]; costs of information on potential vacancies; and the psychological costs of any disutility the worker experiences in searching such as discomfort in a job interview or uncertainty about whether or not an offer will be forthcoming. For simplicity the costs of one search, S, will be assumed to be the same for B and W and to be constant in all periods and over all job locations. Clearly, more plausible assumptions would be that search costs increase with the distance between the job and the initial residential location and with the length of time the worker has been unemployed.[10] Realistically, S also is higher for B than for W because, for example, the informal information systems accessible to W are superior to those available to B, since W is more likely to have friends and relatives who are employed and whose employment is more dispersed throughout the city.

Given the structure and assumptions outlined above, any differences in the search process undertaken by B compared to W would be attributable only to discrimination in the housing market, preventing B from changing his residential location.

Proposition A

If $f(y_b)$ is strictly dominated by $g(y_w)$, B's real acceptance wage must be less than W's: $\overline{y}_b < \overline{y}_w$.

$$\int_{\overline{y}_b}^{L} y_b f(y_b) dy_b - y_b F(y_b) \Big|_{\overline{y}_b}^{L} = \int_{\overline{y}_w}^{L} y_w g(y_w) dy_w - y_w G(y_w) \Big|_{\overline{y}_w}^{L} \tag{9-7}$$

Simplifying and integrating by parts:

$$y_b F(y_b) \Big|_{\overline{y}_b}^{L} - \int_{\overline{y}_b}^{L} F(y_b) dy_b - \overline{y}_b [1 - F(\overline{y}_b)] = y_w G(y_w) \Big|_{\overline{y}_w}^{L}$$

$$- \int_{\overline{y}_w}^{L} G(y_w) dy_w - \overline{y}_w [1 - G(\overline{y}_w)] \tag{9-8}$$

$$\bar{y}_b + \int_{\underline{y}_b}^{L} F(y_b)dy_b = \bar{y}_w + \int_{\underline{y}_w}^{L} G(y_w)dy_w \tag{9-9}$$

If $\bar{y}_w \leqslant \bar{y}_b$, (9-9) becomes:

$$\bar{y}_b + \int_{\underline{y}_b}^{L} F(y_b)dy_b = \bar{y}_w + \int_{\underline{y}_w}^{\bar{y}_b} G(y_w)dy_w + \int_{\underline{y}_b}^{L} G(y_w)dy_w \tag{9-10}$$

Since $[\bar{y}_b - \bar{y}_w] = \int_{\bar{y}_w}^{\bar{y}_b} dy_w$, (9-6) is equivalent to:

$$\int_{\underline{y}_b}^{L} F(y_b)dy_b - \int_{\underline{y}_b}^{L} G(y_w)dy_w + \int_{\underline{y}_w}^{\bar{y}_b} [1 - G(y_w)]\, dy_w = 0 \tag{9-11}$$

But since by assumption $g(y_w)$ strictly dominates $f(y_b)$,

$$\int_{\underline{y}_b}^{L} F(y_b)dy_b - \int_{\underline{y}_b}^{L} G(y_w)dy_w > 0$$

and if $\bar{y}_b \geqslant \bar{y}_w$, $\int_{\underline{y}_w}^{\bar{y}_b} [1 - G(y_w)]dy_w > 0$. Hence, the equality in (9-11) cannot hold if $\bar{y}_b \geqslant \bar{y}_w$.

If, on the other hand, $\bar{y}_w > \bar{y}_b$, (9-9) becomes:

$$\bar{y}_b + \int_{\underline{y}_b}^{\bar{y}_w} F(y_b)dy_b + \int_{\underline{y}_w}^{L} F(y_b)dy_b = \bar{y}_w + \int_{\underline{y}_w}^{L} G(y_w)dy_w \tag{9-12}$$

and

$$\int_{\underline{y}_w}^{L} F(y_b)dy_b - \int_{\underline{y}_w}^{L} G(y_w)dy_w - \int_{\underline{y}_b}^{\bar{y}_w} [1 - F(y_b)]\, dy_b = 0 \tag{9-13}$$

Again, since $g(y_w)$ dominates $f(y_b)$, the first term in (9-13) is positive and $\int_{\underline{y}_b}^{\overline{y}_w} [1 - F(y_b)]\,dy_b$ is nonnegative; so the equality can hold. Thus, the assumption that the distribution of effective wages for B is strictly dominated by the distribution for W implies that W's effective acceptance wage will exceed B's.

Proposition B

Depending on moving costs for W, in some range of k_1, $(0 \leqslant k_1 < k_i)$ B's nominal acceptance wage will be less than W's, and for k_1 greater than k_i within the city, the opposite will be true.

Proof: Let $\overline{k}$ be the distance at which moving becomes beneficial for W. Let B's and W's nominal acceptance wages for employment at any k_1 be defined, respectively, as:

$$\overline{Y}_b(k_1) = \overline{y}_b + P(0)H + T(k_1 - 0) \tag{9-14a}$$

$$\overline{Y}_w(k_1) = \overline{y}_w + \min[P(0)H + T(k_1 - 0); P(k_1)H + M^*; P(k_2)H + T(k_2 - k_1) + M^*] \tag{9-14b}$$

These represent the minimum wages that must be offered B and W, such that they will not expect another search to make them better off than if they accepted the current offer.

$$0 \leqslant k_1 \leqslant \overline{k}_1 : \overline{Y}_w(k_1) - \overline{Y}_b(k_1) = \overline{y}_w - \overline{y}_b > 0$$

In this region B and W incur the same housing and commuting costs. Since throughout the city W's real acceptance wage exceeds B's, here too will W's nominal asking wage be higher than B's by the amount that their real acceptance wages differ: $\overline{Y}_w(k_1 \mid k_1 \leqslant \overline{k}_1) - \overline{Y}_b(k_1 \mid k_1 \leqslant \overline{k}_1) = \overline{y}_w - \overline{y}_b$.

$$\overline{k}_1 < k_1 < k_i : \overline{y}_w - \overline{y}_b > Y_w(k) - Y_b(k)$$

Defining k_i as that distance at which $\overline{Y}_b(k_1) = \overline{Y}_w(k_1)$; $\overline{Y}_w(k_1)$ still exceeds $\overline{Y}_b(k_1)$ but by less than $(\overline{y}_w - \overline{y}_b)$.

$$k_i < k_1 < k^* : \overline{Y}_w(k_1) < \overline{Y}_b(k_1)$$

B's nominal acceptance wage is greater than W's, meaning that B will reject offers that W accepts (if $k_i < k^*$).

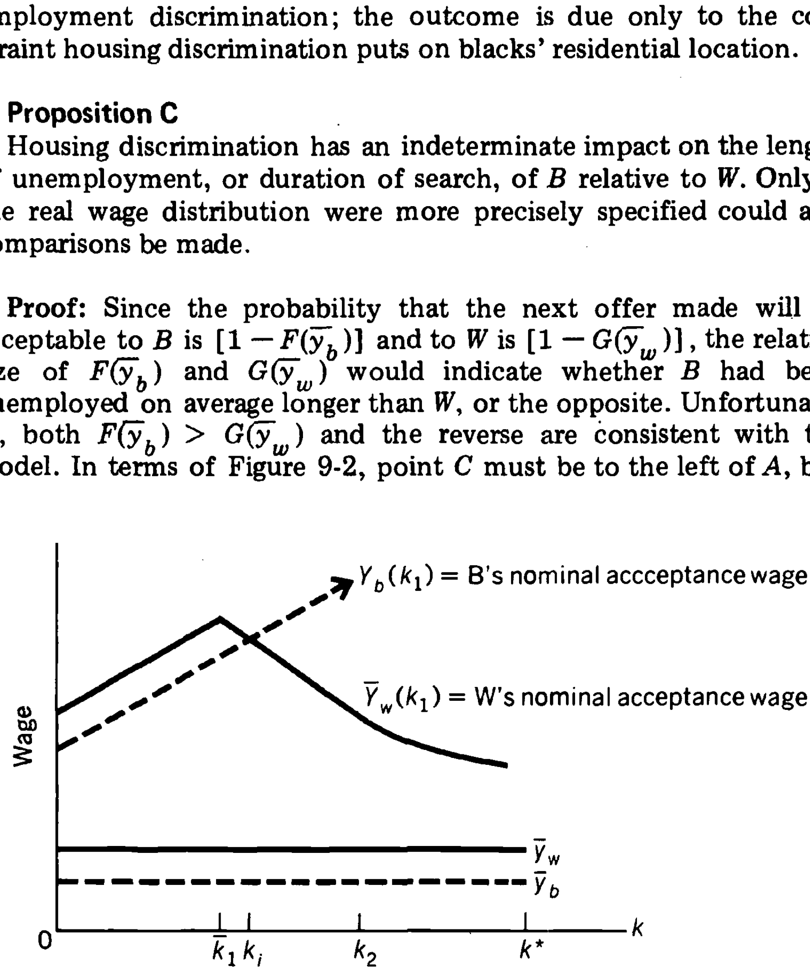
An example of the pattern described above is shown in Figure 9-1.[11] It implies that the average wage for employment near the center of the city (specifically, within a radius of k_i) will be lower for blacks than for whites. The opposite would be true at jobs beyond k_i—blacks who are employed there would expect to be paid more than their white coworkers.

Superficially, this pattern might suggest that central-city firms discriminate against blacks, while suburban firms act in their favor. However, this result has been produced by explicitly excluding employment discrimination; the outcome is due only to the constraint housing discrimination puts on blacks' residential location.

Proposition C

Housing discrimination has an indeterminate impact on the length of unemployment, or duration of search, of B relative to W. Only if the real wage distribution were more precisely specified could any comparisons be made.

Proof: Since the probability that the next offer made will be acceptable to B is $[1 - F(\bar{y}_b)]$ and to W is $[1 - G(\bar{y}_w)]$, the relative size of $F(\bar{y}_b)$ and $G(\bar{y}_w)$ would indicate whether B had been unemployed on average longer than W, or the opposite. Unfortunately, both $F(\bar{y}_b) > G(\bar{y}_w)$ and the reverse are consistent with the model. In terms of Figure 9-2, point C must be to the left of A, but



k = number of miles from CBD.

Figure 9-1.

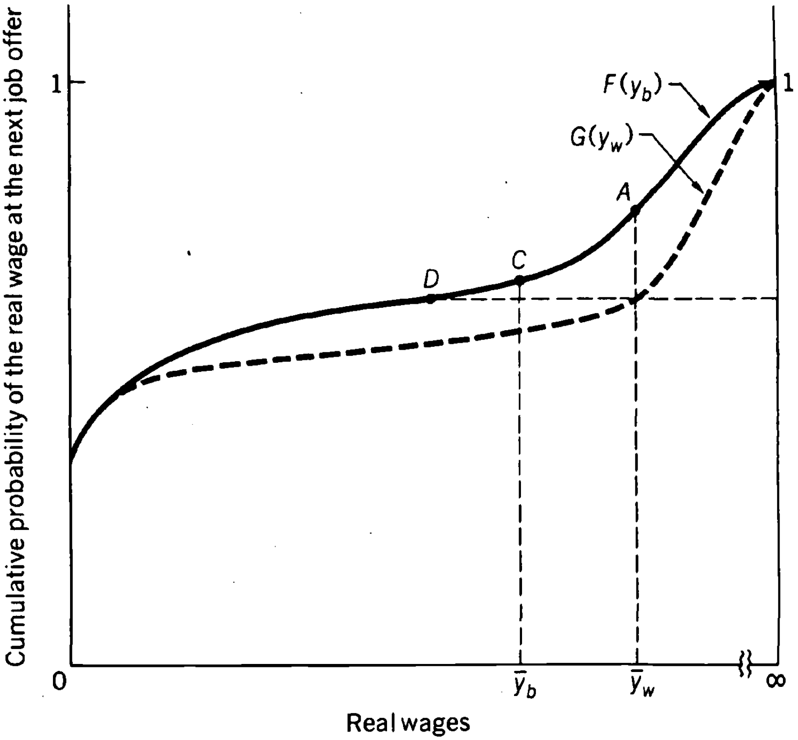


Figure 9-2.

it can be either to the right or left of point D. Here, $F(\bar{y}_b) > G(\bar{y}_w)$, but the opposite is also possible.

(a) If housing discrimination in this model causes B to search longer than W, $F(\bar{y}_b) > G(\bar{y}_w)$ and $Pr(b) = [1 - F(\bar{y}_b)] < [1 - G(\bar{y}_w)] = Pr(w)$; so $\bar{y}_b[1 - F(\bar{y}_b)] < \bar{y}_w[1 - G(\bar{y}_w)]$. Equation (9-9) may be rewritten as:

$$y_b F(y_b)\Big|_{\bar{y}_b}^{L} - \int_{\bar{y}_b}^{L} F(y_b)dy_b < y_w G(y_w)\Big|_{\bar{y}_w}^{L} - \int_{\bar{y}_w}^{L} G(y_w)dy_w \tag{9-15}$$

or,

$$\bar{y}_b F(\bar{y}_b) + \int_{\bar{y}_b}^{L} F(y_b)dy_b > \bar{y}_w G(\bar{y}_w) + \int_{\bar{y}_w}^{L} G(y_w)dy_w$$

Since, from (9-9),

$$(\overline{y}_w - \overline{y}_b) = \int_{\overline{y}_b}^{L} F(y_b)dy_b - \int_{\overline{y}_w}^{L} G(y_w)dy_w$$

by substituting into (9-15), then rearranging terms, we obtain

$$\overline{y}_b F(\overline{y}_b) - \overline{y}_w G(\overline{y}_w) > \overline{y}_b - \overline{y}_w ; \overline{y}_w [1 - G(\overline{y}_w)] > \overline{y}_b [1 - F(\overline{y}_b)]$$

as was initially assumed. Thus the assumption that $F(\overline{y}_b) > G(\overline{y}_w)$ which indicates that B's expected duration of search is longer than W's is not inconsistent with Equation (9-9) and the finding that $\overline{y}_w > \overline{y}_b$.

(b) If on the other hand, $F(\overline{y}) < G(\overline{y}_w)$, Equation (9-9) becomes:

$$y_b F(y_b) \Big|_{\overline{y}_b}^{L} - \int_{\overline{y}_b}^{L} F(y_b)dy_b - \overline{y}_b + \overline{y}_b F(\overline{y}_b)$$

$$= y_w G(y_w) \Big|_{\overline{y}_w}^{L} - \int_{\overline{y}_w}^{L} G(y_w)dy_w - \overline{y}_w + \overline{y}_w G(\overline{y}_w)$$

$$-\overline{y}_b F(\overline{y}_b) - \int_{\overline{y}_b}^{L} F(y_b)dy_b - \overline{y}_b > -\overline{y}_w G(\overline{y}_w)$$

$$-\int_{\overline{y}_w}^{L} G(y_w)dy_w - \overline{y}_w$$

Multiplying through by —1 and subtracting

$$\overline{y}_b + \int_{\overline{y}_b}^{L} F(y_b)dy_b = \overline{y}_w + \int_{\overline{y}_w}^{L} G(y_w)dy_w$$

from both sides leads to the conclusion that $\overline{y}_b F(\overline{y}_b) < \overline{y}_w G(\overline{y}_w)$, which is simply a restatement of the initial assumption.

The condition that $g(y_w)$ dominates $f(y_b)$ and the resultant implication that $\overline{y}_b < \overline{y}_w$ clearly are insufficient for determining whether $F(\overline{y}_b)$ is greater or less than $G(\overline{y}_w)$. Thus, housing discrimination appears to have no general predictable effect on the relative length of search undertaken by B compared to W.

Proposition D

Unless W is totally immobile residentially, B's employment will be more centralized than W's.

Proof:

Case I. For any location of employment, W always benefits from moving out of the center of the city.

Regardless of where he works, W will choose to move from the center of the city, either to k_2, or to k_1 if k_1 is greater than k_2. Since his real acceptance wage is independent of the location of employment, the value to him of a given nominal wage rises continually with distance from the CBD, and so his nominal acceptance wage falls with distance. Because the reverse is true for B (for a given nominal wage, CBD jobs are worth the most to him) and his asking wage rises with distance, the relative probability of B's becoming employed at any location compared to W's probability is a decreasing function of distance from the CBD, regardless of the distribution of wage offers by firms. Thus, housing discrimination, which prevents B from moving, causes B's employment to be more concentrated near the center of the city than it would otherwise be.

Since the amount by which W's real acceptance wage exceeds B's is unknown, no comparison of their nominal asking wages averaged for the whole city can be made.

Case II. W never chooses to move, regardless of the location of employment.

In this instance the real opportunities available are identical for both workers, and any housing discrimination that B experiences is irrelevant, since he, like W, would not choose to leave the central city even if he could. The nominal acceptance wages of both types of workers will rise with distance from the CBD. Their actual employment distributions depend on the distribution of wage offers, but B will have the same probability as W of accepting a job at any location.

Case III. For some locations of potential employment, W will move.

Again, because the real opportunitiés available to W are superior to those facing B, the former's real acceptance wage will exceed the latter's: $\bar{y}_w > \bar{y}_b$. For employment in the center of the city and in the rest of W's no-move zone, the housing and transportation costs would be the same to both workers. Consequently, W's nominal acceptance wage will exceed B's for any job in W's no-move region: $\bar{Y}_w(k_1) > \bar{Y}_b(k_1)$ for all k_1 less than k_i. Thus W is less apt than B to become employed in this area, but if W does accept a job there, his nominal wage will on the average be higher than B's at the same location.

On the other hand, in W's move area, his probability of accepting employment is greater than B's (unless marginal transportation costs are very small[12]). Thus B's employment will be more centralized than W's, but B's expected wage for working in the central city would be less than W's, while W's average wage near the edge of the city would be higher than B's there. The residential mobility of W determines the size of this no-move area and, thus, whether the distribution of B's and W's employment is quite different or only slightly so. The greater the number of firms for which W would find moving beneficial, the more centralized will B's employment be relative to W's.

From comparing B's employment and expected wage distributions over distance with W's under various conditions of mobility, it is clear that unless W is as immobile without discrimination as B is with it, the extreme form of discrimination considered here makes B's employment more centralized and lowers his average nominal wage near the CBD as well as reducing his real wage everywhere, but raises his nominal wage farther out in the city. No conclusion can be reached, however, on his expected nominal wage relative to W's over the whole city without specifying the model more precisely.

MODIFIED FORM OF HOUSING DISCRIMINATION

Clearly, the assumption that housing discrimination totally prevents blacks from moving out of the center city is not true: some blacks do live in suburban areas, although their representation is much lower than their income alone would warrant (Census 1973); and, more relevant for the model under consideration, some blacks move from the central ghetto to the suburban ring. Hence, a more reasonable assumption about the form housing discrimination takes would be then that blacks can move to suburban areas but that the move is much more costly for them than for whites.[13] The additional costs could result from the difficulties and unpleasantness of dealing with white realtors; the refusal of some whites to sell or rent to blacks, forcing them to visit more housing units before finding an acceptable one; or an uncertain reception by white neighbors. Thus, housing discrimination could impose high but noninfinite costs on blacks who move out of the inner city: $M_w < M_b < \infty$.

In this case, B calculates his optimal residential location in the same way that W does. If a job is located beyond $\overline{k}_1^b$ (the distance at which B is indifferent between staying in the center city and moving), he will move either to k_2 or to k_1, whichever is greater. $\overline{k}_1^b$ occurs where:

$$P(0)H + T(\overline{k}_1^b) = \min[P(k_2)H + T(k_2 - \overline{k}_1^b) + M_b^*; P(\overline{k}_1^b)H + M_b^*]$$

If $\overline{k}_1^b \leqslant k_2$, B's optimal residential location for any job for which he chooses to move will be the same as W's. It does not matter that M_b exceeds M_w, since moving costs that are independent of distance moved, as assumed here, do not enter the calculation of k_2. Only for jobs located between $\overline{k}_1^b$ and $\overline{k}_1^w$ will B and W have different residential locations: W will choose to leave the central city while B will not.

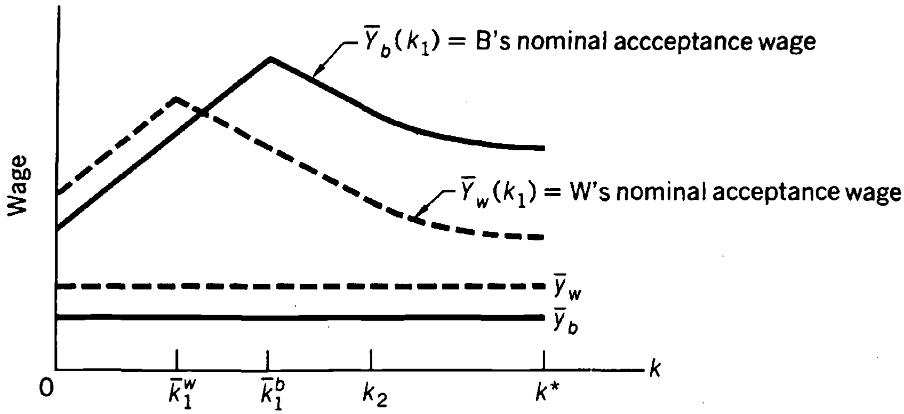
This fact results in some differences between the search processes undertaken by B and W. Since the same nominal wage offers are available to both workers, the real value of any offer to W will always be equal to or greater than the value for B. At all locations beyond $\overline{k}_1^b$, the real wage for W will exceed B's. Again the distribution of real wage opportunities available to W, i.e., $g(y_w)$, will dominate those facing B, i.e., $f(y_b)$. Therefore, as was shown in Proposition A, $\overline{y}_w > \overline{y}_b$.

The nominal acceptance wage for W will again exceed $\overline{Y}_b$, at least to $\overline{k}_1^w$, by $(\overline{y}_w - \overline{y}_b)$. Between $\overline{k}_1^w$ and $\overline{k}_1^b$, $\overline{Y}_w(k_1)$ is decreasing and $\overline{Y}_b(k_1)$ increasing. Beyond k_1^b:

$$\overline{Y}_w(k) - \overline{Y}_b(k) \text{ - } [(\overline{y}_w - \overline{y}_b) + (M_w^* - M_b^*)] \qquad (9\text{-}16)$$

Since the first term is positive and the second negative, the sign of $[\overline{Y}_w(k) - \overline{Y}_b(k)]$ can only be determined if the terms of Equation (9-16) are known more precisely. Intuitively, if M_b is quite large, the situation is similar to the case originally examined, where discrimination prevented B from moving at all and caused $\overline{Y}_b(k)$ generally to exceed $\overline{Y}_w(k)$ at points beyond $\overline{k}_1^w$. Thus it seems probable that $|M_w^* - M_b^*|$ exceeds $(\overline{y}_w - \overline{y}_b)$, and $[\overline{Y}_w(k) - \overline{Y}_b(k)]$ is negative beyond $\overline{k}_1^b$ (as is shown in Figure 9-3), but this cannot be proved as a general rule.

As with the extreme version of housing discrimination, the relative duration of search for B and W in this instance remains indeter-



k = number of miles from CBD.

Figure 9-3.

minate. However, if it were true that $\overline{Y}_b < \overline{Y}_w$ for all k_1 (as seems unlikely), then B would clearly expect to find an acceptable job more quickly than W. If $\overline{Y}_w < \overline{Y}_b$ for some k_1, the answer would again depend on the specific distributions.

One definite conclusion, though, may be drawn concerning the relative concentration of employment. Around the center of the city, where $\overline{Y}_w(k) > \overline{Y}_b(k)$, blacks have a higher probability of receiving an acceptable offer than whites. Not only will blacks' employment be more centralized, but their average wage (at least within the circle of radius $\overline{k}_1^w$) will be lower than the average for whites working in the same area, again even in the absence of any racial discrimination in the labor market.

SUMMARY

The framework outlined here is an attempt to describe one mechanism through which racial discrimination in the housing market could affect the employment situation of blacks by constraining their residential location. The conclusions are not surprising. Simply because the type of discrimination postulated here limits residential mobility, it induces blacks to follow a different job search pattern than they would in the absence of housing discrimination. As would have been expected, housing discrimination lowers the real income of blacks from what would have prevailed in the absence of constrained residential location. This is true even in the suburbs, where discrimination perhaps raises their average wage. It forces blacks to take lower wages in the central city besides possibly concentrating their employment there.

This is only part of the story, though. A general equilibrium analysis would include the response of firms, such as adjustments through factor substitution and plant relocation, to the effects of housing discrimination on the labor market behavior of blacks. The land and housing price-distance functions would also be expected to shift. As long as $P(k)$ had a negative but increasing slope, the conclusions in this study would remain valid. It might become possible, however, to draw broader implications such as the effects on white workers, firms, relative housing prices, and the level and efficiency of production.

NOTES TO CHAPTER NINE

1. Criticism on methodology comes from Saks-Offner (1971) and Masters (1974); on central-city labor demand, from Noll (1970), Fremon (1970), and Lewis (1969); on aggregate demand conditions from Mooney (1969); and on employment discrimination, from Harrison (1974).

2. See von Furstenberg et al. (1974, pt. 2) for a good summary of the literature.

3. "City" as used here is synonymous with SMSA (Standard Metropolitan Statistical Area) or metropolitan or urbanized area concepts, not simply the region legally known as a city. "Center of the city" means the central business district (CBD), and central city or center city and suburbs are used loosely to refer to areas near the center and near the edge of the city, respectively.

4. If wages vary systematically with distance, rents and employment density may not decline with distance. It is necessary to make the additional assumption that either the value of a central location is large enough, or the capital-labor ratio at all distances is high enough for variations in the land rental bill to overshadow variations in the wage bill.

5. At k_2, ∂ (transportation costs)/$\partial k = -\partial$ (housing costs)/∂k.

6. All workers will be referred to as males to simplify the references, although the analysis is applicable to a work force of both sexes.

7. B could be allowed to move within a specified area around the CBD defined as the ghetto, but this would only produce the same results with a more complex analysis.

8. It would be preferable to allow a worker to search first those potential jobs that would afford him the highest utility—for B, CBD jobs, then those next to the CBD, etc.; and for W, jobs at the edge of the city. Salop's model (1973) includes a similar optimal search order, in which the firms with the highest expected wage offers are searched first. However, the costs in terms of complexity seem to outweigh the benefits of more realism.

9. A more desirable though more complicated measure of opportunity cost would be the current wage offer, as in Salop (1973), since this more accurately reflects the income foregone if the worker searches again.

10. If search costs are allowed to increase with the length of search, the acceptance wage will be lower the greater the duration of search. As the reservation wage drops, if it falls so low that the value of welfare payments or other non-labor-market activities exceeds it, the worker will leave the labor force and join the ranks of the discouraged workers.

11. There are two instances in which the pattern in Figure 9-1 does not hold: (1) If the parameters are such that at no employment location does W choose to move out of the center of the city, $P(0)H + T(k^* - 0) < P(k^*)H + M^*$ This is essentially the situation for B, whose "moving costs" effectively prohibit him from leaving the ghetto. This seems highly unlikely, given that a much greater fraction of workers employed in the ring of SMSAs live in the ring rather than living in the central city and commuting out.

(2) A less extreme version of this condition would be that only at a very distant k_1 would W decide to move, and that the falling $\overline{Y}_w(k_1)$ would not have intersected the rising $\overline{Y}_b(k_1)$ by k^* Since the difference between B's and W's searches arises from B's inability to move outside the ghetto and since the most likely state of the world includes frequent benefits for W from moving, these two extreme conditions will be ignored.

12. Very low marginal transportation costs could prevent B's nominal acceptance wage from ever equaling W's at any distance by causing $\overline{Y}_b(k_1)$ and $\overline{Y}_w(k_1)$ to be so flat that even at $k_1 > \overline{k}_1$, where $\partial\overline{Y}_b(k_1)/\partial k_1 > 0$ and $\partial\overline{Y}_w(k_1)/\partial k_1 < 0$, the two curves might never intersect at $k_1 \leqslant k^*$.

13. Price discrimination is another form which housing discrimination might take. Unfortunately, little could be concluded about its effect on black employment opportunities. The real acceptance wage for W would exceed that for B because of stochastic dominance. Beyond that, little else can even be considered probable: whether $\overline{Y}_b(k_1)$ is greater or less than $\overline{Y}_w(k_1)$ at any location is uncertain and, therefore, so are relative concentrations of employment by race. The comparative lengths of search are again totally indeterminate. Consequently, there seems to be little point to a more complete analysis of the effects of price discrimination.

REFERENCES

Census. 1973. U.S. Bureau of the Census. *Census of Population: 1970. Mobility for Metropolitan Areas.* Subject Reports, PC(2)-2C.

Fremon, Charlotte. *The Occupational Patterns in Urban Employment Change, 1965-1967*. Urban Institute, 1970.

Hadar, Josef, and William Russell. 1969. "Rules for Ordering Uncertain Prospects." *American Economic Review*, March.

Harrison, Bennett. 1974. "Discrimination in Space: Suburbanization and Black Unemployment in Cities." In von Furstenberg et al., eds. (1974).

Kain, John. 1968. "Housing Segregation, Negro Employment and Metropolitan Decentralization." *Quarterly Journal of Economics*, May.

Kohn, M., and S. Shavell. 1974. "The Theory of Search." *Journal of Economic Theory*, October.

Lewis, Wilfred. 1969. "Urban Growth and Suburbanization of Employment: Some New Data." Mimeographed. Washington, D.C.: Brookings.

Masters, Stanley. 1974. "A Note on John Kain's 'Housing Segregation, Negro Employment, and Metropolitan Decentralization'." *Quarterly Journal of Economics*, August.

McCall, J.J. 1970. "Economics of Information and Job Search." *Quarterly Journal of Economics*, February.

Mills, Edwin S. 1972. *Urban Economics*. Glenview, Ill.: Scott, Foresman.

Mooney, Joseph. 1969. "Housing Segregation, Negro Employment and Metropolitan Decentralization." *Quarterly Journal of Economics*, May.

Mortenson, Dale. 1970. "Job Search, the Duration of Unemployment, and the Phillips Curve." *American Economic Review*, December.

Nelson, Phillip. 1970. "Information and Consumer Behavior." *Journal of Political Economy*, March-April.

Noll, Roger. 1970. "Metropolitan Employment and Population Distribution and the Conditions of the Urban Poor." in John Crecine, ed., *Financing the Metropolis: Public Policy in Urban Economics*. Urban Affairs Annual Reviews 4. Beverly Hills, Calif.: Sage.

Rothschild, Michael. 1973. "Models of Market Organization with Imperfect Information: A Survey." *Journal of Political Economy*, November-December.

Saks, Daniel, and Paul Offner. 1971. "A Note on John Kain's 'Housing Segregation, Negro Employment and Metropolitan Decentralization'." *Quarterly Journal of Economics*, February.

Salop, S. 1973. "Non-Random Search and Unemployment." *Review of Economic Studies*, April.

von Furstenberg, George M. et al., eds. 1974. *Patterns of Racial Discrimination.* Volume I: *Housing*. Lexington, Mass.: Lexington Books.