IMF WORKING PAPER

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WP/94/108

INTERNATIONAL MONETARY FUND

Research Department

Disequilibrium in the Labor Market in South Africa

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September 1994

Abstract

Unemployment in South Africa is decomposed into a cyclical and a structural component. The estimates suggest that unemployment is largely structural. Alternative explanations for the persistence of deviations of market wages from full-employment levels are examined. Three models that are empirically capable of generating the observed wage and employment gaps are presented. The predictions of the models for wages and employment are discussed in light of recent and prospective developments in South Africa.

Summary

This paper characterizes wages, employment and unemployment in South Africa from a macroeconomic viewpoint. Unemployment is decomposed into a Keynesian or cyclical component that can be identified with deficient aggregate demand, and a classical or structural component that can be identified with aggregate supply. The evidence suggests that unemployment is largely structural and associated with supply factors rather than due to cyclical factors associated with the recent recession.

Alternative explanations for the persistence of deviations of market wages from full-employment levels are explored. Three models are discussed: a nutrition-efficiency-wage model; a wage-incentive model; and a model of collective bargaining. Each is shown to be empirically capable of generating the kinds of wage and employment gaps observed in South Africa. While the models are, therefore, observationally equivalent at an aggregate level, it is useful to examine the different models because they stress alternative factors in creating a wage gap and thus unemployment.

The predictions of the models for wages and employment are discussed in light of recent and prospective developments in South Africa. These developments include: the effects of increases in the capital stock and improvements in multifactor productivity; the redistribution of social expenditures that is underway; reductions in effective transportation costs associated with the removal of apartheid; structural measures that increase labor market flexibility; and changes in union membership.

I. Introduction

The labor market in South Africa can be viewed as being comprised of two independent, though closely related, factor markets: one for skilled labor and the other for unskilled labor. Besides the wage differential between skilled and unskilled labor, there is an apparent asymmetry in the mechanisms by which the two factor markets equilibrate. 1/

Until recently there was virtually no unemployment of skilled labor and even now, when unemployment has appeared, the level is low enough to be consistent with frictional explanations. 2/ Furthermore, real wages of skilled labor have apparently declined during the recent recession, indicating a flexible real wage for skilled labor. In short, the market for skilled labor appears to clear, with real wages adjusting to equilibrate demand and a relatively inelastic supply in a classical manner. In the market for unskilled labor, however, there is, by any definition, a large amount of unemployment, with estimates varying between 20 percent and 50 percent. Therefore, while profit maximization objectives would suggest that firms are on their demand curves for labor, indications are that market equilibrium is not occurring anywhere near a full-employment wage.

Section II develops a simple aggregative framework for the economy that permits quantitative characterization of the market for unskilled labor. The employment gap in the market is decomposed into a cyclical component that can be identified with deficient aggregate demand and a structural component that can be identified with aggregate supply. The estimates suggest that unemployment is largely structural rather than cyclical.

Section III explores alternative explanations for the persistence of deviations of market wages from full-employment levels. Three models are discussed: a nutrition-efficiency-wage model, a wage-incentive model, and a model of collective bargaining. Each is shown to be empirically capable of generating the kind of wage gap observed in the market for unskilled labor in South Africa. At an aggregative level the models are, therefore, observationally equivalent. In any given sector, however, one of the models is likely to be more relevant than the others, as the economy comprises various sectors that differ in terms of the average levels of wages, industrial structure, and the extent of unionization. At the macroeconomic level, it is useful to examine the different models because they stress alternative factors in creating a wage gap and thus unemployment.

The predictions of the models for wages and employment are discussed in light of recent and prospective developments in South Africa. First, since the empirical work suggests that the market-clearing wage is at or below the subsistence level, a natural model to consider is the nutritional model of

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1/ Skilled labor is interpreted in this paper as labor classified as possessing "high-level" skills (see Appendix). In 1989 it comprised about 15 percent of the labor force in the non-primary sector.

2/ Indications are that unemployment within the highly skilled labor market began to appear only in 1985, coinciding with the imposition of sanctions and the subsequent slowing of economic activity.

Leibenstein (1957). The analysis suggests that, to the extent that the redistribution of social expenditures toward the nonwhite population that is under way in South Africa succeeds in raising the nonwage income of unskilled labor, the market wage will decline and employment will expand. A reduction in effective transportation costs, which were a significant burden imposed by apartheid on workers, would have a similar effect. The model predicts that improvements in labor productivity stemming from factors that are external to workers' effort, such as increases in physical capital and multifactor productivity, would be reflected primarily in increases in employment rather than in wages.

Second, a wage-incentive model that follows that of Shapiro and Stiglitz (1984) is discussed. The model suggests that increases in labor supply, reductions in labor separation rates with the abatement of the recent recession, improvements in the motivation of the labor force with declines in political unrest, and structural measures that increase labor market flexibility should all lead to lower product wages and prompt an expansion in employment. Improvements in labor productivity that are due to increases in the capital stock or multifactor productivity should be accompanied by increases in both wages and employment.

Third, a model of collective bargaining between employers and a union that follows the work of McDonald and Solow (1981) is discussed. It is argued that to the extent that unions have been responsible for creating a wage gap and lowering employment, and since union density in the private business sector is already very high, union density may decline over time. To the extent that trade unions or federations of trade unions, such as the Congress of South African Trade Unions (COSATU), have broader political agendas, concerns about the size of the membership are likely to increase over time. This could shift their objective functions in favor of employment at the expense of wages.

Section IV offers some concluding observations.

II. A Macroeconomic Characterization of Wages, Employment, and Unemployment

A simple aggregative framework relating output (value added) to three factors of production--unskilled labor, skilled labor, and physical capital--is used to characterize production. Skilled labor and unskilled labor are assumed to be combined using a Constant Elasticity of Substitution (CES) function to produce what is termed "effective" labor. Effective labor then combines with physical capital through a CES production function to yield output. These functions can be written as

$$Q = A\left[a(L\exp(\lambda_1 t))^{\rho_1} + (1-a)K^{\rho_1}\right]^{\frac{1}{\rho_1}}, \tag{1}$$

$$L = B\left[b(LS)^{\rho_2} + (1-b)(LU)^{\rho_2}\right]^{\frac{1}{\rho_2}} , \tag{2}$$

where Q denotes output, L denotes effective labor, K denotes physical capital, and LS and LU denote, respectively, skilled and unskilled labor; a, b, A and B are constants with a and b restricted to having values between 0 and 1. Since L is not observable, the constant B simply represents a choice of units in which L is measured and in the following it is normalized to unity. The term $\exp(\lambda_1 t)$ is used to allow for technical progress which is assumed to be labor-augmenting. The ρ_is are parameters that determine the elasticity of substitution, σ_i, between effective labor and capital, and between skilled and unskilled labor, by the relationship

$$\sigma_i = \frac{1}{1 - \rho_i} . \tag{3}$$

1. **The demand for unskilled labor**

First order conditions for profit maximization require that the marginal product of unskilled labor be equated with its real product wage. This defines the demand for unskilled labor as a function of the real product wage for given levels of the state of technology, physical capital, and skilled labor employed. If the stock of physical capital and skilled labor are assumed to be predetermined at a point in time in that they can only be adjusted slowly, 1/ then, given the assumption of diminishing returns to labor, there will exist a well-defined downward sloping demand curve for labor. Such a curve is plotted in Figure 1, where LU^d denotes the demand for unskilled labor and LU_f represents the full employment level. 2/ It follows that the intersection defines a full-employment wage, WU_f.

If, for any reason, the real wage exceeded the full employment wage, but firms continued to operate on their demand curve, for example, at point Y in Figure 1, then there would be unemployment of $LU_f - LU_c$, and a "classical" wage gap can be defined as the difference between the prevailing wage WU_1 and the full employment wage WU_f.

1/ For the economy as a whole, this is, of course, always true if the markets for the rental of capital and skilled labor each clear. The demand function for unskilled labor can then be expressed as a function of the full employment levels of the capital stock and skilled labor.

2/ The following discussion draws on Lipschitz and Schadler (1984).

Of course firms need not always be on their labor demand curve. Consider, for example, the case where aggregate demand falls short of aggregate supply at the prevailing wage. Substitution of the firm's labor demand curve into the production function yields an output supply curve that is, like the labor demand curve, a decreasing function of the real wage. At the prevailing real wage, if aggregate demand falls short of firms' desired aggregate supply, for the output market to clear, firms will have to be off their supply curve. Correspondingly, the firm will be off its labor demand curve. Deficient aggregate demand could thus move the economy to a point such as X in Figure 1 with unemployment exceeding that due to the classical wage gap. This additional unemployment (LU_c–LU_1) in Figure 1, is often termed "Keynesian" in that an expansion in aggregate demand can be expected to raise employment without requiring an adjustment in real wages. If aggregate demand were to exceed aggregate supply at the prevailing wage, however, real wages become a binding constraint. Firms will not be willing to increase the supply of output unless real wages decline.

In the ensuing analysis unemployment in South Africa is decomposed into a Keynesian component that can be identified with deficient aggregate demand and a classical component that can be identified with aggregate supply.

On the basis of equations (1) and (2), the first order condition for the employment of unskilled labor implies that the elasticity of demand for unskilled labor with respect to the real product wage is[1]/

$$ e^{LU}_{WU} = \frac{d\ \ln(LU)}{d\ \ln(WU)} = - \frac{1}{\dfrac{1}{\sigma_1}(1-\alpha_L)e^L_{LU} + \dfrac{1}{\sigma_2}(1-e^L_{LU})} , \tag{4} $$

where α_L denotes labor's share in income and e^L_{LU} denotes the elasticity of effective labor with respect to the input of unskilled labor. Taking a log-linear approximation, the wage gap can be written as [2]/

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[1]/ Note that this definition of the elasticity of demand for labor allows output to vary as the wage rate changes. At a microeconomic level, a firm's own wage elasticity of the demand for labor is often defined at a constant level of output. See, for example, Hamermesh (1986).

[2]/ The calculations reported below were also carried out without the log-linear approximation. Since only small differences were found--of about 1/2 of a percent for changes of 20 percent implied by the log-linear approximation--the log-linear approximations are reported to maintain transparency of the calculations.

Figure 1. The Demand for Unskilled Labor.
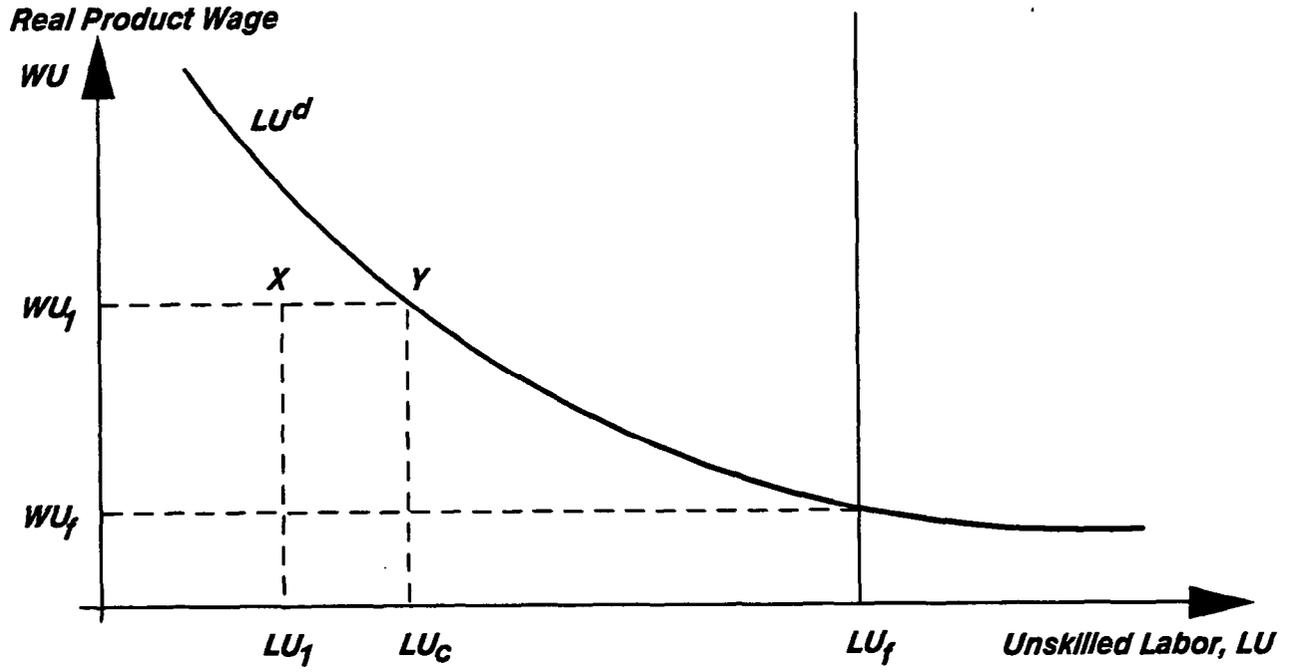
$$wu_g = wu - wu_f = \left[\frac{1}{\sigma_1}(1-\alpha_L)e^L_{LU} + \frac{1}{\sigma_2}(1-e^L_{LU})\right](lu_f - lu) , \tag{5}$$

where lower case wu and lu are used to denote the logarithms of real wages and employment.

To estimate the wage gap it is necessary to parameterize (1) and (2). This is done in the next two subsections. In principle, one would want to estimate the production function directly. Unfortunately, there are several well-known technical problems in doing this. The approach followed here is to carry out econometric estimation only where necessary. Where possible the functions are parameterized on the basis of available data for a particular base year. The point of departure of the present framework from standard production functions employing aggregate labor and capital is the distinction between skilled and unskilled labor. Since little is known a priori about the substitutability between skilled and unskilled labor, and effective labor input is an unobservable variable, parameters of the effective labor function are estimated in the next subsection. Using the estimated series for effective labor input, the aggregate production function is then parametrized on the basis of data for a base year, 1989, and what appears to be a realistic value for the elasticity of substitution between labor and capital on the basis of published estimates. 1/

2.   The effective labor function

Ideally, estimates of σ_2 (that is $1/(1-\rho_2)$) and b in equation (2) would be obtained by estimating the relationship between the ratio of unskilled to skilled workers and their relative wages implied by the first order conditions for profit maximization. However, while data on employment levels by skill category for South Africa is available, a breakdown of data on labor compensation by skill level is not available. The data that is available on compensation is on a racial basis. In the following, the methodology of Bayoumi and Corker (1991) of expressing observed income shares of whites and nonwhites as an estimable function of employment levels of skilled and unskilled whites and nonwhites is adopted.

Any analysis employing historical data on labor compensation in South Africa must make allowance for wage differentials between white and non-white wages attributable to the apartheid regime. It is assumed here that while various forms of apartheid restrictions—such as job reservation, etc.—led to wage rates of white labor exceeding those of nonwhite labor in the same skill category, white and nonwhite labor were equally productive in that skill category. Following Porter (1978) it is assumed that firms attempted to equate the marginal product of each type of labor with its

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1/ 1989 is chosen as the base year to coincide with the last year of the sample period in estimating the effective labor function. The reasons for the choice of sample period in estimation are mentioned below.

"effective" real product wage, with the effective real product wage defined as a weighted average of wages paid to whites and nonwhites. For any skill category of labor the firm's first order condition is then

$$\frac{\partial Q}{\partial (L_E + L_N)} = W = c{\cdot}W_E + (1-c){\cdot}W_N \,,\tag{6}$$

where the subscripts E and N are used to denote white and nonwhite, respectively. The weight c represents the ratio of white to total employment for that skill category. The wage differential between white and nonwhite labor for any particular skill category is modelled as an exogenous function of time, so that

$$W_E = (1 + \beta_1 \exp(-\beta_2 t))W_N \,,\tag{7}$$

where the parameter β_1 measures the level of the discriminatory wage differential in the base year (when $t = 0$) and β_2 is the rate at which the wage differential erodes over time. It is further assumed that the extent of wage discrimination is the same across skill categories, so that β_1 and β_2 are constrained to be the same across skill categories. The white share of labor income can be described by the identity

$$\alpha_E = \frac{LS_E{\cdot}WS_E}{Q} + \frac{LU_E{\cdot}WU_E}{Q} = \frac{LS_E{\cdot}WS_E}{LS{\cdot}WS}\alpha_S + \frac{LU_E{\cdot}WU_E}{LU{\cdot}WU}\alpha_U \,,\tag{8}$$

where α_S and α_U represent the shares of skilled and unskilled labor in income. Given the CES nature of the effective labor function, if firms are on their labor demand curves, the ratio of the factor shares of skilled and unskilled labor can be expressed as

$$\frac{\alpha_S}{\alpha_U} = \frac{b}{1-b}\left[\frac{LS}{LU}\right]^{\frac{\sigma_2-1}{\sigma_2}} .$$

$$\tag{9}$$

Substituting (7) into (6), the resulting expression and (9) into equation (8), and making similar substitutions into the definition of the share of nonwhite labor income, the ratio of white to nonwhite labor income shares can be expressed as

$$\frac{\alpha_E}{\alpha_N} = \left(1+\beta_1 \exp(-\beta_2 t)\right) \left[\frac{\dfrac{(LS_E/LS)(LS/LU)^{\sigma^*} b^*}{(1+(LS_E/LS)\beta_1 \exp(-\beta_2 t))} + \dfrac{(LU_N/LU)}{(1+(LU_E/LU)\beta_1 \exp(-\beta_2 t))}}{\dfrac{(LS_N/LS)(LS/LU)^{\sigma^*} b^*}{(1+(LS_E/LS)\beta_1 \exp(-\beta_2 t))} + \dfrac{(LU_N/LU)}{(1+(LU_E/LU)\beta_1 \exp(-\beta_2 t))}} \right] , \qquad (10)$$

where $\sigma^* = (\sigma_2-1)/\sigma_2$ and $b^* = 1/(1-b)$. Equation (10) was estimated using nonlinear least squares using data on remuneration by racial group and employment by skill category and racial group for the period 1970–89 for the nonprimary sector. 1/ The following results were obtained

Table 1. Parameter Estimates from Relative Factor Share Equation

	Value	Standard Error
σ^*	0.36	0.39
b^*	2.19	1.53
β_1	0.29	0.13
β_2	0.10	0.02

Durbin–Watson = 1.24 $\bar{R}^2$ = 0.98

Note: The estimation period was 1970–89. t was arbitrarily set equal to zero in 1985 so that estimates for β_1 could be compared to those of McGrath (1990), Knight and McGrath (1987), and Bayoumi and Corker (1991).

The coefficients related to the effective labor function, σ_2^* and b^* are somewhat imprecisely estimated. Given the indirect route necessary to

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1/ Data sources and definitions are presented in the appendix. The reason for the choice of sample period is that employment by race and skill category were reported up to 1989; thereafter, employment by skill category seems no longer to be broken down by racial group, making the methodology used here inapplicable.

estimate them, this is not surprising. Since these are the only estimates available, however, they are employed below. The estimate of σ_2^* implies an elasticity of substitution between skilled and unskilled labor of 1.56. The fact that this elasticity is estimated to be greater than unity implies that a change in the composition of the employed work-force in favor of skilled labor—as has occurred in South Africa—will be associated with a less than proportionate decline in the relative wage of skilled labor (approximately 2/3 of the percentage change in the ratio of skilled to unskilled labor). The estimate of b^* implies an estimate for b in equation (2) of 0.69. Using these estimates, a series for effective labor was constructed and the elasticity of effective labor with respect to unskilled labor, which also represents unskilled labor's contribution to effective labor input, was found to be a little less than half (0.46). The above estimates imply that the marginal product of skilled labor was 6.83 times that of unskilled labor in 1989 and therefore a large wage differential should exist between skilled and unskilled labor.

The coefficients related to the wage differential between white and nonwhite wages within a skill category imply a level difference in 1985 of 29 percent. While the estimate here is somewhat higher than that of Bayoumi and Corker (1991) of 22 percent, and that of Knight and McGrath (1987) of 21 percent using microeconomic data for the same year, the estimate is comparable. The estimate of β_2 implies that this differential declined at an average of 10 percent per annum over the sample period. Projecting beyond the sample period, these estimates imply that the discrimination wage wedge should have declined to around 13 percent by 1993. However, it is likely that even this relatively small differential overestimates the present wedge given the likely acceleration in the erosion of the discriminatory differential with the formal removal of apartheid in 1989.

3. The aggregate production function

To completely characterize the demand curve for unskilled labor, an estimate of the elasticity of substitution between labor and capital and the share of labor in total income is required. The elasticity of substitution between capital and effective labor input is assumed to be 0.5. This value is at the low end of the range of 0.5 to 0.8 found by Artus (1984) for the major industrial countries to which South Africa compares in terms of capital intensity as measured by the capital-output ratio. 1/ It is somewhat higher than Fallon's (1992) estimates of between 0.2 and 0.25 for the elasticity of substitution between capital and unskilled and semi-skilled labor, respectively.

The share of labor income in the nonprimary sector is estimated to be 65 percent in 1989. Using the estimated effective labor series, the share

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1/ The capital-output ratio in the nonprimary sector of South Africa is estimated at around 3.7 in 1989, compared to around 3 in the U.S. (Adams and Chadha (1992)) and 3.9 for Germany (McDonald and Thumann (1990)).

of labor income in output, and the assumed elasticity of substitution between capital and labor, it is possible to parameterize the production function for any given year under the assumption that the output market clears. This is done in Table 2 which presents some basic data on the South African economy. Using the parameter values in Table 2 and the estimates in Table 1, the point estimate for the elasticity of the demand for unskilled labor with respect to the real product wage in equation (4) is -1.5 (-3/2). This implies that the wage gap (in logarithms) is some 2/3 of the employment gap, that is

$$wu - wu_f = \frac{2}{3}[lu_f - lu]$$

4. **The employment gap**

The National Manpower Commission estimates that of a total population (including the ten homelands) of 39.4 million people in 1991 there were 13.4 million economically active ones. 1/ In accordance with international conventions, the labor force is defined as the economically active population. It should be noted, however, that such a definition may considerably underestimate the labor force since current measured participation rates for males in the labor force are very low by both international standards and relative to what they have been in the past. The labor force participation rate of males in the working age group of 15-65, has declined from 93 percent in 1960 to 74 percent in 1991. 2/ Of the economically active population, 8 million were employed in the formal sector, of which 6.3 were in the nonprimary sector. Of the remaining 5.4 million, 2.8 million are estimated to earn a living in the informal sector while 2.6 million were unemployed. Measuring the employment gap for the formal nonprimary sector is complicated by how those employed in the large informal sector should be treated. It is important to note that the statistics available on the informal sector include a wide range of activities. Clearly, some informal sector activities are equivalent in pay—if not superior, in an after-tax sense—to those in the formal sector. A well-known and much-discussed informal sector activity has been the taxi industry which has mushroomed over the last few years. 3/ Official estimates of informal sector activity, however, include a number of other activities. Those classified under "scavenging" for example, are, at best,

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1/ See Race Relations Survey (1993).
2/ See Barker (1992).
3/ Khosa (1990) estimates that while there were 40,000 licensed taxis in South Africa in 1988, there were 80,000 "pirate" taxis.

Table 2.   Basic Data and Parameterization of Production Function

	1989
Total Economy	
Gross domestic product, factor cost (in millions of rand)	207,716
Net capital stock (in millions of rand)	675,248
Nonprimary sector	
Gross domestic product, factor cost (in millions of rand)	171,485
Net capital stock (in millions of rand)	603,715
Gross compensation of labor (in millions of rand)	111,465
Gross compensation of capital (in millions of rand)	60,020
Employment in the nonprimary sector (number of people)	
Skilled labor	880,051
Of which: white	566,355
Unskilled labor	5,187,070
Of which: white	1,175,805
Effective labor input	1,747,380

Production function parameters for the nonprimary sector on the basis of 1989 data

	1989
Parameter "a"	0.84
Parameter "A"	0.13

Capacity Utilization Rate in Manufacturing

	1981	1989	1991
Reported	86.4	84.5	81
Index 1/	1.0	0.98	0.94

1/   The maximum reported utilization rate during 1970-92 was in 1981.

activities which provide a "wage" well below subsistence. 1/ In the following, two employment gap measures are used by treating those reported to be employed in the informal sector alternatively as fully employed and completely unemployed. The associated classical wage gaps can then be interpreted, respectively, as the decline in wages necessary in the formal nonprimary sector to potentially absorb the current unemployed, and that necessary to absorb both the unemployed and those employed in the informal sector.

The imposition of sanctions in 1985 and the recession in the industrial countries in the late 1980s has generated a protracted recession for the South African economy. It is important, therefore, to distinguish between the recessionary or Keynesian component of the employment gap, that may be expected to be closed once the recession dissipates without requiring an adjustment in real wages, and that associated with supply in that there exists a (classical) wage gap that is associated with the real wage exceeding the market clearing wage. If one were directly estimating the demand for unskilled labor as depicted in Figure 1, then one way this can be accomplished is to include a cyclical indicator—such as capacity utilization—that provides a measure of the extent to which firms may be off the production function or labor demand curve corresponding to full utilization of the capital stock. This methodology is employed by, for example, Lipschitz and Schadler (1984). A very similar approach is followed here. Note that the demand curve for unskilled labor in Figure 1 was drawn for a fixed level of the capital stock. Changes in the capital stock shift the demand curve for labor. In particular, decreases in either the capital stock or the extent of utilization of a fixed stock would shift LU^d horizontally to the left. In decomposing the employment gap into Keynesian and classical components it is assumed that in response to deficient aggregate demand, firms are unable to change the level of their capital stock in the short run, but can vary its utilization rate. Ex post, for any observed utilization rate below the maximum, the labor demand curve in Figure 1 can be viewed as having shifted to the left of that defined by the maximum utilization rate. The horizontal difference between the labor demand curve defined by the current utilization rate and that defined by the maximum utilization rate can, at any wage rate, then be identified as the Keynesian employment gap. 2/ This is done in Table 3 where the capacity utilization rate in manufacturing (reported in Table 2) has been used as a proxy for the rate of capital utilization in the nonprimary sector. For

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1/ Transport and scavenging each accounted for some 6 percent of employment in the informal sector according to a Central Statistical Service survey in 1989. The major activities were trading and hawking (25 percent) and crafts (33 percent).

2/ Measuring the cyclical component of capacity utilization as the difference between the actual utilization rate and the maximum observed utilization rate rather than some "normal" rate likely overestimates the Keynesian component of unemployment.

Table 3. Employment Gaps and the Classical Wage Gap for Unskilled Labor
in the Nonprimary Sector, 1991

Full Employment Definition	Current Employment (Index)	Full Employment (Index)	Employment Gaps (Percent of Total)		Classical Wage Gap 1/ (Percent)
			Keynesian	Classical	
Current employment + Unemployment	1.0	1.48	13.5	86.5	21.9
Current employment + Unemployment + Informal sector employment	1.0	2.00	6.5	93.5	42.0

1/ Calculated as 2/3 of the log difference of the index of full employment
from the sum of the index of current employment and Keynesian unemployment.

Table 4. Estimated Market, Market Clearing, and Subsistence Wages, 1991

(In rand per month)

	1991	Percent Below Market Wage
Average gross remuneration of unskilled labor (market wage) 1/	1,048	--
Classical full employment wage 2/	818	22
Classical full employment wage 2/ (including informal sector)	608	42
Average household subsistence level 3/	697	33
Average remuneration in informal sector 4/	717	32

1/ Estimated income share of unskilled labor per worker in the nonprimary
sector.
2/ Calculated on the basis of percentages reported in Table 3.
3/ Based on a September 1991 household survey (see Race Relations Survey
(1993)) for an average family.
4/ Informal Sector Output is assumed to be 10 percent of GDP in 1991.
The Central Statistical Service (1990) survey reported output to be
8 percent of GDP in 1989. Since this is a highly labor-intensive sector, it
was assumed that labor's share in income of the sector was 90 percent.

1991, capital utilization is estimated to be 94 percent of maximum. 1/
The shift in the demand for unskilled labor for a change in the capital
utilization rate can be determined by differentiating the firms' demand
curve for unskilled labor with respect to the capital stock at any wage
rate. Expressed in elasticity form

$$\frac{\partial LU}{\partial K}\frac{K}{LU} = \frac{1}{\sigma_1}(-e\frac{LU}{WU})(1-a)A^{\frac{\sigma_1-1}{\sigma_1}}(\frac{K}{Q})^{\frac{\sigma_1-1}{\sigma_1}} \tag{11}$$

so that, as a log-linear approximation, for the parameter values reported
above, the increase in employment that can be expected from an increase in
the capital utilization rate to its maximum is

$$lu_c - lu = 1.05[k_f - k]$$

Table 3 shows that between 6.5 to 13.5 percent of the employment gap in
1991 could be attributed to Keynesian factors and could be expected to
disappear as the recession abates. However, the remaining, and more
substantial classical employment gap is likely to persist. It is estimated
that market-clearing wages of unskilled labor are 22 to 42 percent lower
than prevailing wage rates.

Table 4 compares the estimated average wage of unskilled labor in the
nonprimary sectors with alternative concepts of the classical full
employment wage, an estimated household subsistence level, and estimated
average wage income in the informal sector. While the narrow definition of
the classical employment gap implies a full-employment wage that exceeds the
subsistence wage, the broader definition implies a full-employment wage that
is below the subsistence level. Since the subsistence wage is intermediate
between the two extremes, a reasonable working hypothesis is that the full-
employment wage is at, or perhaps a little below, the subsistence wage.
Estimated average remuneration in the informal sector is insignificantly
different from the subsistence level.

In summary, unemployment appears to be largely structural and
associated with supply factors rather than due to cyclical factors
associated with temporarily deficient aggregate demand. Further, for the
formal non-primary sector to absorb the portion of the labor force that is
outside the formal sector, the estimates suggest that wages would need to
fall below the subsistence level. The nutrition-efficiency-wage model

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1/ The capacity utilization rate declined further in 1992 to about
91 percent of maximum. If a 91 percent utilization rate were assumed, the
Keynesian components of the gaps reported would increase from 6.5 and 13.5
percent to 10 and 20.8 percent, respectively.

presented in the next section shows that this would be neither a desirable nor a sustainable outcome. The source of alternative employment—the informal sector—appears to offer on average the subsistence wage. The next section explores alternative explanations for the gap between formal sector wages and the full-employment wage.

III. Equilibrium Explanations of the Classical Wage Gap and their Implications

This section presents three models that are potentially capable of explaining persistent deviations of wages from their market-clearing levels: a nutrition-efficiency-wage model; a wage-incentive model; and a model of a monopoly union that bargains collectively with employers. The ability of the models in explaining wage gaps of the magnitude observed in the market for unskilled labor in South Africa are examined. It is assumed throughout the section that firms' production technology is characterized by diminishing returns to labor. Labor supply is assumed to be perfectly elastically supplied at a fixed real reservation wage, denoted $\bar{W}$. In the nutrition model, this reservation wage could be identified with the subsistence wage. In the wage-incentive and union models, $\bar{W}$ can be thought of as the alternative income labor can earn when not employed in the formal sector. In keeping with the empirical characterization of the market for unskilled labor in Tables 3 and 4, wages and parameters are measured at a monthly frequency, except where explicitly noted.

1. The nutrition model

The nutrition-efficiency-wage model is based on the idea that at low levels of income there is a technically-determined relationship between nutrition and labor productivity (Leibenstein (1957), Mirrlees (1975), and Bliss and Stern (1978)). The most straightforward way to capture this link in a macroeconomic model is to assume that all wage and non-wage income is consumed and posit that worker effort or productivity is an increasing function of income. If worker effort can be costlessly observed and supervised, firms will offer wage rates to workers taking into account the effects of compensation on worker productivity.

Let $e(W + NW)$ denote worker effort as a function of labor income, W, and non-wage income, NW. For simplicity, assume further that the effort function is concave so that while worker effort increases with income, it does so at a diminishing rate. Firms, in maximizing profits, will minimize wage costs per unit of effective labor input. That is, they will minimize

$$\frac{W \cdot L}{e(W + NW) \cdot L} = \frac{W}{e(W + NW)}, \tag{12}$$

with respect to the wage. The cost-minimizing wage or the efficiency-wage, W^*, is then determined by the first order condition

$$\frac{\partial e(W^* + NW)}{\partial W^*} \cdot \frac{W^*}{e(W + NW)} = 1 , \qquad (13)$$

where the elasticity of effort with respect to the real wage is unity. Equation (13) implies that for a given level of non-wage income, the efficiency wage is completely rigid. Only factors that directly impact the worker's effort function will have an effect on the efficiency wage. Improvements in labor productivity due to factors that are external to the effort function, such as increases in the capital stock or the level of multifactor productivity, will have no impact on the efficiency wage. These factors will, however, affect employment. The profit-maximizing employment level is determined by the traditional condition that the (effective) marginal product of labor equals the (efficiency) wage. An increase in the capital stock or total factor productivity would, by raising the marginal product of labor, increase the demand for labor. Similarly, factors that succeeded in creating a decline in the efficiency wage would prompt an expansion in employment.

In equilibrium, unemployment will exist if labor supply at the efficiency-wage exceeds labor demand. While unemployed workers may be willing to work at a wage lower than the efficiency-wage, it is not in the interest of firms to offer a lower wage. A wage cut below the efficiency-wage would lower effective labor input sufficiently that the firm would be worse off. A firm would therefore offer W^* since, by definition, there is no wage that yields a lower labor cost.

The efficiency wage—and hence the wage gap and the level of unemployment—is determined entirely by the technical relationship between worker effort and the wage rate, that is by the parameters of the effort function. While the hypothesis that nutritional status affects labor productivity positively has been tested successfully by, among others, Strauss (1986) and Deolalikar (1988), the state of the art does not permit a general and complete characterization of the effort function. 1/

Consider a specific example. Strauss (1986) estimates workers' output elasticity with respect to calorie intake for a sample of farm households in Sierra Leone. He finds it to be 0.49 at an average daily energy intake of 1,500 kcal, 0.34 at the sample mean of calorie intake, and 0.12 at 4,500 kcal. The curvature implied by these estimates can be used to calibrate an effort function of the form $A(W-\bar{W})^\gamma$ where A is a constant, W is the wage rate, and $\bar{W}$ represents a subsistence wage. Measuring wages in

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1/ In addition to estimates of the curvature of the effort function, an estimate of the intercept--that is, worker effort as income (consumption) approaches zero--is necessary. It is unlikely that meaningful observations for such low levels of income can be obtained. In the example that follows, it is assumed that worker effort is positive only once the wage exceeds the subsistence level.

calories, equating the subsistence wage with a calorie intake of 1,500, and the average with 3,000, an elasticity of 0.34 at the average calorie intake implies a value for γ of 0.17. The efficiency-wage can then be calculated to be 21 percent higher than the subsistence level. While workers are willing to work at the subsistence wage, they work so much better at a higher wage that a substantial wage gap can result.

The political transformation underway in South Africa is affecting changes in social benefits and structures that will impact on the non-wage income of workers. Changes in non-wage incomes of workers should affect worker effort and therefore the equilibrium efficiency wage. First, social expenditures on education, health, and housing have begun, and will continue, to be redistributed toward the black population. Since this is also the segment that largely comprises unskilled labor, increases in government transfers in such form imply an increase in the average non-wage income of such workers. By some estimates, equalizing social expenditures across racial groups, while holding the central government's social expenditures constant as a proportion of GDP, will increase average nonwage incomes of unskilled workers by as much as 11 percent. 1/ Caution needs to be exercised in interpreting these numbers for the purposes here, however. To the extent that increased education spending, for example, succeeds in putting people into school who currently or recently have not been in school, such expenditures will not necessarily represent an increase in non-wage income at the individual level. Similar considerations apply to housing, where a sizeable segment of the population has not been paying rent. Clearly, however, while the magnitude of the redistribution of social expenditures may overstate the effective increase of non-wage income of employed workers, the direction of change seems less debatable. Second, there will be changes in the social structure. The locational separation of races required by apartheid often entailed significant transportation time and cost for unskilled labor in getting to work. As workers begin to live closer to the work place, there should be a decline in transportation costs over time. The effects are equivalent to an increase in non-wage income in the model.

It is straightforward to show, by differentiating equation (13), that the efficiency-wage will decline in response to an increase in non-wage income

$$\frac{d(W)^*}{d(NW)} = -1 - \left[\frac{e'}{(-e'')} \frac{1}{W^*}\right] < 0 , \tag{14}$$

where the single and double primes are used to denote the first and second derivatives of the effort function, respectively. It can be shown that the

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1/ See Van der Berg (1992) for estimates of the costs and implications of equalizing social expenditures.

decline in the efficiency wage in response to an increase in non-wage income will lead to an increase in labor demand and, consequently, employment should expand.

2. The wage-incentive model

To establish the essential features of the Shapiro and Stiglitz (1984) wage-incentive model, consider an economy inhabited by N infinitely lived risk-neutral identical workers. A worker can be either employed in an industrial sector inhabited by a large number of identical small firms or can be unemployed. If employed the worker earns a real wage W. When employed, the worker faces the decision of whether to actually work, and expend effort e, or simply shirk. A worker maximizes the expected present value of his utility, discounting the future at the rate ρ. The flow of utility of an employed worker who is not shirking is assumed, for simplicity, to be given by W - e, where effort can take on either a constant value e or is zero. To capture the fact that there is turnover at firms, it is assumed that all employed workers face an exogenous separation probability, b. The firm can only monitor worker performance imperfectly, so there exists a probability, q, that an employed worker who is shirking gets caught. If a worker is caught shirking he is fired. When unemployed the worker earns a fixed real amount, $\bar{W}$. 1/

Let V_t^X denote the expected present value of utility of a worker in state X at time t. Workers can be in one of three states: unemployed; employed and working; or employed and shirking. For an employed worker expending effort, the flow of utility at any point in time is the excess of the real wage over effort, plus the probability that the worker gets laid off times the decline in present value of utility from becoming unemployed. 2/ Thus, the change in the present value of utility of an employed worker who is not shirking can be written

$$\dot{V}_t^{NS} = \rho V_t^{NS} - \left[W_t - e + b \cdot (V_t^U - V_t^{NS}) \right] , \qquad (15)$$

where the term in square brackets represents the flow of utility at a point in time, and a dot over a variable indicates its derivative with respect to time. Similarly, for an employed shirker

$$\dot{V}_t^S = \rho V_t^S - \left[W_t + (b + q) \cdot (V_t^U - V_t^{NS}) \right] . \qquad (16)$$

1/ $\bar{W}$ in principle represents a host of factors--unemployment benefits, self-employed income, household production activities, etc.

2/ The simplifying assumption is made that a shirker always remains a shirker, and a non-shirker always remains a non-shirker. Since the analysis below is conducted for a steady state, this assumption is of no consequence.

The shirker has a higher utility at each point in time in that he does not expend effort. However, he faces a higher probability of becoming unemployed since he may get caught shirking and would then be fired.

In equilibrium, to obtain positive effective labor input, the firm must pay a wage such that employed labor has an incentive to expend effort and no one shirks. So, at each point in time, $V^{NS} \geq V^S$. Since firm profits are decreasing in wages, the firm will pay a wage such that this is just true, that is $V^{NS} = V^S$, which is hereafter denoted simply V_t. Then, subtracting (16) from (15), it follows that

$$V_t = V_t^U + \frac{e}{q} . \qquad (17)$$

Workers, therefore, receive a constant premium—in present value terms—from being employed. The change in the present value of being unemployed can be written, in similar fashion to (15) and (16), as

$$\dot{V}_t^U = \rho V_t^U - \left[\overline{W} + \delta_t (V_t - V_t^U) \right] , \qquad (18)$$

where δ_t represents the probability that an unemployed worker obtains a job—the accession rate into employment. Note that (17) must hold at each point in time, and since e and q are constants, the change in present values of an employed and an unemployed worker must be equal. Subtracting equation (18) from (15) (or (16)), yields

$$W_t = \overline{W} + e + \frac{e}{q} (\rho + b + \delta_t) . \qquad \text{(NSC)} \qquad (19)$$

This condition is referred to as the No Shirking Condition (NSC) in that it represents the minimum wage that firms must pay in order to provide workers with an incentive to expend effort. The NSC shows that the wage paid to workers exceeds the alternative wage by a term that compensates workers for their effort and a premium. The premium is an increasing function of the exogenous separation probability, b, and the probability of re-employment, δ_t, and a decreasing function of the probability that a shirking worker is caught and then fired, q.

In steady state, the outflow of workers from firms due to turnover will equal gross new hires from the pool of unemployed workers. δ_t is then constant and given by

$$\delta = \frac{bL}{u} = \frac{bL}{N-L} . \qquad (20)$$

Substituting (20) into (19), the NSC can be graphed as in Figure 2. Market equilibrium occurs at point Y where the firm is on its (classical) labor demand curve, determined by the marginal product of labor, subject to the

Figure 2. The Wage Incentive Model.
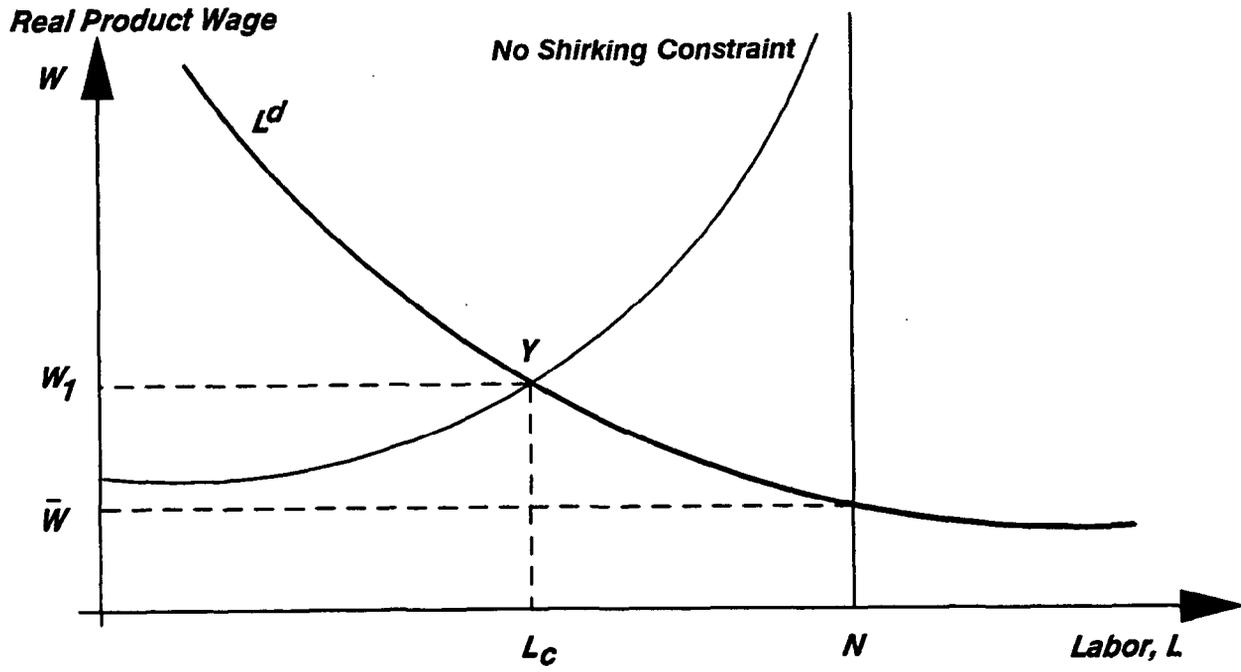
NSC constraint. Note that the NSC converges to a positive number that exceeds $\bar{W}$ as employment goes to zero, and approaches infinity as employment approaches total labor supply, N. Consequently, equilibrium always entails some unemployment.

The contribution of the approach is more general than the set of restrictive simplifying assumptions might at first suggest. The key postulate of the approach is that firms have imperfect information about the behavior of workers. This leads firms to pay workers a wage that exceeds market clearing levels so as to provide labor an incentive to perform on the job, thus creating unemployment. In the following, in discussing the role of the different parameters in the NSC and, hence, in creating a wage gap, both literal and broader interpretations are discussed.

Consider the role of worker effort or disutility from working in the NSC. Taken literally, this is likely to be "small" for most occupations since in the model it represents the additional disutility from working after having shown up for work and staying on the job. Except in physically demanding occupations, it is unlikely that this is more than 5 percent (measured in units of the real wage) of the alternative or subsistence wage. The parameter e can be used, however, to capture a host of other factors relevant to performance on the job. Two of these seem particularly relevant in the context of the South African unskilled labor force. Firstly, e can be used to represent the motivation of the labor force. In light of the political and social history of apartheid, worker disutility from performing on the job in an environment that was perceived to be unfair and uncertain could be substantial. Secondly, e can be used to capture the employer's perceived probability that workers will strike or that they will "stay away" during a time of general unrest, etc. These factors can lead to a substantially greater wage gap than is suggested by the literal disutility of worker effort on the job.

Labor turnover statistics for South Africa, which are available on a monthly basis for certain sectors of the economy, can be used to determine parameter values for the accession rate into employment, δ, and the separation probability, b. 1/ The hiring (or "engagement") rate for the manufacturing sector is reported to be around 1.7 percent of the employed labor force) during 1991. The hiring rate can be translated into an accession rate out of unemployment of 3.5 percent expressing gross hiring as a proportion of the pool of unemployed labor. 2/ Labor separation rates, which include discharges and resignations, are reported to be 1.8 percent in manufacturing and 3.9 percent in construction in 1991. There are some peculiarities in the reported separation rate series for the manufacturing

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1/ See South African Labor Statistics (1991).
2/ Calculated as 1.7 percent of the employed unskilled labor force of 5.4 million in the nonprimary sector in 1991, divided by 2.6 million unemployed (Corresponding to the narrow definition in Table 3).

sector. 1/ A point estimate of 3 percent is, therefore, taken as representative for the economy.

The imperfect ability of firms to monitor the performance of its employees is captured by the parameter q, which represents the probability that a worker who shirks gets caught. In principle, one would expect this to be high in a modern economy where supervisors and managers oversee employees. Note, however, that the model assumes that a worker who gets caught shirking is immediately and costlessly fired. In reality the ability of firms to fire workers is likely to be less than perfect. Moreover, a decision to fire a worker often takes time to be implemented and usually entails some form of cost such as severance pay. 2/ Interpreting q as the joint probability that a poor performer is caught and fired during a year, we consider values of 22 percent and 46 percent. These yearly probabilities imply values for q of 2 percent, and 5 percent at a monthly frequency.

Employing the parameter values discussed above—a disutility of effort of 5 percent of the subsistence wage; a separation rate of 3 percent; an accession rate of 3.5 percent—and a monthly discount rate of 1 percent, the NSC can yield substantial wage premia over the alternative wage. If the probability of a poor performer being detected and fired during a year is about half (46 percent), the premium is 11 percent. With a probability of about a fifth (22 percent), the premium is 24 percent. A broader interpretation of the disutility of on-the-job performance would imply larger wage premia.

The framework can be used to ascertain the role of various factors in affecting the path of real wages and employment in the future. Six factors are discussed. Four of these argue for a decline in real wages over time accompanied by increases in employment, while two present conditions under which real wages should rise with differing effects on employment. First, note from equation (20) that as labor supply increases, as would be expected, the NSC declines and equilibrium wages should decline. Second, as the recession abates, the labor separation rate due to turnover can be expected to decline and with it the NSC. Third, if the labor market could be made more flexible so that a poor (or non) performer could be dismissed more easily or quickly, q should rise, lowering the NSC. Fourth, as social

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1/ In particular, a secular decline from 1970 to 1991 is reported for the separation rate in manufacturing. A possible explanation is that the statistics do not accurately capture job losses due to firm closures.

2/ Factors such as the legal framework for the labor market, the strength of unions, and social conditions are important determinants of the ability and willingness of employers to fire poor performers. In a recent case (1992) in Industrial Court where the National Union of Metalworkers of South Africa (NUMSA) filed suit against Schnaier Metal Industries for unfair dismissal of workers for misconduct, the court ruled that even in cases where an employee is caught in the act of misconduct, the employee may not be dismissed without a fair hearing. In addition, a worker must be given time to prepare for such a disciplinary hearing.

and political conditions change, if the motivation of the labor force increases, e should decline, lowering the NSC. Fifth, were labor productivity to improve, shifting the marginal product or labor demand curve up in Figure 2, the equilibrium wage and employment should rise. Sixth, if and when the labor market begins to tighten in that increases in hiring exceed growth of the pool of unemployed from growth in labor supply, the accession rate should rise, raising the NSC and lowering employment. 1/

3. Collective bargaining

Accompanying political reforms, the 1980s saw a rapid rise in the membership and strength of trade unions in South Africa. Registered union membership increased from around 0.8 million in 1980 to 2.9 million by 1992, representing approximately 34 percent of the employed labor force. If only workers in sectors that have traditionally been covered by the Labor Relations Act 2/ are considered, that is agriculture, domestic workers, and civil servants are excluded, then approximately 56 percent of workers in the private economy are unionized. Collective bargaining thus plays an important role in the determination of wages.

At the aggregate level it is difficult to isolate the influence of unions from other forces. Union density and strike activity both increased during the 1980s. Fallon (1992) finds that an indicator of strike activity is statistically significant in explaining black wages. While union density has clearly risen to very high levels, it should be kept in mind that the growth of trade unions has occurred in part for political reasons. A judgement on whether the presence of trade unions can explain the entire wage gap in South Africa requires a characterization and parameterization of trade unions' objective functions and the form of bargaining between unions and employers. As was done for the models in the previous two subsections, a simple model of collective bargaining between a union and an employer is presented and predicted wage gaps for reasonable parameter values are computed.

Following McDonald and Solow (1981), consider a monopoly union that can set the wage unilaterally. The employer then chooses the volume of employment. Barker (1992) suggests that negotiations on employment have not—so far—been an important element of the collective bargaining process in South Africa. We continue to assume that the firm's production function is characterized by diminishing returns to labor so that the marginal

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1/ It should be noted that due to rapid expected labor supply growth, even optimistic forecasts of output growth for South Africa often succeed only in keeping the pool of unemployed constant over the medium term. See, for example, the Economic Advisory Service (1993).

2/ The Labor Relations Act legalizes collective bargaining by allowing unions and employers in a particular sector to register with the government and, if they choose to do so, to form an Industrial Council. Industrial Councils are forums for collective bargaining on wage and non-wage matters at the industry level.

product of labor curve represents the profit—maximizing level of employment for the firm.

Suppose the union has N identical members. If L of them are employed, each member has probability L/N of having a job and achieving a utility level of Z(W) — e and probability 1—(L/N) of not being employed by the firm. As in the last section, e is used to denote the disutility of working and Z(W) is a standard utility function. If not employed by the firm, a worker achieves a utility level, $Z(\bar{W})$, where $\bar{W}$ represents a summary measure of alternative compensation. Expected utility of a union member is, therefore,

$$\left(\frac{L}{N}\right)[Z(W) - e] + \left[1 - \left(\frac{L}{N}\right)\right][Z(\bar{W})] . \tag{21}$$

Treating membership, N, as a constant, it is possible to draw indifference curves representing the union's objective function in wage and employment space, as shown in Figure 3. The indifference curves have the usual downward—sloping convex shape and utility increases with movements away from the origin. They have the special property that they are asymptotic to the horizontal axis at the wage given by $Z(W) = e + Z(\bar{W})$.

As Figure 3 shows, the union's utility is maximized at the point Y where an indifference curve is tangent to the employer's labor demand curve. The union will, therefore, pick the wage corresponding to point Y. Mathematically, this point represents the maximum of the union's utility function subject to the constraint that the firm is on its labor demand curve. The equilibrium point Y can, therefore, be represented by the condition

$$\frac{u'(W) \cdot W}{[u(W) - e - \bar{W}]} = - \frac{f'(L)}{[f''(L)] \cdot L} , \tag{22}$$

where the elasticity of the gain from employment equals the elasticity of the demand for labor.

To see that this model can predict substantial wage gaps consider the special case of risk neutral workers and suppose that Z(W) can be represented as in the last subsection by W. Then, the above condition

Figure 3. A Model of Collective Bargaining.

Real Product Wage
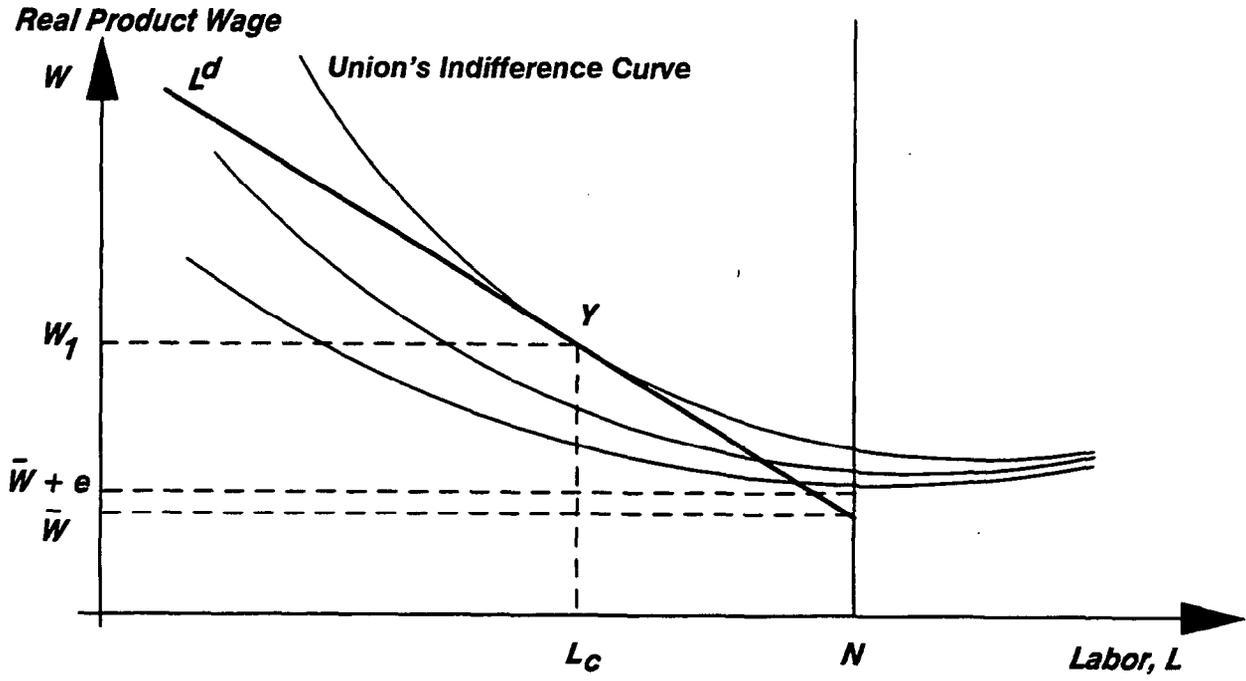
implies that for a disutility of effort of 5 percent of the alternative wage, and an elasticity of labor demand of 1.5, $W = 3.15 \bar{W}$. 1/

The implications of this sort of model are well-known. The extent of the wage-gap created by unions should be an increasing function of union density. The model suggests that, to the extent that competitive wages are paid in the non-unionized sector, the wage-gap will grow with increases in union strength. To the extent that unions play a role of wage leadership, increases in union wages will also raise economy-wide wages, and unemployment will increase.

An important consideration that the model presented above ignores, however, is the dynamic effects of union behavior on union membership. As workers in the union become unemployed, they are likely to drop out of the union over time, and membership will decline. To the extent that unions have political interests, as COSATU in South Africa appears to, the size of membership will play a role in the union's objective function, modifying the behavior represented in Figure 3. Effectively, if union membership over time is a function of the number of workers remaining employed, and the union cares about the size of membership per se, this should shift the indifference curves of the union down as greater weight is given to employment. This should lead, in equilibrium, to lower wages and higher employment.

IV. Conclusion

The evidence suggests that the massive unemployment in South Africa is largely structural rather than cyclical. The substantial employment gap that exists at the current real wage can, therefore, be expected to be reduced only modestly as the pace of economic activity recovers. The structural employment gap can, in principle, be closed in a variety of ways. Broadly speaking, these can be grouped into factors that (i) increase the demand for labor at a given wage, that is, that shift the demand curve for labor out; (ii) decrease wages and result in downward movements along the labor demand curve; and (iii) reduce constraints on the supply of "effective labor". The magnitude of unemployment in South Africa implies that it is imperative for policy to operate on all three fronts in attempting to ameliorate the employment gap.

1/ While this may appear excessive, it should he kept in mind that the calculations assumed risk-neutral workers. With risk-averse workers, the wage gap would be lower. Also, the assumption of a constant elasticity of demand is not reasonable for such large changes. Further, it should be noted that, as is well-known, the form of bargaining presented is not Pareto optimal. There exists a Pareto-superior region where both employers and the union would be better off. Bargains struck in the Pareto superior region would imply lower wages and higher employment. The point remains, however, that the model can imply substantial wage gaps.

Economic growth driven by increases in the physical capital stock or improvements in multifactor productivity, which shift the labor demand curve out, represents the most painless way of potentially closing the gap. Due to rapid expected labor supply growth, even optimistic forecasts of output growth in South Africa often succeed only in keeping the employment gap constant in the medium term. Wage restraint is, therefore, essential for improving the outlook for the employment gap. Several channels were identified, whereby recent and prospective developments in South Africa should result both in movements down the labor demand curve, and changes of a more structural nature that should work to alleviate constraints on the supply of "effective labor," thus lowering the path of equilibrium wages. It is important that the effects on wages through these channels be realized.

Sources of Data Used in Estimation

The data used in the estimation of the effective labor function were provided by Bayoumi and Corker (1991) and are what were used in that study. Some Salient features and sources are briefly mentioned.

Data on skill levels by racial groups for the nonprimary sector are available from manpower surveys for workers divided into 28 occupational categories. These occupations are then aggregated into three skill categories: high-level, middle-level, and semi/unskilled. High level occupations comprise professional jobs including managers, engineers, lawyers, nurses, and educators. Middle level occupations represent clerical or skilled manual jobs, while semi-skilled and unskilled jobs are not differentiated. In the estimation, workers in the high-level skill category were denoted "skilled" while the remainder were aggregated into an "unskilled" category.

Annual data on remuneration of labor by racial group for the nonprimary sector between 1970 and 1989 are from South African Statistics (See Bayoumi and Corker (1991)).

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