A NOTE ON UNEMPLOYMENT DIFFERENTIALS BETWEEN BLACK AND WHITE WORKERS IN THE UNITED STATES

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I

In a carefully drawn statistical study of the US labor market which appeared recently in *Economica*, Strauss and Horvath[1] suggest that the difference in incomes between black and white workers in the United States reflects barriers to entry to higher paying professions rather than discrimination in wages for the same work. They show that when the labor force is properly stratified by industry and occupation, there is no significant difference in wage rates by race. When the occupational normalization is not undertaken, the difference is significant, although the gap is narrowing somewhat in recent years. It is clear from this and other studies[2] that as anti-discrimination laws are progressively enforced, and win higher levels of voluntary acceptance, it becomes less reasonable to explain racial income differences solely in terms of wage discrimination.

It is much more likely that the inequitable distribution of income is related to the high levels of unemployment among blacks, the greater variability in their employment, the inaccessibility of higher paying jobs for many black workers, and the crowding of black labor into lower paid occupations.[3] In this note we focus our attention on differential employment rates for black and white men for the period 1953–74 as an index to the demand for labor of black compared to white workers. Our belief is that the occupational distortions we have mentioned will move more or less in inverse relationship with the relative demand for black labor. This simplification permits us to construct a tractable dynamic model which formalizes the contention of black workers that they are "last hired and first fired." The mathematics of this view is shown to imply that the relative employment of blacks is positively related to the *rate of growth* of aggregate demand. This accelerator-

[1] Strauss, R.P., Horvath, F.W., "Wage Rate Differences by Race and Sex in the US Labour Market: 1960–70," *Economica*, August 1976, pp. 287–98.

[2] Harworth, J.G., Gwartney, J. Harworth, C., "Earnings, Productivity and Changes in Employment Discrimination During the 1960's," *American Economic Review*, March 1975, pp. 158–68; Freeman, R., "Decline of Labor Market Discrimination and Economic Analysis," *American Economic Review*, May 1973, pp. 280–6. Detailed statistics are to be found in Pascal, A.H., *Racial Discrimination in American Life*, Lexington Books, Massachusetts, 1972.

[3] Bergmann, B.R., and Lyle, G., "The Occupational Standing of Negroes by Areas and Industries," *Journal of Human Resources*, Fall 1971, pp. 411–33. Comanor, W.S., "Racial Discrimination in American Industry," *Economica*, November 1973, pp. 363–78.

like model is tested, and long run measures of the responsiveness of the employment differential to growth in national income are advanced.

Earlier efforts at testing the "last hired, first fired" thesis produced one negative conclusion by Gilman,[4] and a somewhat more positive result by Bergmann.[5] After correcting for occupation, skill, locational and related differences between workers of the two races, Gilman found that he was unable to observe a significant time lag between their hiring rates. There is a striking similarity between this outcome, and the result of the Strauss-Horvath article; they were unable to observe wage differences once the social characteristics of the races were eliminated. This prompts us to adopt a different methodological approach which relates "last hired" not so much to clock time, as to changes in aggregate demand. We suggest that acceleration in demand is the agent which not only overcome bias in advancing blacks to higher paid and stable employment, but also provides the skills, experience and union seniority which make them more employable. For this reason, our study is carried on for male adults, black and white, without otherwise normalizing the data, except of course for seasonal variation. The very normalization, we suggest, has tended to wipe out the mechanism through which racially differentiated demand operates.

One immediate consequence is that those who emphasize the "costs of growth" from an environmental point of view, tend to ignore the costs of "no growth" in the exacerbation of inequity in the distribution of employment and income. Man clearly has problems as a social as well as a biological animal. The existence of socially identifiable groups who receive an inequitably small share of labor income is one of those problems. Patently this is not confined to the United States, where the situation of the blacks is most familiar to the authors. *Mutatis mutandis*, similar analyses could doubtlessly be made of the sectarian schism in Ulster, the tribal tensions in Nigeria, or, writ large, the "north-south" world division.

II

Discrimination, in the static sense defined by Gary Becker,[6] reflects the degree to which blacks suffer *current* racist attitudes in employment policy. In this sense, discrimination consists of a discounting of the actual marginal product of black workers by a discrimination coefficient reflecting the bias of white employers and fellow workers. Thus there is a lowered effective demand for black workers. But we contend that insofar as the present situation reflects the difficulty of entry by blacks into occupations due to maldistribution of human capital or lack of seniority, it is a function of *past* as well as current attitudes. As a result, blacks are more likely to be unemployed than whites, even if static discrimination were completely eradicated. The model we propose deals with *dynamic discrimination*, concerned with the acquisition of the features of employability over time.

Let total employment in time period t be N_t, taken as proportional to the level of

[4] Gilman, H.J., "Discrimination and the White-Nonwhite Unemployment Differentials," Ph.D. dissertation, University of Chicago, August 1963.

[5] Bergmann, B. and Kaun, D., *Structural Unemployment in the United States*, U.S. Department of Commerce, Washington, D.C., 1966.

[6] Becker, Gary S., *The Economics of Discrimination*, University of Chicago Press, Chicago, 1957.

·economic activity in that period, Y_t. Therefore, $N_t = a Y_t$, where a is the labor-output ratio. Total employment is divided between the black and white labor force, $N_t = N_{bt} + N_{wt}$, leading to the expression for employment of blacks, $N_{bt} = a Y_t - N_{wt}$. We shall argue that the white employment is largely determined by the tightness of the labor market in the period previous to the current one, so that the employment of the blacks is in large measure residual. Blacks are "last hired and first fired" because, to a considerable degree, they are used to fill in the gap between total employment, N_t, and white employment.

In making this specification we are effectively saying that relative to the jobs to be performed, the whites are the preferred workers; they are presumed to have the skills, union seniority, as well as skin color more pleasing to white employers and fellow workers. Employers are presumed to estimate their anticipated need for labor in year t, on the basis of aggregate GNP demand in period $t-1$, and to attempt to hire white workers. As the pool of unemployed white labor diminishes, employers turn to black workers. This means that employment of blacks depends not only on the level of national income, but also on the ·exhaustion of the supply of white workers. The blacks, we assert, are hired with a lag, at a later time period as residual employees. Black employment is, therefore, a lagged func-·tion of a decaying pool of white labor.

Of course, this specification is an exaggeration. Clearly some white workers do not have skills that make them preferred candidates for the jobs available, so that they will fall in the residual category. The reverse is true of some black workers. Consequently, some blacks are hired first and some whites are hired last. Yet even though the specifica-·tion of the whites as uniformly preferred, and the blacks as not-preferred, introduces an element of artificiality into our model, we retain formulation because it permits us to focus ·on the essential issues in a macroscopic way without becoming involved in a detailed disag-·gregation and matching of labor skills and job requirements. The proof of the pudding is that even the highly aggregated model we suggest survives statistical test.

The employment of whites, then, is supposed to respond positively to an increase in national GNP in the preceding year, Y_{t-1}. However the impact of lagged GNP as a stim-·ulus to further white employment is expected to decay as white employment asymptotically approaches full employment of the white labor force L_w.[7] For computational purposes, we suggest a convenient form for white unemployment, $a^* Y_{t-1}^{-d}$, where a^* and d are positive parameters. White employment, therefore is $N_{wt} = L_w - a^* Y_{t-1}^{-d}$, as illustrated in Figure 1. Black employment in year t, as the residual after whites have already been hired as a func-·tion of GNP in year $t-1$, is therefore $N_{bt} = a Y_t - L_w + a^* Y_{t-1}^{-d}$.

Let us now define the *relative employment differential* as the ratio of the relative employment rates black to white:

$$e = \frac{N_{bt}/L_b}{N_{wt}/L_w}.$$

If we now define the growth rate as $g = (Y_t - Y_{t-1})/Y_{t-1}$, and the relative size of the labor forces as $\lambda = L_b/L_w$, direct substitution gives us:

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[7] The specification of the time subscript of L_w is a bit awkward since it could refer either to the beginning or end of the period in which the hiring of whites occurs. However, this does not become an issue in·what follows. We will therefore assume that labor force does not change between successive time periods, and dispense with the time subscript.

FIG. 1
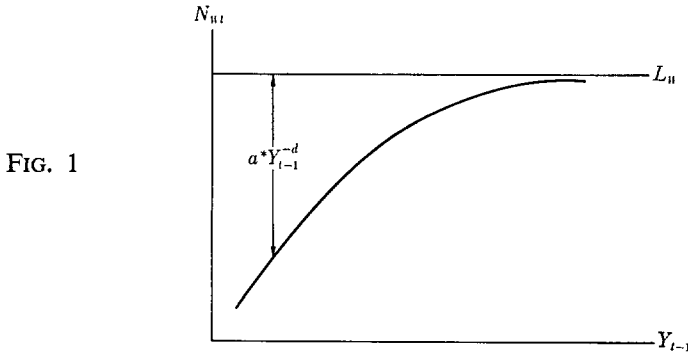
$$e = \frac{1}{\lambda}\left[\frac{(g+1)aY_{t-1}}{L_w - a^* Y_{t-1}^{-d}} - 1\right].$$

We see that the current level of the relative employment of blacks compared to whites depends on the ratio of their labor forces, the level of GNP in the preceding period, and the rate of growth of GNP. Important for our theory is the suggestion that GNP must *continue to grow* merely to *maintain* the relative employment position of the blacks.

To see how e responds to changes in $(g+1)$, λ, and Y_{t-1}, we take partial derivatives:

1. *Relation to growth*: $\partial e/\partial(g+1) = aY_{t-1}/\lambda(L_w - a^* Y_{t-1}^{-d})$. This derivative is certainly positive; the relative employment of blacks increases with growth in GNP. Furthermore the magnitude of this response of e to g is seen to be directly proportional to the level of GNP and inversely proportional to the relative size of the black labor force compared to the white.

2. *Relation to relative size of labor force*: $\partial e/\partial\lambda = -e/\lambda$; e is a rectangular hyperbola in the $e-\lambda$ plane. This negative derivative agrees with Becker's thesis that discrimination is positively correlated with the relative size of the black population, although his theoretical basis differs from ours.

3. *Relation to levels of GNP*:

$$\frac{\partial e}{\partial Y_{t-1}} = \frac{1}{\lambda}\frac{(g+1)a\left[L_w - a^* Y_{t-1}^{-d}(1+d)\right]}{(L_w - a^* Y_{t-1}^{-d})^2}$$

As Y_{t-1} increases toward a condition of white full employment the expression simplifies to $\frac{(g+1)a}{\lambda L_w}$. The relative employment of blacks is seen as positively related to the level of GNP. However, the *degree* to which this condition of generally tight labor markets affects the blacks is directly proportional to the *rate of growth* in GNP, and inversely proportional to the relative size of the black labor force compared to white.

The basic thesis to be tested is that the relative employment of blacks to whites is positively correlated with the rate of growth of GNP, the level of GNP, and inversely correlated with the relative size of the black labor force.[8] The relationship was approximated by a linear regression of e on growth and GNP. Since dynamic discrimination means that the current status of blacks depends on what happened to their employment in previous periods,

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[8] Due to the problems of collinearity it was only possible to test for the first two explanatory variables.

the current level of e was taken to depend on lagged values of the explanatory variables over some substantial interval. Various distributed lag structures were tested. Statistically meaningful results were obtained from two forms:

(a) $e_t = a + bg_{t-1.5} + cY_{t-1}$, where the growth variable was centered 1.5 years previous to the timing of e; since the values for $g_{t-1.5}$ were computed by averaging the annual data for g_{t-1} and g_{t-2}, this explanatory variable was actually a rectangular form of distributed lag for the 8 quarters centered 6 quarters previous. Y was lagged simply for one year.

(b) A Koyck distributed lag regression model: $e_t = a + bg_t + lbg_{t-1} + l^2bg_{t-2} + \ldots + l^n bg_{t-n} + cY_{t-1} + lcY_{t-2} + l^2cY_{t-3} + \ldots + l^n cY_{t-(n+1)}$ where l is some positive number less than unity to be determined by the regression.

Summing the infinite series, the equation becomes:

$$e_t = le_{t-1} + a(1-l) + bg_t + cY_{t-1}.$$

The Koyck form conforms to our notion dynamic discrimination. Growth must extend over considerable periods of time to permit the acquisition of human capital and seniority by blacks.[9] The weights of the coefficients of g and Y, lagged indefinitely into the past, diminish geometric progression. The statistical advantage of this form is that only l must be estimated, even though there is actually an infinite number of lagged explanatory variables. The parameters of the equation were estimated in a "stepwise" fashion by first introducing g, the variable which made the greatest contribution to the reduction of the residual variability.

The results of Models (a) and (b) are summarized in Table 1.

TABLE 1

REGRESSION RESULTS OF THE RELATIVE EMPLOYMENT DIFFERENTIAL AND
RATE OF GROWTH AND LEVEL OF GNP USING DIFFERENT LAG DISTRIBUTIONS

	Model*	a	b	c	R^2	DW	h^{10}
(a)	Six quarter lag.	.886	.319	0.000104	.737	1.138	
		(84.1)	(2.38)	(5.77)			
(b) (1)	Koyck distr.						
	$l = .933$	0.849	0.219		.808	2.18	.45
	(8.46)	(1.21)	(3.125)				
(2)	Koyck distr.						
	$l = .803$	.858	0.209	0.0000208	.817	2.06	.22
	(4.31)	(13.20)	(2.92)	(2.92)			

* t values in parentheses.
Source: *Employment and Earnings,* Bureau of Labor Statistics, U.S. Department of Labor for Black and White Male Employment 1953–74; *Survey of Current Business,* U.S. Department of Commerce for GNP and growth rates.

The reliability of the estimates in (a) were flawed by problems of autocorrelation. Although the regression coefficients appeared significant, the Durbin-Watson statistic was borderline and the more refined Von Neumann test revealed significant positive autocor-

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[9] See the discussion in Grilliches stressing the need for a theoretical rationale for distributed lag forms. Grilliches, Zvi, "Distributed Lags: A Survey," *Econometrica,* Vol. 35, No. 1 (January 1967).

[10] h is the statistic developed by Durbin to test for serial correlation in models such as ours where autocorrelation may have been introduced by using lagged values of the dependent variable as explanatory variables. See, J.Durbin, "Testing for Serial Correlation in Least-Squares Regression when some of the Regressors are Lagged Dependent Variables," *Econometrica,* Vol. 38, Mo. 3, Nay 1970.

relation. Nonetheless, the estimates are consistent with the more significant outcomes of (b). The Koyck model (b) improved the results markedly. The coefficient of growth was significant in both versions, and the best available test indicates that autocorrelation was not present.[11]

The influence of Y on e is small in both models in which it occurs. It would require an increase of $100 billion in GNP to improve the employment of blacks vis-a-vis whites by one percentage point in model (a). In model (b), the coefficient of Y is not statistically significant; if the estimate were to be accepted, GNP would have to rise approximately $500 bil. to achieve a one percent improvement in e.

All the models are remarkably unanimous in their conclusions as to the impact of an increase in the rate of economic growth on e. A one percent increase in the rate of growth for one year would cause about a quarter of a percentage point improvement in the relative position of the blacks.

The influence of continuous growth on relative employment is even more substantial. Since prolonged periods of growth exert their influence not only through the current period but through the (diminishing) weight of all previous periods as well, a period of continuous expansion applies a multiplier effect on the incresae in e. The magnitude of this multiplier is $\frac{1}{(1-l)}$ and the long-run coefficient of g becomes 1.06. It would take only a one percent increase in steady state growth to increase e by one percentage point.

This multiplier is likely to be an understatement of the long run effect. There are, after all, two interrelated aspects of the "last hired-first fired" effect. On one hand, workers who may not have all the skills desired, or who may be the victims of racial prejudice are drawn as residual workers into employment as aggregate demand increases. As long as their employability is not altered, they will be discharged just as rapidly when the business cycle turns down. But on the other hand, the fact of the employment experience increases employability by imparting human capital, acquiring seniority, and overcoming the xenophobic aspect of racist bias. It is this first aspect which is probably emphasized in the present model, based as it is on a multiplying up of shorter term effects into a long run coefficient. It proved difficult to segregate these effects statistically by measuring continuous years of employment with the aggregated data at our disposal, but the probable nature of the bias makes our case stronger than we have been able to demonstrate quantitatively.

III

We conclude that the intuition of blacks that they were "last hired and first fired" has a basis in fact. Moreover, it implies that the relative employment of blacks compared to whites is positively related to the rate of growth of GNP, and that such growth is a prerequisite to achieving the elimination of the dynamic aspects of discrimination. Finally, we are concerned to urge those who advocate limitations to growth on ecological grounds to consider the distributional aspect of their policies for minority and deprived groups.

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[11] The statistic h is standard normal for large samples. Its use for our sample, however, is in accord with current practice.