An Input Output Analysis of Structural Change in Apartheid Era South Africa: 1975-93

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Abstract. This paper examines the sources of structural changes in output growth of South Africa's economy over 1975-93 using a decomposition method within the input-output (IO) framework. The model uses four comparable IO tables for 1975, 1981, 1988, and 1993 as the main data sources and accounts for output changes from a demand side perspective. It decomposes output growth into private consumption, government consumption, investment and export components and also measures the impact of import substitution and changes in intermediate input use (as indicated by changes in IO coefficients). It is found that before 1981, overall output growth was multi-components driven with all the above components contributing positively to economic growth. However, the collapse of investment demand is by far the single largest factor contributing to the economic stagnation that categorises the post 1981 period. Whilst the efficiency of factor utilisation remains an issue for further research, a significant rise in the IO coefficient share during the entire 1975-93 period indicates a deepening interdependence between industrial sectors over this period. However, analysis by sub-periods suggests that after 1981, both the mining and manufacturing sectors failed to sustain their role as engines of economic growth.

Key words: Output growth; structural change; input-output analysis; decomposition; South Africa.

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I. Introduction

During the apartheid era, South Africa's economic performance steadily worsened with slow growth in the 1970s being replaced by stagnation and decline during the 1980s and early 1990s. Previous research has attributed this poor economic performance to the inherent inefficiencies of the apartheid regime; South Africa's increasing international isolation; the costs of maintaining the apartheid system through internal repression and external aggression (McMillan, 1992; Jones & Inggs, 1994; Batchelor & Willet, 1998); and the government's industrial policies, which directed a substantial share of investment to strategically important but economically nonviable activities such as armaments production and synthetic oil production (Nordas, 1996; Jones & Inggs, 1994; Kaplinsky, 1992). Nevertheless, there has actually been relatively little research quantifying how these factors actually influenced South Africa's aggregate and intersectoral growth.

South Africa's development since the 1970s must also be divided into at least three clearly identifiable sub-periods, which are marked by substantially different government policies and economic conditions. Thus, the 1970s were characterised by respectable growth, although the government continued to implement the apartheid system and pursue an import-substituting industrial development policy, which favoured capital intensive industries (Fallon & Pereira de Silva, 1994). Likewise, increasing internal and external opposition to Apartheid resulted in the government implementing its "Total Onslaught" policy of increased internal repression and destabilising its newly independent black ruled neighbours through armed incursions. As a result of the Total Onslaught policy, as well as increased international opposition culminating in oil and arms embargoes, the government also invested heavily in the development of the arms and synthetic oil industries (McCarthy, 1994; Kaplinsky, 1992)). The magnitude of the government's investment in strategic industries is demonstrated by the significant shift in the share of manufacturing investment that was publicly funded, which increased from 19 percent in 1971 to 46 percent in 1980 (SA Reserve Bank Quarterly Bulletin). Thus, the 1970's might be best described as a period of import substituting development policies, increasing international isolation, and substantial investment in strategically important industries.

During the early to mid 1980s, stagnation set into the economy as lower gold prices rocked the mining sector, and increasing boycotts and other external pressure resulted in substantial foreign disinvestment. However, while military spending continued to absorb an increasing share of the economy's resources, actual investments in the strategic industries declined as production facilities were completed. As a result of these trends, private gross fixed investment fell 12 percent between 1981 and 1988, public investment fell 41 percent, and total investment fell 25 percent.(SA Reserve Bank Quarterly Bulletin). In an effort to offset the malaise which was beginning to grip the economy, the government also substantially altered its economic policies by both removing many of the restrictions on the mobility

and employment of black workers and moving to a more export-oriented industrial development policy which relied heavily on export subsidies. Thus, the 1980s can be characterised as a period in which the economic restrictions of apartheid were eased and the government switched to export promoting policies in an effort to counteract growing economic malaise.

Finally, the late 1980s and early 1990s were marked by many of the same basic economic characteristics and government policies that characterised the early to mid 1980s. However, during this period the government made the fundamental decision that because of its inherent inefficiencies and international opposition, the apartheid system was no longer economically viable. It therefore began to negotiate and prepare for the transition to democracy that actually took place in 1994. Thus, this last period can be best viewed as a transition period in which the economy continued to stagnate and the international community maintained pressure in order to insure that the transition to democracy actually took place.

As the economic and structural consequences of these three periods are likely to be substantially different, unravelling the factors responsible for South Africa's poor economic performance during the apartheid era requires a method of analysis which can provide a detailed and quantitative examination of structural change and its causes by sectors and by sub-periods. The decomposition approach within the input-output (IO) framework provides a well established method for chronicling the structural changes of an economy, particularly if a series of comparable tables are available for the economy in question. It can be used to identify the effects of government policies on economic growth and structural changes, as the pattern of individual components of demand reflects economic policies. Since Chenery's pioneering work (1960), the method, with some extension or improvement, has been applied extensively by academics[1] and governmental organisations, such as the US Congressional Office, the World Bank and the OECD (Korres, 1996). However, most applications have concentrated on industrialised economies, with only a few on developing countries such as China were substantial insights into the structural changes associated with economic development have been gained (Liu, 1998). Its extension to analyse structural change in South Africa will expand this literature by providing insights about structural change in an economy where economic policies and international isolation have impeded the process of economic development.

The present study adopts this decomposition approach to examine the structural changes in South Africa's economy between 1975 and 1993. The objectives are twofold. Firstly, it will analyse intertemporal variations in technical structures by using the national IO tables of 1975, 1981, 1988 and

[1] For instance, Chenery (1960), Kenemitsu and Ohnishi (1989) for Japan; Carter (1970), Feldman and Palmer (1985), Blair and Wyckoff (1989) for USA; Forssell (1985) for Finland, Staglin and Wessels (1972) for Germany; Driver (1994) for the UK; Urata (1988) for the Soviet Union; Albala-Bertrand (1996) for Chilie; and Korres (1996) for Greece; and Liu(1998) for China.

1993. This will give detailed information on the structural characteristics of the economy, which are analytically useful, but not apparent from the established time series data of industrial output and national income. Secondly, by decomposing output demand into six elements, this study intends to reveal the sources and magnitudes of factors responsible for output changes, and hence, insights into South Africa's poor apartheid era economic development.

The rest of this paper is organised as follows. Section II describes the methodology and the data. Section III compares the changes in the IO models over the sample period. Section IV discusses the results of a decomposition analysis of the sources of output growth. Section V compares the results with those from previous studies on other economies. The analyses lead to some important conclusions and policy implications in Section VI.

II. Measurement and Decomposition of Structural Change: an Input-Output Approach

The IO model is widely used in the study of economic structural changes for several reasons. First, an IO table provides a comprehensive and consistent statistical account of an economy by taking into account the most important economic transactions (or direct input coefficients), which generally cannot be obtained from a national statistical book in most countries, especially in developing countries. Second, an IO table explicitly accounts for the interdependence of different economic activities by incorporating the size and composition of the various industries' mutual input demands (measured by interdependent coefficients or the Leontief inverse), which enable us to incorporate both direct and indirect industrial interrelations into the analysis. Third, as the comparison takes two or more snapshots of the economy at different moments to analyse the changes over a period of time, it exploits most of the advantages of the IO framework and avoids the static nature of the method. Fourth, within the IO framework, it is possible to decompose the structure changes into different components, such as final demand, import substitution, export expansion, and technological change.

1 Measurement and Comparison of the Magnitude of Structural Changes

By definitions, IO (or technical) coefficients represent the direct requirements of the output of any sector i per unit of any other purchasing sector j (i,j = 1,2, ..., n); the Leontief inverse matrix represents the direct and indirect requirements of sector i per unit of final demand for the output of sector j. This is a powerful tool of analysis since it measures the total impact of exogenous shocks on the economy.

The matrices that form the basis of the present study are 34 order IO coefficients (A) and Leontief inverse (R) matrices. In order to evaluate changes in these matrices over time, we firstdefine the difference matrices:

$$\Delta \boldsymbol{A} = \boldsymbol{A}^{t} - \boldsymbol{A}^{0} \qquad \Delta a_{ij} \in \Delta \boldsymbol{A} \tag{1}$$

$$\Delta \boldsymbol{R} = \boldsymbol{R}^{t} - \boldsymbol{R}^{0} \qquad \Delta r_{ij} \in \Delta \boldsymbol{R} \tag{2}$$

where $\boldsymbol{\Delta A}$ and $\boldsymbol{\Delta R}$ are the difference matrices. $\boldsymbol{A^t}$ and $\boldsymbol{A^0}$ are direct (34 order) coefficient matrices for the base year (0) and terminal year (t) respectively, and $\boldsymbol{R^t}$ and $\boldsymbol{R^0}$ are the corresponding Leontief inverse matrices.

Second, to avoid the self-cancelling effect of positive and negative coefficient differences, measurements of absolute differences for A matrix $(\bar{\boldsymbol{e}}^{\boldsymbol{a}})$ and R matrix $(\bar{\boldsymbol{e}}^{\boldsymbol{r}})$ are computed as:

$$\bar{e}^{a} = \sum_i \sum_j \left| a_{ij}^{t} - a_{ij}^{0} \right| \Big/ n^2 \quad (i, j = 1,2,...,34) a_{ij}^{t} \in A^{t}, a_{ij}^{0} \in A^{0} \tag{3}$$

$$\bar{e}^{r} = \sum_i \sum_j \left| r_{ij}^{t} - r_{ij}^{0} \right| \Big/ n^2 \quad (i, j = 1,2,...,34) r_{ij}^{t} \in R^{t}, r_{ij}^{0} \in R^{0} \tag{4}$$

where *n* is the number of sectors.

Third, we also employ the measures of absolute relative differences (Harrigan, *et al*., 1980) for the A matrix $(\bar{\xi}^{a})$ and the R matrix $(\bar{\xi}^{r})$ to gauge the relative importance of these differences:

$$\bar{\xi}^{a} = \frac{\sum_i \sum_j \left| a_{ij}^{t} - a_{ij}^{0} \right| \Big/ a_{ij}^{0}}{(n^2 - k)} \quad (i, j = 1,2,...,34) a_{ij}^{t} \neq 0, a_{ij}^{t} \in A^{t}; a_{ij}^{0} \neq 0, a_{ij}^{0} \in A^{0}. \tag{5}$$

$$\bar{\xi}^{r} = \frac{\sum_i \sum_j \left| r_{ij}^{t} - r_{ij}^{0} \right| \Big/ r_{ij}^{0}}{(n^2 - l)} \quad (i, j = 1,2,...,34) r_{ij}^{t} \neq 0, r_{ij}^{t} \in R^{t}; r_{ij}^{0} \neq 0, r_{ij}^{0} \in R^{0}, \tag{6}$$

where *k* is the number of corresponding cells for which either $\boldsymbol{\alpha^t_{ij}}$ or $\boldsymbol{\alpha^0_{ij}}$ are zero, and *l* is the number of corresponding cells for which either $\boldsymbol{r^t_{ij}}$ or $\boldsymbol{r^0_{ij}}$ are zero.

To draw attention to the overall similarity or dissimilarity between the respective matrices rather than the differences in individual coefficients, a simple regression model can be used for crudely estimating the statistical significance of the differences:

$$a_{ij}^{t} = \hat{\alpha} + \hat{\beta} a_{ij}^{0} + \varepsilon_{ij} \tag{7}$$

The contribution made by individual sectors to the general results estimated by (7) can be compared using:

$$a_{ij}^{t} = \hat{\alpha}_j + \hat{\beta}_j a_{ij}^{0} + \varepsilon_{ij} \quad (j = 1,2,...,34) \tag{8}$$

Joint *F* tests[2] are applied to compare the estimated $\hat{\alpha}$ and $\hat{\beta}$ values in (8) with the expected values of zero and unity. The tests can be obtained from the following: the quadratic form of the joint distribution of $\hat{\alpha}$ and $\hat{\beta}$,

$$\boldsymbol{Q} = \frac{1}{\sigma_u^2}[\boldsymbol{n}(\alpha - \alpha)^2 + 2\boldsymbol{n}\bar{\boldsymbol{X}}(\alpha - \alpha)(\beta - \beta) + \sum \boldsymbol{X}_i^2(\beta - \beta)^2] \tag{9}$$

has a χ^2 distribution with 2 degrees of freedom. Recalling the definition of the *F* distribution, it then follows that

$$\boldsymbol{F} = \frac{\boldsymbol{Q}/2}{\hat{\sigma}_u^2/\sigma_u^2} \tag{10}$$

has the ***F*** distribution with 2 and n-2 degrees of freedom.

2 Decomposition of Structural Changes in Output

The decomposition methodology within the IO framework was originally developed by Chenery (1960) and Chenery *et al.* (1962), and extended by Syrquin (1976), Kubo (1986) and Wyckoff and Sakurai (1992). A considerable number of recent applications of the method exist in the literature (e.g., Fujimagari, 1989; Lee, 1990; Barker, 1990; Driver, 1994; Dewhurst, 1994; Korres, 1996; Liu, 1998). Building on this literature, we will trace the change in industrial gross output to six sources, i.e., domestic private consumption demand expansion, government consumption demand expansion, investment demand expansion, export demand expansion, import substitution effects, and changes in intermediate input usage as measured by the IO coefficients. Total change in output equals the sum of the changes in each sector and can also be decomposed either by sector or by category of demand.

The decomposition of output changes involves separating out the influence of technology, demand growth, demand composition and trade (i.e., export and import) on the growth of total output and that of particular sector's output. The analysis of demand-side sources of growth is based on the following material balance condition:

$$x_i = d_i(w_i + c_i + v_i + g_i) + e_i \tag{11}$$

where $\boldsymbol{x}_i$ denotes the domestic output in sector i, $\boldsymbol{d}_i$ is the ratio of domestic demand for domestically produced goods and services to total domestic demand in sector i defined as $(\boldsymbol{x}_i - \boldsymbol{e}_i)/(\boldsymbol{w}_i + \boldsymbol{c}_i + \boldsymbol{v}_i + \boldsymbol{g}_i)$, $\boldsymbol{w}_i$ is intermediate demand, $\boldsymbol{c}_i$ is consumption demand, $\boldsymbol{g}_i$ is government consumption demand, $\boldsymbol{v}_i$ is investment demand, and $\boldsymbol{e}_i$ is export demand. In matrix notation and using an input-output coefficient, (11) can be transformed to:

$$X = (I - \hat{D}A)^{-1}[\hat{D}(C + V + G) + E)] \tag{12}$$

[2] For a detailed description of the methodology, see Johnston (1972), pp.28-9.

where $\hat{\boldsymbol{D}}$ is a diagonal matrix of ***d*** ratios, ***A*** is the matrix of IO coefficients, and ***X, C, V, G*** and ***E*** are vectors. Then, the decomposition of output change over a period amounts to calculating the first difference of (12). That is:

$$\begin{aligned}\Delta X &= X_1 - X_0 \\ &= (I - \hat{D}_1 A_1)^{-1}[(\hat{D}_1(C_1 + V_1 + G_1) + E_1] - (I - \hat{D}_0 A_0)^{-1}[(\hat{D}_0(C_0 + V_0 + G_0) + E_0]\end{aligned} \tag{13}$$

Let ***R*** denotes the Leontief inverse matrix, $(\boldsymbol{I} - \hat{\boldsymbol{D}}\boldsymbol{A})^{-1}$, and ***F*** denotes the final demand matrix, $[\hat{D}(C + V + G) + E]$, then (13) can be rewritten as:

$$\Delta X = R_0 \Delta F + \Delta R F_1 \tag{14}$$

After some manipulation, the change in output can be decomposed into several different sources as described by

$$\Delta X = R_0 \hat{D}_0 \Delta A X_1 + R_0 \hat{D}_0 \Delta C + R_0 \hat{D}_0 \Delta V + R_0 \hat{D}_0 \Delta G + R_0 \Delta E + R_0 \Delta \hat{D}(C_1 + V_1 + G_1 + W_1) \tag{15}$$

The first term on the right-hand side of (15), $R_0 \hat{D}_0 \Delta A X_1$, represents the effect of change in input-output coefficients, measured by changes in total coefficients; the second term, $R_0 \hat{D}_0 \Delta C$, represents the effect of consumption demand expansion; the third term, $R_0 \hat{D}_0 \Delta V$, the effect of investment demand expansion; the fourth term, $R_0 \hat{D}_0 \Delta G$, represents the effect of government consumption demand expansion; the fifth term, $R_0 \Delta E$, the effect of export demand expansion; and the sixth term, $R_0 \Delta \hat{D}(C_1 + V_1 + G_1 + W_1)$, the effect of import substitution measured by changes in the ratio of domestic demand for domestically produced goods and services to total demand. Dividing these individual sources by $\boldsymbol{\Delta X}$, we can obtain the share measures of structural change indicating how much each decomposition term affects changes in the share of output accounted by each industry.

3 Data and Some Issues in Application

The main sources of data used in this study are South African Basic Values IO tables for 1975, 1981, 1988, and 1993, as released by the Central Statistical Service (CSS). Basic Value Input Output Tables are also available for 1978, 1984, and 1989 but have been excluded in order to focus on the 1975-81, 1981-88, and 1988-93 periods, which were felt to best fit the three distinct periods discussed in the introduction.

As a complete set of production price deflators was not available for all industries, we first attempted to deflate our data by employing a full set of GDP component deflators as derived from the South African Reserve Bank's Quarterly Bulletin. However, comparison of these deflators to the available output deflators clearly demonstrates that they will exaggerate the decline in output growth in some industries during the post 1981 period and therefore introduce substantial bias into our results. We therefore, employed output deflators available from the CSS for the Agriculture, Mining, Manufacturing, and Utilities sectors, which account for approximately 55 percent of production. However, as we must deflate the output of all sectors, we then adjusted the available GDP deflators for the other sectors in an effort to make them more compatible with the other output deflators.[3] This adjustment was made by multiplying the available GDP component deflator for a given year by the ratio of the total South African output deflator to the total GDP deflator for that year. Given our data limitations, we feel that these adjusted deflators provide the most accurate and consistent price data available for our purposes.

Finally, to ensure that our inter-industry transactions data is based on equivalent industrial definitions in each year, we have aggregated the tables to match the available price data. Thus, the modelling was run using a 10-sector version and a 34-Sector version, with the later using output price deflators available from the CSS to break the Mining sector into 2 sectors and the Manufacturing sector into 24 sectors. We present the results of the 10-sector version in the following sections for convenience of presentation only. Similar results for the 34-sector version are available upon request.

III. A Comparison of Structural Changes

1 Overview of output structural changes

Table 1 shows some dramatic changes in output share of the national economy over the entire 1975-93 period, which suggests that South Africa experienced service-oriented structural change similar to that of many economies. Thus, while the Manufacturing and Construction sectors suffered substantial declines in their share of output, Transportation & Communication, Financial Services, and Social & Personal Services experienced substantial gains in their share of output. However, reviewing the change in output shares for the sub-periods suggests a quite different interpretation. Thus, the 1975-81 period actually generated faster than average growth in the Mining and Manufacturing sector, while their decline was focused in the post-1981 period. This suggests that the intersectoral structure of economic growth changed dramatically in the early 1980s, and also indicates that the traditional engines of South African growth, Mining and Manufacturing, were no longer driving the economy forward. Finally, as Construction goods are predominantly investment goods, we must note that the consistent negative change in this sector's share of output is indicative of the relatively low investment demand,

[3] These were the Construction, Commerce, Transportation and Communication, Financial Services, Social and Personal Services, and Other categories.

relative to international standards, which plagued the South African economy over the entire 1975-93 period.

Table 1 Changes in output and GDP shares (%) by sectors

	Change in Production Share				Change in GDP Share			
	1975-93	1975-81	1981-88	1988-93	1975-93	1975-81	1981-88	1988-93
Agriculture	0.29	0.17	0.06	0.06	0.43	0.28	0.07	0.09
Mining	0.52	1.94	0.05	-1.48	-2.09	-1.38	-0.83	0.12
Manufacturing	-3.27	1.22	-1.20	-3.29	-2.15	2.83	-2.71	-2.27
Utilities	0.56	-0.04	0.31	0.29	2.33	0.67	1.02	0.65
Construction	-4.27	-1.72	-1.99	-0.56	-2.82	-1.30	-1.25	-0.28
Commerce	-0.22	-1.82	1.13	0.48	-1.09	-1.87	1.00	-0.22
Transportation and Communication	2.61	0.88	-0.13	1.86	1.23	0.76	-0.16	0.63
Financial Services	2.08	-0.71	0.89	1.89	3.12	0.10	2.08	0.95
Social and Personal Services	1.22	0.12	0.60	0.49	0.69	0.09	0.42	0.18
Other	0.48	-0.05	0.26	0.27	0.34	-0.19	0.38	0.16

Changes in a sector's GDP share were not always in the same direction as changes in its output share. For instance, while Mining's output share increased during 1975-81, its GDP share fell; the opposite was true over the 1981-88 and 1988-93 periods. The difference is due to change in the ratio of intermediate demand to output. In this sense, the analysis based on sources of output changes may reveal more clearly some fundamental problems related to an economic structure than one based on sources of GDP change.

2. Changes in IO coefficients and interdependent coefficients

Generally, the change in IO coefficients is interpreted loosely as technological change. Technological change - change in the physical requirements for the specific goods and services used in producing a given basket of goods, however, may be only one of many influential factors that may also contribute to the changes. [4] Nevertheless, as a primary interest of this study is in the overall effects of changes in IO coefficients, we thus define technological change not in a purely technical manner, but in an empirical manner as increases or decreases in direct input requirements, represented by IO coefficients. Changes in interdependent coefficients (or Leontief inverse matrix), on the other hand, allow us to assess the additional indirect effects of differences in IO coefficients. By definition, the larger the coefficients, the higher the degree of interdependence between industrial sectors.

[4] Such as product mix, scale of operations, relative prices of input, degree of capacity utilisation, and degree of aggregation of industrial sectors.

Table 2 Distribution of changes in coefficients

	IO coefficients matrix (A)			Leontief inverse matrix (R)	
Class Mid-point	Number of observation	Cumulative frequency (%)	Class Mid-point	Number of observation	Cumulative frequency (%)
-0.045	15	1.3	-0.045	20	1.7
-0.040	3	1.6	-0.040	6	2.2
-0.035	1	1.6	-0.035	7	2.9
-0.030	4	2.0	-0.030	8	3.5
-0.025	7	2.6	-0.025	9	4.3
-0.020	14	3.8	-0.020	15	5.6
-0.015	23	5.8	-0.015	17	7.1
-0.010	37	9.0	-0.010	30	9.7
-0.005	29	11.5	-0.005	47	13.8
0.000	459	51.2	0.000	190	30.2
0.005	362	82.5	0.005	404	65.1
0.010	72	88.8	0.010	104	74.1
0.015	45	92.6	0.015	82	81.2
0.020	24	94.7	0.020	58	86.2
0.025	19	96.4	0.025	28	88.7
0.030	8	97.1	0.030	24	90.7
0.035	12	98.1	0.035	16	92.1
0.040	3	98.4	0.040	25	94.3
0.045	2	98.5	0.045	15	95.6
0.050	3	98.8	0.050	10	96.5
>0.050	14	100.0	>0.050	41	100.0
Σ	1156	100.0	Σ	1156	100.0

The elements of change in IO coefficients (**ΔA)** and changes in independent coefficients (**ΔR)** have been formed into a frequency distribution and shown in detail in Table 2 for the 1975-93 period. Table 3 then provides means ($\overline{\Delta}$), standard deviations ***(σ***), absolute difference ($\bar{\boldsymbol{e}}$), absolute relative difference ($\overline{\xi}$), and the number of sectors (n) that changed significantly for the respective element sets, for the entire 1975-93 period, as well as the sub-periods.

Table 3 Magnitude of changes in coefficients

	$\overline{\Delta \boldsymbol{a}}$	σ_a	$\bar{\boldsymbol{e}}_{\boldsymbol{a}}$	$\overline{\xi}^{\boldsymbol{a}}$	n_a	$\overline{\Delta \boldsymbol{r}}$	σ_r	$\bar{\boldsymbol{e}}_{\boldsymbol{r}}$	$\overline{\xi}^{\boldsymbol{r}}$	n_r
1975-81	0.00039	0.01142	0.0044	0.897	28	0.0022	0.0166	0.0073	0.370	22
1981-88	-0.00003	0.01670	0.0058	1.210	22	0.0008	0.0251	0.0102	2.894	16
1988-93	0.00065	0.01902	0.0069	1.157	24	0.0020	0.0295	0.0133	0.583	23
1975-93	0.00101	0.01619	0.0067	1.461	24	0.0050	0.0259	0.0131	0.940	28

Table 2 shows that the distribution of direct coefficient differences for 1975-93 is centred around zero, although skewed to the right, thereby indicating that the average of the direct coefficients in 1993 is greater than it was in 1975. In terms of proportions of IO coefficient changes, 39.7 per cent stayed at the same level as in 1975, 48.8 per cent increased and 11.5 per cent decreased . However, the absolute difference ($\bar{\boldsymbol{e}}^{\boldsymbol{a}}$) and particularly the absolute relative differences ($\overline{\xi}^{\boldsymbol{a}}$) are larger than the mean difference ($\overline{\Delta \boldsymbol{a}}$), and therefore indicate the existence of substantial differences in individual coefficients for some cells. Moreover, by applying a simple regression model (Equation 8) with joint (null) hypothesis tests that if α^t and β^t are close to zero and unity, respectively, in any absolute or

meaningful statistical sense, it is found that, in terms of IO coefficients, only 10 out of 34 sectors were not statistically significant from the values in starting year at $p < 0.05$[5]. Thus, we can conclude that 24 sectors have changed their technology over the 1975-93 period. Furthermore, similar analysis reveals that significant changes in technology occurred in each sub-period, although the negative value for $\overline{\Delta \boldsymbol{a}}$ during the 1981-88 period suggests that the structure of technological change during this period may have been somewhat different than during the other periods.

Changes in the Leontief inverse for the entire 1975-93 period are even more skewed to the positive as 16.4 per cent had no change, 69.8 per cent increased and 13.8 per cent decreased (Table 2). This suggests that interindustrial linkages were strengthened considerably. Moreover, the test of the changes in the interdependence coefficients (the Leontief inverse) shows that 28 of 34 sectors had significant changes in their interdependence coefficients (Table 3). This leads us to rejecting the null hypothesis and to conclude that some substantial change in the economy's IO structure had occurred between 1975 and 1993. However, the relatively low value of $\overline{\Delta r}$ and n_r, as well as the high value of $\overline{\xi^r}$ during the 1981-88 period suggest that a few sectors saw dramatic changes in their intersectoral linkages during this period while others may have seen little or no change.

The total (direct and indirect) impacts of these structural changes can be assessed by constructing backward and forward sectoral output multipliers, which measure the total value of industry requirements per unit of final demand for the industry in question. The higher the multiplier the greater the interdependence of the sector with the rest of the economy. From Table 4, we can see that both the forward and backward output multipliers increased for all sectors during the 1975-93 period. Nevertheless, the income multiplier decreased for nine out of ten industries, a finding that is consistent with the declining per capita income which plagued South Africa for much of this period. Thus, while the economy grew more interdependent over the entire 1975-93 period, its ability to generate real income increases actually declined.

Analysis of the three sub-periods once again reveals different trends. Thus, for example, changes in the forward output multiplier reveal that during the 1975-81 period, the economy substantially increased its dependence on inputs from the Mining, Manufacturing, and Transportation & Communication sectors, but actually saw reduced dependence on inputs produced in the Utilities, Construction, and Commerce sectors. In contrast, during the 1981-88 period, changes in the forward output multipliers reveal a considerable decline in the usage of inputs produced by the Mining and Transportation &

[5] This means that neither α nor β exceeds the value T=2.037 with 32 df at the 5 per cent level of significance.

Table 4 Changes in multipliers and in share of contribution to value added (VA): 1975-93

	Change in Backward Output Multiplier		Change in Forward Output Multiplier		Change in Income Multiplier		Change in Share of contribution
	Value	Rate	Value	Rate	Value	Rate	to total VA(%)
Whole Period (1975-1993)							
Agriculture	0.400	0.234	0.141	0.103	0.040	0.010	-0.005
Mining	0.369	0.250	0.086	0.060	-0.116	-0.025	-0.004
Manufacturing	0.174	0.075	0.610	0.133	-0.831	-0.135	-0.015
Utilities	0.092	0.050	0.091	0.051	-1.056	-0.214	0.010
Construction	0.280	0.122	0.117	0.090	-0.860	-0.127	-0.037
Commerce	0.265	0.165	0.204	0.106	-0.288	-0.054	-0.018
Transportation and Communication	0.349	0.231	0.525	0.337	-1.025	-0.177	0.025
Financial Services	0.129	0.094	0.341	0.177	-0.396	-0.095	0.032
Social and Personal Services	0.373	0.246	0.254	0.231	-0.731	-0.125	0.011
Other	0.149	0.059	0.212	0.170	-0.606	-0.096	0.002
Subperiod 1 (1975-1981)							
Agriculture	0.240	0.140	0.003	0.002	0.272	0.067	-0.004
Mining	0.095	0.064	0.249	0.175	-0.184	-0.040	0.029
Manufacturing	0.077	0.033	0.395	0.086	-0.125	-0.020	0.006
Utilities	-0.030	-0.016	-0.095	-0.053	-0.636	-0.129	0.003
Construction	0.072	0.031	-0.013	-0.010	-0.150	-0.022	-0.013
Commerce	0.099	0.061	-0.051	-0.027	0.096	0.018	-0.029
Transportation and Communication	0.136	0.090	0.080	0.051	-0.087	-0.015	0.011
Financial Services	0.020	0.014	0.099	0.051	0.378	0.090	-0.007
Social and Personal Services	0.067	0.044	0.016	0.014	-0.047	-0.008	0.002
Other	-0.089	-0.035	0.004	0.003	-0.075	-0.012	0.003
Subperiod 2 (1981-1988)							
Agriculture	-0.117	-0.060	0.075	0.054	-0.713	-0.164	0.004
Mining	0.121	0.077	-0.287	-0.172	0.118	0.027	-0.011
Manufacturing	0.026	0.011	0.314	0.063	-0.605	-0.100	-0.005
Utilities	-0.077	-0.042	-0.063	-0.037	-0.379	-0.088	0.007
Construction	0.024	0.010	0.001	0.001	-0.773	-0.117	-0.017
Commerce	0.038	0.023	0.126	0.067	-0.479	-0.088	0.011
Transportation and Communication	-0.083	-0.050	-0.073	-0.045	-1.130	-0.198	0.000
Financial Services	0.084	0.060	0.024	0.012	-0.305	-0.067	0.005
Social and Personal Services	0.057	0.036	0.063	0.057	-0.431	-0.074	0.007
Other	0.176	0.071	0.069	0.055	-0.434	-0.069	-0.001
Subperiod 3 (1988-1993)							
Agriculture	0.277	0.151	0.063	0.043	0.481	0.132	-0.006
Mining	0.154	0.091	0.124	0.090	-0.050	-0.011	-0.022
Manufacturing	0.071	0.029	-0.099	-0.019	-0.101	-0.018	-0.017
Utilities	0.200	0.114	0.249	0.152	-0.041	-0.010	0.001
Construction	0.185	0.078	0.130	0.101	0.063	0.011	-0.006
Commerce	0.129	0.074	0.129	0.064	0.095	0.019	-0.001
Transportation and Communication	0.295	0.189	0.518	0.331	0.192	0.042	0.014
Financial Services	0.025	0.017	0.219	0.107	-0.470	-0.110	0.034
Social and Personal Services	0.249	0.152	0.175	0.148	-0.253	-0.047	0.002
Other	0.062	0.024	0.139	0.105	-0.098	-0.017	0.001

[a] This column is calculated based on the value added (VA) multiplier, an alternative measure indicating the relative contribution to value added by each sector per unit worth of total final demand. It is argued that the VA multiplier is more illustrative than others as the latter do not take into account of final demand changes. For detailed description and discussion of the method, see Blair and Wyckoff (1989).

Communication sectors, but a relatively large increase in the usage of inputs produced by the Commerce sector.

Changes in the backward output multiplier suggest that backward input demand linkages increased in all three sub-periods for most industries. Thus, only the Utilities sector reduced its backward linkages in both the 1975-81 and 1981-88 period while backward linkages declined in the Other category during

1975-81 and in the Agriculture and Transportation & Communication sectors during 1981-88. Interestingly, both the Mining and Manufacturing sectors experienced increases in their backward output multipliers in all periods, which suggests that they continued to increase their potential to function as forward sectors driving the process of growth.

Nevertheless, the last column of Table 4 once again highlights the distinction between the 1975-81 period and the later periods, as only the Utilities (+), Construction (-), Transportation & Communication (+), and Social & Personal Services (-) sectors exhibited the same trends in each of the three sub-periods. Most significantly, the Manufacturing and Mining sectors both recorded increases in their contribution share to total value added in 1975-81, but decreases in the later periods. We therefore interpret this as clearly demonstrating that while these sectors played a substantial role in South Africa's development before 1981, they were unable to play this role in the later period. (For the 34-sector version of Table 4, see Appendix Tables A1, A2, and A3.)

IV. Decomposition of Output Changes by Sources

Decomposition of growth into components for the period 1975-93 (including the three sub-periods of 1975-81, 1981-88, and 1988-93) is presented in Table 5. The first column is the growth rates over the entire period, while for ease of comparison column 2 provides annualised growth rates. Columns 3 to 8 then report the growth that can be attributed to the different components of output growth, and therefore sum to the overall growth rate reported in column 1.

Over the whole 1975-93 period, the total growth across all 10 sectors was 38.6 percent. Investment "expansion" is associated with a 11.5 percent reduction in total output during this period, thereby demonstrating the overwhelmingly negative effect that foreign disinvestment and declining private and public investment demand had on the South African economy. Looking at sub-periods reveals that the contribution of investment demand was positive in the 1975-81 period when it alone accounted for 5.2 percent of growth and negative in the 1981-88 and 1988-93 periods when it caused declines in output that respectively amounted to -8.6 percent and -5.2 percent. However, as we discussed above, much of the investment growth which occurred in the 1975-81 period was public investment in the economically nonviable strategic industries, a fact which suggests that the positive contribution made by investment growth in this period may have had little or no impact on long term growth.

Table 5 Sources of output structural change: 1975-93

	Overall growth (%)	Annual growth (%)	Contribution to output growth					
			Private consumption	Government consumption	Investment expansion	Export expansion	Import substitution	Changes in IO Coefficients
1975-93								
Agriculture	50.2	2.29	33.1	2.7	-11.2	1.1	4.8	19.6
Mining	44.9	2.08	3.9	0.5	-4.7	31.1	8.1	6.0
Manufacturing	27.5	1.36	17.1	2.6	-12.7	13.4	2.5	4.5
Utilities	52.5	2.37	25.9	3.7	-6.3	10.3	2.4	16.5
Construction	-22.0	-1.37	1.3	3.4	-32.9	0.3	0.2	5.8
Commerce	38.5	1.83	30.6	2.2	-7.1	3.0	1.0	9.0
Transport & Communication	119.6	4.47	47.7	4.4	-8.6	13.5	5.8	56.7
Financial Services	73.4	3.11	34.6	6.8	-2.3	5.2	5.0	24.1
Social & Personal Services	137.1	4.91	81.3	7.4	-1.2	2.2	-1.2	48.7
Other	79.5	3.30	38.2	-32.5	-12.1	13.5	-8.0	80.3
Total	**38.6**	**1.83**	**22.0**	**2.4**	**-11.5**	**10.4**	**2.7**	**12.6**
1975-81								
Agriculture	28.3	4.25	12.1	1.6	12.3	2.4	4.6	-4.7
Mining	63.6	8.55	1.3	0.3	2.7	34.7	11.9	12.7
Manufacturing	25.3	3.83	7.8	2.1	6.4	3.2	2.9	2.9
Utilities	18.4	2.86	5.2	3.0	3.3	6.5	3.0	-2.6
Construction	5.7	0.92	0.2	1.2	5.9	0.2	0.3	-2.1
Commerce	12.1	1.93	5.9	2.2	4.1	0.6	1.0	-1.8
Transport & Communication	50.5	7.05	17.0	2.8	2.6	16.8	4.3	6.9
Financial Services	21.1	3.24	0.7	2.8	2.0	2.8	3.9	9.0
Social & Personal Services	38.6	5.59	33.1	2.6	0.6	0.0	-0.6	2.8
Other	12.0	1.91	8.1	-2.1	5.8	6.1	-3.5	-2.3
Total	**25.0**	**3.79**	**6.7**	**1.9**	**5.2**	**5.6**	**3.1**	**2.5**
1981-88								
Agriculture	5.2	0.73	10.7	0.8	-9.9	-4.7	-1.5	9.9
Mining	3.1	0.43	0.5	0.1	-4.8	18.1	-2.3	-8.5
Manufacturing	0.6	0.09	2.4	0.2	-10.1	4.3	0.1	3.7
Utilities	9.0	1.24	7.1	0.9	-5.7	5.3	0.0	1.4
Construction	-24.0	-3.85	0.5	0.9	-24.4	0.2	-0.1	-1.2
Commerce	12.2	1.65	8.1	0.7	-4.8	2.5	-0.4	6.1
Transport & Communication	1.2	0.17	15.4	0.5	-5.1	-1.3	0.7	-9.0
Financial Services	14.0	1.90	10.6	3.8	-1.1	0.8	0.4	-0.5
Social & Personal Services	35.0	4.39	18.8	5.5	-0.9	1.5	1.9	8.3
Other	17.5	2.34	13.6	-15.9	-9.7	7.1	-0.5	23.0
Total	**3.0**	**0.42**	**5.2**	**0.5**	**-8.6**	**4.1**	**-0.2**	**2.1**
1988-93								
Agriculture	10.9	2.09	6.2	0.1	-8.3	3.6	1.6	7.7
Mining	-10.2	-2.12	1.2	0.1	-1.0	-20.4	6.4	3.6
Manufacturing	0.4	0.08	5.8	0.2	-5.8	3.6	-0.6	-2.8
Utilities	20.1	3.72	7.9	-0.1	-3.2	-2.2	1.0	16.7
Construction	-2.8	-0.56	0.7	1.5	-14.7	-0.4	0.2	9.8
Commerce	10.4	2.00	12.5	-0.6	-4.8	-0.5	0.5	3.2
Transport & Communication	43.5	7.48	5.3	0.5	-2.6	-1.3	0.0	41.4
Financial Services	27.9	5.05	17.5	0.1	-2.8	0.9	2.5	9.7
Social & Personal Services	28.2	5.09	12.2	-2.0	-0.8	0.0	0.3	18.5
Other	28.1	5.08	9.3	-7.9	-5.4	-2.4	-7.4	42.0
Total	**7.9**	**1.54**	**7.4**	**-0.1**	**-5.2**	**-0.4**	**0.6**	**5.5**

Private and government consumption demand together accounted for a 24.4 percent increase in total output over the entire 1975-93 period, which is equivalent to 63.3 percent of all output growth. However, while the actual growth in total output attributable to private consumption is fairly stable, this is not the case for government consumption demand. Thus, a 1.9 percent, 0.5 percent, and -0.1 percent increase in total output can be respectively attributed to changes in government consumption demand in the 1975-81, 1981-88, and 1988-93 periods. This finding suggests that the government's demand for products had a much larger impact on structural change during the 1975-81 period than in later periods.

Turning to export expansion and import substitution, we see that both contributed positively to growth over the entire 1975-83 period, with a 10.4 percent increase in output attributable to export growth and a 2.7 percent increase attributable to import growth. However, import-substituting growth was primarily concentrated in the 1975-81 period when it increased total output growth by 3.1 percent. In contrast, growth attributable to export expansion accounted for a 5.6 percent increase in total output during 1975-81 and a 4.1 percent increase during 1981-88, with much of this growth concentrated in the Mining and Manufacturing industries. This would seem to be indicative of the government's shift in the early 1980s to a more export promoting industrial policy that was heavily dependent on export subsidies in order to overcome international sanctions. However, considering the cost of the export subsidies, and the fact that increased exports only accounted for a 3.1 percent increase in total output during the 1981-88 period, we can only conclude that export promotion did not effectively overcome the increasing international sanctions that limited its effectiveness.

The changes in IO coefficients[6] indicate interesting shifts in the pattern of intermediate demand. Thus, Increases in intermediate demand for the entire 1975-93 period had a positive effect in all sectors and accounted for a 12.6 percent increase in total output, which amounted to 32.6 percent of all output growth. These effects were greatest in tertiary sectors such as Transport & Communication, Financial Services, and Social & Personal Services, while Mining, Manufacturing, Construction, and Commerce saw only one digit growth in demand attributable to intermediate input usage over 18 years. These figures, together with the changes in the multipliers discussed in the previous section, suggest that as economic development progressed over the entire 1975-93 period, intersectoral linkages were enhanced as reflected by an increasing share of intermediate demand to final production. However, we also cannot escape the conclusion that several sectors, including Mining and Manufacturing, were becoming relatively less important input suppliers.

Looking closely at sectoral levels in different sub-periods, we find that changes in IO coefficients were somewhat varied. For example, in Mining, changes in IO coefficients played a large and positive role during the 1975-81 period (12.7 percent growth), but a large and negative role over 1981-88 (-8.5 percent growth), and a small positive role in 1988-93 (3.6 percent growth). This indicates that the forward linkages of the mining sector were significantly weakened during the 1981-88 period and that they did not recover by 1993, which can be interpreted to indicate that any efforts to promote economic growth by adding value to mining inputs, appear to have failed. By contrast, the effects on Agriculture,

[6] The causes of changes in IO coefficients may be due to a range of factors, such as technological progress, industrial mix, the scale of operation, the degree of capacity utilisation and so on. Whilst pure technological progress and the degree of capacity utilisation would lead one to expect declining IO coefficients, the effects of other factors on economic growth may not be always clear, and indeed dependent on situation. Thus, to analyse the causes of IO coefficient change is a complex issue and beyond the scope of the present study. Nevertheless, the problem is not serious to the present study as our objective is confined to analysing the effects on output change.

Utilities, Construction, and Commerce shifted from negative in the first sub-period to positive in the second and/or third sub-period. These changes show that intersectoral linkages did not increase in a steady upward trend in all industries.

V. Comparison of Sources of Growth

By calculating the proportion of total output growth attributable to each demand component, we can compare the results of the present study with those for similar studies of other countries. Thus, as Table 6 reveals, South Africa is clearly distinguished from other countries by the unbalanced structure of its economy.

Table 6. Comparison of source of output growth

	Period	Overall Growth (%)	Domestic demand expansion (1)=(2)+(3)	Consumption expansion (2)	Investment expansion (3)	Export expansion (4)	Import substitution (5)	Changes in IO coefficients (6)
S Africa	1975-93	38.6	33.4	63.3	-29.9	26.9	7.1	32.6
	1975-81	25.0	55.2	34.4	20.8	22.2	12.4	10.2
	1981-88	3.0	-97.3	190.0	-287.4	136.2	-7.5	68.6
	1988-93	7.9	27.7	93.1	-65.4	-4.5	7.9	68.9
China	1956-65		107.2	58.1	49.1	1.9	9.2	-18.3
	1965-75		85.7	39.4	46.3	5.6	-1.3	10.1
	1975-81		80.3	59.5	20.8	16.4	-7.9	11.2
	1987-92		48.1	28.4	19.7	19.4	3.2	29.3
India	1959-68		81.0	76.5	4.5	5.1	7.4	6.6
	1968-73		91.6	55.4	36.2	6.0	9.3	-7.0
USSR	1959-66		95.3	48.8	46.5	3.6	-0.8	2.0
	1966-72		95.1	59.3	35.8	9.5	-8.6	4.0
Korea	1963-70		81.8	n.a.	n.a.	21.9	-1.8	-1.9
	1970-73		51.9	n.a.	n.a.	55.7	-3.2	-4.4
Taiwan	1961-66		61.3	n.a.	n.a.	37.6	-1.1	2.2
	1966-71		52.7	n.a.	n.a.	49.5	-0.2	-2.0
Chile	1977-86		80.0	n.a.	n.a.	42.0	-30.0	8.0

Sources: Table 5 in this paper; Urata (1987), Albala-Bertrand (1996), Liu(1998).
Note: Columns 2-6 should add up to 100 per cent.

This can be seen in particular from the following four features: Firstly and most significantly, investment made a -29.9 percent contribution to economic growth in South Africa over the 1975-93 period, while in every other country, investment contributed positively to growth. As a result of this declining investment, total domestic demand expansion only contributed 33.4 percent of total output growth, which is extremely low by international standards. Secondly, consumption accounted for 63.3 percent of overall growth during 1975-93, a figure which is only eclipsed by India during the 1959-66 period. This fact coupled, with low overall growth rates, suggests that South Africa was functioning as a "survival economy" in which low growth made consumption expansion the dominant demand stimulant. Thirdly, export expansion accounted for 26.9 percent of all South African growth during 1975-93, which is a relatively large share. Nevertheless, if we consider that export growth only increased output by 10.4 percent over the entire 1975-93 period (Table 5), the absolute contribution of

export expansion was quite low in comparison to other developing capitalist countries such as Korea and Taiwan. Finally, given the current technological structure of the country's economy, the large role played by changes in the IO coefficients can be mainly interpreted as the result of inefficient input usage.

Turning next to the sub-periods, we see that during the 1975-81 period, South Africa experienced relatively balanced growth, with all components contributing positively to growth. However, even during this period South Africa can be distinguished from the other countries for several reasons. Firstly, even though the 1975-81 period was a period of significant investment expansion in South Africa, investment actually accounted for a relatively low share of total growth by international standards. Secondly, import-substitution also contributed a relatively high share of total growth, thereby demonstrating the extremely high level of import substituting activities which categorised the economy during this period. Finally, consumption demand expansion accounted for a relatively low proportion of total growth, suggesting that while respectable growth was achieved during this period, it could not substantially improve living standards.

The absence of significant growth in the South African economy after 1981 can be primarily attributed to the massive declines in investment demand that occurred in both the 1981-88 and 1988-93 period. In contrast, consumption expansion and export expansion respectively accounted for 190 and 136.2 percent of growth during the 1981-88 period while increased input usage accounted for 68.6 percent of total output growth. However, given the low growth rate over the period, the large shares of consumption, exports, and changes in the IO coefficients were mainly due to the dramatic decline in investment demand, which increases the relative contribution of the other components.

VI. Conclusions

Over the 1975-93 period, South Africa's economy steadily worsened because of the inherent inefficiencies of the apartheid regime, the costs of maintaining this system through internal repression and external aggression, South Africa's increasing international isolation, and the government's efforts to overcome this isolation through the development of strategic industries. Given this history, the present study has adopted the IO decomposition approach in order to provide a detailed analysis of structural change in apartheid era South Africa. This has revealed that over the 1975-93 period the South African economy was characterised by relatively slow unbalanced growth in which declining investment demand had a substantial negative impact on growth.

Analysis of the economy's changing IO structure also revealed considerable changes in South Africa's economy, in terms of both IO coefficients and interindustrial linkages. Thus, both forward and

backward output multipliers increased for all sectors during the 1975-93 period. This could theoretically be attributed to rising efficiency resulting from increased specialisation or declining efficiency resulting from excessive use of intermediate inputs and low capacity utilisation. However, given the presence of declining total factor productivity growth throughout most of our period of analysis (Nordas, 1996; IDC, 1996), it is reasonable to conclude that the large share of output growth attributable to changes in IO coefficients is indicative of the later rather than the former, although further study of this issue is required. This conclusion is also consistent with our finding that the income multiplier decreased for nine out of ten industries, which clearly demonstrates that despite increasing economic interdependence, the economy's ability to generate real income increases actually declined. Finally, changes in the value added multiplier demonstrate that South Africa's particularly poor performance after 1981, can be attributed at least partially to a decline in the ability of the Mining and Manufacturing sectors to drive economic growth.

Our decomposition analysis also reveals a clear distinction between the pre 1981 period which exhibits a relatively healthy economic structure with all demand components contributing positively to growth, and the post 1981 period of economic stagnation and highly unbalanced growth. Thus, during the 1975-81 period, the respectable growth achieved by South Africa can be largely attributed to investment expansion, a result that is indicative of the government’s substantial investment in strategic industries before 1981. Likewise, import-substituting growth was unusually high by international standards and accounted for 12.4 percent of all growth, which we interpret as evidence of the country’s efforts to achieve self-sufficiency in the face of growing international isolation. However, while export expansion also contributed a significant share of total growth during both the 1975-81 and 1981-88 periods, this share was low relative to other developing capitalist economies such as Korea and Taiwan. Moreover, we must emphasise that export expansion only increased output by 10.4 percent over the entire 1975-93 period, and can therefore conclude that South Africa's international isolation substantially reduced its ability to generate export-oriented growth.

The decomposition analysis of the 1981-88 and 1988-93 period reveals that the decline in investment demand is the single largest demand-side source for the stagnation in economic output that plagued the South African economy after 1981. However, while the poor economic climate and foreign disinvestment made private investment decline during this period, the much larger decline in public investment discussed above suggests that government policies were a significant contributor to this investment decline. As a result, the large share of the consumption and export component in total output growth during 1981-88 was not actually due to their own expansion, but can be more properly attributed to the massive decline in investment demand. Moreover, declines in export growth after 1988 left consumption demand to provide 93.1 percent of all growth in the 1988-93 period. This extremely

unbalanced economic structure demonstrates that the South African economy manifestly failed to overcome the burdens of the apartheid system as well as the costs of international opposition to it.

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Appendix

Table A1: Changes in Backward Output Multipliers (34 Sectors): 1975-93

	Output Multiplier (K_{o1})				Change in Output Multiplier			
	1975	**1981**	**1988**	**1993**	**1975-93**	**1975-81**	**1981-88**	**1988-93**
Agriculture	1.725	1.941	1.847	2.135	0.409	0.216	-0.095	0.288
Coal Mining	1.468	1.724	1.908	2.242	0.774	0.257	0.184	0.334
Other Mining	1.459	1.540	1.657	1.727	0.268	0.081	0.117	0.070
Food	2.528	2.627	2.740	2.872	0.343	0.099	0.113	0.132
Beverages	2.415	2.524	2.532	2.609	0.194	0.110	0.008	0.077
Tobacco Products	2.287	2.604	2.456	2.743	0.456	0.317	-0.148	0.288
Textiles	2.339	2.443	2.400	2.340	0.001	0.104	-0.043	-0.060
Clothing	2.300	2.387	2.306	2.430	0.131	0.087	-0.081	0.124
Leather Products	2.379	2.623	2.646	2.736	0.357	0.244	0.024	0.089
Footwear	2.275	2.308	2.247	2.280	0.005	0.033	-0.061	0.033
Wood & Wood Products	2.287	2.222	2.320	2.341	0.054	-0.065	0.098	0.021
Furniture	2.194	2.229	2.421	2.406	0.212	0.035	0.191	-0.015
Paper and Printing	2.140	2.273	2.294	2.447	0.307	0.133	0.020	0.153
Chemical Products	2.389	2.391	2.334	2.271	-0.118	0.001	-0.057	-0.063
Petroleum and Coal Products	2.298	2.313	2.493	2.672	0.374	0.015	0.180	0.179
Rubber and Plastic Products	2.208	2.333	2.249	2.627	0.419	0.125	-0.084	0.379
Ceramics	1.888	1.811	2.370	1.831	-0.057	-0.077	0.559	-0.539
Glass Products	2.181	2.067	2.167	2.030	-0.151	-0.114	0.101	-0.138
Other Non-Metallic Mineral Products	1.983	1.929	2.073	2.026	0.043	-0.054	0.144	-0.047
Iron and Steel	1.995	2.145	2.174	1.967	-0.028	0.150	0.029	-0.207
Non -Ferrous Metals	2.245	2.206	2.075	2.180	-0.064	-0.039	-0.131	0.105
Metal Products	2.196	2.261	2.335	2.410	0.214	0.065	0.073	0.075
Machinery	2.080	2.149	2.298	2.180	0.100	0.069	0.150	-0.118
Electrical Machinery	2.301	2.232	2.386	2.197	-0.104	-0.069	0.154	-0.189
Motor Vehicles	2.828	3.063	2.652	2.668	-0.160	0.235	-0.411	0.016
Other Transport Equipment	2.207	2.353	2.030	2.202	-0.006	0.146	-0.323	0.172
Other Mfg. Industries	2.059	2.254	2.210	2.405	0.346	0.195	-0.043	0.195
Utilities	1.873	1.865	1.793	1.962	0.089	-0.008	-0.072	0.170
Construction	2.248	2.274	2.343	2.465	0.218	0.026	0.069	0.122
Commerce	1.627	1.720	1.769	1.873	0.246	0.092	0.049	0.104
Transportation and Communication	1.559	1.638	1.576	1.857	0.297	0.079	-0.062	0.281
Financial Services	1.392	1.409	1.489	1.505	0.113	0.017	0.080	0.016
Social and Personal Services	1.502	1.572	1.638	1.875	0.373	0.069	0.066	0.238
Other	2.543	2.470	2.650	2.707	0.164	-0.073	0.181	0.056
				Increasing	26	26	21	25
				Decreasing	8	8	13	9

Table A2: Changes in Forward Output Multipliers (34 Sectors): 1975-93

	Output Multiplier (K_{o2})				Change in Output Multiplier			
	1975	**1981**	**1988**	**1993**	**1975-93**	**1975-81**	**1981-88**	**1988-93**
Agriculture	2.753	2.922	2.732	3.073	0.320	0.169	-0.191	0.342
Coal Mining	1.717	1.748	1.493	1.485	-0.232	0.031	-0.255	-0.008
Other Mining	3.008	3.144	2.495	3.316	0.309	0.136	-0.649	0.821
Food	2.111	2.268	2.345	2.576	0.465	0.156	0.077	0.231
Beverages	1.273	1.359	1.492	1.284	0.011	0.086	0.132	-0.207
Tobacco Products	1.002	1.003	1.048	1.005	0.003	0.001	0.044	-0.043
Textiles	2.387	2.773	2.655	2.330	-0.057	0.386	-0.117	-0.325
Clothing	1.087	1.152	1.251	1.277	0.190	0.065	0.099	0.027
Leather Products	1.236	1.180	1.153	1.338	0.101	-0.056	-0.028	0.185
Footwear	1.012	1.082	1.154	1.100	0.088	0.070	0.072	-0.054
Wood & Wood Products	1.827	1.659	1.508	1.583	-0.244	-0.168	-0.151	0.076
Furniture	1.036	1.044	1.094	1.060	0.024	0.008	0.050	-0.034
Paper and Printing	3.309	3.417	3.681	2.970	-0.339	0.108	0.264	-0.711
Chemical Products	4.134	4.996	5.971	5.065	0.931	0.862	0.975	-0.906
Petroleum and Coal Products	1.877	2.010	2.444	2.371	0.494	0.133	0.434	-0.073
Rubber and Plastic Products	1.613	1.738	1.358	2.041	0.429	0.125	-0.380	0.683
Ceramics	1.047	1.021	1.820	1.024	-0.023	-0.025	0.799	-0.796
Glass Products	1.372	1.395	1.358	1.308	-0.063	0.024	-0.037	-0.050
Other Non-Metallic Mineral Products	1.596	1.396	1.708	1.502	-0.094	-0.200	0.312	-0.206
Iron and Steel	3.325	3.000	3.021	2.287	-1.038	-0.325	0.021	-0.734
Non -Ferrous Metals	1.742	1.786	1.528	1.758	0.016	0.044	-0.259	0.230
Metal Products	2.460	2.377	2.134	2.253	-0.207	-0.083	-0.243	0.119
Machinery	2.209	2.575	2.423	2.617	0.408	0.366	-0.151	0.194
Electrical Machinery	1.652	1.671	2.320	1.760	0.108	0.020	0.648	-0.560
Motor Vehicles	2.117	2.437	2.292	1.820	-0.298	0.320	-0.145	-0.472
Other Transport Equipment	1.378	1.430	1.257	1.248	-0.130	0.053	-0.173	-0.010
Other Mfg. Industries	1.141	1.120	1.358	1.312	0.172	-0.021	0.238	-0.046
Utilities	3.445	3.279	3.259	3.796	0.351	-0.167	-0.020	0.538
Construction	1.380	1.416	1.393	1.625	0.244	0.036	-0.023	0.231
Commerce	4.329	4.284	4.599	4.830	0.501	-0.045	0.315	0.231
Transportation and Communication	2.741	2.966	2.406	4.234	1.493	0.225	-0.560	1.829
Financial Services	4.226	4.353	4.032	4.559	0.333	0.128	-0.321	0.527
Social and Personal Services	1.232	1.264	1.403	1.838	0.606	0.033	0.139	0.434
Other	2.626	2.632	2.694	3.573	0.947	0.006	0.062	0.879
				Increasing	23	25	17	17
				Decreasing	11	9	17	17

Table A3: Changes in Income Multipliers (34 Sectors): 1975-93

	Income Multiplier (K_e)				Change in Income Multiplier (K_e)			
	1975	**1981**	**1988**	**1993**	**1975-93**	**1975-81**	**1981-88**	**1988-93**
Agriculture	4.083	4.310	3.645	4.122	0.039	0.227	-0.665	0.477
Coal Mining	5.593	5.152	5.216	5.103	-0.490	-0.441	0.064	-0.113
Other Mining	4.532	4.388	4.490	4.374	-0.158	-0.144	0.102	-0.116
Food	5.799	5.828	5.420	5.451	-0.348	0.029	-0.408	0.031
Beverages	5.738	5.796	5.044	5.206	-0.532	0.058	-0.752	0.162
Tobacco Products	5.510	5.897	4.987	5.356	-0.154	0.387	-0.910	0.368
Textiles	6.108	6.244	5.672	5.192	-0.917	0.136	-0.573	-0.480
Clothing	6.519	6.658	6.030	5.922	-0.597	0.139	-0.628	-0.108
Leather Products	6.427	6.468	5.604	5.471	-0.957	0.041	-0.864	-0.133
Footwear	6.651	6.406	5.405	5.227	-1.424	-0.246	-1.000	-0.178
Wood & Wood Products	6.321	5.879	5.564	5.251	-1.070	-0.442	-0.315	-0.313
Furniture	6.628	6.454	6.005	5.724	-0.904	-0.174	-0.448	-0.281
Paper and Printing	6.169	6.206	5.270	5.455	-0.714	0.036	-0.936	0.186
Chemical Products	6.031	5.856	5.161	4.801	-1.230	-0.175	-0.696	-0.360
Petroleum and Coal Products	5.418	5.083	5.261	5.474	0.056	-0.335	0.178	0.213
Rubber and Plastic Products	5.998	5.906	5.416	5.842	-0.156	-0.093	-0.489	0.426
Ceramics	5.933	5.710	5.377	5.196	-0.737	-0.222	-0.333	-0.182
Glass Products	6.172	5.590	4.689	4.408	-1.765	-0.583	-0.901	-0.281
Other Non-Metallic Mineral Products	5.794	5.497	5.225	4.902	-0.892	-0.298	-0.271	-0.323
Iron and Steel	5.920	5.965	5.163	4.551	-1.369	0.045	-0.802	-0.612
Non -Ferrous Metals	5.423	5.201	4.250	4.376	-1.048	-0.222	-0.951	0.126
Metal Products	6.468	6.360	5.862	5.950	-0.518	-0.107	-0.499	0.088
Machinery	6.453	6.629	5.822	5.414	-1.039	0.176	-0.807	-0.409
Electrical Machinery	6.267	6.190	5.684	5.350	-0.918	-0.078	-0.505	-0.335
Motor Vehicles	7.046	6.983	5.823	5.735	-1.311	-0.063	-1.161	-0.087
Other Transport Equipment	6.988	7.153	6.191	5.863	-1.126	0.165	-0.962	-0.328
Other Mfg. Industries	5.865	5.975	5.288	5.292	-0.573	0.111	-0.688	0.004
Utilities	5.111	4.479	4.058	3.937	-1.175	-0.632	-0.421	-0.122
Construction	6.787	6.649	5.884	5.894	-0.893	-0.139	-0.765	0.010
Commerce	5.512	5.608	5.052	5.080	-0.432	0.096	-0.556	0.028
Transportation and Communication	5.931	5.783	4.633	4.824	-1.107	-0.148	-1.150	0.191
Financial Services	4.363	4.718	4.322	3.816	-0.547	0.355	-0.396	-0.506
Social and Personal Services	5.901	5.882	5.401	5.132	-0.769	-0.019	-0.481	-0.268
Other	6.422	6.368	5.897	5.812	-0.610	-0.053	-0.471	-0.086
				Increasing	2	14	3	13
				Decreasing	32	20	31	21