A MODEL OF OPTIMAL PLANT INTEGRATION IN THE PRESENCE OF EMPLOYEE DISCRIMINATION

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The theory of wage discrimination against racial minorities has been developed by Gary Becker and Lester Thurow from different premises. Becker [4, pp. 31-32] assumes that the demand for black labor is reduced in a competitive system because hiring blacks, quite literally, taxes the tolerance of white employers. Thurow [23, p. 107-24], on the other hand, views effective wage discrimination as resulting from the exercise of monopoly of capital and monopsony of black labor by whites. In spite of divergent assumptions about the organization of product and factor markets, both authors are most specific in their treatment of employer discrimination. A comprehensive general equilibrium analysis of this aspect, based on utility maximization, has only recently been provided by Kenneth Arrow [1]. By contrast, this paper will concentrate solely on the microeconomic effects of a preference for racial homogeneity among the workers themselves.

The racial composition of the work force within an establishment may be an important working condition. Employers may attempt to optimize race ratios in the same way as expenditures on amenities, such as heat, dust, and noise control, all of which affect the desirability and productivity of employment in the plant.[1] The supply function of senior labor shifts upwards if hiring more minority workers worsens human and social relations in the judgment of the older workers belonging to the racial majority. As a result, non-discriminating employers can profit from hiring additional minority workers only if the marginal value product of the latter is at least equal to the minority wage rate plus the induced cost increase just described, which is external to the minority workers. A model of employer adaption to any widely held racialist attitudes of their employees is therefore necessary before the complexity of making government intervention effective in the hiring process can be appreciated.

I. THE MODEL

Because of differences in the present distribution of skills, it is assumed that black and white workers are imperfect substitutes in production and that the marginal rate of substitution of black for white workers (dL_w/dL_b) within the plant is diminishing. In many locations the skill distribution of blacks is still highly skewed in relation to the job requirements of most plants. Hence, blacks cannot be substituted for whites at a one-to-one rate beyond some point.[2] Rather, given the size of the total labor input, white workers are complementary to black workers. Furthermore, at least one of the races finds that workplace advantage falls at given wages as the percentage of workers belonging to the opposite race increases.[3]

It can be argued that the racial composition of the occupational group is of more concern to workers than the racial mix in the plant as a whole. In that case the occupational dispersion of the races, rather than their aggr-

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egate employment share would be the proper argument in the discrimination functions. However, it is equally conceivable that the effectiveness and job security of supervisory personnel -- even of plant engineers and union shop-stewards -- suffers if the "lower" work force is primarily drawn from a different race. In addition, given the distribution of skills demanded in the plant, a rising percentage of blacks implies integration of an increasing number of occupational groups further up in the job hierarchy (see [5, pp. 310-12]). Hence, the extent of integration within occupations, which may be one of the subjects of adverse preferences, is highly correlated with the percentage of black workers in the plant. As this percentage grows, the compensation required to overcome race aversion rises at either a constant, a decreasing, or an increasing rate, depending on the structure of employee preferences. By contrast, suppliers of capital and employers are assumed to maximize monetary returns or profits only. The definition of the variables follows:

C	Total Labor Costs
D_w, D_b	Employee Discrimination Functions for White and Black Workers
E_w	Equivalent Labor Input Measured in Efficiency Units of White Workers
L_b, w_b	Black Workers (Man Years) and Their (Annual) Wage Rate
L_w, w_w	White Workers and Their Wage Rate
Q, K	Output and the Capital Stock (Service Years) of the Plant
a	Efficiency Discount of Black Workers in the Labor Equivalence Function
b	The Percentage of Black Workers in the Plant
f, g	The Discrimination Coefficient of Whites and Blacks
$\overline{w}_w$, $\overline{w}_b$	Intercept of the Wage Equivalence Function at $b = 0$ for Whites and at $b = 1$ for Blacks

The basic equations of the model are identified below:

$$E_w = L_w + L_b e^{-ab} \qquad \text{Labor Input Equivalence} \qquad (1.1)$$

$$Q = f(E_w, K) \qquad \text{Linear Homogeneous Production Function} \qquad (1.2)$$

$$w_w = \overline{w}_w + fD_w \qquad \text{Wage Equivalence for Whites} \qquad (1.3)$$

$$w_b = \overline{w}_b + gD_b \qquad \text{Wage Equivalence for Blacks} \qquad (1.4)$$

$$D_w = b \qquad \text{Alternative Discrimination Functions for Whites with Slope - Constant} \qquad (1.5a)$$

$$D_w = be^{1-b} \qquad \text{- Decreasing} \qquad (1.5b)$$

$$D_w = 1 - (1-b)e^{b} \qquad \text{Alternative Discrimination Functions for Whites with Slope - Increasing} \qquad (1.5c)$$

$$D_b = 1 - b \qquad \text{Alternative Discrimination Functions for Blacks with Slope - Constant} \qquad (1.6a)$$

$$D_b = (1-b)e^{b} \qquad \text{- Decreasing} \qquad (1.6b)$$

$$D_b = 1 - be^{1-b} \qquad \text{- Increasing} \qquad (1.6c)$$

$$C = w_w L_w + w_b L_b \qquad \text{Definition of Labor Costs} \qquad (1.7)$$

$$b = L_b / (L_w + L_b) \qquad \text{Definition of b} \qquad (1.8)$$

The marginal rate of substitution in production between black and white workers is defined as the slope of the iso-product curve at fixed values of E_w and K. It is derived by total differentiation of (1.1) and by using (1.8) to find db.[4]

$$(dL_w/dL_b)_{\bar{Q}} = (ab - ab^2 - 1)/(e^{ab} + ab^2). \qquad (1.9)$$

Similarly, the marginal rate of substitution in hiring is defined as the slope of the iso-cost function and obtained by total differentiation of equation (1.7). In this model the relative wage rates required by employees to tolerate integration of the work force are functions of b.

$$(dL_w/dL_b)_{\bar{C}} = \frac{(1-b)b\delta w_b/\delta b + (1-b)^2\delta w_w/\delta b + w_b}{b^2\delta w_b/\delta b + (1-b)b\delta w_w/\delta b - w_w}. \qquad (1.10)$$

After substituting for the partial derivatives from alternative pairs of discrimination functions given above, the optimal value of b, b*, is at the point where the lowest iso-cost curve touches the iso-product curve from below,[5] if an interior profit maximum exists.

Since the iso-product curve is convex - down in the (L_b, L_w) space, an interior maximum involving an integrated rather than an all-black or all-white work force exists only if the iso-cost curve is found to be less convex. This condition holds if the inequality below is satisfied.

$$(\delta/\delta b)[(dL_w/dL_b)_{\bar{Q}} - (dL_w/dL_b)_{\bar{C}}] > 0. \qquad (2.1)$$

Since the slope of the iso-product curve at b = 0 is -1, a weak requirement is also that the slope of the iso-cost curve be less than unity in absolute value at the intercept. Substituting the discrimination functions (1.5b) and (1.6b) into the wage equations (1.3) and (1.4) to derive the partials $\delta w_b/\delta b$ and $\delta w_w/\delta b$ shows that this conditon is satisfied only if $f < (w_w - w_b)e^{-1}$.[6] If the pairs (1.5a) and (1.6a) or (1.5c) and (1.6c) are used instead, it suffices that $f < (w_w - w_b)$ or $w_w > w_b$, respectively, at the intercept with b of zero. Clearly the condition for an interior maximum are least stringent if race aversion is at first relatively small but rising at an increasing rate as integration proceeds (form c in Figure 1).

It will be demonstrated that the likelihood of an interior profit maximum, which determines the expected racial composition of the work force, depends crucially on the form of the discrimination function. In his model of employer discrimination, Becker first assumes that black and white workers are perfect substitutes in production. He then argues that if the employer attaches an extra cost, equal to a percentage surcharge on the wage, to every black he hires, he will either hire only whites or only blacks, depending on whether his subjective tax on black labor is greater or less than the existing wage differential between whites and blacks. Becker also assumes that the discriminator must be willing to forgo profits, if he is to be effective, thus casting doubt on the long-term viability of discrimination in a competitive system (see [4, p. 6] and also [1, pp. 11-14] and [8, p. 14]).

In examining employee discrimination, Becker again deduces corner solutions if black and white workers are perfect substitutes ([4, p. 48] and [1, pp. 39-40]). While the structure of racial preferences is not made explicit, the author's arguments may be taken to imply that the size of the discrimination term is roughly proportional to the number of blacks with whom whites have to be in contact within the plant. If whites dislike working with two more blacks and two less whites twice as much as exchanging only one white fellow worker for a black, their discrimination function is of the form (1.5a). For blacks, the symmetric preference leads to equation (1.6a) which signifies that the discrimination premium required per unit of L_b increases at a constant rate with the percentage of the work force belonging to the white race. By contrast, the pairs of equations b and c imply that race aversion increases at a decreasing rate to a maximum or at an increasing rate from a minimum. The former pattern is to be expected if whites take a symbolic, breach-in-dyke, or "job busting" view of integration, while the latter pattern would emerge if whites feel fairly secure with token integration but react to the accelerating loss of power and prestige expected from rising job penetration by blacks.[7] All three patterns are shown in Figure 1 with workplace disadvantage due to integration assumed to be quantified in terms of the wage supplements required as compensation.

Substituting for the partials in (1.10) yields the following marginal rate of substitution in hiring if the discrimination functions are of form a in Figure 1.

$$(dL_w/dL_b)_{\bar{C}} = \frac{(b-1)bg + (1-b)^2 f + \bar{w}_b + g(1-b)}{-b^2 g + (1-b)bf - \bar{w}_w - fb} . \qquad (2.2)$$

By differentiating with respect to b it can be shown that the iso-cost curve is convex whether racial dislikes are mutual ($f = g > 0$) or one sided ($f > 0$, $g = 0$, or $g > 0$, $f = 0$).

As long as black and white workers are perfect substitutes in production, Becker is obviously correct in suggesting corner solutions. However, inspection of (2.2) also shows that raising the discrimination coefficient for whites, f, increases the chance of moving to the all-white corner or of staying there. At a b of zero, increasing f raises the marginal rate of substitution of white for black workers in hiring thus increasing the cost competitiveness of white employees. Raising g affects the employment opportunities of blacks adversely at the same point but increases the likelihood of moving to the all-black corner from intermediate positions already involving a sufficiently high b.[8] Since the employer cannot move immediately from one corner to the other, the higher f the more whites penalize him for hiring blacks, and the higher g the more blacks reward him by allowing him to lower their wages as their percentage increases. At some intermediate level of integration, involving the highest costs of obtaining the equivalent labor input E_w, there will be an unstable balance between these two forces while the work force will resegregate progressively on either side. Still under the assumption of perfect substitutability in production, employers with perfect foresight would, of course, prefer to move to the all-black position from such a point because costs can be reduced furthest at that corner, provided $w_b < w_w$.

If the economic system and the structure of racial preferences are such that corner solutions are to be expected, the enforcement of fair employment laws requires continuing government pressure. Hiring patterns would have to be imposed which are not optimal from the point of view of the private businessman maximizing profits without any racial preferences of his own. However, it will be shown in the next section that this result is not

inevitable.

II. OPTIMAL INTEGRATION OF THE WORK FORCE

After fixing the parameters of the model, illustrative calculations can be used to show how the optimum value, b*, depends on the form of the employee discrimination function and the size of the discrimination coefficients. Black and white workers are now again assumed to be less than perfect substitutes in production, and the discount of black workers in the labor equivalence function, a, is set equal to 0.5. If the basic white wage (at b = 0), $\bar{w}_w$, is taken to be the numeraire equal to unity, the basic black wage (at b = 1), $\bar{w}_b$, is equal to $e^{-1/2}$, or 0.607.[9] In the presence of mutual discrimination, both races will require higher wage rates to be indifferent to integration of an establishment's labor force.

In columns 2 and 3 of Table 1, both f and g are fixed at 0.1. In part 1a, where white resentment of integration rises at first at a high rate but decelerates to a maximum at b = 1, integration is so costly that the iso-cost curve almost coincides with the iso-product curve throughout its range.[10] The optimal percentage of blacks lies between 30 and 40 percent of the labor force where their wage rate is 66 percent of that of whites. However, the marginal cost even of complete segregation amounts to only 2 percent of the marginal product at the all-white position and 5 percent at the opposite extreme. This can be seen by comparing the marginal rate of substitution in production (column 1) to that in hiring (column 2 of Table 1a). From the microeconomic point of view, the racial composition of the work force is almost a matter of indifference, thus giving the government much latitude in setting quotas if that is deemed necessary.

In the second part of the table, the situation is quite different. Here missing the optimum is extremely costly for employers, employees, or both. When race aversion premiums rise from a minimum at either b = 0 or b = 1 at an increasing rate, both races find that workplace advantage is little affected by slight degrees of integration from their respective positions. Hence the marginal rate of substitution in hiring is at first equal to the wage ratio and very much smaller than the marginal rate of substitution in production by a b value of zero. As b begins to rise, the race aversion premium for the remaining whites, which adds to the cost of extending the hiring of blacks, increases slowly at first, while blacks experience a marked improvement in working conditions. In contrast to the previous case, the marginal rate of substitution in hiring thus falls below the wage ratio until b reaches 0.5 and b* lies between 50 and 60 percent if discrimination is mutual.

Because black discrimination declines rapidly at small b, it is favorable to increased black employment in part 1b. As shown in column 4 of Table 1b, the marginal rate of substitution in hiring rises in the relevant range of b when g is reduced to zero. Since at the margin black workers are relatively more expensive beyond a b value of about one-third if they do not discriminate, b* is lowered to the 40 to 50 percent range, while in part 1a of the Table, b* is raised for precisely the opposite reasons as g goes to zero. The iso-cost curves flatten out whenever discrimination coefficients are reduced, so much that, in 1b, the iso-cost curve comes close to a straight line with a slope of approximately -0.6 if g equals zero. There is even a shallow concave portion up to a b of 0.4, suggesting that an interior local maximum might be found even if white and blacks were perfect substitutes in production but at less than a 1.1 rate. For instance, if the slope of a straight-line isoquant is -0.623, a local profit maximum would occur at a b of 20 percent.

III. EVALUATION

The comparative neglect of employee discrimination as a major cause of earnings differentials between whites and blacks is understandable. Since the theory is based on the premise that widespread racial homogeneity preferences color the assessment of working conditions and thus influence the supply of labor to the plant, it is certainly more disquieting than theories concentrating on the convenient targets of capitalists and employers. Throughout this paper it was assumed that the latter maximize profits without racial preferences of their own. Since they neither discriminate nor compensate the effects of employee attitudes in their hiring, employers are expected to take full account of the increase in labor costs accompanying plant integration due to the race aversion premiums which must be paid to employees.

Whether employers choose all-white, all-black, or integrated work forces under the circumstances depends on the marginal rate of substitution in production between black and white workers and on the rate of substitution in hiring which is determined by local supply conditions and the structure of racial preferences. Until more is known about the form of the discrimination functions applicable to particular industries and regions, the private cost of government imposed or employer predilected integration away from the optimum can be very small -- as when discrimination is increasing at a decreasing rate with the percentage of workers belonging to the other race - or it can be potentially large. The extent of government coercion and the size of social benefits required to justify fair employment laws or subsidies vary accordingly. If interior profit maxima exist, they are likely to involve black employment shares of at least 30 to 40% in the plants concerned, given the basic wage differential of the model. To the extent the model is applicable, wage supplements for blacks would therefore have to be designed to increase the probability that interior maxima will occur.

In a society where racial preferences are widespread among the workers, the marginal cost of hiring a person bears no fixed relation to the wage rate, except in the special case where preference externalities are offsetting. The wage, in turn, normally differs from the value of the marginal product, even in a competitive system. While the first black added to a previously all white shop is at least as efficient on the average as the white worker whom he replaces, he can rarely be employed at the same wage as whites, because hiring him often means that the white workers will have to be compensated. If the economic costs of racial identification and of meeting racial preferences have to be disregarded according to society's norms of fairness and efficiency, such a treatment would obviously be reprehensible and wasteful.

Still it would not need to produce effective wage differentials or differences in labor force participation rates, if blacks were free to organize all-black shops from which whites would likewise in effect be excluded by the race aversion of the black majority. However, because of the lasting effects of past deprivations, the skill distribution and human capital structure of blacks is as yet too skewed toward the lesser grades to permit equal efficiency even if nonhuman capital is supplied without regard to race. Thus, without government intervention, blacks will have no other recourse than to take permanently higher unemployment rates if equal wages are paid for equal work,[11] or to buy their way into white shops with their wages and occupational status depressed to compensate the resentment of white fellow workers.[12]

Thurow relates that in South Africa the occupational distribution of blacks is a subject for negotiation when the wages of white miners are determined.[13] Similarly, it is conceivable that government pressure for integration has boosted the relative size of the wage settlements won by construct-

tion workers throughout the U.S. in recent years. When "outreach" programs led to an increase in the percentage of black workers in automobile plants within the city of Detroit, the firms reported increased turnover, discipline problems, and adverse effects on productivity (implicit wage increases). There have been reports of "mounting unrest among whites as departments approach an imaginary 'tipping point'."[14] If these episodes are indicative of the existence of widespread racial homogeneity preferences at the workplace, the recalcitrance of the problem become obvious.

If it were just employer discrimination society had to contend with, fair employment laws and public pressure could be successful in curtailing its wage reducing effects. It is much harder to legislate successfully against expressions of employee racial preferences which generally tend to make iso-cost curves convex, thereby increasing the chance that corner solutions are optimal and integration is bad business. Such preferences, no matter how disguised, may impose a cost on the increased hiring of blacks which is external to the blacks but internal to the business establishment.

If black counterdiscrimination is insufficient to offset this and the net externalities are to be neutralized so that fair employment can become more profitable even though racialist attitudes among employees may persist, tax credits or other forms of subsidies have to be instituted for businesses hiring an integrated labor force.[15] If these subsidies are optimal, the unemployment rates of blacks should fall over time until competition in the labor market has eliminated the skill-adjusted differential in basic earnings. The corresponding crude differential in actual rather than basic earnings, which includes any race aversion premiums arising in integrated employment, accounts for about one-half of the total income inequality between whites and blacks.[16]

Since discrimination coefficients vary between plants, occupations and regions, no precise offset to the net externalities is feasible. Nevertheless, this paper has provided an analytical framework capable of explaining part[17] of the seemingly secular earnings and employment disadvantages of American blacks without inventing mythical entities such as white employers who confront and exploit black labor as a nationwide monopsony.[18] It was also shown that the conventional theory of externalities can be used to justify remedial action on behalf of black workers without immediate recourse to the ideology of either redistribution or restitution.[19] Nonetheless, compensatory redistribution from white to black workers or consumers is, of course, involved if the subsidies are financed through a general payroll tax. This form of financing appears most logical if the race aversion premiums demanded by employees are the cause of the discriminatory "tax" on black wages in the first place.

TABLE 1. MARGINAL RATES OF SUBSTITUTION[a] BETWEEN BLACK AND WHITE WORKERS IN PRODUCTION AND HIRING, AND RELATIVE WAGE RATES, AT VARIOUS

(1a) Discrimination is Increasing at a Decreasing Rate[b]

$(dL_w/dL_b)_{\overline{Q}}$ $(dL_w/dL_b)_{\overline{C}}$ w_b/w_w $(dL_w/dL_w/dL_b)_{\overline{C}}$ wb/w_w

Proportion Black (b)	(1)	(2)	(3)	(4)	(5)
		-------f=g=0.1 -------		-------f=0.1, g=0----	
0	1	0.978	0.707	0.878	0.607
0.1	0.904	0.880	0.689	0.782	0.592
0.2	0.818	0.801	0.674	0.709	0.581
0.3	0.742	0.736	0.661	0.655	0.572
0.4	0.676	0.683	0.649	0.617	0.565
0.5	0.621	0.637	0.637	0.591	0.560
0.6	0.575	0.595	0.624	0.573	0.557
0.7	0.538	0.555	0.609	0.562	0.554
0.8	0.508	0.516	0.593	0.556	0.553
0.9	0.484	0.478	0.574	0.552	0.552
1	0.466	0.442	0.551	0.551	0.551

(1b) Discrimination is Increasing at an Increasing Rate[c]

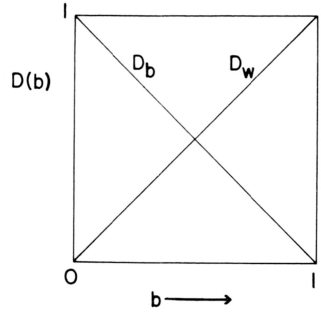
0	1	0.707	0.707	0.607	0.607
0.1	0.904	0.669	0.681	0.615	0.606
0.2	0.818	0.645	0.660	0.623	0.605
0.3	0.742	0.630	0.643	0.628	0.603
0.4	0.676	0.620	0.627	0.630	0.600
0.5	0.621	0.613	0.613	0.629	0.596
0.6	0.575	0.607	0.601	0.623	0.590
0.7	0.538	0.598	0.589	0.613	0.583
0.8	0.508	0.587	0.577	0.598	0.575
0.9	0.484	0.572	0.565	0.577	0.564
1	0.466	0.551	0.551	0.551	0.551

[a] The absolute values are reported. It is assumed that a = 0.5.

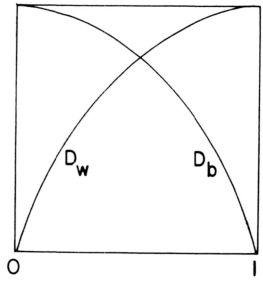
[b] The discrimination functions are (1.5b) and (1.6b) and $\overline{w}_w = 1$, $\overline{w}_b = 0.607$.

[c] The discrimination functions are given by equations (1.5c) and (1.6c).

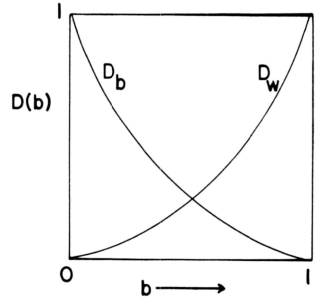
Figure I. DISCRIMINATION FUNCTIONS (D) BY RACE PLOTTED AGAINST THE PERCENTAGE OF BLACK WORKERS (b)



(a)



(b)



(c)

FOOTNOTES

[1] The conditions for optimal investment in the improvement of working conditions have been stated by John Owen [17, pp. 23-28].

[2] If blacks are artificially crowded into the lowest paying occupations, and comparatively overqualified, reduction of such crowding may initially involve the promotion of blacks to positions in which they are more efficient than their white counterparts. Hence, the marginal rate of substitution of black for white workers could at first be greater than unity in the vicinity of their present employment share. See [6, pp. 295-299]. If the discrimination coefficients rise with the average level of skills required in different industries, our model need not be inconsistent with Mrs. Bergmann's "crowding" hypothesis. The possibility of complementarity between black and white workers was anticipated by Finis Welch [25].

[3] Becker assumed that the size of the establishment might be significant in itself in that the larger the shop, the more whites have contact with blacks at any given race ratio. Since the work force may, however, also be more specialized, layered, dispersed and, until the Civil Rights Act of 1964, even formally segregated by departments, jobs, and unions within the large plants, it is not clear that scale is important. Cf. [4, pp. 41-42, 70-71] and [18, pp. 466-67].

[4] The resulting identity is $db = [(1 - b)\, dL_b - b dL_w]/(L_b + L_w)$.

[5] The optimal solution can be found directly by using the Lagrangean

$$C' = w_w L_w + w_b L_b + \lambda(E_w - L_w - L_b e^{-ab}).$$

With E_w and K constant, output is constant. The optimal racial employment ratio is then found by setting the partial derivatives of C' with respect to L_b and L_w equal to zero. In this formation, λ is the ratio of marginal cost to marginal productivity of integrated labor of each race. This ratio is unity for segregated labor, but at an interior point of maximum efficiency in production, λ must be less than one for both white and black workers. The greatest possible loss of output due to complete segregation in employment is a function of the difference $(1 - \lambda)$, though the effect of employment segregation on the marginal productivity of capital must also be considered. For a related complete derivation see [11, pp. 66-69].

[6] At $b = o$, $w_w = w_w$ and $w_b + g$, so that raising either g or f increases the probability of an all-white outcome by reversing the inequality.

[7] Throughout his book, Becker [4] emphasizes the importance of the dispersion of racial preferences in determining effective racial wage discounts. Under competitive conditions in hiring, the race aversion premiums whites can command are governed by employees with the least aversion who can still be attracted to integrated plants. Under democratic union rule with seniority rights, the median discrimination coefficient is likely to prevail with the intensity of racial preferences more randomly distributed over integrated and all-white shops. Because industrial unions may thus prevent the normal market outcome that would have the least color-conscious workers employed in the most integrated plants, they may be able to raise the white race aversion premium at any b. Unions can therefore lower the profitability of integration to employers. This may explain Rapping's finding [18, p. 460] that unions may have reinforced the exclusion of blacks to some

extent, at least up to 1960. See also [13, pp. 53-57]. The income effects of excluding workers from unions can be inferred from [12, pp. 558-69].

[8] If g rises from 0 to 0.1 and the marginal rate of substitution in production between black and white workers is constant at -0.6 (implying perfect substitutability at a less than one-to-one rate), the value of b at the tipping point falls from over 60 percent to under 60 percent. At the corresponding points, the slope of the iso-cost curve equals that of the iso-product curve.

[9] The utility level associated with the wage rate that can be paid to workers in all-black establishments represents a lower bound. All wage rates for black workers in integrated employment must afford at least equal utility. Since firms with an all-black labor force are as yet rare, the aggregate demand for black labor may, in fact, be such as to enable blacks to achieve a higher level of utility in integrated employment. The hypothetical basic wage rate affording this higher level of utility at $b = 1$ would then exceed $e^{-1/2}$. Raising w_b increases the chance of moving to an all-white corner but does not affect the thrust of this analysis in any other respect as long as the race aversion premiums are independent of the level of w_b, as our specification implies. At the macro-level, or for appraising the effectiveness of wage subsidies, w_b would, of course, have to be made endogenous.

[10] At b of 0, $f = 0.1$ is barely below $(w_w - w_b)e^{-1} = (1 - 0.707)/2.719 = 0.108$.

[11] Bell [5] and Bergmann [6] emphasize that freedom of entry into higher-level occupations, equal promotions for equal merit, and equal training for equal ability and promise are more important dimensions of fair employment than equal pay for equal work. However, the discriminatory denial of promotions and training for demonstrated merit and promise can also be interpreted as a system of unequal rewards or a subtler form of wage discrimination over time.

[12] If the discrimination coefficient f is considered as a variate distributed from zero over some positive range, plants with low f will hire a greater percentage of blacks than plants with high f regardless of the form of the discrimination function as long as b remains small. The effective wage curtailment of blacks (the differences between the value of their marginal product and their wage) therefore depends on the weighted distribution of f among plants relative to the supply of workers of both races in any given labor market. Negative discrimination coefficients, which would imply racial heterogeneity preferences, are considered unlikely.

[13] See [23, p. 127]. Similarly, it has been observed in the United States that "union leaders sometimes try to set up a bargaining situation in which the company is expected to make economic concessions in order to win acceptance for Negroes." See [21, p. 383].

[14] "The high wages of the automobile industry hold workers already in plants, but as the percentage of Negroes approaches one-half, new white worker applications decline and those who apply tend not to stay." See [15, p. 105, and pp. 106-09]. See also [7, p. 374].

[15] To remove the externalities, it is not necessary to offset all race aversion premiums, but only to equalize the wage ratio w_b/w_w to the marginal rate of substitution in hiring. The marginal wage supplement for black workers, $S = S(b)$, is therefore obtained by subtracting S from the numerator of equation (1.10) so that $dL_w/dL_b = -w_b/w_w$ for all b. Analytically,

$$S = (w_b/w_w)(b^2 \delta w_b/\delta b + (1-b)b\delta w_w/\delta b) + (1-b)b\delta w_b/\delta b + (1-b)^2 \delta w_w/\delta b$$

It can be seem from Table la that $\underline{S}$ is positive up to b = 50% if g=f=0.1, and up to b = 100% in both parts of the table if $\underline{g}$, and hence $\delta w_b/\delta b$, falls to zero. Implementation of the program may be expected to affect the basic wage differential by offsetting one of the external obstacles to increased hiring of blacks. However, the value of $\underline{b}$ at which S equals zero is unaffected by changes in relative wage rates produced by changes in w_b/w_w.

[16] Dave O'Neill [16] and Paul Siegel [20] both find that between 55 and 40 percent of the earnings differential between whites and blacks is attributable to current discrimination. Somewhat lower estimates are implied by [9], [10], and [19]. For details by occupation and sex see [2], [22], and [24].

[17] The elimination of current labor market discrimination may be expected to raise the demand of blacks for formal education and other forms of human capital investment so that the historical draught of past discrimination may also begin to be lifted. See [3, pp. 749-50].

[18] This interpretation of employment discrimination and Richard Muth's analysis of residential segregation [14, pp. 106-12] are in many ways symmetrical. Muth regards the "seller's preferency" and "real estate collusion" hypotheses as incapable of explaining residential segregation and bases his explanation on buyer's preferences for living with members of his own race. On the factor side, there are many sellers and few buyers, the reverse of the situation in real estate. Here the seller's preference hypothesis appears to be the most cogent to demonstrate the disadvantage of blacks in most integrated job situations, while the skewness of the occupational distribution of blacks towards low-skilled jobs explains why they cannot escape from this predicament.

[19] For a thorough evaluation of the efficiency and equity of both non-market regulations and subsidy incentive approaches to equalizing economic opportunities, see [5].

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