

III The Effects of Apartheid on the Distribution of Labor Income

Since the early 1970s, and more especially since the mid-1980s, the labor market distortions and rigidities that were an inherent part of the apartheid system have gradually eased. Over the same period, the share of nonwhite labor income in total GDP has increased significantly, from 26 percent in 1970 to 34 percent in 1989. This chapter provides an empirical analysis of the changing nonwhite labor income share and addresses the effects of the diminishing discrimination in labor markets.¹²

The analysis concludes that a principal factor in the improvement in labor income distribution over the past two decades has been the reduction in the gap between white and nonwhite wages for jobs requiring similar skills, which is estimated to have declined from 90 percent at the beginning of the 1970s to about 14 percent at present.¹³ This finding suggests that further improvements in income distribution between the races in the period ahead will have to derive mainly from better training and employment opportunities for nonwhites rather than from the elimination of the remaining wedge between wages for different racial groups.

Basic Model

The model was designed to evaluate the historical impact of apartheid on the income accruing to workers in different racial groups. In this regard, the model assumes that two variables have determined the distribution of labor income along racial lines: the changing skill mix of the labor force and a narrowing of racial differentials in pay for similar jobs. Both of these variables are linked to the evolution of apartheid during the 1970s and 1980s.

The apartheid system is assumed to have had two main effects on the supply of labor. First, at the *premarket* level, educational discrimination is as-

sumed to have distorted the supply of skilled labor and to have restricted the income growth of certain racial groups. Second, at the *market* level, the effective segmentation of the labor market has allowed white workers to gain an economic rent at the expense of workers in the other racial groups. The degree of segmentation had, until the mid-1980s, been maintained mainly through formal job reservation and the "pass laws" that severely restricted the mobility of nonwhite labor. With the abrogation of these laws in the mid-1980s, the segmentation that continued was enforced through informal restrictions. The apartheid system also distorted labor markets through the differential treatment of white and nonwhite labor organizations.

At the heart of the specification of the model is a production function of the Cobb-Douglas form. Specifically, it was assumed that

$$Y = A L^{\alpha} K^{1-\alpha} e^{gt}, \quad (1)$$

where Y is output, L is aggregate labor input, K is capital input, and A is a scaling constant. The coefficient g represents the rate of growth of multifactor productivity caused by technological progress or improved resource utilization. Under the usual assumptions of profit maximization subject to competitive market conditions, the parameter α represents the share of total income going to labor, with the remaining share $(1-\alpha)$ assumed to go to capital.¹⁴

Labor input is assumed to be composed of two components: skilled and unskilled labor.¹⁵ These are assumed to have a constant elasticity of sub-

¹²A by-product of this analysis is the estimation of a production function, which is used in Chapter IV to examine medium-term scenarios for the South African economy.

¹³This estimate suggests a trend consistent with the more detailed analysis of Knight and McGrath (1987) for 1976 and 1985.

¹⁴Historically, the labor share has been fairly constant although estimates of its level diverge widely. See the appendix to this chapter for details of the parameterization of the production function.

¹⁵In practice, the labor force is composed of a continuous spectrum of skills. Broadly speaking, the division here classifies professionally qualified workers and managers in the skilled category and the remainder of the labor force in the unskilled category. See the annex to this chapter for a more detailed explanation of the data sources and definitions employed.

stitution (CES), which implies that aggregate labor input can be written in the following manner:

$$L = B.(\gamma.LU^\rho + (1-\gamma).LS^\rho)^{1/\rho}, \quad (2)$$

where LU and LS are unskilled and skilled labor, respectively, B is a constant term, the parameter γ is related to the relative marginal productivity of skilled labor to unskilled labor, and the constant elasticity of substitution between skilled and unskilled workers is given by the formula:

$$\sigma = 1/(1-\rho). \quad (3)$$

Ideally, direct estimates of σ could be obtained from estimates of the implied log-linear relationship between the ratio of skilled to unskilled workers and the ratio of their relative wages. Unfortunately, however, the required data on relative wages were not available. Instead, the parameters were estimated indirectly, utilizing data on labor income shares along racial lines in the following manner.

The indirect estimation approach assumes that, while white and nonwhite labor are equally productive within each skill category, the wage rates obtained by white workers include an element of economic rent associated with apartheid labor restrictions. Thus, the amount of income going to white labor can be written as the sum of white skilled and unskilled labor earnings at their "fair market" wage rate (the wage rate that is equal to their marginal product) adjusted by a markup representing the economic rent associated with apartheid:

$$L_w W_w = Z_s LS_w W_s + Z_u LU_w W_u, \quad (4)$$

where $L_w W_w$ represents the total white wage bill, LS_w and LU_w refer to skilled and unskilled white labor respectively, and W_s and W_u refer to the fair market wage for white skilled and unskilled labor. The variables Z_s and Z_u , which represent the economic rents obtained by white workers, are assumed to be greater than or equal to unity. Non-white labor is assumed to receive the residual value of the total income accruing to labor.

Equation (4) can be rewritten in terms of the shares of total income going to white workers and nonwhite workers as follows:

$$\alpha_w = Z_s(LS_w/LS).\alpha_s + Z_u(LU_w/LU).\alpha_u \quad (5a)$$

$$\alpha_n = \alpha - \alpha_w, \quad (5b)$$

where α_w and α_n are the respective shares of income going to white and nonwhite workers—for which official data are available—and α_s and α_u are the respective shares of labor income going to skilled and unskilled workers.

To convert equation (5a) into an estimating equation, the unknown values α_s and α_u must be modeled and the wage wedges Z_s and Z_u parameterized. The modeling of α_s and α_u utilizes the following property of a CES function:

$$\alpha_s/\alpha_u = C(LS/LU)^{\sigma*}, \quad (6)$$

where $\sigma^* = (\sigma - 1)/\sigma$ and $C = (1 - \gamma)/\gamma$. From this expression, relative income shares by skill category can be expressed in terms of available data on the skill composition of employment.

The gap between the wages of white and non-white workers was assumed to be the same in each skill category and to have declined steadily over time. Specifically, the following function was used:

$$W_w/W_n = 1 + \delta e^{-\beta t}. \quad (7)$$

The coefficient δ measures the markup of white wages over nonwhite wages in the period where $t=0$ (normalized to 1985 in the estimation), while the coefficient β measures the speed at which the differential is eroded over time.

The following equation, in which these assumptions are combined, was obtained:

$$\alpha_w/\alpha_n = (1 + \delta e^{-\beta t}) \frac{(LU_w/LU) + (LS_w/LS)C(LS/LU)^{\sigma*}}{(LU_n/LU) + (LS_n/LS)C(LS/LU)^{\sigma*}}. \quad (8)$$

Estimation Results

Equation (8) was estimated using nonlinear least squares for the period 1970–89 for the nonprimary sector. The year 1970 was chosen as the starting point both because it was the earliest year for which consistent data could be obtained and because it marked the approximate start of the erosion of the apartheid system (Terreblanche and Nattrass (1990)). The following results were obtained:

	Value	Standard Error
δ	0.22	0.09
β	0.10	0.02
C	3.42	2.61
σ^*	0.64	0.44
$DW = 1.21$	$RBAR^2 = 0.98$	$SE = 0.033$

The coefficients relating to the erosion of the apartheid wage wedge (δ and β) are relatively precisely estimated, with both coefficients being significant at conventional levels. The point estimate of δ indicates the degree of the wage gap between whites and nonwhites attributable to "apartheid

rents" in 1985. At 22 percent, the estimate corresponds closely to the measure of wage divergence that Knight and McGrath (1987) attributed to discrimination in their more detailed study of wage differentials in South Africa.¹⁶ The coefficient β indicates that this gap has been declining by 10 percent a year over the entire sample period, which implies that it declined from a value of 92 percent in 1970 to less than 14 percent by 1990. Knight and McGrath also present data for wage differentials in 1976; the gap implied by the estimated equation here—about 50 percent—again corresponds roughly to the estimates in that more detailed study.

The coefficients relating to the CES production function, σ^* and C , are less well estimated, with t -statistics slightly below conventional significance levels. The estimated value of σ^* implies an elasticity of substitution between skilled and unskilled labor of 2.76. This relatively high coefficient implies that the expansion of the skilled work force over the estimation period has been associated with a comparatively small decrease in the relative wages of skilled workers.¹⁷ This result is consistent with evidence in Knight and McGrath, which indicates little change in the relative wages of skilled and unskilled workers between 1976 and 1985.

In view of the imprecise estimate of the elasticity of substitution, experiments were carried out in which different values for σ were imposed on the estimation process. In general, it was found that changing the elasticity of substitution had a small effect on the measured apartheid wage gap but a relatively large effect on the implied path of relative wage rates. As σ fell toward unity, for example, the relative wage of skilled workers was estimated to have declined sharply during the sample period. Correspondingly, the higher the value of σ , the smaller the fall in relative wages.

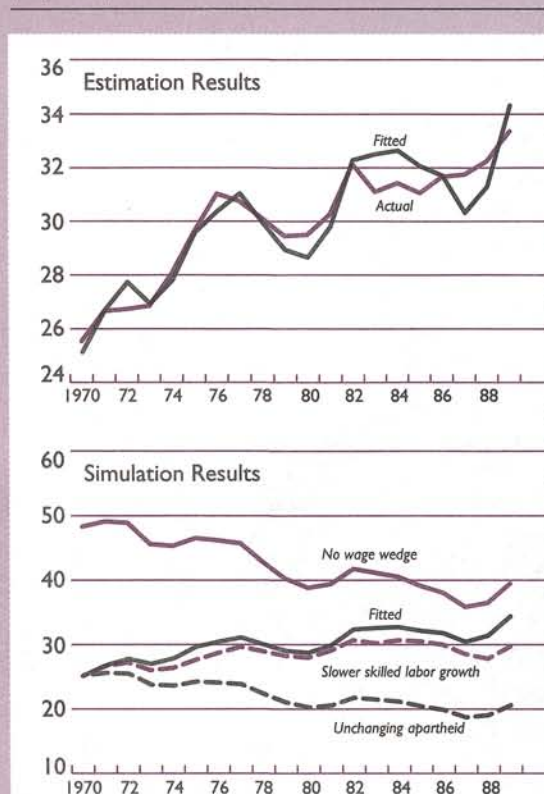
Analysis of Income Shares

Using the estimated model, the paper analyzes trends in the racial shares of income during 1970–89, when the labor income received by nonwhites as a proportion of GDP is estimated to have risen from less than 26 percent to nearly 34 percent (see Chart 1, upper panel). Simulation analysis shows that the dominant factor in this rise was a loosening

of the effects of apartheid as measured by a steadily declining gap between the wages paid to different racial groups for the same type of work. Indeed, the simulations suggest that if the measured wage differential in 1970 had not been eroded during the 1970s and 1980s, the income share of the nonwhite labor force might have declined substantially as a proportion of GDP because its skills did not improve rapidly enough (see Chart 1, “unchanging apartheid”).

Although skilled employment grew nearly twice as fast for nonwhites as for whites, the level of nonwhite skilled employment started from such a low base that, in absolute terms, the number of skilled white workers increased by more. Thus, given that skilled wages are estimated at six to seven times the level of unskilled wages, the income share of whites would have continued to rise relative to nonwhites had apartheid not been relaxed. Even so, the relatively rapid growth of nonwhite skilled employ-

Chart 1. Nonwhite Labor Income—Nonprimary Sector
(In percent)



Source: IMF staff estimates.

¹⁶The numbers in Knight and McGrath refer to the wage differences between white and black workers. However, because the other races are a relatively small part of the overall work force, the comparison is still useful.

¹⁷However, because of the relatively rapid growth in skilled employment, the share of labor appropriated by the skilled segment of the labor force rose sharply over the sample period.

ment did support nonwhite income share to some extent: if such growth had occurred at the same rate as for whites, nonwhite income might have been some 4 percent of GDP lower by 1989 (see Chart 1, “slower skilled labor growth”).

Appendix:

Production Function Estimates and Data Sources

Production Function Estimates

This section describes the estimates of the remaining parameters of the production function: labor income share (α) and multifactor productivity growth (g). While not directly relevant to the analysis of income distribution, the estimated production function is a key element of the model used in the medium-term scenarios described in Chapter IV.

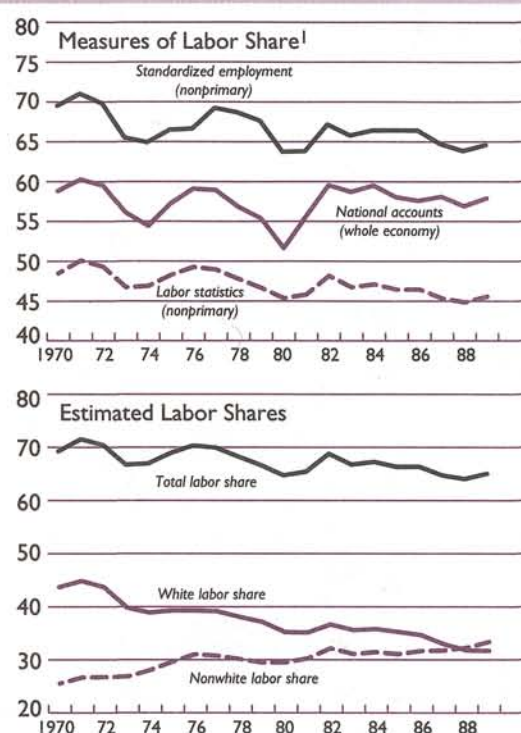
The parameter α was calibrated from different estimates of labor's share of total income.¹⁸ The available data confirm that labor's income share is relatively constant, although estimates of its level diverge widely. For example, consistent data from *South African Labor Statistics* (Republic of South Africa, Central Statistical Services (1991)) suggest a value of about 45 percent—which would be very low by industrial country standards—whereas the national accounts estimate for the whole economy is close to 60 percent (Chart 2). The low estimate from the *South African Labor Statistics* data probably reflects underrecording of employment. If the employment data are grossed up to reflect recent estimates on a “standardized” basis, the share for the nonprimary sector is about 65 percent. This value was chosen because it is closer to international levels and more consistent with the national accounts.

Multifactor productivity growth, g , was estimated residually as the “unexplained” growth in nonprimary GDP after the contributions from capital and labor input are accounted for. The latter is the skill-adjusted series constructed using equation (2). In general, after adjustment is made for a gradual rise in skill levels, labor input growth has exceeded that of total employment (Chart 3). Estimated multifactor productivity has been declining, on average, over the last two decades, although, since 1983, it has been essentially stagnant. The estimates here correspond closely to official estimates of multifactor productivity, which also paint a rather disappointing picture.

¹⁸Income was defined as nonprimary GDP at factor cost.

Chart 2. Labor Income Share—Nonprimary Sector

(In percent)



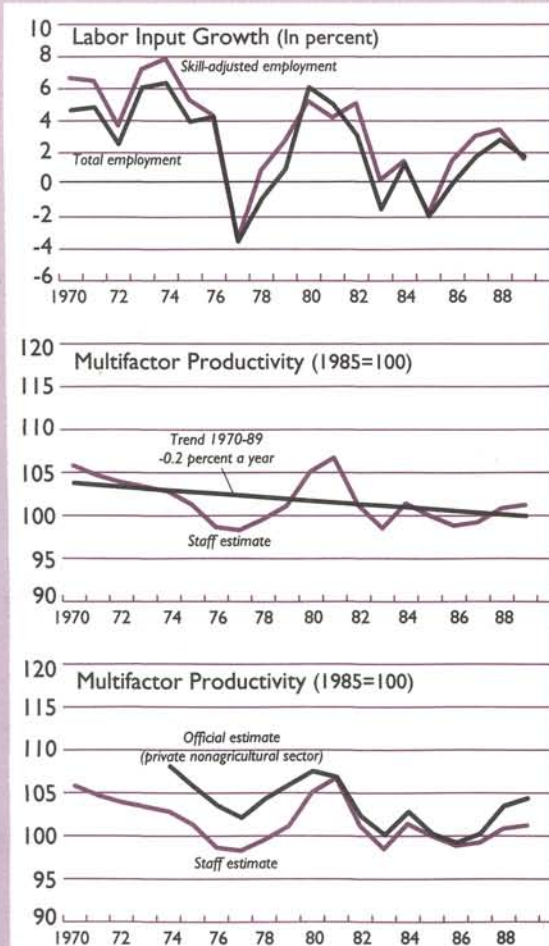
Source: IMF staff estimates.

¹ Income from employment as a percent of sectoral GDP at factor cost.

Data Sources and Definitions

This section briefly describes the data used in estimating the production function.

Data on *skill levels by racial groups* for the nonprimary sector plus mining are available from the manpower surveys, which measure the number of workers in 28 occupations by racial group. These occupations are then aggregated into three types of occupations: high-level, middle-level, and semi-/unskilled. High-level occupations are essentially professional jobs: managers, engineers, lawyers, nurses, and educators. The latter two occupations make up some 40 percent of the total and are particularly important for the nonwhite racial groups. Middle-level occupations represent clerical or skilled manual jobs, while semi-/unskilled jobs are not differentiated. In the estimation, the skilled workers were those in the high-level occupations, while the unskilled workers were an aggregate of

Chart 3. Labor Input and Productivity Estimates—Nonprimary Sector

Source: IMF staff estimates; and South African Labor Statistics.

the middle-level and semi-/unskilled job categories. This appeared to be the most reasonable division given the need of a modern economy for highly trained individuals. One concern, however, is that the mix of employment within these occupations may not be the same across racial groups; in particular, white workers may tend to have more skilled jobs within the broad skilled and unskilled job categories, which may cause biases in the estimation. The surveys were carried out every other year from 1965 to 1987, after which they were conducted annually; from 1965 to 1987, the data for even-numbered years were linearly interpolated.

Annual data on *remuneration of labor by racial group* for the nonprimary sector between 1970 and 1989 were obtained from *South African Labor Statistics* (1991 and earlier issues). The data give employment, total wages and salaries, and wage rates by racial group. Standardized employment series, which were used in some of the calculations, were also obtained from *South African Labor Statistics*, while the national accounts data came from a tape supplied by the Reserve Bank.