A MODEL OF A SOUTH-AFRICAN-TYPE ECONOMY

BY

Richard C. Porter

CENTER FOR RESEARCH ON ECONOMIC DEVELOPMENT
The University of Michigan
Ann Arbor, Michigan 48108

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ABSTRACT

The purpose of this article is to give a broad stylized picture of how the South African economy "works", of the behavior of its economic actors, of the constraints to and the goals of white policy, and of the directions of future economic growth and resource allocation.

The basis of the South-African-type economy is a market economy where market constraints and policy parameters are determined by whites and for whites. Despite this white dominance, however, there are many restrictions on the feasible range of white policy, and there are fundamental conflicts between different white groups and different white goals. Despite near complete power to fix white wage rates well above black wage rates and to preclude employers from hiring blacks to replace more costly whites, white policy-makers cannot fully exercise their power lest they generate politically unacceptable levels of white unemployment. Even when full employment of white workers is achieved, the resource allocation is economically inefficient -- that is, the maximum potential white income is not realized; further, there are conflicts between the interests of white capital and white labor; and the goal of high white income is in conflict with other white goals, namely, "industrialization" and economic "independence" of blacks. Over time, if the capital stock grows more rapidly than the white labor force, these conflicts are intensified, between white capital and labor and between the various white goals of growth, industrialization, and independence of blacks. Finally, the sense and manner in which whites "exploit" blacks is explored: essentially it is that the potential gains of integrating the capital-abundant white economy with the labor-abundant black economy are realized by the whites.

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Cet article a pour but de dépeindre d'une façon générale et stylisée le fonctionnement de l'économie sud-africaine, le comportement de ses participants, les contraintes et les objectifs de la politique économique des blancs, et les directions de la croissance économique à venir et de la répartition des ressources.

L'économie de type sud-africaine est basée sur une économie de marché où les contraintes de marché et les paramètres politiques sont déterminés par les blancs et pour les blancs. Il y a cependant, en dépit de la dominance blanche, beaucoup de restrictions à l'étendue possible de la politique économique des blancs, et il existe des conflits fondamentaux entre différents groupes blancs et différents objectifs blancs. En dépit du fait qu'ils aient le pouvoir presque total de fixer les taux de salaire des blancs bien au-dessus de ceux des noirs et d'empêcher les employeurs d'engager des noirs pour remplacer les blancs plus couteux, les responsables blancs de la politique économique ne peuvent totalement exercer leur pouvoir par crainte de produire des niveaux d'emploi de blancs politiquement

inacceptables. Même en cas de plein-emploi des travailleurs blancs, la répartition des ressources est économiquement inefficace - c'est-à-dire que le revenu potentiel maximum des blancs n'est pas atteint; de plus, il existe des conflits entre les intérêts du capital et de la main-d'oeuvre blancs; et l'un des objectifs des blancs, consistant à atteindre un niveau de revenu élevé, est en conflit avec les autres, à savoir, "l'industrialisation" et "l'indépendance" des noirs. Avec le temps, si le stock du capital s'accroit plus rapidement que la main-d'oeuvre blanche, ces conflits entre capital et main-d'oeuvre blancs, entre les objectifs blancs variés de croissance, industrialisation et indépendance des noirs se trouvent intensifiés. Enfin, le sens et la manière dont les blancs "exploitent" les noirs sont explorés: le point essentiel est que ce sont les blancs qui réalisent les gains potentiels obtenus en intégrant l'économie blanche abondant en capital à l'économie noire abondant en main-d'oeuvre.

I. Introduction

While it has never prevented economists from extensive and careful study of the American south before the Civil War, moral distaste for an economy founded in institutionalized racism seems to have discouraged economists outside South Africa from its analysis.[1] This neglect is the more surprising considering that South Africa is a perennial topic for discussion in international conclave, that its principal export is still unique among the world's primary products, and that it provides one of the few case studies of successful "late", however inequitable, industrialization and development.[2]

The purpose of this article is to give a broad, stylized picture of how the South African economy "works", of the behavior of its economic actors, of the constraints to and goals of white policy, and of the directions of future economic growth and resource allocation. The model is heuristic, that is, aimed primarily at understanding rather than empirical application. It is sufficiently removed from an exact replica of the South African economy that it is appropriately labeled a "South-African-type" economy. My concern to achieve a highly simplified model is only partly to make its analysis more manageable and understandable; it is also motivated by a desire to uncover the quintessence of that economy, unobscured by the extraneous elements of the much more complex reality.

The basis of the South-African-type economy is a market economy where

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[1] Two interesting exceptions are Enke (1972) and Knight (1962).

[2] The beginnings of a comparative study of South African development are offered by Trapido (1962). An indication of the relative inequity is found in Ahluwalia (1974): the poorest 40% of the population receives 6.2% of the income in South Africa, the lowest of 66 countries he surveys (pp. 8-9).

market constraints and policy parameters are determined by whites and for whites. Despite this white dominance, however, there are many restrictions on the feasible range of white policy, and there are fundamental conflicts between different white groups and different white goals. Despite near complete power to fix white wage rates well above black wage rates and to preclude employers from hiring blacks to replace more costly whites, white policy-makers cannot fully exercise their power lest they generate politically unacceptable levels of white employment (Section III). Even when full employment of white workers is achieved, the resource allocation is economically inefficient -- that is, the maximum potential white income is not realized; further, there are conflicts between the interest of white capital and white labor; and the goal of high white income is in conflict with other white goals, namely, "industrialization" and economic "independence" of blacks (Section IV).

Over time, if the capital stock grows more rapidly than the white labor force, these conflicts are intensified, between white capital and labor and between the various white goals of growth, industrialization, and independence of blacks (Section V). Finally, the sense and manner in which whites "exploit" blacks is explored : essentially it is that the potential gains of integrating the capital-abundant white economy with the labor-abundant black economy are realized by the whites (Section VI).

Before turning to the model itself, I should like to say a word about my personal outlook. Because so much is written about South Africa that is outrage without analysis, I have tried to offer analysis without outrage. There is much about South Africa that merits outrage; I leave its expression to others.

II. The Model

To understand the basis of the South-African-type economy, it is useful to consider three sectors, one where black labor works without capital, a second where black labor works with capital, and a third where black and white labor work together with capital. The three sectors reflect in a simple way the spectrum of black-white, labor-capital relations actually found in such an economy. The three sectors are described below.

1. Reserves. There, black labor works alone to produce output with constant average productivity of labor:

$$X_R = bL_R^B , \tag{1}$$

where X is output, L is labor input, the subscript refers to the sector (R for Reserves), and the superscript to the color of the labor (B for Black). The simplifications implicit in this production relation need some defense. In the "reserves" of South Africa -- also called "homelands" or "Bantustans" -- the agriculture is tribal, communal, traditional, and extensive. Thus, while they are hardly devoid of land and capital, constant factor proportions and constant returns to scale makes (1) a satisfactory representation of the production function.[1] The capital is miniscule and largely self-produced; little violence to reality is done by ignoring its creation and mobility. "Reserves" play three roles: i) the standard of living there, b per worker, provides a floor on which the black wage level in other sectors is based; ii) the reserves offer the "unlimited supplies of (black) labor" from which growing sectors elsewhere can draw;[2] and iii) they provide

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[1] "...the average yield of maize...is 3 bags per morgen [a measure of land area]....For over 30 years there has been little change...." Horrell, (1969), p. 43.

[2] The phrase is from Lewis (1954).

a functional location for all black labor not demanded elsewhere in the economy.[1]

2. Agriculture. The essence of this sector is that its capital is white and its labor is black:

$$X_A = X_A\ (K_A,\ L_A^B)\ , \qquad (2)$$

where the subscript A refers to Agriculture, the variable K represents white-owned capital,[2] and the function, $X_A\ (\cdot)$, displays constant returns to scale and diminishing returns to each factor. Two critical simplifications should be noticed. One, there is no sector of the South African economy in which white labor is not in fact found, at least in a supervisory or managerial capacity. But for a large part of that economy, white labor is of trivial quantitative importance. This is most clear for agriculture, forestry, and fishing -- from which this sector of the model derives its name -- but there are other sectors with few whites, such as mining where they comprise less than ten percent of the labor force.[3] And this sector of the model may also encompass manufacturing in the future, if the development of black-labor-intensive, "border area industrialization" ever becomes significant.[4] The second simplification is that land and any

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[1] Not incidentally in South Africa, the "reserves" also provide a separate geographic location, but this has little economic significance. Few changes are required in the structure of the model if "the reserves" are beyond the nation's border, as has been historically true to some extent in South Africa.

[2] No superscript is needed for capital since it is assumed entirely owned by whites. In South Africa, the law as well as poverty forestalls black ownership of non-reserve land and capital.

[3] Albeit a critical ten percent, as any student of South African history knows: efforts to reduce the white-black ratio have been successfully fought by white labor, to the point of near-revolution, throughout this century (see Wilson, 1972). But the important fact remains, for our purposes, that most of the labor is black.

[4] This is an effort, as yet quantitatively insignificant, to move the focus of industrialization from the large cities to the "borders" of the reserves. The purpose is to stop the rapid growth of the urban black labor force without giving up the goal of continued, rapid industrialization. See Bell (1973).

concomitant diminishing returns to it are neglected. Despite the large size of South Africa -- in terms of cultivable non-reserve area per rural worker -- defense of this assumption really rests on the grounds that the insight lost from the exclusion of land is small in comparison to the additional complexity caused by its explicit consideration.[1]

3. Industry. Both black and white labor work, with capital, to produce output in this sector:

$$X_I = X_I \left(K_I, L_I^B + L_I^E\right) , \tag{3}$$

where the subscript I refers to Industry, the superscript E refers to "Europeans",[2] and the function, $X_I(\cdot)$, displays diminishing returns to each factor and constant returns to scale. Here, as with the other two sectors, the model presents a greatly simplified stereotype of reality. To begin with, one should note that white labor is quantitatively important not only in "industry" but also in a variety of public-utility, commerce, and service sectors.[3] Most critical, and warranting careful examination, is the assumption that white and black labor services are perfect substitutes. Indeed, that black and white laborers are not treated as perfect substitutes is the very essence of the

[1]The urbanization of "poor white" farmers over the past half century in South Africa has not been due, it should be noted, to diminishing returns to land but to fragmentation of the land-and-capital ownership shares.

[2]Labels are, I realize, fraught with values, but here I choose "Europeans" over the more logical "Whites" simply to save the letter, w, for wage rates. Note that, throughout, the additional and differential South African color bars facing "colored" and "Asiatic" workers are ignored in this simple rendition of the South-African-type economy. These latter two groups in fact comprise (1970) about 12 percent of the population, as compared to 70 percent blacks ("Bantu") and 17 percent whites ("European") (Houghton, 1973, p. 34).

[3]Employment statistics for 1970 in South Africa show that 55 percent of the jobs in "manufacturing, commerce, and finance" were filled by whites (Biesheuvel, 1974, p. 292).

"South-African-type" economy. But the equally clear concomitant is that the differential treatment is not justified by innate productivity differences; and the simplest way to capture this in a one-kind-of-labor model is to assume black and white labor are identical from a production-function viewpoint.[1]

It is assumed that all producers in the agricultural (A) and industrial (I) sectors act competitively in both product and factor markets. Further, the economy is seen as "small and open", which means that world prices are unaffected by the supplies and demands of this economy. Thus, we can take internal prices as determined completely by external market conditions and internal policy decisions -- i.e., prices are exogenous to the model. For convenience, all output units are normalized so that the price of any physical unit is one monetary unit; X_R, X_A, and X_I therefore represent not only the physical units of output but also the money value of output. Demands for products can be ignored since any sector's excess demand or excess supply can always be removed through international trade at the given and exogenous world market price.[2] Finally, any monopolistic imperfections in the labor markets of this economy are ignored. These omissions are made partly for simplicity (clearly not for realism), but mostly because it seems important to show that neither the government budget nor external trade nor monopoly power is essential to understanding the allocative and distributional workings of such an economy. Their introduction will surely

[1]More realistic, but more complex, is a two-kinds-of-labor model with skilled and unskilled labor being imperfect substitutes (for each other as well as for capital). The discrimination then derives from the process by which white labor becomes the skilled and black labor the unskilled. The greater realism of such a model is probably not worth the price in terms of greater analytical complexity; nevertheless, some ideas about that model are presented in the Appendix.

[2]If internal prices are different from world prices, such trade will generate government budget revenues or expenditures. I ignore these for simplicity, although the model would gain a giant step on reality if the government's budget and relative price policies were considered. For a brief history of South Africa's manipulation of prices, see Kooy and Robertson (1966) and Groenewald (1964).

alter the inefficiencies and inequities, but none is a necessary ingredient.

Racial discrimination has appeared in many forms in South Africa -- through access to education, apprenticeship, or on-the-job training, through access to certain occupations, through white/black employment ratios, through union contracts, through direct government prohibitions, penalities, or rewards, through informal pressures, and through cultural predilection.[1] Empirically, the most important means of discrimination today is the first of the above: black workers simply cannot acquire the education and training necessary to qualify for the more skilled and better paid jobs. A realistic representation of a "South-African-type" economy would need (as mentioned earlier) to consider at least two kinds of labor and the process by which some workers move from one kind to the other. But here, in a model with only one kind of labor, no monopolies (i.e., unions), and no government budget (i.e., education/training), it is helpful to consider a currently, though not historically, less important technique of discrimination -- the job-reservation ratio, whereby a certain fraction of each employer's workers must be white (i.e., European). Thus,

$$L_I^E = c\ (L_I^B + L_I^E)\ , \tag{4}$$

where c is the fraction of the total employment in the industrial sector reserved for European labor.[2]

Competitive profit-maximizing producers in the agricultural and industrial sectors employ labor up to the point where its marginal revenue product equals

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[1] For a history and description of the many facets of discrimination, see Doxey (1961). Also, for recent changes, see Horrell (various years).

[2] Frankel (1959) has called this the "multi-racial team system": "Over large sections of economic enterprise those responsible can increase or decrease the size of the team, but they cannot easily vary its proportionate racial composition..." (p. 120). The job-reservation ratio (c) represents the minimum fraction of whites that must be hired, but there will be no incentive for cost-minimizing capitalists to exceed that minimum.

its wage. In agriculture, where only black workers are hired, this means simply that

$$\delta X_A/\delta L_A^B = w^B, \tag{5}$$

where w^B is the wage rate for black labor and δ refers to the partial derivative (of equation (2)). In industry, the same criterion applies to the labor-hiring decision, but the wage rate is more complicated; since hiring one worker means hiring a fraction, c, of whites and a fraction, 1 - c, of blacks, the relevant wage rate of one worker is a weighted average of the two wage rates:

$$\delta X_I/\delta(L_I^B + L_I^E) = cw^E + (1 - c)w^B, \tag{6}$$

where w^E is the wage rate of European labor. I assume that, through government, management and union actions, the three parameters (c, w^B, and w^E) are exogenously specified -- although we shall see in later sections that not all combinations of c, w^B, and w^E are feasible.[1]

[1] For simplicity I assume that $w_A^B = w_I^B$ although that is neither necessary nor realistic in the South African context. Implicitly, I think of w^B as greater than b -- which is realistic, though also not necessary. In short, the sectoral mobility of black labor is sufficiently restricted through "pass laws" and "influx control" that sizeable inter-sectoral black wage rate differentials can be, and have been, maintained; see Frankel (1944) and Houghton (1960). Needless to say, we consider only situations where $w^E > w^B$. In fact, average black wages in manufacturing are less than 20 percent of average white wages, but most of this is due to the blacks' exclusion from high-wage, high-skill, high-status occupations. Where blacks and whites do the same or comparable jobs, the black wage rate ranges from 30 percent (school-teachers) to 85 percent (bank clerks) of the white wage rate (Biesheuvel, 1974 and Schlemmer, 1972-73, pp. 12-13).

Profit-maximizing firms also allocate capital so as to attain equality between its marginal revenue product and its cost:

$$\delta X_A/\delta K_A = r_A, \text{ and} \tag{7}$$

$$\delta X_I/\delta K_I = r_I, \tag{8}$$

where r_A and r_I are the rates of return to capital in agriculture and industry, respectively. The total capital stock ($\bar{K}$) is deployed between the two capital-using sectors,

$$\bar{K} = K_I + K_A, \tag{9}$$

according to the relative rates of return in the two sectors:

$$K_A/K_I = k(r_A/r_I), \tag{10}$$

where $k' \geq 0$.[1] If capital markets were perfect,[2] then equation (10) would become $r_A = r_I$. Finite values of k' are still more realistic in the South African context;[3] the extreme of sector-specific capital, i.e., k' equal to zero, will occasionally be considered.

Finally, both black and white labor forces must be accounted for. Whatever black labor is not demanded by agriculture and industry is sent to (or more accurately, not permitted to leave) the reserves, so that

$$\bar{L}^B = L_A^B + L_I^B + L_R^B, \tag{11}$$

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[1]The prime refers to the derivative.

[2]And there were no differences between sectors with respect to risk differentials, etc.

[3]See Viljoen (1965), pp. 302 f.

where $\bar{L}^B$ is the total (exogenous) black labor force. Public policy in South Africa has been traditionally and strongly intolerant of white unemployment, so that for political equilibrium the system requires

$$\bar{L}^E = L_I^E , \tag{12}$$

where $\bar{L}^E$ is the total (exogenous) white labor force.

This completes the model of the South-African-type economy. For convenience, the equations and variables are gathered in Tables 1 and 2. The workings of the model-economy are analyzed in the next section, but one source of potential conflict in such an economy becomes immediately apparent by counting equations and variables. There are eleven variables, one fewer than the number of equations; there is a clear hint that there may be limits to the ranges of parameters and exogenous variables for which the simultaneous fulfillment of all twelve equations is possible. In short, the whites of South Africa may not be <u>economically</u> able to choose <u>any</u> values of c, w^B, and w^E despite their <u>poltiical</u> power to do so.

III. <u>The Solution</u>

Since the system of twelve equations which comprise this model is largely recursive, it is possible to solve it sequentially and, in the process, gain an understanding of the underlying economic mechanism. Consider Figure 1; its two parts each display the familiar neo-classical production function with constant returns to scale (the solid convex curves emanating from the origins), Figure 1A for the agricultural sector and Figure 1I for the industrial sector. In each, the tangency of a straight line with the production function indicates the long-run equilibrium of profit-seeking but profit-less competitors where the intercept of the tangent represents the wage rate and the slope represents the rate of return to capital. In agriculture (Figure 1A), only black labor is

Table 1

The Equations of the Model

Equation	No.	Description
$X_R = bL_R^B$	(1)	Production function for reserves.
$X_A = X_A(K_A, L_A^B)$	(2)	Production function for agriculture.
$X_I = X_I(K_I, L_I^B + L_I^E)$	(3)	Production function for industry.
$L_I^E = c(L_I^B + L_I^E)$	(4)	Job-reservation ratio.
$\delta X_A/\delta L_A^B = w^B$	(5)	Marginal revenue product of labor equals wage in agriculture.
$\delta X_I/\delta(L_I^B + L_I^E) = cw^E + (1-c)w^B$	(6)	Marginal revenue product of labor equals weighted-average wage in industry.
$\delta X_A/\delta K_A = r_A$	(7)	Marginal revenue product of capital equals rate of return to capital in agriculture.
$\delta X_I/\delta K_I = r_I$	(8)	Marginal revenue product of capital equals rate of return to capital in industry.
$\bar{K} = K_I + K_A$	(9)	Disposition of total capital stock.
$K_A/K_I = k(r_A/r_I)$	(10)	Mobility of capital in response to relative rates of return to capital.
$\bar{L}^B = L_A^B + L_I^B + L_R^B$	(11)	Disposition of total black labor force.
$\bar{L}^E = L_I^E$	(12)	Disposition of total white labor force.

Table 2

The Variables of the Model

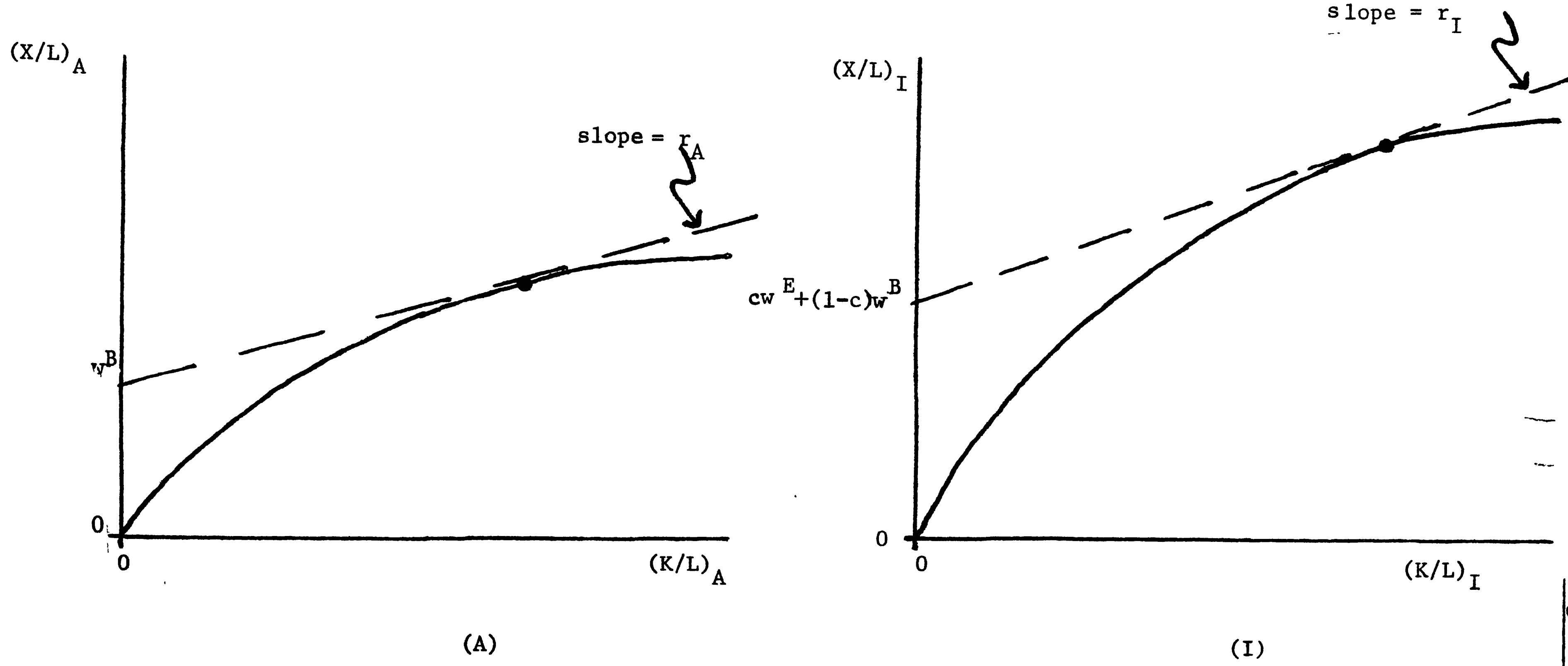
Variable	Definition
X_R	Output (value) of the reserves.
X_A	Output (value) of agriculture.
X_I	Output (value) of industry.
L_R^B	Labor (black) employed on the reserves.
L_A^B	Labor (black) employed in agriculture.
L_I^B	Labor (black) employed in industry.[1]
L_I^E	Labor (European) employed in industry.[1]
K_A	Capital employed in agriculture.
K_I	Capital employed in industry.
r_A	Rate of return to capital in agriculture.
r_I	Rate of return to capital in industry.
$\bar{L}^B$	Total black labor force.
$\bar{L}^E$	Total European labor force.
$\bar{K}$	Total capital stock.

Parameters

b	Average (and marginal) product of labor in reserves.
c	Fractional industrial employment reserved for whites.
w^E	Wage rate of white labor.
w^B	Wage rate of black labor (in agriculture or industry).

Note: 1. In later sections, L_I is sometimes used for the total industrial labor force, i.e. $L_I^E + L_I^B$.

Figure 1



employed, so the wage rate is simply w^B; and the highest rate of return to capital (r_A) consistent with the production function of that sector is shown by the dashed line. Similarly, for the industrial sector (in Figure 1I), the wage rate is given -- as the average of the wage rates of both white and black labor, weighted by the fractions in which they must be employed (i.e. $cw^E + (1-c) w^B$). The slope of the dashed tangent line indicates the rate of return to capital in industry (r_I).

Thus, given the two wage rates (w^E and w^B) and the industrial job-reservation ratio (c), competitive forces determine the rate of return to capital (r) and the proportion in which capital and labor are used (K/L) in each sector. As the figures are drawn, and as empirical observation generally discloses, capital per worker and output (i.e., value added) per worker are both higher in the industrial sector, though logic does not require these results.

The total stock of capital at any time will be allocated between the two capital-using sectors (equation (9)) according to the relative rates of return to capital earned in these sectors (equation (10)). Since these rates of return are already determined by the production functions once wages are set, they are inalterable despite the mobility of capital because of the assumption of constant prices and returns to scale; preferences of investors, given these rates of return, then determine the absolute size of the capital stock in each sector. Imperfect mobility of capital insures that both sectors will exist when $r_A \neq r_I$, as must occur except by the greatest coincidence or the most accurate fine-tuning of government tariff (i.e. price) policy.

Once capital is allocated between the two sectors, the prior determination of factor proportions means that the absolute level of output and employment in each sector is determined. Thus, for agriculture L_A^B is determined; for industry the sum, $L_I^B + L_I^E$ is determined. Then the job-reservation procedure (equation 4) determines the racial composition of the industrial work force.

i.e. of L_I^B and of L_I^E, separately. With demands for black labor satisfied in agriculture and industry, the remaining black workers $(\bar{L}^B - L_A^B - L_I^B)$ are "allocated" to the reserves.

The economy has allocated its resources. Once w^E, w^B, and c have been chosen, inputs of labor and capital, the rate of output, and the rate of return to capital are decided in each sector. There is, however, one basic problem: there is no reason to suppose that the white labor demanded by industry (L_I^E) will be equal to the white labor force $(\bar{L}^E)$.[1] Should unemployment appear in their ranks, whites can act to alleviate it through alterations in one (or more) of the key parameters of the model, c, w^E, and w^B. After all these are not fixed by technology but rather by (white) policy; hence they are subject to change through union-management negotiations and/or through government minimum-wage and job-discrimination policies. Let us consider the impact on white employment of a change of c, w^E, and w^B, each in turn.[2]

1. Change in the white wage rate (w^E). The impact of a ceteris-paribus reduction in the white wage rate, from w_0^E to w_1^E is shown in Figure 2. On the vertical axis (i.e. $(X/L)_I$), the intercept of the (dashed) tangent is lowered and the slope of the tangent to the production function raised. Clearly, r_I increases (i.e. from r_I^0 to r_I^1), drawing at least some new capital into the industrial sector. But the increase in r_I also induces a decline in the

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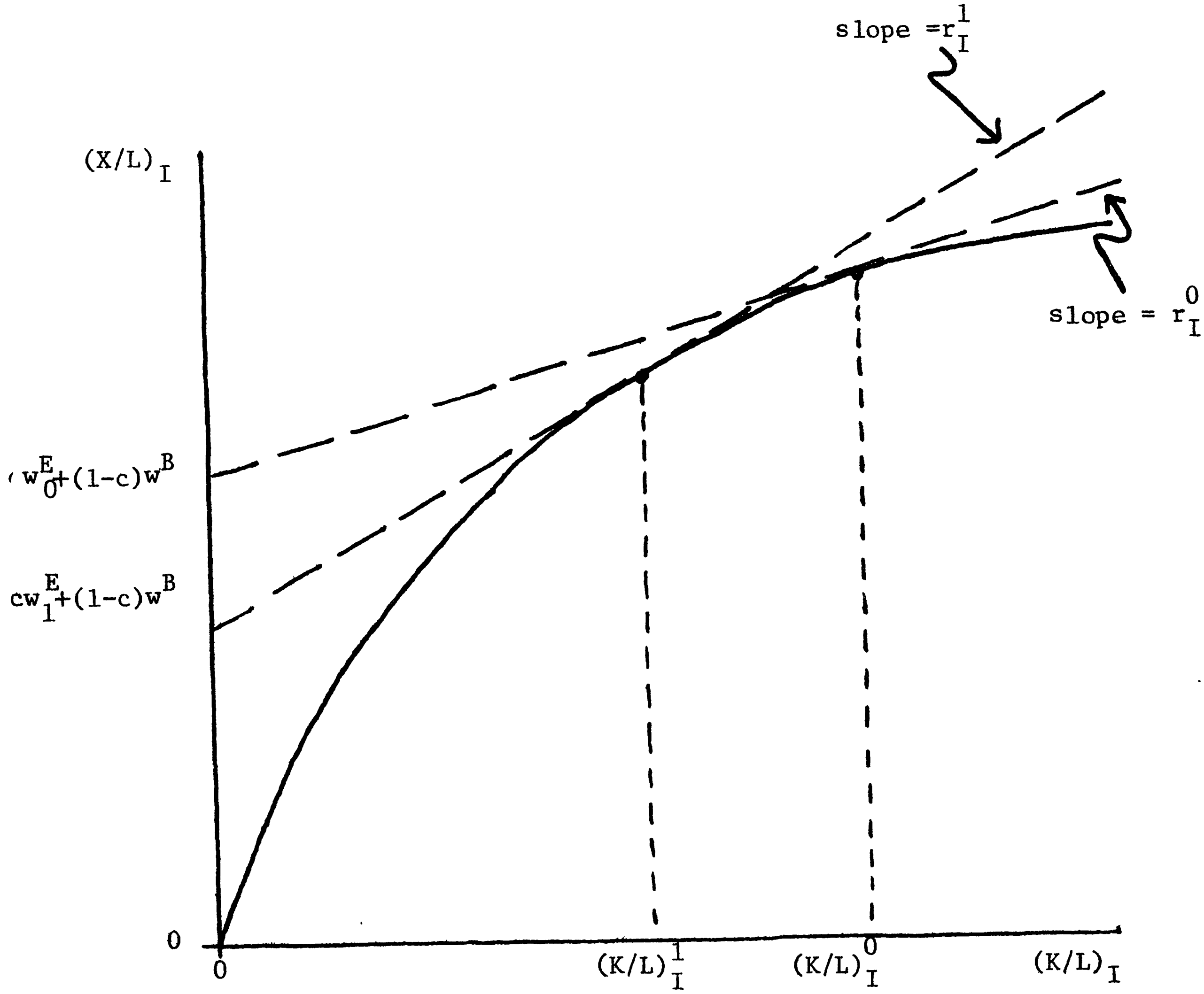
[1] Mathematically, we have solved for the eleven dependent variables using equations (1) - (11). Only by coincidence does that solution satisfy equation (12).

[2] Throughout, we will treat these parameters as independent and under the control of "policy". This is of course solely for analytical convenience; there are innumerable political and historical forces pushing, constraining, and linking these policy parameters. Indeed, most of the economic writing on South Africa is concerned with these forces -- and more specifically, with the question whether growth and industrialization tend to end or to perpetuate discrimination. For a summary of this debate, see Yudelman (1975).

Figure 2



capital-labor ratio (from $(K/L)_I^0$ to $(K/L)_I^1$). The total labor force in the industrial sector is increased in two ways, by the increase in K_I and by the fall in $(K/L)_I$. Since white labor makes up an unchanged constant fraction (c) of the total industrial labor, white and black employment in industry both rise.

Cuts in the white wage rate can therefore serve to ameliorate white unemployment. While we reserve for the next section a full discussion of the internal conflicts and contradictions of the South-African-type economy, it should not go unnoticed here that the reduction of white wages is not likely to be a happy way out of the white unemployment dilemma where white workers make up a majority of the electorate.

2. Change in the job-reservation ratio (c). The effect of a *ceteris-paribus* increase in the job-reservation ratio from c_0 to c_1 is shown in Figure 3. The vertical-axis intercept of the (dashed) tangent is raised and the slope of the tangent is lowered. The higher effective wage rate in industry causes a reduction of its rate of return to capital (from r_I^0 to r_I^1), and at least some capital will move out of the sector. Since the capital-labor ratio rises (from $(K/L)_I^0$ to $(K/L)_I^1$), the total labor force in the industrial sector is reduced in two ways, by the decline in K_I and by the rise in $(K/L)_I$. What happens to white employment is not clear -- whites form a larger fraction of industrial employment since c has risen, but total industrial employment has fallen.

Thus, an increase in the job-reservation ratio (c) is not a sure cure for white unemployment. Indeed, for many plausible production functions, a rise in c will reduce white employment.[1]

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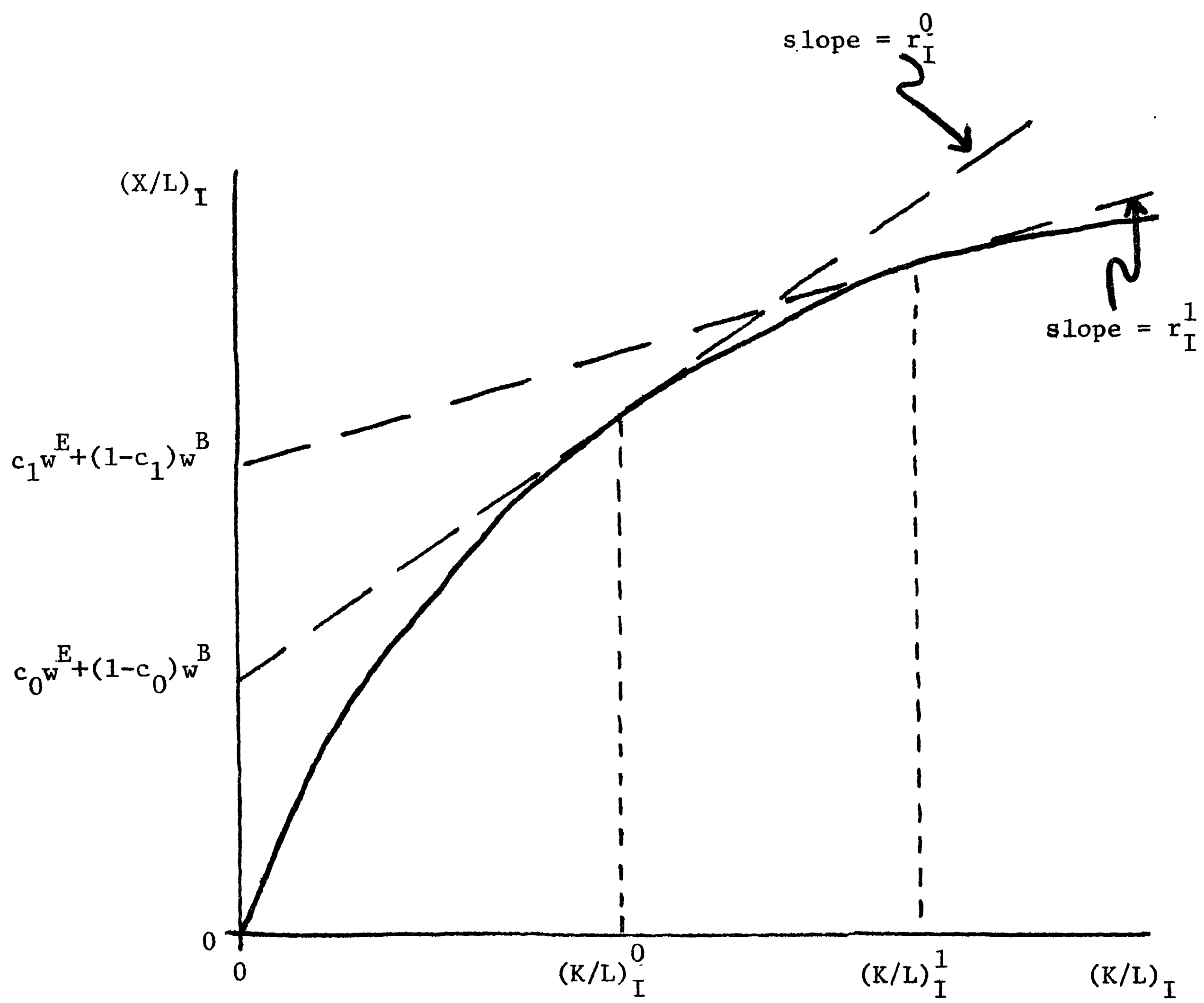
[1]Whether white employment rises or falls depends primarily on the degree of convexity of the industrial production function.

Figure 3


slope = r_I^0
slope = r_I^1
$(X/L)_I$
$c_1w^E+(1-c_1)w^B$
$c_0w^E+(1-c_0)w^B$
0
0
$(K/L)_I^0$
$(K/L)_I^1$
$(K/L)_I$

3. Change in the black wage rate (w^B). A reduction of the black wage rate (w^B) would appear to be the surest means to white full employment -- as well as the politically most acceptable means (to whites).[1] A reduction in w^B reduces the weighted-average wage rate in the industrial sector and raises the rate of return to capital there. This in turn reduces the capital-labor ratio and draws capital into the sector, both forces for increased employment and hence, given c, increased white employment.

There is, however, one problem with this reasoning. The lower black wage rate applies to the agricultural sector as well; thus the rate of return to capital increases there too. Whether capital moves into or out of the industrial sector depends upon whether the rate of return to capital rises more in industry or agriculture. Accordingly, the reduction of the black wage rate is not a certain means to increase white employment. Of course, if the mobility of black labor between agriculture and industry could be sufficiently restricted, it might be possible to reduce the black wage rate in industry and not in agriculture, which would have the desired effect on white industrial employment.

In sum, the model yields a solution, but not necessarily for any values of the three key policy parameters, the black wage rate (w^B), the white wage rate (w^E), and the job-reservation ratio (c). Despite their total control of the political mechanism, and their near complete power to determine the mobility, job opportunities, and wage rates of blacks, whites are constrained by economic reality. As long as whites are unwilling to accept unemployment as part of the solution, there are limits to the values of w^B, w^E, and c that they can select.

Already therefore, we see that a conflict between different white goals can arise, in this case between a high white wage rate and low white unemployment.

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[1] Provided, of course, that the wage rate is sufficiently above the black workers' opportunity cost in the reserves (b) that a reduction in w^B will not dry up the flow of black labor to agriculture and industry.

There are other conflicts, to which we now turn.

IV. Conflicts

Recall that, by a South-African-type economy, I mean an economy where the whites use their position of political dominance to constrain the opportunities of blacks -- with respect to wage rates, education, occupation, mobility, etc. -- in order to raise white incomes. Yet, even if the white population were so monolithic as to seek no other goal than this, the maximization of its own total income,[1] the solution is not an easy one, from a political point of view. There is an easy part: clearly, the black wage must be put as low as possible, consistent with the ability of agriculture and industry to attract the black workers they need from the reserves. Then the hard part. Maximization of total white incomes implies, as a little reflection indicates, an economically efficient solution; and efficiency implies, in turn, that the private cost of labor to capitalists equal the social opportunity cost. This means that all industrial and agricultural labor, white as well as black, should be priced at the same rate, namely the marginal value product on the reserves (b) plus (or minus) whatever differential is required to induce sufficient blacks to leave the reserves.

In short, efficiency requires that identical factors of production be priced identically. But politically, in a South-African-type economy, this is impossible. The mechanism which would be required, namely, taxation of high returns to white capital in order to make transfers to the low-wage white

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[1] I.e. the sum of $w^E L_I^E$, $r_I K_I$, and $r_A K_A$.

laborers, neither exists nor is thinkable.[1] Indeed one of the oldest and strongest foundations of South African economic policy has been its "civilized labor" policy, whereby the white wage rate must always be high enough to maintain, without any income supplements, "the standard recognized as tolerable from the usual European standpoint."[2]

In short, with profit-maximizing competitive capitalists and without a system of transfers from white capital to white labor, an efficient solution is not practicable. Even the single, simple goal of maximization of total income is in conflict with political reality.

Where there is no acceptable mechanism for redistributing income between white capitalists and white workers, the trade-off between the two white shares becomes an allocative as well as a distributive problem of public policy.[3] To simplify the illustration of this trade-off, we make two further assumptions, that capital is completely immobile between sectors (i.e. $K_I = \bar{K}_I$ and $K_A = \bar{K}_A = \bar{K} - \bar{K}_I$) and that the black wage rate is already or elsewhere determined (i.e. $w^B = \bar{w}^B$).[4] Then, as can be seen in figure 1A, the rate of return to capital in agriculture (r_A) is determined and hence also the total earnings of white capitalists in agriculture ($r_A\bar{K}_A$). The problem then reduces to that of

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[1]At least, as an explicit transfer policy. Taxation of capital to expand public employment of whites may in fact be aimed at achieving this implicitly, but, unless the public employment is productive, it introduces a new source of inefficiency and hence is not just a transfer process.

[2]From a 1924 government statement, quoted in Horrell (1971), p. 57.

[3]In South Africa, the trade-off is also a cultural and political problem. The government and white labor are predominately "Afrikaner" (i.e. of Dutch descent), and the capitalists "English". That apartheid policies are more fervently backed by Afrikaners is not inconsistent with economic advantage.

[4]This floor for w^B may be determined by "subsistence" or by the opportunity cost of labor in the reserves (b).

finding the income possiblity frontier between the white labor income and the white capital income within the industrial sector. Formally, policy seeks to maximize white labor incomes in industry ($cw^E L_I$) subject to three constraints:[1] i) a given level of white capital income (i.e. $r_I \bar{K}_I$ = a constant); ii) full employment of white labor (i.e. $cL_I = \bar{L}^E$); and iii) marginal-product determination of labor-hiring (i.e. $\delta X_I / \delta L_I = cw^E + (1-c)\bar{w}^B$). The constraints are sufficient that there is nothing left to maximize. The first constraint, the floor to white capital income, determines the r_I which, in turn for a well-behaved neo-classical production function, determines the capital-labor ratio, $(K/L)_I$, and hence L_I (since $\bar{K}_I$ is assumed given). The second constraint, full employment of the white labor supply, then forces a level for c. And the final constraint, the equality of the marginal product of labor with the weighted-average wage, then fixes w^E.

Given the return to capital r_I^0 (and hence capital income, $r_I^0 \bar{K}_I$), the white wage rate w^E (and hence white labor income, $w^E \bar{L}^E$) is determined. Surprisingly, however, the relationship between the two is not necessarily inverse. To see this, consider in Figure 4 a particular rate of return to capital, r_I^0. The tangency to the production function indicates the capital-labor ratio, $(K/L)_I^0$, and the weighted-average wage rate, $(cw^E + (1-c)\bar{w}^B)$, appropriate to r_I^0. Since $\bar{K}_I$ is fixed, determination of $(K/L)_I^0$ means determination also of L_I^0; and this, together with the requirement of white full employment means determination of c_0.[2] Finally, with both c_0 and $(cw^E + (1-c)\bar{w}^B)_0$ determined, w_0^E follows. Now consider an increase in r_I, to r_I^1 (the dashed tangency in Figure 4). $(K/L)_I$ falls, which means that c must fall, too (i.e. $c_1 < c_0$). And the weighted-average

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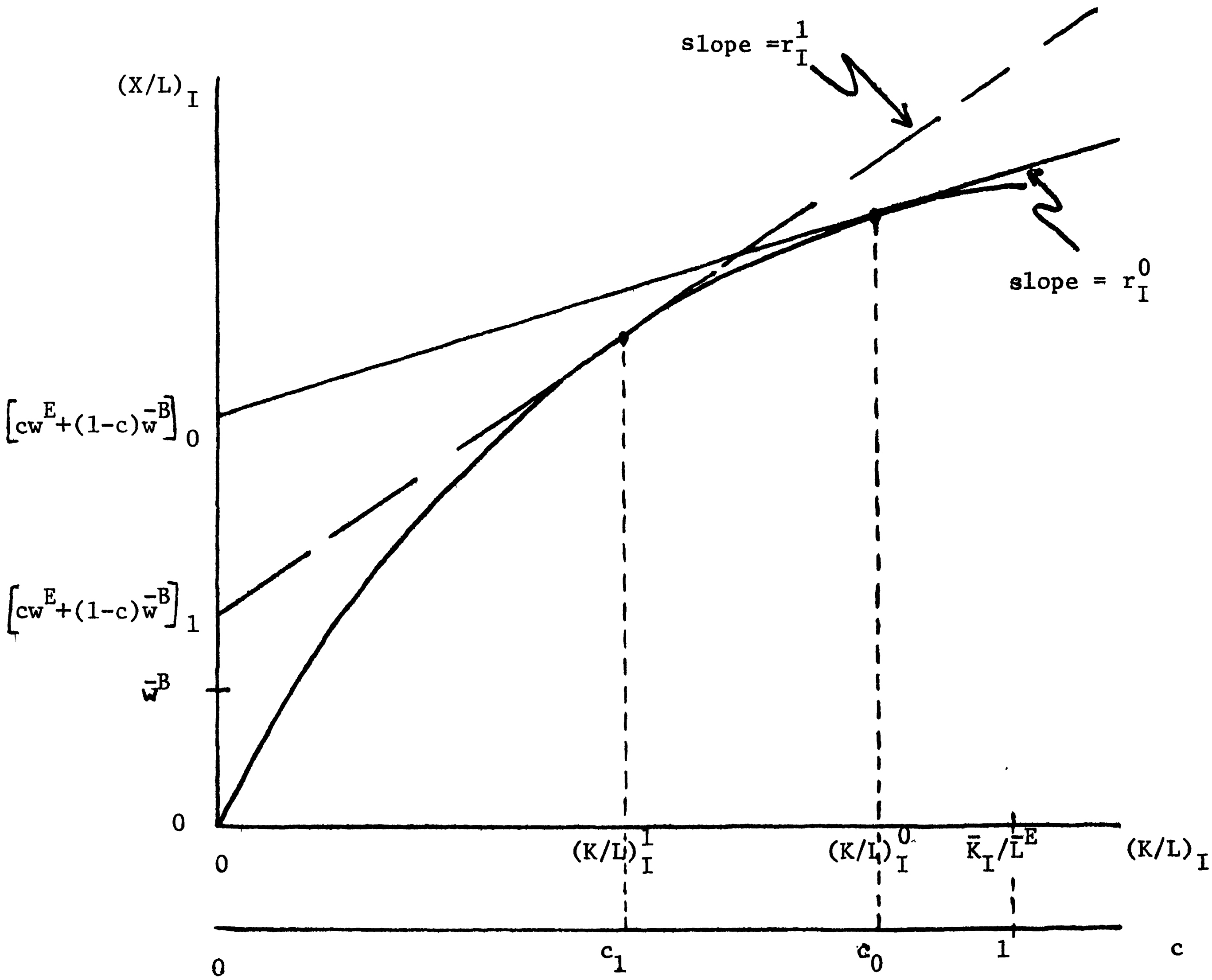
[1] Recall that L_I is the total industrial labor force, i.e. $L_I^B + L_I^E$.

[2] In fact, c (shown on the horizontal axis of Figure 4) is no more than a rescaling of $(K/L)_I$, i.e. $c = (\bar{L}^E / \bar{K}_I) \cdot (K/L)_I$.

Figure 4


slope $=r_I^1$
$(X/L)_I$
slope $= r_I^0$
$\left[cw^E+(1-c)\bar{w}^B\right]_0$
$\left[cw^E+(1-c)\bar{w}^B\right]_1$
$\bar{w}^B$
0
0
$(K/L)_I^1$
$(K/L)_I^0$
$\bar{K}_I/\bar{L}^E$
$(K/L)_I$
0
c_1
c_0
1
c

wage rate must also fall, to $(c\, w^E + (1-c)\bar{w}^B)_1$. But whether w^E must also fall or not depends upon the shape of the production function.

The income possiblity curve is illustrated in Figure 5, with white labor income on the vertical axis and white capital income on the horizontal axis. A variety of slopes and curvatures are shown -- only two things are certain: i) that the entire curve falls inside (i.e. below) the dot-dashed 45^o line which shows the maximum attainable total white income (which is achievable only if $w^E = \bar{w}^B$); and ii) that if there are upward-sloped segments, they are dominated (as the hatching of Figure 5 shows).[1]

Thus there are conflicts between capital and labor in this white-dominated economy, even when the single goal is so seemingly straightforward as maximization of white incomes. But this maximization is not really the only goal; and the existence of other goals introduces further sources of conflict. It is difficult to distill the essence of "the" goals of South African whites: their policies as well as their philosophy reflects the schizophrenia that is inevitable where the black presence is deplored while the white living standard depends upon it.[2] Nevertheless, two broad kinds of goals seem to emerge clearly.

One, the concept of apartheid has economic as well as political and social meaning. It means that black labor should work apart from white labor. In

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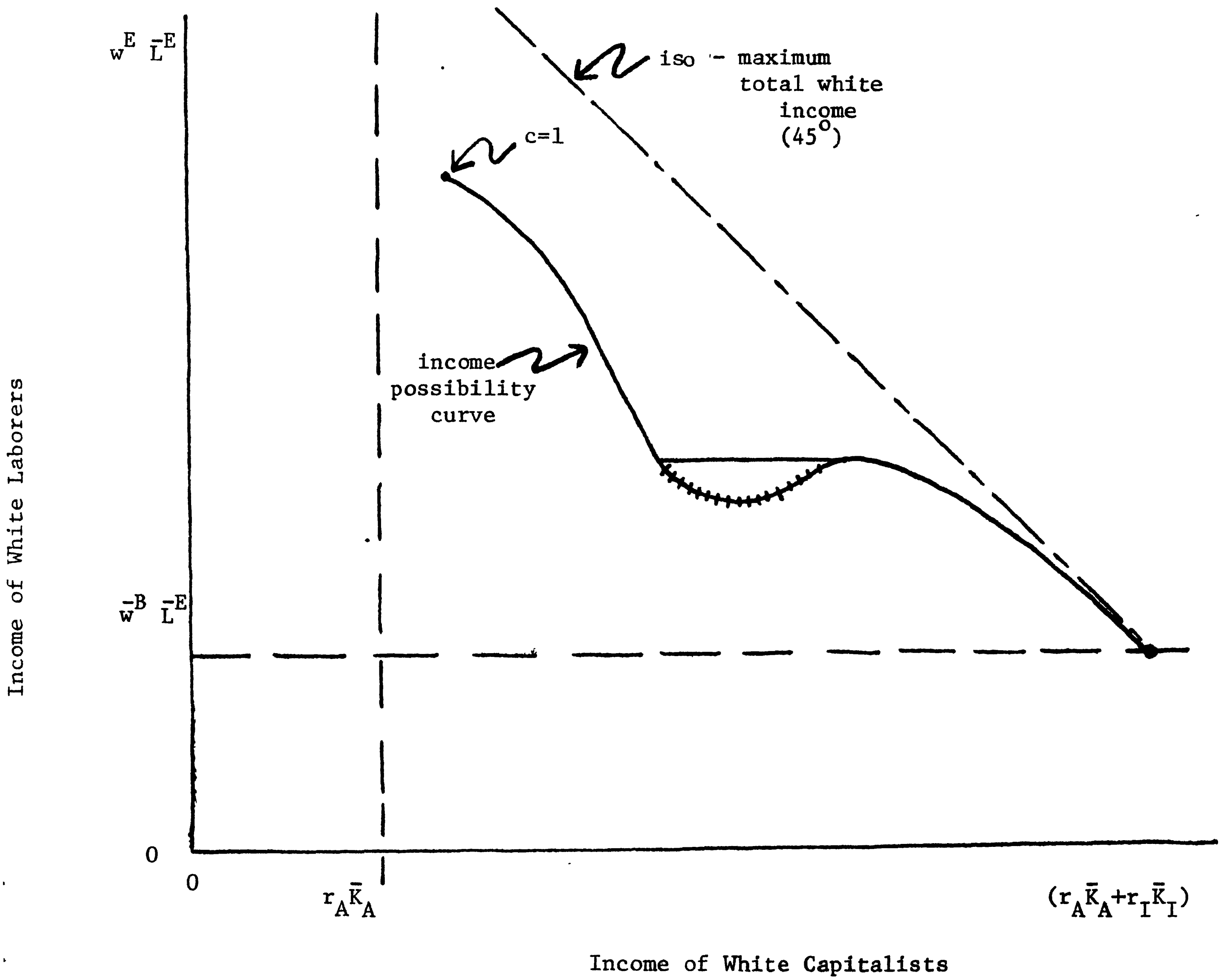
[1]Note the end-points of the income possibility curve. At the northwest, it must cease once r_I has fallen so low, and hence $(K/L)_I$ risen so high, that c must equal one to achieve full white employment (given $\bar{K}_I$). At the southeast, there is no practical interest in considering $w^E < w^B$. As we move from the point where c=1, by lowering w^E and hence raising $(L_I^E + L_I^B)$, the income of capitalists must rise; whether the income of white labor rises or falls depends on the magnitude of the (negative) second derivatives of $X_I(\cdot)$.

[2]"South Africa is ridden with almost total lack of consensus on values, i.e., on what its people consider desirable goals to achieve" (Van den Berghe 1965 , p. 4).

Figure 5



$w^E \bar{L}^E$
iso - maximum total white income (45°)
c=1
income possibility curve
$\bar{w}^B \bar{L}^E$
Income of White Laborers
0
0
$r_A\bar{K}_A$
$(r_A\bar{K}_A+r_I\bar{K}_I)$
Income of White Capitalists

part, this simply means that instead of increasing the fraction of black workers in all industry, new factories with a high percentage of black workers should be located away from the white cities (i.e. the "border areas industrialization" program). But it also has meant a continued resistance to the rising importance of black labor in agriculture and industry. This resistance stems both from labor's fear that white full employment is threatened and from a more profound fear of excessive white economic "dependence" on black labor which could eventually endanger the whites' political and social dominance. Thus, one goal of the South-African-type economy is, ceteris paribus, a reduction in the level (or growth rate) of black employment outside of the reserves (i.e. of L_I^B and L_A^B).

And two, South Africa has long encouraged the growth of industry at an even faster rate than the natural forces of economic development evoke. In this, it is no different from every other developing country of the past two centuries; and it has employed the usual policies of tariff protection, tax advantage and direct subsidy to encourage the industrialization. This goal stems partly from the usual beliefs about the inferiority of primary products and the positive externalities and dynamic benefits generated by industry, but in South Africa there is much more. Policies to encourage industry emerged at the same time as excessive fragmentation of farm ownership was creating a class of "poor whites" in the cities. As whites refused to do the unskilled rural work (reflected in the model by the absence of L_A^E), it was necessary to encourage a rapid growth of demand for white labor in industry (L_I^E) to insure a politically feasible distribution of the rising average white standard of living. And finally, since World War II, changes in international attitudes and the political structure of Africa have generated a fear of isolation; industrialization reduces the dependence of South Africa on its mineral exports and its industrial imports. Although trade is ignored in our model, these concerns can all be reflected in the model as a goal, ceteris paribus, of higher levels (or higher growth rates) for industrial output, industrial capital, and the rate of return to capital in industry.

These various goals are summarized, in simplistic fashion, in Table 3. In the column labeled "goal", the sign indicates the direction of change desired, ceteris paribus, in each of the relevant variables of the model (and a few combinations of variables, namely, X_I/X_A, $L_I^B + L_A^B$, and K_I/K_A). The variables are collected into four groups, concerning output, labor, capital, and the reserves, respectively. The impact on these goals of changes (Δ) in the three parameters (w^E, c, and w^B) are shown in the next three columns (the final column, labeled Δp, is discussed shortly); positive parameter changes are examined because these are the preferred directions of change, again ceteris paribus.[1] The signs of Table 3 can be derived quickly since the analysis follows closely that of Section III.

A rise in the white wage rate (w^E) does not affect the rate of return to capital in agriculture but does reduce the rate of return to capital in industry (as reference to Figure 2 shows). This causes a movement of capital from industry to agriculture. Since $(K/L)_A$ is unchanged, this means greater employment and output in agriculture. In industry, $(K/L)_I$ rises and since K_I has fallen, there is a reduction in (white and black) employment and output in this sector. What happens to total black employment in agriculture and

[1]That higher w^E and c are preferred is obvious. The case for higher w^B is less clear; it rests on the whites' desire for labor stability, international respect, and urban quiet.

Table 3

Relation of Policy Instruments to Goals

Variable	Goal	Parameter Change $\Delta w^E>0$	$\Delta c>0$	$\Delta w^B>0$	$\Delta p>0$
X_I	+	-	-	?	+
X_A	+	+	+	-(?)	-
X_I/X_A	+	-	-	?	+
L_I^E	+	-	?	?	+
L_I^B	-	-	-	?	+
L_A^B	-	+	+	-(?)	-
$L_I^B + L_A^B$	-	?	?	?	?
K_I	+	-	-	+(?)	+
K_A	+	+	+	-(?)	-
K_I/K_A	+	-	-	+(?)	+
r_I	+	-	-	-	+
r_A	+	0	0	-	0
X_R	+	?	?	?	?
L_R	+	?	?	?	?

industry is not clear,[1] and hence the labor and output changes in the reserves are also not certain.

An increase in the white job-reservation ratio (c) does not affect the rate of return to capital in agriculture but does reduce it in industry (as reference to Figure 3 shows). This causes a movement of capital toward agriculture, and all the same qualitative results follow as with a rise in w^E -- except for one. While total industrial employment declines, the fact that c has risen makes it uncertain whether white employment declines. As with the rise in w^E, it is uncertain whether the sum of L_A^B and L_I^B rises or falls. But it can be shown that a rise in c, if it is equivalent to a rise in w^E in the sense that it has the same effect on r_I, will increase $(L_A^B + L_I^B)$ less or decrease it more than the rise in w^E.[2] Thus, an increase in c runs into the same conflicts as does an increase in w^E -- namely the discouragement to industry -- except that it is less certain to reduce the demand for white labor and that it is more likely to reduce the "visible" black labor force (i.e. $L_I^B + L_A^B$).

An increase in the black wage rate (w^B) reduces the rate of return to

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[1] $$\Delta(L_I^B + L_A^B) = \Delta\left[\frac{\bar{K}-K_I}{(K/L)_A}\right] + (1-c)\Delta\left[\frac{K_I}{(K/L)_I}\right],$$ which reduces to
$$\Delta(L_I^B + L_A^B) = L_I \left\{\left[(1-c) - \frac{(K/L)_I}{(K/L)_A}\right]\frac{\Delta K_I}{K_I} - (1-c)\frac{\Delta(K/L)_I}{(K/L)_I}\right\}.$$
Unless $(K/L)_I$ is less than $(1-c)\ (K/L)_A$, which seems unlikely since industry is usually much more capital-intensive than agriculture, the sign of the the expression in braces is uncertain.

[2] $$\Delta(L_I^B + L_A^B) = \Delta\left[\frac{\bar{K}-K_I}{(K/L)_A}\right] + \Delta(1-c)\left[\frac{K_I}{(K/L)_I}\right],$$ which reduces to
$$\Delta(L_I^B + L_A^B) = L_I\left\{\left[(1-c) - \frac{(K/L)_I}{(K/L)_A}\right]\frac{\Delta K_I}{K_I} - (1-c)\frac{\Delta(K/L)_I}{(K/L)_I} - \Delta c\right\}.$$
For a given change in r_I, ΔK_I and $\Delta(K/L)_I$ are the same for Δc as for Δw^E. The only difference from the preceding footnote lies in the final term, which is negative for positive Δc.

capital in both the agricultural and the industrial sectors, and it is not clear where the larger fall will occur without precise knowledge of the production functions. We will assume that, because black labor is of greater importance in agriculture, the rate of return to capital falls by more there (although a question mark in parentheses appears wherever the determinancy of a sign depends upon this assumption). Capital then shifts from agriculture to industry, and agricultural labor and output declines. This policy, a rise in w^B, gives rise not so much to conflict as uncertainty. It definitely reduces the size of the agricultural sector, but beyond this it is just not clear which goals it strengthens and which it weakens.

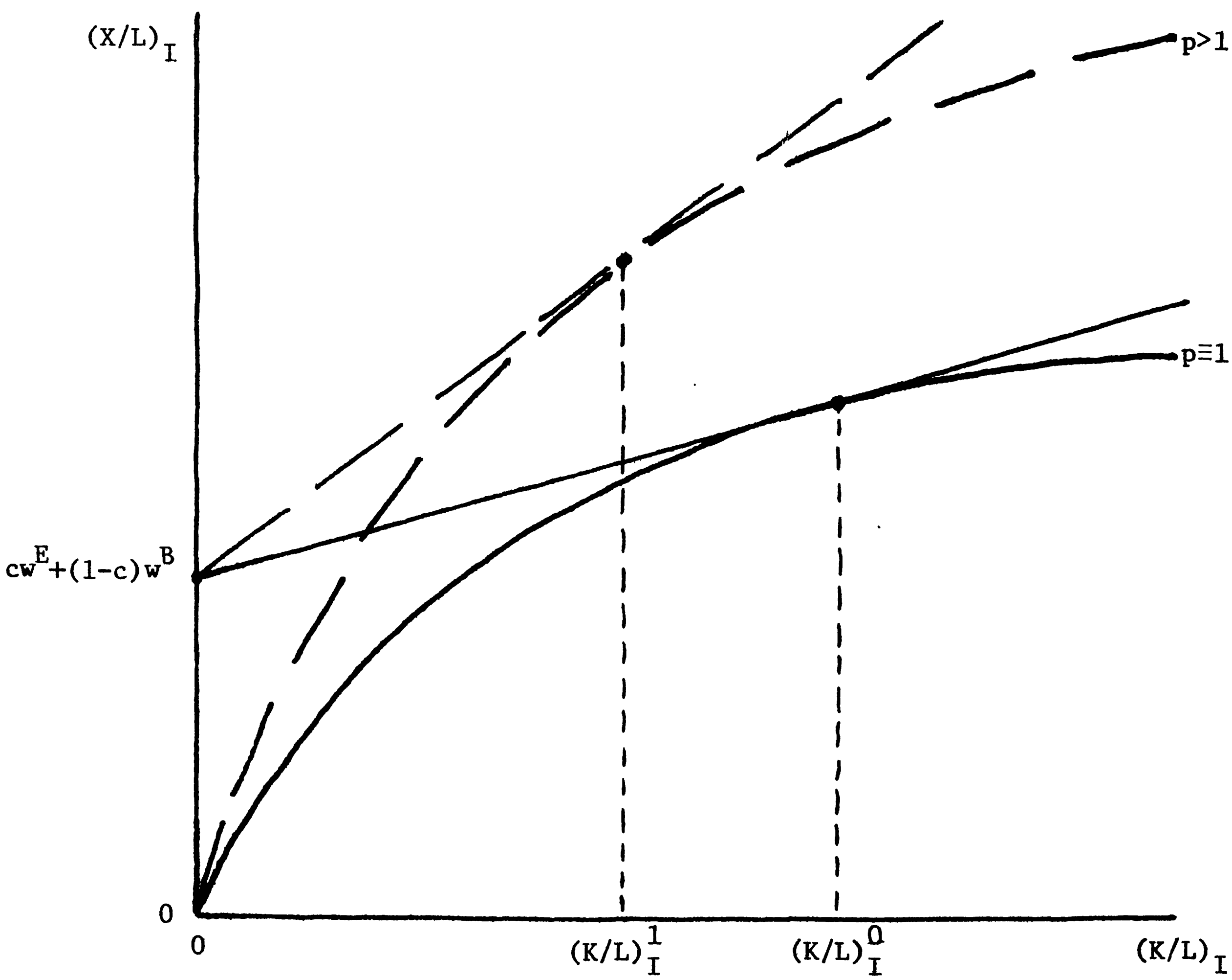
Does price policy offer an escape from these uncertainties and conflicts? If agricultural output (i.e. both X_A and X_R) is assumed to be not only the numeraire good but also the output in which both wage rates (i.e. w^E and w^B) are denominated, then the government's tariff policy permits it to vary the domestic price of industrial output (i.e. of X_I). Explicit consideration of industrial price requires change in the model only of equation (3), to

$$X_I = pX_I(K_I, L_I^B + L_I^E), \tag{3'}$$

where p is the price of industrial output. Policy can raise p above or lower it below one. An increase in p shifts the value-of-production function upward; from the viewpoint of producers, such a rise is equivalent to a Hicks-neutral technological improvement. The impact of a rise in p is shown in Figure 6, the solid lines being the production function and relevant tangent when p equals one (as in Figure 1I) and the dashed lines for some value of p greater than one.

For a ceteris-paribus increase in industrial price, the slope of the tangent clearly increases, which means a rise in the rate of return to capital

Figure 6



in industry. The capital-labor ratio in industry (K/L) declines. Since the rise in p has no impact on the rate of return to capital in the agricultural sector, the rise in the rate of return to capital in industry draws capital into that sector. This increased capital, together with the lower capital-labor ratio, insures an increase in industrial employment (of both black and white labor, since c is assumed unchanged). These changes are summarized in the final column of Table 3. Again there is uncertainty about the total impact on black labor in agriculture and industry.[1] But with this exception, the policy of raising p conforms quite well with respect to the various goals of white policy.

While it is fairly realistic to treat black wages as being fixed in terms of food, the rise in p surely lowers real white wages; moreover, if white full employment has already been achieved, the rise in p creates excess demand for whites. But it is possible to combine rises in p and w^E so as to maintain a constant level of white employment. The result, shown in Figure 7, requires that the proportionate increase in the capital stock of industry be exactly equal to the proportionate rise in the capital-labor ratio there.[2] At this new equilibrium (where L_I is unchanged), i) the rate of return to capital in industry is higher,[3] ii) output per worker in industry is higher, and iii) total industrial output (at world prices as well as at domestic prices) is higher.

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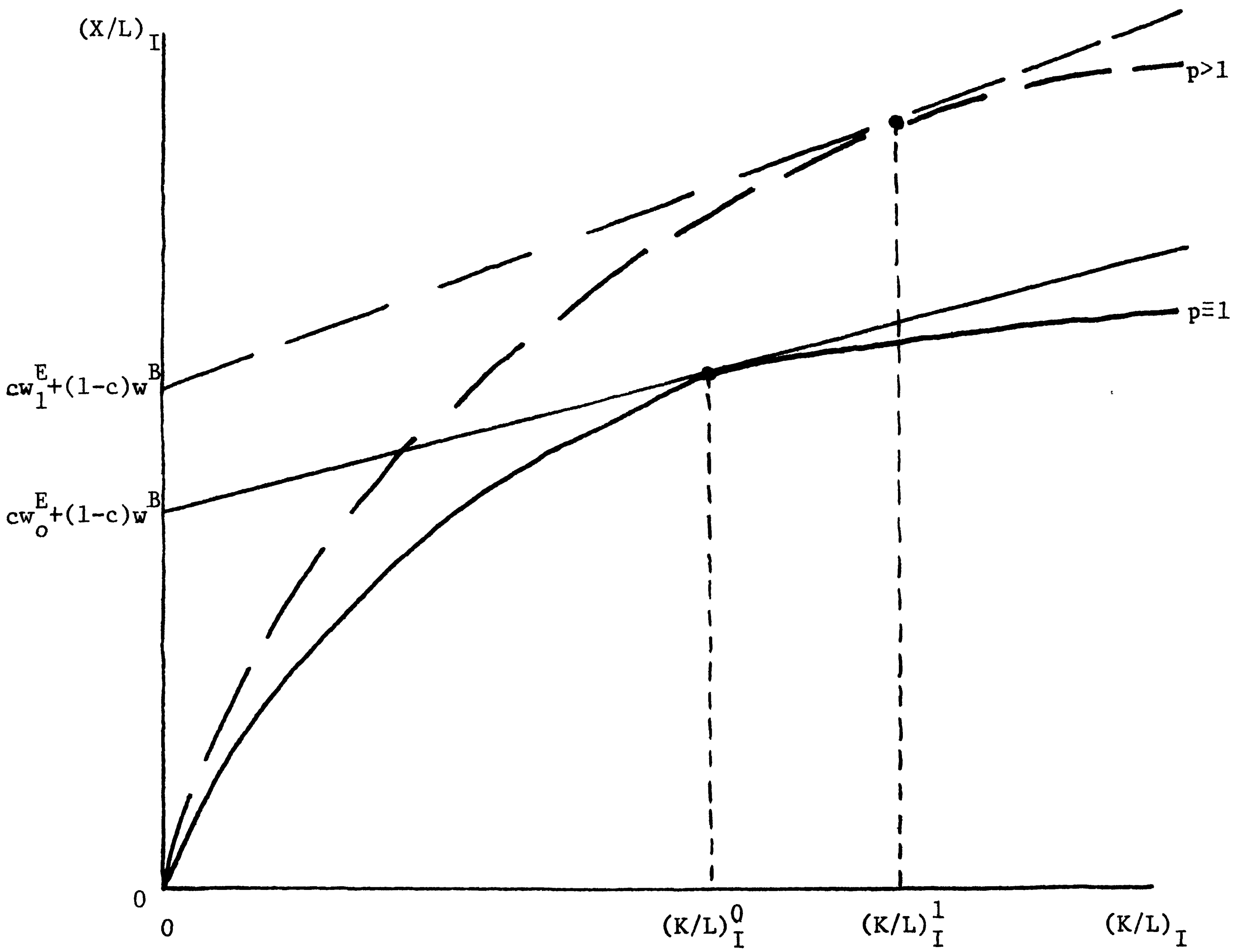
[1]The uncertainty of sign is similar to that shown for a change in w^E, in footnote 1 of page 21.

[2]Since $L_I = \bar{L}^E/c = \dfrac{K_I}{(K/L)_I}$, a constant L_I requires that changes in K_I and $(K/L)_I$ be equal.

[3]Though it has not risen to as much as p times its former level. At $(K/L)_I^0$, the price increase raises the slope of the value-of-production function to p times the former slope. Since $(K/L)_I$ rises, the actual slope at $(K/L)_I^1$ is lower than p times its former level.

Figure 7



Note also that total black employment off the reserves is reduced, since their industrial employment ($=(1-c)L_I = (1-c)\bar{L}^E/c$) is unchanged and their agricultural employment is reduced as agricultural capital leaves while no change in $(K/L)_A$ occurs.

From the viewpoint of the white voters, labor and capital, this combined policy, rising p and rising w^E, would seem an almost ideal solution. However, one must look not at the nominal but at the real income changes involved. Assume that all whites, both laborers and capitalist, buy some food (at unchanged prices) and some manufactures (at now higher prices). Clearly, agricultural capitalists lose since not even their nominal rate of return has risen. The real rate of return to capital in industry may also have fallen; the nominal rate has risen less than industrial prices, so if these capitalists spend most of their income on manufactures, they will be worse off. And the nominal white workers' wage rate has risen by more than industrial prices, so no matter what their consumption pattern the real white wage rate has risen.[1] Thus, the simultaneous rise of p and w^E does increase industrial output and reduce white "dependence" on black labor, but it does so at the cost of serious income redistribution among whites, from capital (especially agricultural capital) to labor.

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[1]When the value-of-production function increases by a factor p, an equal proportional increase of the weighted-average industrial wage, $cw^E + (1-c)w^B$, would imply the new tangency to be at the same capital-labor ratio as before (i.e. at $(K/L)_I^0$ in Figure 7). Since the capital-labor ratio rises (from $(K/L)_1^0$ to $(K/L)_I^1$), the proportionate increase in the weighted-average wage rate exceeds the proportionate increase of industrial prices. But the white wage rate is only a part of that weighted-average, and the rest (i.e. $(1-c)w^B$) does not rise at all. So w^E rises a fortiori by proportionately more than industrial prices.

Moreover, there is almost certainly a loss in the total output of the economy, measured in world prices -- that is, the sum of X_R, X_A, and X_I is reduced. The movement of labor from agriculture to the reserves cannot increase output since the marginal product of each black worker in agriculture (w^B) must have been at least as high as his opportunity cost in the reserves (b), after adjustment for any non-pecuniary differences. The movement of the first unit of capital from agriculture to industry involves no loss since the owner must have been indifferent between his earnings in agriculture (r_A^0) and in industry (r_I^0). As subsequent capital flows occur, there is no change in the rate of return to capital in agriculture, since capital and labor are withdrawn together there (at constant $(K/L)_A$). But the addition of this capital to industry is made with a constant industrial labor force, and hence the rate of return to capital in industry must fall. In short, there is a decline in total output in world prices, which is, after all, the real output. The gainers (white labor) gain less than the losers (white capital) lose.[1]

This section can be summarized in a sentence. The complete white domination of the economy and its policy parameters does not free whites from awkward conflicts and contradictions, between the sub-classes of white labor and white capital and between the different policy goals which whites simultaneously seek. All this so far has arisen within a static framework; similar problems will be seen to emerge in the dynamic analysis of the next section.

V. Dynamics

As a first step to uncovering the growth paths of a South-African-type economy, let us ignore (quite unrealistically) technical change and assume (more

[1] This gives a somewhat inaccurate picture of South African tariff policy and problems. Actual policy has protected both industry and agriculture while taxing the exports of the mining sector. Our model is not large enough to analyse this situation; but it does point out the potential conflict between tariff policy and the owners of capital, especially in the disprotected sector.

realistically) that none of the fruits of capital accumulation are passed on to black workers.

Consider first the path of balanced growth, by which I mean that the capital stock, employment, and output in both agriculture and industry all grow at the same, constant rate. As Figure 1A shows, if the black wage rate (w^B) is held constant over time and unlimited supplies of black labor continue to be available from the reserves, growth in the agricultural sector occurs with the rate of return to capital (r_A) constant. Thus, balanced growth (of labor, capital and output) in agriculture can occur at any growth rate; with w^B fixed over time at $\bar{w}^B$, r_A will remain constant at $\bar{r}_A$.

If the behavior of the capital market in allocating new capital between agriculture and industry is unchanging over time, balanced growth of the capital stocks, K_A and K_I, requires that the relative rates of return to capital, r_A/r_I, remain constant. Since r_A is constant for any agricultural growth rate, r_I must also remain constant if balanced growth is to occur. But this, as can be seen in Figure 1I, requires that the weighted-average industrial wage rate, $cw^E + (1-c)\bar{w}^B$, remain constant over time. Since $\bar{w}^B$ is constant, this means that w^E can rise only if c falls.

What happens to c depends on the relative rates of growth of the total capital stock in the economy and the white labor force. Balanced growth means that the rate of growth of the total capital stock is also the sectoral rate of growth of capital and employment in each of agriculture and industry. But the rate of growth of white employment in industry is given at the exogenous growth rate of the white labor force.[1] Thus, if the total capital stock grows at a more rapid rate than the white labor force, c must decline (and vice versa). In the context

[1] Recall that the white labor force is always fully employed. If there is white immigration, we assume that it does not respond endogenously.

of the actual South African economy, with its high capital and output growth rates and small white population (including immigration) growth rate, only the case of a secularly declining c is relevant.[1]

Where there are constant growth rates for capital and for the white labor force, balanced growth means a constant rate of decline of c but it does <u>not</u> mean a constant rate of increase of w^E. Two prerequisites for balanced growth in the model are a constant weighted-average wage rate in industry, i.e.

$$cw^E + (1-c)\bar{w}^B = \text{a constant}, \tag{13}$$

and full employment of the white labor force, i.e.

$$c(L_I^E + L_I^B) = \bar{L}^E. \tag{14}$$

Take time derivatives of equations (13) and (14) and write them in terms of growth rates (hereafter, a dot over a variable means its growth rate):

$$\dot{w}^E = -\left(\frac{w^E - \bar{w}^B}{w^E}\right)\dot{c}, \text{ and} \tag{15}$$

$$\dot{c} = \dot{\bar{L}}^E - \dot{K}. \tag{16}$$

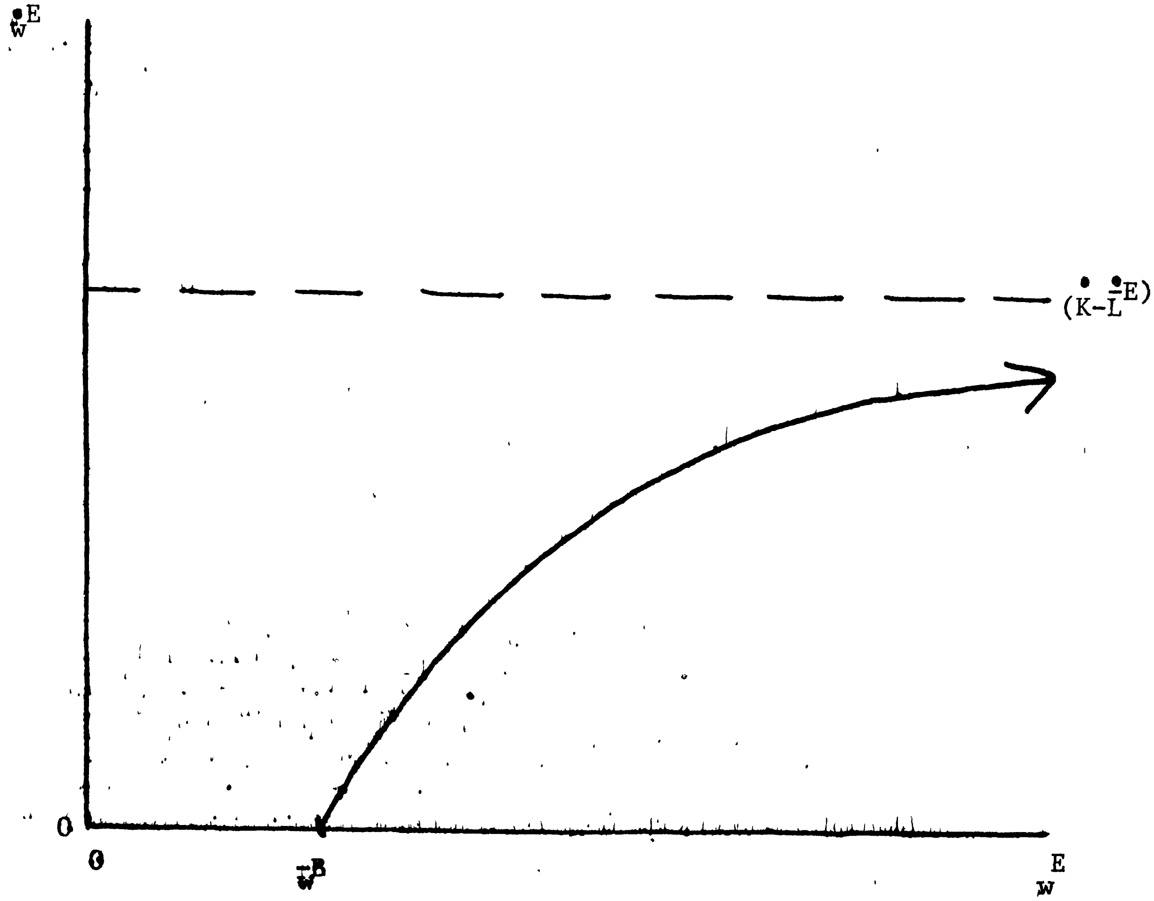
In equation (16), $\dot{K}$ is substituted for the growth rate of $(L_I^E + L_I^B)$ since they are equal with balanced growth. Note that, from equation (16), constant growth rates for the white labor supply and for capital (and the latter larger) imply a constant, negative growth rate for c. Now substitute $\dot{c}$ of equation (16) into equation (15), to get

$$\dot{w}^E = \left(\frac{w^E - \bar{w}^B}{w^E}\right)(\dot{K} - \dot{\bar{L}}^E), \tag{17}$$

which is illustrated as Figure 8. $\dot{w}^E$, the growth rate of w^E, rises over time.

[1] Over 1911-70, real South African GDP grew at over 4 percent per year, while the white population grew at less than 2 percent. Since 1960, the disparity has been even greater. See <u>Africa</u>, 1974, pp. 744-45.

<u>Figure 8</u>



Thus, balanced growth does not mean that everything rises either at the same or at a constant growth rate. With the white labor force growing more slowly than the capital stock, c must decline at a constant rate and w^E must grow at a rising rate. Finally, it should be noticed that the distribution of income is also changing during this balanced growth. While the income of capitalists grows at the same rate as the capital stock (since neither r_A nor r_I changes), the income of white labor grows less rapidly than the capital stock.[1] This means of course, that the total income of black labor in agriculture and industry is growing faster than the capital stock, even though the black wage rate remains constant. Indeed, it should be recognized that the average income per capita of all blacks will be rising, provided $\bar{w}^B$ is greater than b, unless the black population is growing so rapidly that no relative transfer of black labor from reserves to agriculture and industry is occurring.

Balanced growth would seem a heart-warming proposition for whites. The rate of return to their capital is not falling and the wage rate of their labor is rising at a rising rate. There is a relative redistribution of white income shares from labor to capital, but this problem at least grows progressively smaller. The conflict arises with respect to the other goals of South African development -- i.e. a reduced, or a least not increased, dependence on black labor and increased industrial share of total output. Balanced growth does not support the latter goal, by definition; and even balanced growth requires the growth of black employment in industry[2] at a faster rate than capital and output there.

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[1] See equation (17) or Figure 8. Only asymptotically does the growth rate of white labor income (i.e. $\dot{w}^E + \dot{\bar{L}}^E$) reach the growth rate of capital (i.e. $\dot{K}$).

[2] And in industry and agriculture together.

To achieve the goal of industrialization, policy must unbalance growth so as to raise the rate of growth of industry above that of agriculture. Still holding the black wage rate constant and ignoring technological progress, we see that the government must change w^E and c over time so as to raise the ratio of r_I to r_A. The latter, r_A, cannot be reduced (without a change in $\bar{w}^B$) so the former, r_I, must be raised. This, in turn, requires a reduction in the weighted-average wage rate in industry. Initially, this probably means reducing the rate of growth of w^E,[1] and eventually, it means that c must fall even faster; neither of these are desired and hence represent the trade-offs, or cost, of industry-biased growth.

The introduction of technological change alters the balanced-growth analysis very little. With $\bar{w}^B$ still constant, technical progress in agriculture, assumed disembodied for simplicity, raises the rate of return to capital there. Balanced growth requires that the rate of return to capital rise equally rapidly in industry. Depending on whether technical progress is greater in industry or agriculture, the weighted-average industrial wage rate will have to rise or fall. In this case, blacks are being denied any share in the fruits of either the capital accumulation or the technical progress, but it is not clear who the white beneficiaries are. Capitalists surely, since rates of return to capital rise; but whether white laborers share in the gains due to such progress depends on: i) the relative rates of technical advance in industry and agriculture and ii) the degree of factor substitutability in the industrial production function. The more rapid the industrial rate of technical progress and the greater substitutability in the industrial production function: i) the more rapid the rise of r_I, ii) the more rapid the

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[1]A reduction in c also lowers the weighted-average wage rate, but such a change may not be consistent with full employment of white labor. See Section IV.

growth of K_I, iii) the faster the fall in $(K/L)_I$[1], iv) the faster the growth in in L_I, v) the faster the fall in c, and hence vi) the faster the rise in w^E that is possible while maintaining balanced growth. But, once technical progress is introduced, it is no longer clear that its fruits are automatically divided between white capital and white labor in politically acceptable shares.

The asymmetry arises because it is black labor and not black capital that is exploited, and black labor is a much closer substitute for white labor than for white capital. Thus, the constancy of the black wage rate (at $\bar{w}^B$), which keeps r_A rising rapidly and hence pushes up r_I as well, puts downward pressure on the white wage rate. One way around this for white laborers, curiously, is to press for higher black wage rates.[2] If $\bar{w}^B$ grew as rapidly as technical progress in agriculture, there would be no rise in r_A, and hence no need for a rise in r_I. The weighted-average industrial wage rate could then rise just as rapidly as industrial technical progress took place. With technical progress and a constant $\bar{w}^B$, as we saw earlier, the weighted-average industrial wage rate can only rise if technical progress occurs more rapidly in industry than in agriculture.[3]

Finally, it is interesting to examine the impact on this economy of inflows of foreign capital and of increased white immigration. Such examination is easily conducted, since the former means basically a more rapid accumulation of capital (i.e. higher $\dot{K}$) and the latter a more rapid rate of growth of the white labor

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[1]Unless the technological change is "very labor-saving" by the Hicks definition, the point of tangency must shift to the left with the weighted-average wage rate constant. See Porter (1968), pp. 71-73.

[2]Which many South African (white) labor unions in fact do. This is "curious" only to neo-classical economists; see Reich (1971).

[3]All this assumes that technical progress occurs exogenously.

force (i.e. greater $\dot{L}^E$). The impact of each on the paths of output, employment, etc. is easily derived, but the interesting question is how these changes affect the well-being of the blacks. The answer is: little. The black wage rate, w^B, can be set, within limits, wherever the white policy-makers wish, and it is in no way necessarily dependent on $\dot{K}$ or $\dot{L}^E$. Higher rates of capital accumulation or lower rates of white labor-force growth will, <u>ceteris paribus</u>, reduce c, and the former will raise L_I as well. If one counts participation of blacks in the "modern" (i.e. non-reserve) sectors as adding to their well-being, then there is some positive impact.[1] In reality, however, more rapid capital accumulation in industry means not only a more rapid decline in c but also increased training and better access to skilled jobs for blacks. The model, with but one kind of labor, cannot treat this. The model also does not consider the possibility that such investment will raise w^B, either because of the need for skill differentials among blacks, because of pressure on South African foreign investors from their home countries, or because of the whites' inability to resist the pressure for better wages by the growing urbane, black, industrial labor force.

The desire in South Africa for faster rates of foreign capital inflow and white immigration point up anew the dynamic conflicts of goals and means there. Greater capital inflow is sought in order to accelerate industrialization, even though it means a more rapid decline of c. And greater white immigration is sought to repair the damage to c, even though it in turn reduces the rate at which w^E can rise.

In sum, with dynamics as well as statics, there are conflicts between different white groups and between different white goals.

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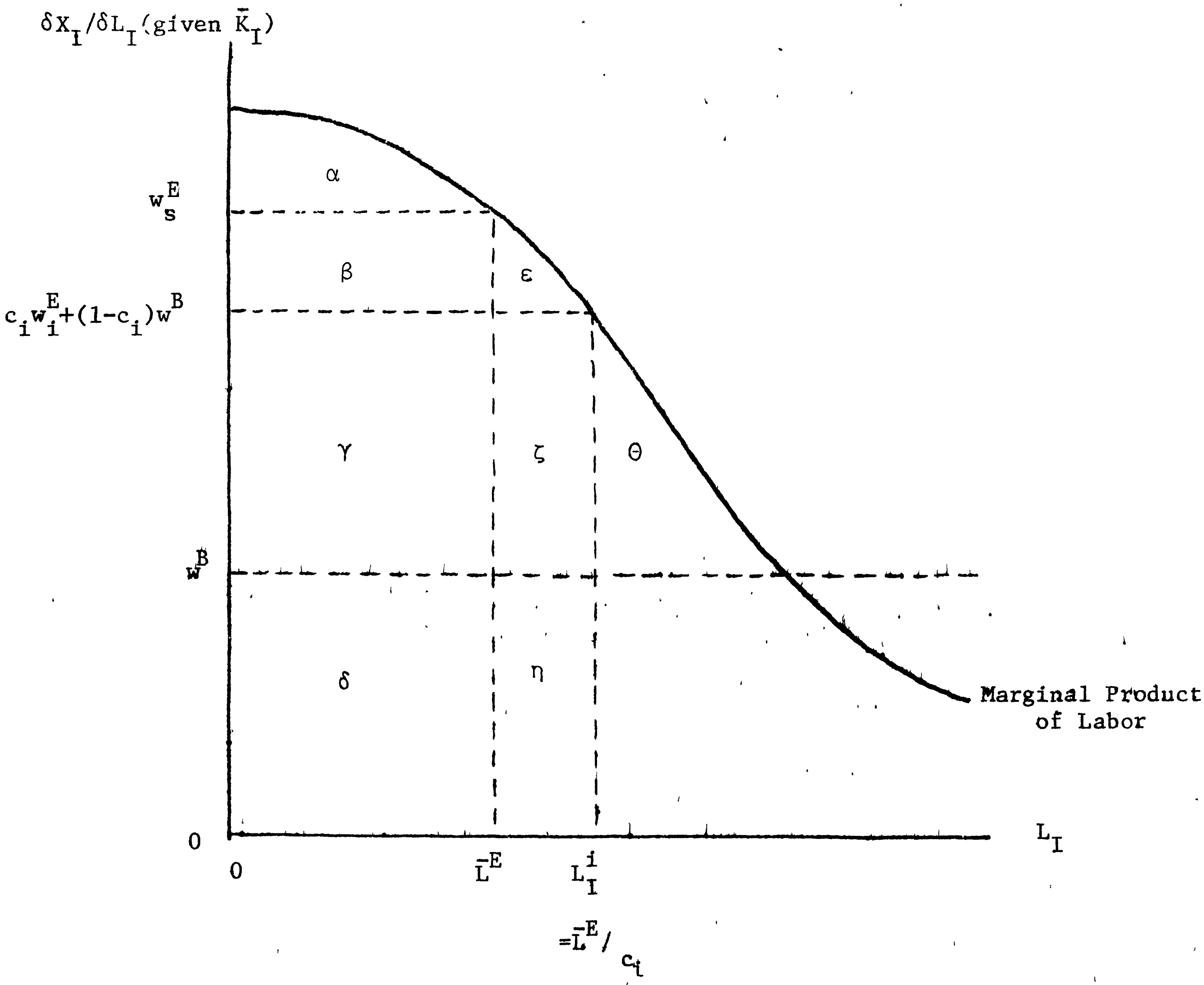
[1] Note, however, that if the positive impact of capital accumulation is small, the negative impact of <u>decumulation</u> is also small. On sabotage as a black weapon, see van den Berghe (1965), pp. 162-164.

VI. Exploitation

Finally, the model yields an answer to what is, ultimately, the most interesting question: in what sense and manner is there exploitation of blacks by whites? Before we can answer the question, however, we must carefully define the word "exploitation". Certainly, it is unrevealing to define as exploitation all income differences between whites and blacks. Rather, exploitation must be measured by comparison of the South-African-type economy with some other, more equitably structured system. Here, we will consider as the alternative an efficient, competitive system where white capitalists do not have the opportunity of using black labor, i.e. a complete economic apartheid of black and white factors of production.

The manner and extent of exploitation are most sharply seen in the industrial sector, where we will intitially focus; and to simplify the analysis at first, we will assume that capital is completely immobile between sectors (i.e. $K_I = \bar{K}_I$). Since capital is constant, the marginal product of labor $(\delta X_I/\delta L_I)$ can be plotted against labor, as in Figure 9. Consider first the situation where no black labor can be used. Full employment of the white labor force $(\bar{L}^E)$ requires a wage rate of w_s^E (the subscript, s, refers to segregation). The total earnings of the (white) industrial capital are represented by the area, α, and the total earnings of the white industrial labor by the sum of the areas, $\beta + \gamma + \delta$. Now, consider the situation where black labor can be hired, at a wage rate of w^B. Suppose L_I^i (i for integration) total laborers are hired. The job-reservation ratio (c_i) is determined by the need to maintain white full employment (i.e. $c_i = \bar{L}^E/L_I^i$); and the white wage rate (w_i^E) is determined by the need for the weighted-average wage rate to equal the marginal product of labor at L_I^i. Now, the total earnings of industrial capital are represented by the areas, $\alpha + \beta + \varepsilon$; integration

Figure 9



$\delta X_I/\delta L_I$ (given $\bar{K}_I$)
w_s^E
$c_i w_i^E + (1-c_i)w^B$
w^B
0
α
β
ε
γ
ζ
Θ
δ
η
Marginal Product of Labor
L_I
0
$\bar{L}^E$
L_I^i
$=\bar{L}^E/c_i$

clearly increases the earnings of capital. The <u>total</u> industrial labor earnings are represented by the areas, $\gamma + \zeta + \delta + \eta$; since the black workers (i.e. $L_I^i - \bar{L}^E$) must be paid a wage rate of w^B, the black labor earnings are represented by the area, η, leaving the areas, $\gamma + \zeta + \delta$, for white labor. It is not certain whether integration has benefited white workers -- this depends upon whether $\zeta \gtrless \beta$. But it is certainly true that <u>all</u> whites together, labor plus capital, gain by integration, to the extent of the areas $\varepsilon + \zeta$.

We can now see the source and extent of the exploitation. When the races are separate, the white economy is relatively capital-abundant, as indicated in Figure 9 by the low earnings of capital, α, and the high wage rate, w_s^E. The black economy has no capital and the marginal product of black labor is low.[1] The chance to integrate these very different economies offers great potential for gain. The exploitation derives from the fact that this gain is largely captured by whites. White capitalists gain most clearly, by $\beta + \varepsilon$. White labor may or may not gain from the merger, but whites as a group do,by $\varepsilon + \zeta$. Only to the extent that the modern-sector black wage rate (w^B) exceeds the average product of the reserves (b) -- by more than any differences in the cost-of-living or in non-pecuniary benefits -- is there any gain at all for blacks from the merger.

The exploitation in agriculture is more elemental. There without the merger, there is no white labor at all, so the entire income of white capital (i.e. $r_A K_A$) derives from its capture of the gains from "trade" with black labor. Here, too, if w^B does not exceed b, white capital extracts <u>all</u> the gains, raising its income share from zero.

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[1]Not, it should be repeated, because black labor is untrained. We are assuming throughout that black and white labor are identical from the viewpoint of productive efficiency.

Of course, if racial segregation were established, either white labor would move to agriculture or agricultural capital would move to industry. But the qualitative results are not changed and the quantitative magnitudes are exacerbated. Regardless of whether white labor or agricultural capital moves, the relative capital-abundance of white industry is increased, so that the potential gains from integration are even greater.

The source of South-African-type exploitation is now clear: the gains from the merger of the white and black economies are largely, if not entirely, appropriated by whites.[1] This points up once again the dilemma of white policy. While white policy seeks separation of the races, white living standards depend (to some extent at least) on their ability to extract gains from integration of the races.

It should be noted, in closing, that there is a broader sense -- not treated above -- in which blacks are exploited in a South-African-type economy. If the "black economy" had not been "merged" with the white economy, it would presumably not go on forever as a capital-less, technically stagnant "reserve". Sensible economic policy by independent blacks would eventually create saving, growth, and diversity in the black economy. The merger of the black economy into the white economy and its consequent subjugation to white policy have denied this possibility; white development efforts have gone preponderantly to the augmentation of technological capacity and human and physical capital in the "modern" sectors

[1]Recall that the actual allocation is inefficient, so that some of the potential gains from integration go unrealized (namely, the area, Θ, in Figure 9). Notice also that, if the two economies were merged into a single, efficient system, black labor still would not gain (again assuming that w^B does not exceed b). That is the price blacks pay for being "unlimited". But in such an economy, w^E falls drastically -- indeed to w^B -- and r rises even further than it does under the actual, inefficient merger. Thus, in an efficient merger of the black and white economies, all the gains-from-trade would be appropriated by white capital and, further, a sizeable income transfer from white labor to white capital would be effected.

where whites could gain most from access to cheap, unskilled black labor. The continued low productivity of the reserves is what makes the continued low black labor wage rate possible. Separation is not the only "solution" offered in world debate over South-African-type economies -- there is also expulsion of white labor and expropriation of white capital, with or without compensation. Usually, theory tells us that such expulsion and expropriation causes a loss to the remaining citizens, unless there is a confiscatory element to the expropriation.[1] Here, this is not the case because the white-black wage differential and the job-reservation system create a second-best situation. Expulsion of white labor would, in the long run, correct the labor-market distortion, bring about an economically efficient solution, and hence yield a surplus more than sufficient to pay capital its pre-expulsion marginal product.

With or without whites, a rising black standard of living ultimately depends on two things: rising agricultural productivity in the reserves and black saving. Until then, blacks will remain laborers and "unlimited" at low real opportunity cost. This brings out the ultimate paradox of white policy: while the demands of internal politics evoke a rhetoric of "separate development", the continued exploitation of blacks requires both their integration and their non-development.

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[1] See Tobin (1974).

Appendix: Introducing Education/Training

In the text, there is but one kind of labor -- differently colored to be sure, but one laborer is assumed to be productively indistinguishable from another. This treatment is selected partly for simplicity but mostly to show that South-African-type discrimination does not depend in any quintessential way on real productive differences between white and black labor. Empirically, however, discrimination in South Africa has never depended primarily on the job-reservation ratio (c) as a means of insuring high employment for high-wage white labor. It is easy to see why not, in an analytical sense: the maintenance of the ratio, at any level, goes against the profit motives of the owners of industrial capital and hence requires a constant legal and bureaucratic enforcement effort.[1] But more relevantly, labor in fact is not all productively identical -- some workers have more education/training than others.[2] And the early history of South Africa's mining and manufacturing, where the white labor was skilled and the black unskilled, has suggested to South African governments a more congenial means of practicing racial discrimination. Education, apprenticeship, and training programs are essentially open only to whites,[3] and hence, wherever skilled labor is required in the productive process, entrepreneurs are precluded from hiring low-wage blacks in place of high-wage whites. The

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[1] For examples, see Horrell (1971), passim.

[2] Also, some workers are innately more "skilled" (whatever that may be taken to mean) than others; but racial bias can hardly be perpetuated through discrimination on the basis of talent.

[3] In South Africa, roughly 90 percent of blacks workers have not passed the first year of high school, while roughly 5 percent of white workers have failed to reach that standard. (Schlemmer, 1972-73, p. 10).

training of blacks by the employers themselves is unprofitable since 1) minimum wage legislation (the "rate for the job"[1]) makes it impossible to charge the necessary additional training costs to black trainees, and 2) the absence of bondage provisions makes it difficult to insure that the returns to general training accrue to the firm. There are, of course, also non-economic motives and laws that operate to insure that such training does not occur.

Formally, we should write the production function for industry, not as it is in the text,

$$X_I = X_I(K_I, L_I^B + L_I^E), \tag{3}$$

but as something like

$$X_I = X_I(K_I, L_I^*), \tag{3''}$$

where L_I^* is an index of "effective labor" which, in turn, can be considered to be "produced" by skilled and unskilled labor:

$$L_I^* = L_I(L_I^B, L_I^E), \tag{18}$$

where L_I^E now refers to the skilled, European labor and L_I^B now refers to the unskilled, black labor. A typical iso-effective-labor curve (solid line) is drawn in Figure A1, and the least-cost combination of labor, $(L_I^E)_0$ and $(L_I^B)_0$, indicated by the tangency to the (dashed) iso-cost line of slope, (minus) w^B/w^E.[2] If the iso-effective-labor functions are homothetic, the relative requirements of skilled and unskilled labor are also determined, as indicated by the ray from the origin of slope, $(L_I^E)_0/(L_I^B)_0$.

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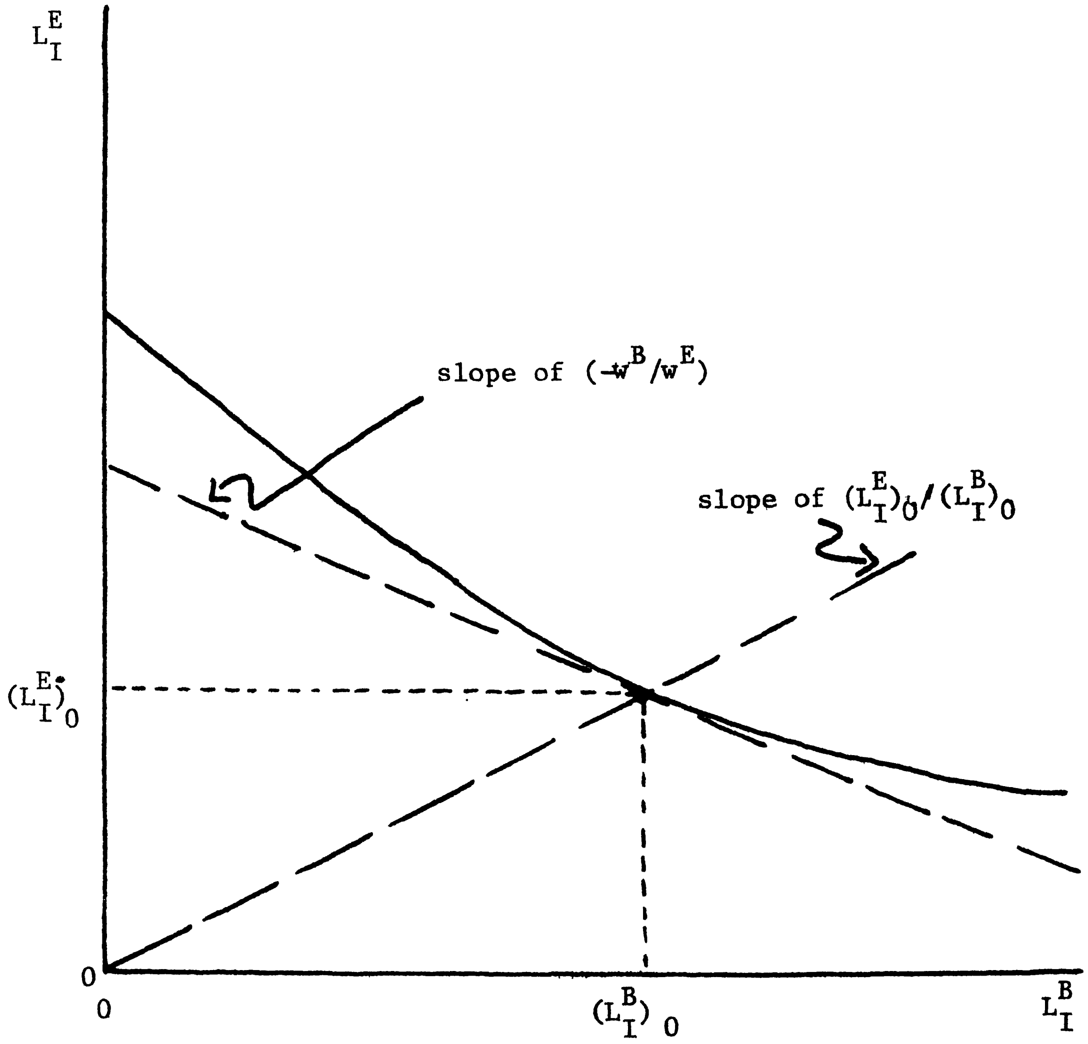
[1]The South African term. In Rhodesia, it is called "European rates" (Faber, 1961, p. 46).

[2]The iso-effective-labor curve is drawn on the assumption that skilled labor can always replace unskilled labor on better than a one-for-one basis. A corner solution is possible, but not very realistic.

Figure A1



The relative usage of white and black labor is therefore determined not by government fiat but by cost-minimization. The ray from the origin indicates c, the ratio of white to total labor. Thus, c is no longer an independent parameter, fixed by government policy, but an endogenous variable determined by the relative wage rates[1], i.e.

$$c = c(w^E/w^B),\ c' \leq 0.^2$$

All of this so far affects the analysis of the text in only one way: we cannot talk about a shift in w^E (or w^B) without considering the induced change in c. Consider an increase in the white (but not the black) wage rate; the effect on the weighted-average industrial wage rate is now

$$\frac{d[cw^E + (1-c)w^B]}{dw^E} = c + \frac{w^E - w^B}{w^B}\ c', \tag{20}$$

where d is the total derivative. The second term on the right must now be considered, and it, being of opposite sign to the first term, implies that the impact of a rise in the white wage rate on the weighted-average wage rate is now qualitatively uncertain. If the second term is small relative to the first, then the qualitative results of the text continue to hold, especially the conclusion that an increase in w^E reduces white employment, other things (except c) equal. But if the second term is large enough, it is possible that a rise in w^E will so reduce c as to reduce the industrial weighted-average wage rate, $cw^E + (1-c)w^B$.

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[1]A higher c could still be imposed by the government, but it would not be cost-minimizing and hence would revive the problem of enforcement.

[2]The prime refers to the derivative. The case of c' equal to zero refers to the need for a minimum ratio of skilled to unskilled workers. c is then independent of w^B and w^E (provided $w^B < w^E$), but it is still not returned to its position as a policy parameter. The model of the text applies throughout, except that movements in c are determined by technological and wage rate changes, and not by independent policy shifts.

This in turn reduces the industrial capital-labor ratio and draws capital into the industrial sector, thus increasing the total industrial labor force. The net result may mean an increase in white industrial employment.[1] My willingness to use the simpler model in the text indicates that I think unlikely such a combination of high substitutability between skilled and unskilled labor, high substitutability between "effective" labor (L_I^*) and capital, and great mobility of capital between sectors.

Consideration of this model, with two kinds of labor, also alters the discussion of efficiency in the text. The wage rate difference ($w^E > w^B$) now does not imply that identical labor is being differentially rewarded; w^E is now the wage rate of skilled labor and w^B of unskilled labor -- the extremely biased process by which only whites become skilled may be appallingly inequitable, but it is not necessarily inefficient. But other, new sources of inefficiency have entered; in this brief appendix, it may be sufficient to note them:

1) If the ability to absorb education (defined as you will) of the most apt excluded black is greater than that of the least apt included white, there begins to appear inefficiency in the sense that any given quantity of training is not distributed at least cost.

2) If the skill differential (i.e. $w^E - w^B$) is set too high[2], employers will employ too few skilled workers -- in the sense that the opportunities for

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[1]And it will mean an increase in black industrial employment.

[2]The evidence on this is legion. For example, Houghton (1973) points out that the skilled wage rate in South Africa runs about five times the unskilled wage rate, whereas in Western Europe and North America the ratio is always less than two (p. 168).

training labor whose additional productivity exceeds the marginal training cost are not exhausted. As long as white policy is reluctant to accept the need to train blacks, despite the fact that the white labor force is growing much more slowly than total industrial employment, the total volume of resources devoted to "training" will be inefficiently small.[1]

These inefficiencies are probably quantitatively more important in the South African economy today than the one treated in the text. But they are also much more difficult to model, and I feel the additional complexity would obscure rather than expand the insights offered in the text into the conflicts and dilemmas faced by South African shites.

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[1]One might think there was a way out for South Africa through skill "deepening" if skill "widening" is not politically acceptable -- i.e. determine the optimal total volume of schooling and cram it into the white bodies available. But this risks inefficiency not only from differential aptitudes for education but also from diminishing returns.

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