2001 Annual Forum

at Misty Hills, Muldersdrift

Explaining the Growth Absence: Reviewing the Evidence that can Account for the Poor Growth Performance of the South African Economy

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10-12 September, 2001

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1 Introduction: the case for a debate on growth in South Africa

South Africa's democratic transition now lies close to a decade in the past. The transition carried with it much by way of hopes in terms of a greater access by its population not only to an improved rights environment. It was envisaged that the political self-realization of all South African citizens would bring with it access to improved economic well-being also. Employment as well as rising per-capita income are obvious indicators of progressive development for the population of a country.

In this paper we review evidence that has emerged over the past four years that can provide some insight into the growth and employment creation performance of the South African economy. The emphasis is explicitly on why limitations in the growth performance of the South African economy may have emerged. As such, the tone will have a tendency toward the gloomy. So let me start at the outset by reminding ourselves that the past decade has seen much by way of achievement on the policy front. Success particularly with regard to macroeconomic stabilization policy is notable, and should not be obscured behind the veil of woe that is the topic of the present discussion. But enough of optimism - and to the task in hand.

We begin with a consideration of some evidence on the long run growth performance of the economy, as well as the track record of employment creation in the economy. Growth in the South African economy is decomposed into its primary sources, in order to identify any fundamental structural changes in the source of economic development. The evidence will indicate that not only has growth and employment creation in South Africa been subject to long term structural decline, but the source of economic growth has also shifted from capital accumulation to TFP growth over time.

Section 2 of the paper is concerned with an analysis of the determinants of perhaps the most fundamental driver of long term growth: investment in physical capital stock. The evidence suggests that rates of return on capital and the user cost of capital are fundamental to the determination of investment in fixed capital stock, but exercise their influence subject to a powerful impact exercised by uncertainty. What is more, the evidence reviewed demonstrates that uncertainty is crucial not only for investment in physical capital stock, but also for the determination of the capital flows that are required to finance the short-fall of savings relative to investment expenditure in South Africa.

In the case of South Africa, uncertainty has strong institutional underpinnings, which section 3 elaborates on. The evidence reviewed in section 3 points to a number of crucial institutional dimensions that exercise an influence not only on capital accumulation, but on employment creation, international trade flows, and the efficiency of output markets in South Africa.

Finally, in section 4 of the paper we consider evidence on the importance of the factors identified by modern (endogenous) growth theory in determining South Africa's growth performance. While a number of different determinants are considered, the discussion focuses on the contribution of investment in human capital. The evidence suggests that what counts is quality of human capital investment rather than quantity. In an extensive review of published evidence we establish that in generating quality human capital, South Africa still leaves much to be desired.

1.1 A Brief Initial Overview

In order to assess where South Africa currently finds itself, we consider two fundamental indicators of its rate of development. The first indicator is given by the growth rate of output in the economy. The second is concerned with the level of employment generated in South Africa's labour markets.

In a third component of this introductory section we consider evidence on the structure of output growth in South Africa by means of decomposition of output growth into the contributions of labour, capital and total factor productivity.

1.1.1 The Growth Performance

Growth continues to elude the South African economy. More seriously, South Africa's growth performance has been on a steady downward trend since the early 1970's. This downward trend is present both when we consider the growth rate in real Gross Domestic Product (GDP), as well as when we consider the growth rate in real per capita GDP - see Figure 1. What is alarming about the evidence of Figure 1 is less the declining trend in the two growth rates depicted. Such evidence is available for a number of countries, and was central to the debate surrounding the long-term economic development of the USA for the last twenty years (until the most recent upsurge in US growth). Instead, what is alarming about the South African evidence is the *extent* of the decline in the two growth rates in GDP. By the 1990's the growth rates were frequently negative rather than positive. Certainly the evidence is of a long term structural decline in growth rather than a sudden poor performance during the course of the 1990's.

The evidence on growth in real GDP is thus not reassuring. But the evidence must be also viewed in context. The declining growth performance of the South African economy mirrors declining growth rates elsewhere in the world. On the other hand middle income countries as a whole grew at 2.7% per annum on average over the 1980-90 period, and at 3.9% per annum on average over the 1990-98 period. In the case of East Asia the acceleration was from 8.0 to 8.1% per annum over the same period. Thus South Africa as a middle income country has performed well below the average maintained by its peer economies.

Two further factors might give us reason to pause before accepting the evidence we have seen at face value. The first is that in the mid-1990's Figure 1 does show evidence of a recovery in growth performance, though it remains to be seen how sustainable the recovery will prove to be. The second is that one of the reasons that has been advanced for the sharp increase in the growth performance of the US economy is that GDP measurement has been improved in order to take better account of quality improvements in output in the economy, especially as concerns the contribution of information technology to production methods. The question that then arises is whether in the South African case a similar impact might not become evident if such revised GDP figures were to be considered.

The South African Reserve Bank has made some attempts to correct its measures of GDP in order to bring the measure in line with revised inter-

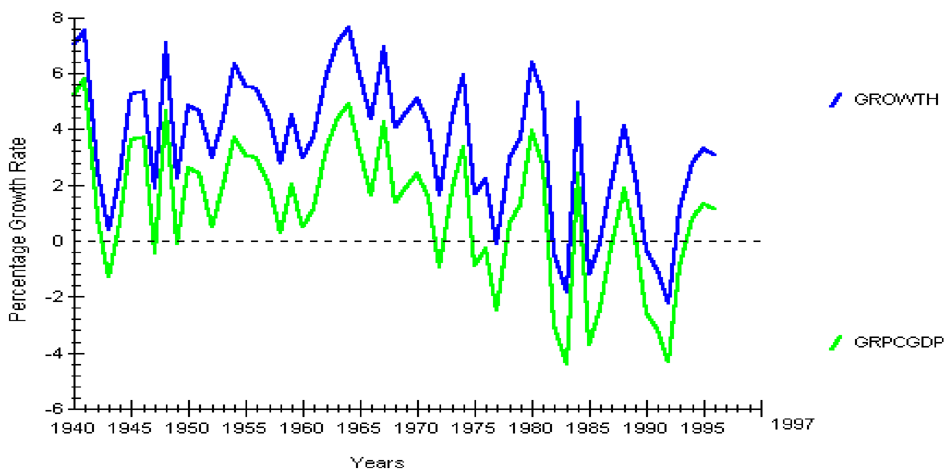

Figure 1: Growth Rates in Real Gross Domestic Product (GROWTH) and Per-Capita Real Gross Domestic Product (GRCGDP)

national best practice. In Figure 4 we report the implied growth rates on both the "old" and the "new" measure of GDP. While it is evident that the revision of the GDP figures has indeed had an impact, the impact is not such as to allay significantly growth concerns for the economy. Moreover, on either measure of GDP it emerges that South Africa has not been able to sustain the growth upsurge of the mid-1990's.

Regardless of which data we consider therefore, growth must remain a central concern for policy makers in South Africa. Understanding the fundamental determinants of growth in South Africa is the pressing need that follows.

1.1.2 Employment Creation

In terms of employment in the economy, the evidence is both more reassuring, and more deeply disturbing than the evidence on economic growth. Consider simply employment in the formal sector of the South African economy, reported over the 1970-97 period in Figure 5.

What is evident in terms of aggregate employment is that formal sector employment continued to expand through the 1970's and 1980's, despite the

Figure 2: Growth Rate in Real GDP over the 1990's in terms of "old" (GROWTH1) and "new" (GROWTH2) GDP measures

declining growth performance of the economy. But equally, what emerges is that the continued expansion of the labour market did not prove to be sustainable in the face of the ever decreasing growth in output. Finally, beginning in the early 1990's we have witnessed a very dramatic fall in the level of formal employment in the South African economy.

What also emerges from the evidence of Figure 5 is that just as the growth rate in output in the economy as a whole has been on a long-term downward trend, so the growth rate in employment has trended down. In both output and employment creation therefore, the evidence suggests a structural constraint in the South African economy.

What is more, this poor performance in job creation during the course of the 1990's is almost universal in the South African economy if considered in terms of the employment growth of the principal sectors of the economy. Agriculture, Forestry & Fishing, Mining, and to a somewhat lesser extent Manufacturing and Services all show falling employment levels during the course of the 1990's. In the case of the Mining sector, the fall is particularly dramatic.[1] Only an ever expanding government sector has proved to maintain

[1] See also the discussion in Fedderke and Pirouz (2000) for a more detailed analysis of

	1970's	**1980's**	**1990's**
AFF	-0.46	-1.29	-1.00
Mining	1.35	0.89	-6.37
Manuf	2.67	1.33	-1.20
Service	4.37	1.54	-0.84
Govt	5.87	3.47	0.41
TOTAL	2.05	1.12	-1.15

Table 1: Average annual growth rates in formal employment by major economic sector of the South African economy

a countervailing trend. This evidence is summarized in Table 1, which serves to confirm the negative average growth rates in all but the government sector during the course of the 1990's.

That the entire private sector has been forced to shed labour over the past ten years has to raise serious concerns about the health of South Africa's labour markets. Much as for the growth performance of the South African economy, therefore, serious questions face us concerning the *reasons* for the poor employment prospects of South Africa's labour force. Indeed, given the evidence presented above, questions surrounding the poor employment creation track record of the economy not only become overriding as regards the labour market, but the question to what extent the poor growth performance of the economy is linked to the poor labour market performance, presents itself also. This is particularly so since all sectors that have faced competitive pressures in any degree have shed labour during the course of the 1990's, and have done so after facing declining growth rates in employment ever since the 1970's. The implication must be that a serious and *general* structural problem is impacting on the performance of the labour market, and that this constraint is a long-standing one which has only emerged in particularly virulent form during the course of the 1990's, preventing employment creation from taking place.

the mining sector.

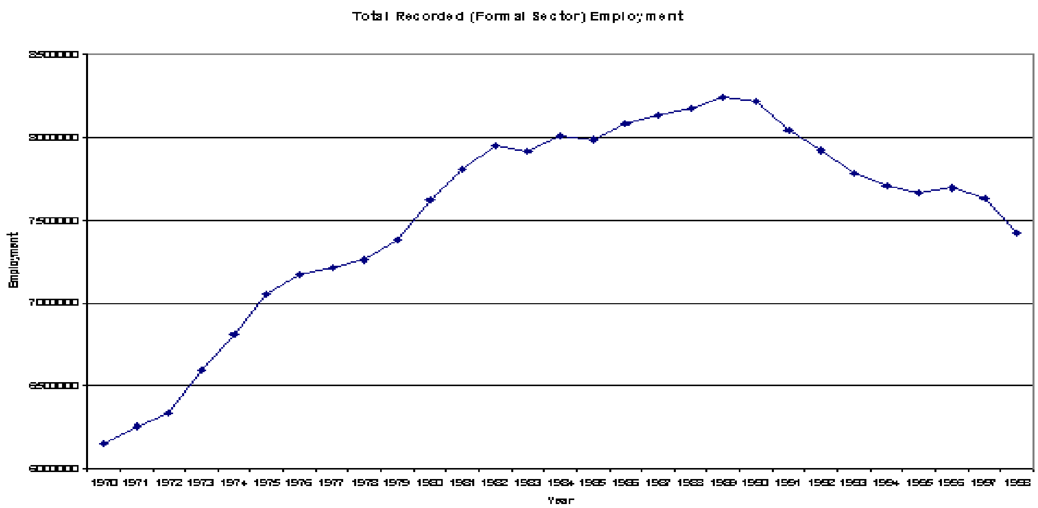

Figure 3: Total formal sector employment in South Africa, 1970-98.

1.2 Evidence on a Changing Structure to South African Output Growth[2]

International evidence from developed countries has often pointed to the significant contribution of growth in total factor productivity rather than growth in factor inputs to output growth.[3] One illustration of this emerges when one considers the relative contribution of labour, capital and the remaining Solow residual or Total Factor Productivity to growth in real output. In effect, the growth in output in developed countries is difficult to explain by reference to growth in factor inputs, and instead the weight of expectation for economic growth begins to fall on the contribution of technological advance.

An important modulation relevant to developing countries has emerged from international evidence.[4] Evidence from developing countries has em-

[2] The discussion of this subsection draws substantialy on the detailed evidence presented in Fedderke (2001f). Readers are referred to this source for any required detail both in terms of more detailed sectoral TFP decompositions, more detailed temporal decompositions, as well as real cost reduction computations.

[3] See for instance Abramovitz (1956, 1986, 1993). For continued and more recent discussion of this evidence see also Fagerberg (1994) and Maddison (1987).

[4] See for instance Lim (1994).

phasized the possibility of a changing trajectory in output growth, beginning with a heavy reliance on capital intensive output growth, shifting to total factor productivity growth with rising per capita GDP.

In what follows we briefly consider evidence on the structure of the South African growth experience over the 1970-97 period, employing standard growth accounting decompositions.

1.2.1 The Methodology and its Limitations

Computation of Total Factor Productivity (TFP) growth is by means of the standard primal estimate given by:

$$TFP = \frac{\dot{Y}}{Y} - s_K \frac{\dot{K}}{K} - s_L \frac{\dot{L}}{L} \tag{1}$$

where s_K and s_L denote the shares of capital and labour in output respectively, Y denotes output, K capital, and L labour.

However, it is vital to realize that evidence to emerge from this simple growth accounting decomposition can only be understood to be broadly indicative. The literature on growth accounting since the contributions of Denison (1962, 1967, 1974) has provided further sophistication to the decomposition (see the discussion above), and further extensions have emerged due to the developments in endogenous growth theory discussed above (for a useful overview of the developments see Barro 1998).[5]

The first crucial limitation of the simple decomposition approach outlined above is that it does not disaggregate factor inputs by quality classes. The work of Jorgenson and Grilliches (1967) and Jorgenson, Griliches and Fraumeni (1987) demonstrates the potentially substantial impact this carries for the conclusions to be drawn from the decomposition. Given the extent of segmentation in South African labour markets, the impact of factor input quality is potentially of considerable significance. Unfortunately data limitations preclude the possibility of pursuing this line of enquiry further.

A second limitation of the simple growth decomposition attaches to the assumption that factor social marginal products coincide with observable factor prices. One response to this difficulty is provided by recourse to a

[5] An alternative methodology, combining the insights from new growth and new trade theory, is given by Anderton (1999). Unfortunately data limitations for South Africa preclude its use. Findings support the conclusion that relative R&D and patenting activity influence import penetration and hence long term growth prospects.

regression approach, in order to obtain direct evidence on factor elasticities. However, the regression approach is subject to its own, and severe limitations. Both factor input growth rates are unlikely to prove exogenous with respect to output growth rates, raising the prospect of bias and inconsistency in parameter estimates due to simultaneity. Moreover, both factor input growth rates are likely to be subject to considerable measurement error, once again raising the prospect of inconsistent parameter estimates. The problem is of particular significance for the capital growth rate, for which capacity utilization carries important implications, and the likelihood of an *under*estimation of the contribution of growth in the capital stock to output growth. For these reasons, while regression approaches are not unheard of, the predominant approach in the literature remains rooted in growth accounting decomposition approaches. The evidence presented here follows suit.

But potentially the most significant limitation of the simple decomposition approach attaches to its assumption of constant returns to scale. Since endogenous growth theory directs its most fundamental challenge against traditional growth theory on this very assumption, this may constitute a fundamental limitation.

Since the potential limitations arising from the assumption of constant returns to scale are addressed in a separate study (see Fedderke 2001g), in the current context we proceed on the assumption that homogeneity of degree one can be invoked. In this the study follows numerous others internationally. Nevertheless, readers should bear in mind the implicit assumptions that underlie the decompositions presented in the discussion that follows.

1.2.2 The Data

Data for the TFP decompositions is drawn from the Trade and Industry Policy Secretariat data base. Variables include the output, capital stock, and labour force variables and their associated growth rates.

1.2.3 TFP Evidence for South Africa

South Africa's aggregate experience mirrors that of many developing countries. Table 2 illustrates that the contribution of growth in total factor productivity to South African growth in aggregate output has been steadily rising since the 1970's. The 1970's and 1980's saw growth that was heavily led by growth in capital and labour inputs, with very little contribution by

	Growth in Real GDP	Labour	Of Which: Capital	Technology
1970's	3.21	1.17	2.54	-0.49
1980's	2.20	0.62	1.24	0.34
1990's	0.94	-0.58	0.44	1.07

Table 2: Decomposition of growth in real GDP into the contribution of factors of production and technological progress, Figures are in percent

technology. In the 1990's the situation is reversed. In the 1990's growth in the labour force input contributed negatively, and growth in the capital input contributed relatively weakly to growth in GDP. Instead, the single strongest contributor to output growth during the course of the 1990's is a strong augmentation in technology.

Thus the evidence suggests the presence of a strong structural break in the SA economy. While in the 1970's and 1980's output growth in the economy as a whole was driven by growth in factor inputs, the 1990's have seen a growing reliance on technological improvements and efficiency gains in the economy. Part of the reason for this evidence is that the 1990's saw a decline in formal sector employment,[6] such that growth in labour inputs could not possibly have added to the growth in real output of the economy. The declining contribution of capital to the growth performance of the South African economy is due to the declining investment rate that South Africa has experienced.[7] We are thus left with a finding that the contribution of technological progress to South African growth in aggregate has been steadily rising since the 1970's - though admittedly it has contributed a rising share to a declining growth rate in output.

The aggregate evidence hides strong sectoral differences, however. We report the summary evidence in Table 3. The implication of the evidence is that the principal South African economic sectors show strong differences in terms of the decomposition of their output growth. The only consistent feature across all four principal sectors of the South African economy is that the contribution of the labour factor input toward output growth has been on a downward trend from the 1970's through to the 1990's. In terms of the con-

[6]See the more detailed discussion in Fedderke, Henderson, Mariotti and Vaze (2000).

[7]See the more detailed discussion in Fedderke (2001a), and Fedderke, Henderson, Kayemba, Mariotti and Vaze (2001).

	Growth in Real GDP	Labour	Of Which: Capital	Technology
Agriculture, Forestry and Fishing				
1970's	4.27	-0.10	2.00	2.37
1980's	4.30	-0.24	-0.56	5.10
1990's	2.40	-0.20	-0.92	3.52
Mining				
1970's	-1.08	0.51	3.81	-5.40
1980's	-0.55	0.18	3.90	-4.63
1990's	-0.60	-2.32	0.10	1.62
Manufacturing				
1970's	4.94	1.67	2.78	0.49
1980's	1.48	0.78	1.21	-0.52
1990's	0.43	-0.47	1.69	-0.79
Service Industry				
1970's	3.41	1.49	2.80	-0.88
1980's	2.81	0.82	1.28	0.71
1990's	1.50	-0.59	0.44	1.65

Table 3: Decomposition of growth in real output into the contribution of factors of production and technological progress, Evidence by principal economic sectors, Figures are in percent

tribution of growth in capital stock, we find that in the agricultural sectors, the mining industry and the service industries capital has been of declining importance as a contributor toward output growth, while for manufacturing industry it has assumed increasing importance.[8]

Finally, in terms of the contribution of technological progress, the strongest efficiency improvements have consistently been evident in the agricultural sectors, though the contribution declined during the 1990's. Mining by contrast, while coming off a low growth rate of technological progress, has been on an upward trend, as has service industry. Manufacturing industry has shown the weakest performance in terms of technological progress in the South African economy - at least during the course of the 1990's.[9]

[8]This is consistent with the evidence contained in Fedderke, Henderson, Kayemba, Mariotti and Vaze (2001).

[9]Note, in the more detailed evidence of Fedderke (2001f) we also present evidence on

	1970's	1980's	1990's
Labour	0.4	0.54	0.08
Capital	-0.14	0.3	0.74
Technology	0.79	0.93	0.38

Table 4: Correlation between alternative sources of output growth and growth in the manufacturing sectors

The implication of the above evidence confirms our initial finding: that technology as a contributor to economic growth in the South African economy has become increasingly important, though sectoral differences cannot be neglected. In particular, the exception to this finding is that in the manufacturing sector specifically the 1990's have seen a process of restructuring, with a strong link between growth in capital stock and output growth, and a declining importance of technological innovation.

The exceptional behaviour of the manufacturing sector deserves a little closer comment. To begin with, we should note that the aggregate story about the manufacturing sector disguises evidence of an important structural break in the nature of growth in the manufacturing sector. In Table 4 we report the correlation between growth in labour, capital and total factor productivity and output growth for the 28 three digit manufacturing sectors of South Africa for the 1970's, 1980's and 1990's.[10] The correlation between output growth and the contribution to output growth by the three sources of output growth changes dramatically between the three decades. In the 1970's and 1980's, the strongest correlation is between output growth and the TFP measure. In the 1990's the strongest correlation is between output growth and the growth rate of capital stock. The implication is that in the first two decades sectors that experienced high growth rates in output, were also likely to have a strong track record of technological innovation. In the 1990's, by contrast, this association has become less prevalent. Instead, strong output growth has become associated with a strong growth rate in physical capital stock.

A number of explanations are possible for this transformation. The first is the evidence now accumulating that capital markets in South Africa un-

real cost reduction contributed by each economic sector, following the methodology of Harberger (1998).

[10] SIC version 5 three-digit classifications were employed.

derwent restructuring during the course of the 1990's.[11] The suggestion is that the 1970's and 1980's saw, through state intervention in capital markets and due to the relative international isolation of this period, strong distortions in capital markets due to policy interventions. The liberalization of the policy environment saw changed incentives and rates of return to investment activity, such that capital came to be reallocated from sectors with strong state involvement, to manufacturing industry. Hence the strong burst in capital creation in manufacturing sectors, including those with historically small capital stock during the course of the 1990's. It remains to be seen whether this will prove to be sustainable.

A further potential explanation for the changing profile in manufacturing sector output growth arises from the likely impact of the period of international isolation South Africa faced during the 1970's and 1980's. In general we might expect manufacturing sectors in developing countries to follow advances in technology generated in developed countries, rather than incurring the cost of generating new technology of their own accord. Such emulation presupposes the possibility of access, however. The period of isolation may have made access to international advances either impossible, or at the very least more costly. As a consequence it may well be that South African manufacturing industry was starved of access to international advances in technology and thus had little option but to engage in technological innovation of its own accord.

A second feature worth noting about technical change in the manufacturing sector is that the aggregate TFP growth for the manufacturing sector hides strong sectoral variation in technological progress. Thus in the 1970's Other Chemicals & Man-Made Fibres and Basic Non-Ferrous Metals both had a contribution from technology to output growth in excess of 10%. And in the case of Electrical Machinery and Plastic Products the technology contribution was between 5 and 10 %. In the 1980's Other Industries and the Coke & Refined Petroleum Products sectors again had technology contributions to output growth in excess of 10%, while TV, Radio & Communication Equipment and Professional & Scientific Equipment had contributions between 5 and 10%. The evidence for the 1990's conforms to the evidence we have already presented for the decade: the contribution of technology to output growth is considerably lower than in previous decades in all manu-

[11] See for instance the discussion in Fedderke, Henderson, Kayemba, Mariotti and Vaze (2001).

facturing sectors, with growth in capital stock being the main contributor to growth in manufacturing for all sectors.

1.3 Implications of the Initial Evidence for the Explanatory Task that Lies Ahead

The evidence considered in this introductory section defines a clear set of questions in trying to come to terms with South Africa's (lack of) growth performance.

First, it should be evident that the need for an understanding of the determinants of long run economic growth is pressing. Sustainable long term welfare improvements in South Africa require economic growth rates comfortably in excess of those maintained by South Africa at least over the past 30 years.

Second, the changing *structure* of South African output growth deserves closer attention. Why in particular has the growth in capital stock contributed in declining measure to the growth in output? What is it about the labour market that has led to the decline in employment creation, and hence to a virtual absence of labour as a positive contributor to output growth in South Africa?

Third, what else besides growth in factor inputs might come to raise real output? The rising contribution of TFP growth gives us one indication - and raises a set of questions that arise from contributions made to new growth theory. How in particular are we to understand the role of human capital, and the contribution of explicit innovative activity (R&D) to TFP growth and hence output growth?

It is to this set of questions that we now turn our attention.

2 Considering the Foundation of Long Run Growth: Investment in Physical Capital Stock

Core determinant of long run economic growth is the investment rate in physical capital stock in the economy. No matter whether we are referring to classical theories of economic growth (of Solow 1956, 1957 vintage, say) or modern endogenous theories of economic growth (take your pick from the generic brands available: Romer 1986, Romer 1990, Grossman and Helpman 1991, Aghion and Howit, 1992), investment in physical capital is consistently a primary source of growth. Empirical investigations confirm the centrality of the investment rate in physical capital. Levine and Renelt (1992) famously establish it as the single most robust variable in empirical cross-sectional growth studies. De Long and Summers (1993) confirm its importance as central motor behind long run improvements in per capita GDP.

This provides us with the obvious starting point for any investigation of long run growth determinants in the South African economy. An understanding of the drivers behind South African investment must form the most basic building block in coming to an understanding of how we can improve the augmentation of South Africa's physical capital stock, and hence the growth rate of output.

In the discussion that follows we draw on earlier work on the characteristics of South Africa's capital markets. We begin with a consideration of evidence on the determinants of investment expenditure.[12] The findings lead to a further set of considerations on more detailed evidence to emerge on the patterns of physical capital investment in disaggregated South African economic sectors.[13]

2.1 Econometric Evidence on the Determinants of Investment in South Africa

The modern theory of investment expenditure has come to be focussed on the effect of irreversibility and uncertainty. While recognition of the importance of these two determinants of a changing size of the capital stock have been long recognized, recent contributions to the theory have provided a more comprehensive understanding of the issues. Most important of these has been that the impact of uncertainty on investment is ambiguous instead of unambiguously positive as the early literature suggested. As a generalization of the same point, our understanding of the dynamics of the investment process has also been enhanced.

Early work on the link between investment and uncertainty recognized that uncertainty would be of material concern whenever firms make irreversible commitments before the state of the world relevant to the pay off

[12] In this instance we draw extensively on the discussion and evidence contained in Fedderke (2001a).

[13] Here we draw on the discussion in Fedderke, Henderson, Kayemba, Mariotti and Vaze (2001).

that is to be generated by the commitment is realized. The main finding from this early literature was that under constant returns to scale production technology, and assuming uncertainty to attach to output price, the marginal product of capital is convex in the uncertain output price, such that rising uncertainty raises the marginal valuation of an additional unit of capital and hence stimulates investment.[14]

The modern literature has emphasized that such a result need not hold under asymmetric adjustment costs. The discussion tends to be cast in terms of a stochastic dynamic environment. Irreversibility of investment decisions and the possibility of waiting, means that the decision not to invest at the present point in time can be thought of as the purchase of an option. The option has value since waiting to invest in an uncertain environment has information value also, and hence investing now rather than tomorrow has an opportunity cost associated with it. One of the core insights of the modern literature is that uncertainty generates a reward for waiting, and hence that increases in uncertainty will potentially lower investment. Thus the modern literature on uncertainty generates two countervailing effects on investment: a positive impulse through a rising profitability of investment (since investing may carry information), and a negative impulse arising from the opportunity cost of investing now rather than in the future (since waiting may carry information). The net effect of uncertainty on investment is thus ambiguous, and a matter to be empirically determined.[15]

Since the modern theory examines the effect of uncertainty on the threshold at which investment is triggered, the focus of the theory is strictly speaking on the dynamics of the process, rather than on the long run equilibrium. A rise in uncertainty raises the threshold at which investment will be triggered, suggesting a negative link between investment and uncertainty. However, uncertainty may also raise the volatility of profit flows, such that the higher threshold level of profitability is satisfied more frequently than in a certain environment, generating more frequent bursts of investment expenditure. In this case, the effect of increased uncertainty may be to raise investment expenditure on average. Thus aggregate investment expenditure during any discrete time interval may or may not increase, though it seems certain that the dynamics of the process will manifest greater lumpiness.

[14] For a review of the early literature, such as Hartman (1972) and Nickel (1978), and Aiginger (1987).

[15] A comprehensive coverage of the modern debate can be found in Dixit and Pindyck (1994), while Price (1995) also provides a useful introduction to the issues.

In the present discussion we examine the determinants of investment expenditure in South African manufacturing industry. The analysis presents a number of advances over the previous literature. Estimation extends to an uncertainty-augmented version of the model in order to be able to identify the impact of uncertainty on investment expenditure. In doing so, it distinguishes between sectoral and systemic uncertainty, and their impact.[16] The present study has at its disposal unique data allowing for a clear identification of the systemic uncertainty in South Africa, both economic and institutional, thus allowing a deepening of our understanding of the impact of this type of uncertainty.[17] To our knowledge, no other study to date has undertaken such an examination in a panel data context, and certainly not in a dynamic panel data context.[18]

Empirical applications of irreversible investment models must control for the impact of uncertainty on the user cost of capital - see for example Ferderer (1993), Guiso and Parigi (1999) and Price (1995). One means of proceeding is to allow for an explicit impact of uncertainty on the investment relation. In the estimations that follow we allow for an explicit impact on investment by both sectoral uncertainty as well as systemic uncertainty. Thus we have

$$I_{it} = b_0 + b_1 d \ln Y_{it}^e - b_2 d \ln uc_{it} + b_3 \sigma_{sct,it}^2 + b_4 \sigma_{sys,it}^2 + \epsilon_t \tag{2}$$

where I_t denotes the investment rate, Y_t^e expected output, uc_t the user cost of capital, σ_{sct}^2 denotes sectoral uncertainty, σ_{sys}^2 denotes systemic uncertainty.[19] The import of the preceding theoretical exposition has emphasized that the signs of the b_3 and b_4 parameters are ambiguous *a priori*, and are to be determined empirically.

Preferred results are presented in Table 5. Results confirm that standard theoretical expectations on the rate of return on capital and the user cost of

[16] Estimation was by means of dynamic heterogeneous panel data analysis, allowing us to explore the possibility of heterogeneous rather than uniform responses to uncertainty across economic sectors. Given the base of modern investment theory in dynamic stochastic processes, such an extension has immediate justification. To our knowledge, such a study does not exist at present. For a more detailed discussion of the estimation methodology see Fedderke (2001a).

[17] WE employ he data set contained in Fedderke, De Kadt and Luiz (2001a).

[18] Though Fielding has employed the Fedderke, De Kadt and Luiz (2001a) data set in an aggregate investment function for South Africa, employing time series estimation techniques.

[19] For the precise definition of the variables deployed, the reader is referred to the discussion in Fedderke (2001a).

	Investment	Stand. Coeff.
Expected Output	0.75^{*} (0.23)	0.30
Real User Cost	-0.10^{*} (0.03)	-0.05
Sectoral Uncertainty	-0.23^{*} (0.11)	-0.09
Systemic Uncertainty	-0.04^{*} (0.00)	-0.51
Speed of Adj. to Equil.	-0.72^{*} (0.10)	

Table 5: Long Run Equilibrium Investment Relation

capital are satisfied. A rising expectation on the rate of return on capital, and rising user cost of capital serve to raise and depress the investment rate in physical capital stock respectively. In this regard investment in physical capital stock in South Africa is thus susceptible to the standard policy levers associated with stimulating investment expenditure.

But the striking finding of the present section is that uncertainty exercises a statistically significant, and strong (see the comparison afforded by use of standardized coefficients) effect on investment expenditure in South African manufacturing industry. Moreover, the effect of uncertainty on investment is unambiguously such as to lower investment rates. Lastly, in establishing the impact of uncertainty on investment expenditure, it is vital that the impact of sectoral and systemic uncertainty be separated. Both systemic and sectoral uncertainty appears to be pertinent for investment - though systemic uncertainty has a stronger impact than does sectoral uncertainty.

2.2 Some Immediate Implications that Follow from the Investment Findings for Growth-Inducing Policy

Uncertainty appears to impact on investment rates in the manufacturing sector in middle income countries. In particular, both sectoral and systemic uncertainty (as proxied by an index of political instability) lowers investment rates in manufacturing industry in South Africa. This result is a consistent and robust finding regardless of which other variables are controlled for in estimation.[20] The international evidence on the impact of uncertainty on

[20]In estimation we also tested for the impact of proxies for credit rationing, openness of the sectors, technological progress, the skills ratio of the labour force, the real wage, and

investment thus finds corroboration in the instance of a middle income country.

The uncertainty findings carry with them immediate policy implications. Stability at a systemic level appears crucial if investment rates in South African manufacturing industry are to rise. This carries implications both for the conduct of macroeconomic policy and the need for an emphasis on price stability in its conduct, but also for the importance of creating a stable political environment able to pursue credible policy orientations over time. By the latter we refer to the importance of creating a policy environment that renders the policy making process predictable, rather than subject to problems of time inconsistency. Past political dispensations in South Africa with their associated large discretionary power vested in the state, rendered the prospect of arbitrary state intervention ever real. The move to a liberal democratic polity has lowered this source of uncertainty and we have seen sound economic reasons for guarding this political advance jealously.

The real user cost of capital was found to be statistically significant as a determinant of investment rates in South African manufacturing industry. The implication of this is twofold. In the first instance the impact of factors that change the user cost of investment - such as high taxation rates for instance - act as a deterrent to investment. Since changes in the real user cost of capital influence the investment rate of manufacturing sectors, changes in the component cost elements that governments can influence will also carry with them long run changes in investment rates. The corollary is that policy makers play a role in creating the appropriate conditions for rising investment rates through an alteration of the real user cost of capital. But equally, the real user cost of capital is only one of a number of determinants of investment. This implies that for policy makers a simple focus on the user cost of capital is not enough. Instead it is imperative that policy makers create the conditions of long term macroeconomic stability, and of sufficient rates of return on investment that create a climate conducive to high investment rates. There are no easy ways out here.

But the importance of uncertainty to investment arises in more than the direct sense noted in the discussion above. The evidence presented has affirmed the importance of uncertainty in *lowering* the investment rate in South African manufacturing. This confirms not only the importance of adjustment costs as determinants of investment expenditure, but also that uncertainty

government crowd-in.

raises the threshold rate of return below which investment is unlikely to occur. At least two further important policy implications flow from this finding. First, it implies that any policy intervention designed to stimulate investment expenditure may face serious constraints in the sense that it may appear ineffectual due to the influence of the relatively high threshold below which investment is simply not triggered. Where an industry is operating below the threshold rate of return on investment, policy intervention may in fact be altering the rate of return on investment and hence the incentive to invest, but may not trigger a physical investment response because the intervention has not been substantial enough to breach the threshold. Thus there may be considerable scope for changing investment incentives by means of policy intervention, without there following any appreciable change in the investment rate. The second policy implication then follows as a corollary. Creation of a macroeconomic as well as microeconomic environment that is stable, predictable and devoid of sudden and arbitrary intervention is an immediate policy goal that emerges from the present study, not only because uncertainty has a direct negative impact on investment rates in manufacturing, but also because it serves to lower the threshold below which investment does not occur. In effect lowering uncertainty carries both a direct positive stimulus to investment, and it serves to render other policy levers more effective in achieving their objective.

It is important to bear in mind that the effects identified above are long term in nature. Hence the conclusions drawn must constantly be modulated by the realization that adjustment to new equilibrium investment rates after any policy intervention will not be instantaneous, but subject to a dynamic adjustment path. Nevertheless, the policy implications for any concern with stimulating growth are clear. Yes, raising the rate of return on capital, lowering the real user cost of capital is important in stimulating investment in physical capital stock. But what is of overriding importance not only directly to investment rates, but also in the secondary sense of improving the effectiveness of the rate of return to investment variables, is the impact of uncertainty.

For the time being I wish to rest the case on uncertainty. What will become evident from the further evidence presented below is that the relevance of uncertainty is deeper than its immediate significance in the context of investment in physical capital stock.

2.3 The Relevance of Market Distortions in Capital Markets?

Before returning to this theme below, I wish to conclude the discussion of the determinants of investment expenditure in South Africa by briefly considering some indicative evidence on the possible presence of distortions in the allocation of capital in the South African economy.

Figure 4 provides details of the average growth rates in the real stock of Machinery & Equipment maintained by economic sectors in South Africa, reported in terms of decade averages.[21] The growth in the real stock of capital as measured by Machinery & Equipment for the economy as a whole has shown a sharp downward trend over the 1970-97 period. While the 1970's saw an average[22] growth rate in real capital stock of 7.08%, this has declined to 3.77% and 1.4% in the 1980's and 1990's respectively.

However, this aggregate trend inevitably conceals strong sectoral differences. In particular, the most noticeable structural change in the growth of capital to emerge is that manufacturing sectors that traditionally had relatively low growth rates in comparison with other sectors in the economy, during the course of the 1990's have shown the most rapid expansion of capital stock in the South African economy.

Thus the ten sectors of the South African economy with the most rapidly growing capital stock in the South African economy in the 1990's were manufacturing sectors (see the column marked Rank90's). By contrast, the 1980's not only saw a very severe negative impact on numerous manufacturing sectors in terms of the growth of their capital stock, but saw a number of sectors with strong state involvement (Electricity, Gas & Water), or strong mining presence (Gold & Uranium, Coal) amongst the leading investors in capital stock.

The 1970's show an even more marked bias toward the strongest growth in capital stock for sectors with a strong mining bias, or heavy state involvement (the ten sectors with the strongest growth rate in capital stock during the course of the 1970's were: Electricity, Gas & Water, Transport, Storage & Communication, Petroleum Refining (hence SASOL), Construction, Gold & Uranium, Coal, Diamond Mining, Community, Social & Personal Services,

[21] We employ decade averages since the growth rate of the capital stock is subject to very strong fluctuations on an annual basis.

[22] Computed as an average across all sectors. It is thus unweighted for the relative size of capital stock in each of the sectors.

A high Rank, indicates a high growth rate	Avg. Growth 1970's	Avg. Growth 1980's	Avg. Growth 1990's	Rank70's	Rank80's	Rank90's
All Economic Activities	7.08	3.77	1.40			
Instruments	-2.33	2.23	-7.79	5	18	1
Gold & Uranium Ore Mining	8.04	8.94	-5.39	31	37	2
Other Maf & Recyc	-2.68	2.03	-4.95	4	16	3
Electricity, Gas & Water	10.96	7.03	-4.16	36	36	4
Agriculture, Forest. & Fish.	5.47	-2.94	-2.72	24	4	5
Wearing Apparel	1.32	2.34	-1.36	17	20	6
Construction	13.48	-1.11	-1.08	39	8	7
Machinery & Appara	0.49	2.47	-0.97	15	21	8
Mining & Quarrying	9.32	6.16	-0.45	34	33	9
Transport, Storage & Commun.	8.15	4.71	-0.13	32	28	10
Electrical Machine	5.58	0.67	-0.01	25	12	11
Textiles & Knit	-4.43	2.50	0.80	1	23	12
Footwear	0.38	0.26	1.45	14	10	13
Coal Mining	15.51	6.33	1.48	40	34	14
Other Chem & Fibre	7.61	0.32	2.07	30	11	15
Tobacco	-0.33	-4.69	3.88	10	2	16
Basic Chemicals	4.24	0.85	4.08	23	14	17
Petroleum Refined	11.02	2.72	4.16	37	25	18
Finance, Insurance, Real Est	5.72	5.86	4.90	26	30	19
Paper	-0.68	18.30	5.05	9	40	20
Furniture	-2.98	9.54	5.12	2	38	21
Diamond & Other Mining	10.00	2.48	5.55	35	22	22
Wholesale & Retail Trade	6.68	0.74	5.66	29	13	23
Fabricated Metals	4.09	-2.47	5.72	22	5	24
Wood	-2.73	2.65	5.98	3	24	25
Other N-Metal Minerals	0.31	2.23	6.45	12	19	26
Motor Vehi & Acces	-1.94	6.08	7.51	6	32	27
Manufacturing	3.99	1.06	8.00	21	15	28
Community, Soc & Per Service	11.49	3.78	8.96	38	27	29
Rubber	0.79	-0.11	9.61	16	9	30
Radio Tv & Communi	6.27	-1.27	9.99	27	7	31
Leather & Tanning	0.35	-2.01	10.44	13	6	32
Plastics	3.25	6.59	10.64	20	35	33
Food	0.12	2.84	10.74	11	26	34
Beverages	3.16	5.89	12.24	19	31	35
Basic Iron & Steel	8.38	-3.52	13.58	33	3	36
Publish & Printing	-1.61	5.66	14.15	8	29	37
Glass	-1.79	10.50	20.38	7	39	38
Bas N-Ferrous Meta	2.12	2.09	25.87	18	17	39
Transport Equipmen	6.47	-10.61	26.19	28	1	40

Figure 4: Proprtional Growth Rate: Machinery and Equipment. Figures are average annual percentage growth rates. Source: Fedderke, Henderson, Kayemba, Mariotti and Vaze (2001).

Basic Iron & Steel, and Other Chemicals & Fibers).

The evidence is such as to suggest the plausibility of a distortion in the South African capital markets due to the heavy reliance on the mining of primary commodities during earlier phases of development of the South African economy, and the presence of substantial government-led investment in capital stock in a number of core sectors (Electricity, Gas & Water, Petroleum Refining). The gradual reduced reliance on primary commodities in the South African economy, and reduced state involvement in "strategic" investments at least plausibly has triggered a restructuring of the South African capital market. In particular, sectors whose access to capital might have been limited due to the demand emerging from mining and state sectors (both increasing the financial cost of entry into financial capital markets), have shown strong growth in their capital stock.

As can be argued for the South African labour market therefore,[23] the evidence suggests that the 1990's, with their greater reliance on market forces and a decreased reliance on state led investment, are leading to a restructuring of the South African capital markets. Since restructuring of capital markets inevitably takes time to accomplish, such a process is likely to be in its early phases.

The encouraging implication of such a line of reasoning (if correct), is that one reason why investment expenditure in South Africa is currently at such low levels is simply that strong growth rates in capital stock are being maintained in sectors with low absolute levels of capital stock. Such sectors may have been prevented from increasing their capital stock from past distortions in the economy's capital markets. But over time, if the restructuring of the capital markets in line with new patterns of development, and greater reliance on market forces is allowed to proceed, the absolute volume as well as the proportional increases in manufacturing sector capital stock may well come to raise the aggregate growth rate of the economy's capital stock to more reassuring levels than are being currently maintained.

An alternative explanation might be that relative factor prices are forcing a switch to capital in place of labour.[24] However, since of the ten sectors with the strongest growth in capital stock, five experienced negative growth

[23] See Fedderke, Henderson, Mariotti and Vaze (2000) - though for the labour markets the reasons for the restructuring are different.

[24] In other words a rising real cost of labour may be making it advantageous to switch from labour- to capital-intensive production.

rates in real per labourer remuneration over the 1970-97 period,[25] and three[26] further sectors experienced growth rates in labour productivity that exceeded those of the real wage, this may not prove to constitute a general explanation of the structural change in capital employment noted.[27]

At the very least, both the move toward a smaller reliance on primary commodities in the South African economy over the 1970 - 1990 period, and greater emphasis on market forces in the policy environment of the 1990's, are at least plausibly the reason for the restructuring of the South African capital market.

At least for purposes of the present discussion, however, the evidence presented above suggests that at least not all is unwell with South African capital markets. The reallocation of capital during the 1990's is a sign that despite the continued maintenance of relatively low aggregate investment rates in the economy, at least the quality of the investment that is being undertaken has improved.

2.4 The Importance of Capital Flows

A long-standing structural constraint in the South African economy has been the short-fall of savings relative to the investment needs of the economy. In Figure 5 we illustrate the private sector savings[28] and investment[29] rates for South Africa. Except for very brief periods in the 1960's and the early 1980's South Africa's private sector has not produced sufficient savings to cover its demand for physical capital formation. The implication is that South Africa has been, and remains reliant on capital inflows in order to finance its physical

[25] TV, Radio & Communications Equipment, Leather & Leather Products, Basic Iron & Steel, Publishing & Printing, and Transport Equipment.

[26] Plastics, Beverages, and Basic Non-Ferrous Metals.

[27] For a more detailed discussion of the labour market issues, see Fedderke, Henderson, Mariotti and Vaze (2000).

[28] Defined as the sum of corporate saving (Unit: R millions, current prices (Period)) [Source: SARB Quarterly Bulletin (S-129)] and saving by households (Unit: R millions, current prices (Period)) [Source: SARB Quarterly Bulletin (S-131)], as a proportion of gross national product at factor cost (Unit: R millions, current prices (Period)) [Source: SARB Quarterly Bulletin (S-127)].

[29] Defined as the ratio of \gross fixed capital formation at current prices by private business enterprises (Unit: R millions, current prices (Period)) [Source: SARB Quarterly Bulletin (S-116)] to gross national product at factor cost (Unit: R millions, current prices (Period)) [Source: SARB Quarterly Bulletin (S-127)].

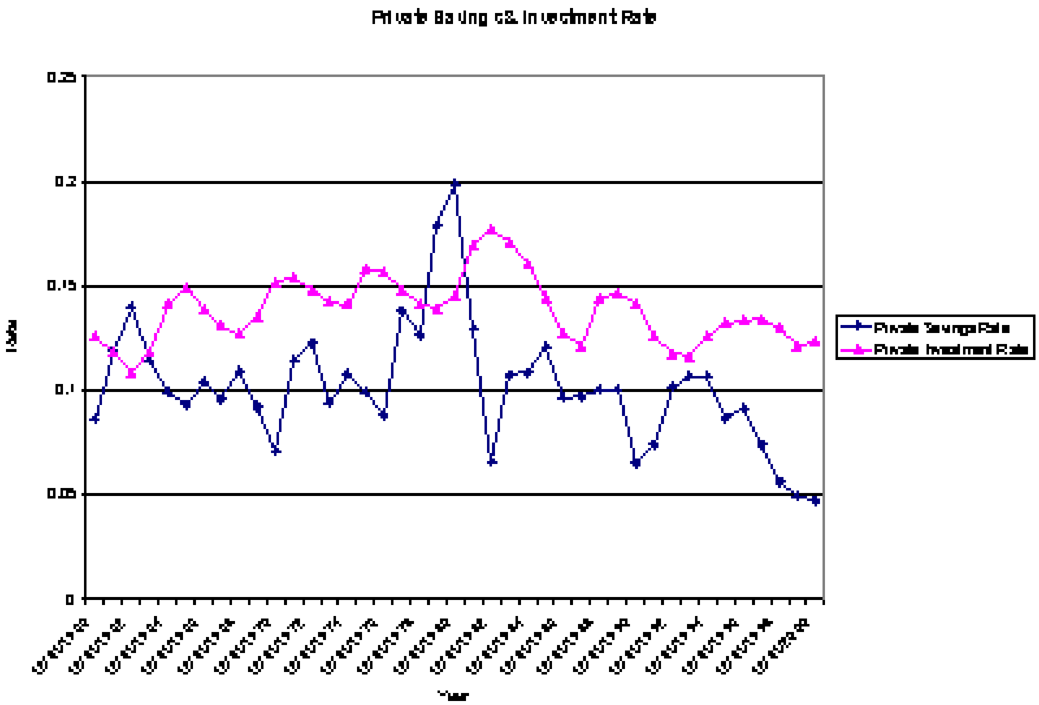

Figure 5: Private Sector Savings and Investment Rates

capital formation.

Understanding the constraints on physical capital formation cannot therefore be divorced from an understanding of international capital flows in the South African economy. Fedderke (2001b, 2001c) provides some insight into factors governing capital flows into and out of South Africa.

Following the theoretical exposition given in Fedderke (2001b) in specifying a model identifying determinants of capital flows,[30] the relevant rela-

[30] While Fedderke (2001b) identifies characteristics of the ratio of domestic to foreign assets both in intertemporal equilibrium as well as the optimal adjustment path to intertemporal equilibrium, since we are here concerned with capital flows, it is the latter that we are concerned with here.

tionship is given by:

$$\varpi_I = \left(\frac{\rho - \left(\rho^2 + \frac{4\delta}{d}\right)^{\frac{1}{2}}}{\rho - \left(\rho^2 + \frac{4\beta(1-\pi_d)}{b}\right)^{\frac{1}{2}}} \right) \left(\frac{K_0^f - \overline{K^f}}{K_0^d - \overline{K^d}} \right) e^{\frac{1}{2}t\left[\left(\rho^2 + \frac{4\beta(1-\pi_d)}{b}\right)^{\frac{1}{2}} - \left(\rho^2 + \frac{4\delta}{d}\right)^{\frac{1}{2}}\right]} \quad (3)$$

where ρ denotes the rate of time discount, α, β, relate to the marginal rate of return on domestic assets, γ, δ to the marginal rate of return on foreign assets, a, b, to the marginal cost of adjusting domestic asset holdings, c, d, to the marginal cost of adjusting foreign asset holdings, and π_d to the risk of expropriation that attaches only to domestic assets.

The implication of equation 3 quite straightforwardly is that we would expect:

$$Capital\ Outflow = \left(\overset{+}{Risk}, \overset{+}{Foreign\ Return}, \overset{-}{Domestic\ Return} \right) \quad (4)$$

The crucial findings from estimation[31] are presented in Table 6. Estimations are for the standard short and long term capital flow measures reported in the balance of payments (TNORM),[32] and three measures of capital flight constructed according to the indirect method (KFIND),[33] the balance of payments method (KFBOP),[34] and the derived method (KFDRV).[35] We have two proxies for the rate of return on a capital asset portfolio, with DIDIFFL denoting the change in the exchange rate adjusted interest differential,[36] GROWTH the percentage change in gross domestic product. As risk proxies we employ DOVAL defined as the change in the degree of over/undervaluation of the exchange rate in terms of PPP, DlnPOL1 defined as the change in an index of political rights,[37] and lnPOL2 which is the index of political instability we have already encountred in the investment discussion above.

[31] Estimation is by ARDL cointegration techniques. See the detailed discussion in Fedderke (2001c). Detailed descriptions of the variables employed in estimation can be found in the paper.

[32] We adopt the convention throughout that a positive magnitude denotes capital inflows, a negative magnitude capital outflows.

[33] See the discussion in World Bank (1985).

[34] See Cuddington (1987).

[35] See Dooley (1988).

[36] Defined as the difference between the foreign and the domestic interest rate. Thus a postive DIDIFFL should trigger capital outflows.

[37] See Fedderke, De Kadt and Luiz (2001a) for a detailed description of the index underlying this variable.

	TNORM	KFIND	KFBOP	KFDRV
$DIDIFFL$	-0.22	-0.11	-0.45	-0.64
$GROWTH$	0.36	0.39	0.70	0.54
$DlnPOL1$	-0.30	-0.11	-0.19	0.59
$lnPOL2$	-0.53	-0.60	-0.18	-0.13
$DOVAL(+1)$	0.25	-0.15	0.25	1.10

Table 6: Standardized Long-Run Coefficients from ARDL Estimation

The crucial point to emerge for purposes of the present discussion is that the results do conform to the portfolio theoretic expectations generated by the theoretic discussion contained in Fedderke (2001b). Thus an improved rate of return on assets, and reduced risk on assets will increase capital inflows into South Africa - though there are some differences between the various capital flow measures on the imputed magnitude of the impact the various rate of return and risk dimensions.

The second point to note is that capital flows (irrespective of the “normal flows”/“flight” distinction) in South Africa prove to be sensitive to political risk. We note that both changes in the level of political rights, and the level of political instability impacts on capital flows. Higher instability, and political liberalization in South Africa both served to stimulate capital outflows. We note further that it is difficult to argue that the three capital “flight” measures are more responsive to risk than the “normal” capital flow measures of the balance of payments - with the one exception of the KFDRV measure.

Estimation results thus establish a number of concrete and constructive results. Estimation results suggest that capital flows for South Africa show strong sensitivity to risk factors, and political risk factors in particular. We note that both changes in the level of political rights, as well as the level of political instability impacts on capital flows. Higher instability, and political liberalization in South Africa both served to stimulate capital outflows. It is thus vital that the uncertainty that stems from processes of political transformation in South Africa, and the uncertainty stemming from political instability be addressed in the interests of long term capital inflows into South Africa.

The risk dimensions that proved to be crucial for investment in physical capital stock in South Africa directly, thus transfer their importance to one of the crucial enabling conditions for investment in South Africa. Given the short-fall of private savings relative to investment expenditure, we continue to rely on capital inflows into the economy. Short of achieving an increase in the social savings rate therefore, South African reliance on capital inflows strengthens the need to minimize any source of uncertainty that may detract from investment directly, or from capital inflows. Transparency, predictability, credibility of political processes will serve a crucial role in determining whether the process of democratization in South Africa brings about economic as well as political benefits for the majority of the South African population.

Further, to the extent that the aggregate growth measure contributes to the long run determination of capital flows, the implication is that capital inflows follow on from the creation of favourable growth prospects. Capital inflows are thus potentially secondary stimuli to economic growth, in the sense that they themselves respond to already favourable growth performance. Of course, the additional capital inflow may further enhance the growth in output.

Capital flows and flight have become more favourable to South Africa since the early 1990's. However, lowering political uncertainties, and the need to offer healthy rates of return to potential investors should continue to be a central concern of policy makers.

3 Further Reflections on Some Institutional Factors Relevant to Long Run Development Prospects

In the discussion thus far we have encountred the importance of institutional determinants both of investment in physical capital stock, as well as capital flows into the South African economy. Uncertainty arising from the nature and instability of the South African political dispensation of the past has undoubtedly had significant impacts on the process of physical capital formation in the South African economy, as well as its ability to attract capital inflows.

An obvious extension to this line of inquiry is whether the need for a consideration of institutional factors as determinants of long run growth prospects is not only more extensive in the sense of requiring attention to a wider range of institutional indicators, but also more extensive in the sense that institutional dimensions may exercise an influence on growth directly, as well as indirectly via capital formation and capital flows.

3.1 Direct Institutional Impacts on Output Growth?

The possibility of a link between social and political institutions and long run economic development has long been the subject of an extensive literature in its own right. From modernization theory[38] with its postulated positive association between economic and political development, the emphasis on property rights as foundational to long run development in the work of North (1981, 1990) and North and Thomas (1970, 1973), the emphasis on the importance of the credibility of political dispensations,[39] to the recent introduction of social capital,[40] explorations of the possibility of a link between institutions and economic development are a recurrent theme in the literature. Theoretical forays have been accompanied by a growing body of empirical evidence.[41]

Interpretations of the evidence should be undertaken with some measure of care, however. The theory underlying the link between institutions and economic growth is still under development, and as a consequence interpretation of empirical specifications is not without ambiguity.[42] Moreover, there is no reason to suppose that the nature of the link between institutions and output is homogeneous across countries.[43] If so, there is considerable scope for further explorations of the link between institutions and economic development in more detailed clinical examinations of country-specific case studies. Fedderke, De Kadt and Luiz (2001b) represents one such attempt for the case of South Africa, exploring the role of political instability, political rights and property rights[44] in South African growth processes in a time series context employing long runs of data. In the process the questions outlined in the introduction to the present section of this paper are explored in greater detail. Which institutional dimensions are important to the growth process

[38] See for instance the classic Lipset (1959), while Diamond (1992) provides a useful overview of subsequent developments.

[39] See for instance Borner, Brunetti and Weder (1995).

[40] See Coleman (1988, 1990), Putnam (1995) and Fukuyama (1995a, 1995b).

[41] Barro (1991) is the classic reference that perhaps triggered the rush.

[42] See for instance the discussion in Fedderke and Klitgaard (1998).

[43] Fedderke (2001d) demonstrates not only that the steady state characteristics of growth processes are highly sensitive to the nature of the postulated link between institutions and production, but that there is strong empirical evidence to suggest that the link differs fundamentally between countries.

[44] These institutional indicators are again drawn from Fedderke, De Kadt, and Luiz (2001a).

in South Africa, and are the channels of influence direct or indirect?

Results obtained through the econometric investigations do suggest some clear patterns of association between the institutional and economic variables incorporated in the study. Figure 6 summarizes the findings, which are consistent with the evidence already presented on the investment function above, but also add additional nuance.[45] First, note that the crucial *impact* of the institutional dimensions on economic growth in South Africa appears to have been on the capital-labour ratio. Moreover, the empirical evidence suggests that both political instability *and* property rights are important determining factors of capital accumulation in the South African economy. Thus the evidence suggests that it may indeed be a range of institutional dimensions that are important for long run capital accumulation, rather than just a single isolated aspect of the institutional environment. This represents a potentially important extension to the findings noted on the investment rate noted above. In particular, we should note that the policy need identified above of increased sensitivity to perceptions of stability surrounding the policy making process requires further modulation.

Second, given the long-term nature of physical capital commitments, it would indeed be strange if property rights were not of foundational importance to economic agents who can anticipate the pay-off to their activity only some (often considerable) time in the future, often subject to considerable risk quite apart from any ambiguity they face in ownership. Where the agent who is responsible for setting the rules of the game that constitute the institutions in terms of which we undertake economic activity is not seen to be fully and *credibly* committed to those rules which confer ownership in the pay-off agents obtain for the risk they undertake, confidence and hence investment is inevitably going to be compromised.

Third, little evidence emerges suggesting that the institutional variables impact on output directly in addition to the indirect link via the investment rate. Instead, we find that economic development as measured by the level of real per capita output comes to drive institutional development both in terms of the rights structure within the political realm, as well as in terms of the level of political instability that prevails in South African society.

Finally, it is worth emphasizing once again the fundamental significance of the findings reported above and in the section on investment for the conduct

[45] The reader is referred to the paper for the detailed estimation results that underlie these conclusions.

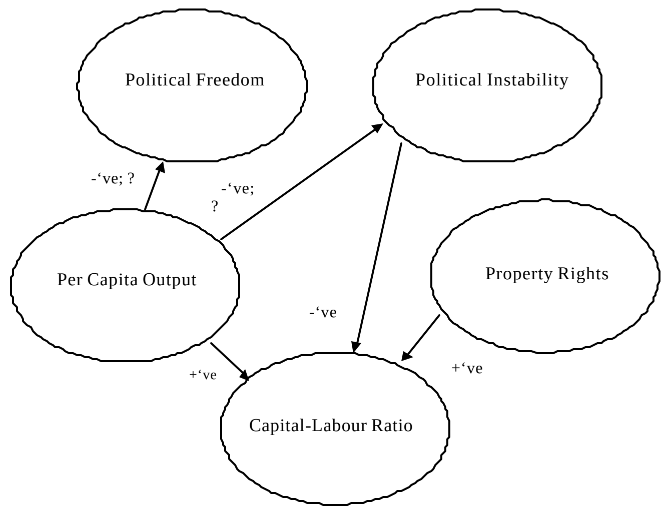

Figure 6: Patterns of Association

of economic policy. On the basis of evidence that has emerged both on the domestic economy and internationally,[46] there is little doubt that the pursuit of macroeconomic stability is vital as part of growth enhancing economic policy. But macroeconomic stability is only a part of the story, and one might argue the easy part. Far more demanding is the need to establish that the policy commitment is a credible one, and that the institutional framework within which it is achieved is one that will itself hold and allow economic agents to realize the fruit of their labour.

Where institutional stability requirements are not met, we stand to lose the benefits that should accrue due to the commendable and considerable achievements that South Africa has realized through its strict macroeconomic discipline.

[46] See the discussion in Mariotti (2001) on evidence on the impact of macroeconomic policy on South African long run economic growth, as well as (for instance) Barro (1991) and Fischer (1991, 1993) on international evidence.

3.2 A Further Set of Considerations: the impact of market distortions

In the discussion of capital markets in South Africa, I have already pointed to the potential importance of capital market distortions in the allocation of capital in the South African economy. There is no need to revisit capital markets at this point. But of course, what may apply to capital markets may well also be relevant to other markets in the economy. In effect, my concern here is perhaps with the single most important institution for long run economic development of all: the market. Evidence is beginning to accumulate that the functioning of the market mechanism in South Africa leaves considerable room for improvement.

For purposes of the present discussion I would like to emphasize three potential candidates that carry particular weight.

- The 1990's have seen a laudable first attempt on the part of South African policy makers to initiate trade liberalization. One need not dwell on the well known reasons why economists would come to welcome the removal of the distortions that trade barriers introduce in this context. Rather, what gives cause for concern is that the extent of trade liberalization in South Africa during the 1990's has been somewhat less comprehensive than is often thought. In considering effective protection rates of South African economic sectors, Fedderke and Vaze (2001) show that sectors responsible for approximately 50% of South African GDP have experienced *increased* effective protection over the 1988-98 period. A further 35% of GDP has experienced little or no change in effective protection, leaving only 15% of GDP subject to significant liberalization. What is more, evidence to suggest that lowering of protection has led to increased import penetration is ambiguous at best, while there is far stronger evidence suggesting that those sectors subject to significant liberalization have also been those realizing the strongest successes in improved export performance in the economy.

  The point here is simple: the distortionary impacts of trade barriers matter, and we have some way go in removing these impediments to improved efficiency and productivity in the South African economy.

- We have already seen from the discussion in the introduction to this paper that the lack of employment creation in South Africa carries implications beyond the direct welfare losses that attach to foregone work opportunities. Lack of utilization of the labour factor of production also means foregone growth opportunities. For this reason the lack of attention paid to the mispricing and hence resource misallocation, as well as the labour market rigidities that characterize South African labour markets is astonishing.

The point about the importance of inappropriate pricing and rigidities in South African labour markets is arguably one of the single most widely documented characteristics of the South African economy to have emerged during the course of the 1990's. The wage elasticity of employment has time and again been found to be negative in empirical study after empirical study. Supporting descriptive evidence points in the direction of continuing rigidities creating obstacles to employment creation. Readers who require additional evidence are referred to discussions in Lewis (2001), Arndt and Lewis (2000), Nattrass (2000), and Fields (2000), all of whom contain references to yet further evidence. Fedderke and Pirouz (2000) deal with the case of the South African mining sector that has been subject to particularly heavy labour shedding during the course of the 1990's. Similarly, Fedderke, Henderson, Mariotti and Vaze (2001) show that employment gains in South African labour markets have been realized only in sectors in which productivity gains have outstripped increases in the real wage rate.

It is also worth mentioning that the problem is *not* trade liberalization. As the discussion above has reminded us, trade liberalization in South Africa has been imperfect at best. But even accepting that trade liberalization has impacted on South African labour markets, Fedderke, Shin and Vaze (2000) show that the demand effects have if anything been such as to stimulate demand for labour. Instead, what has damaged employment prospects have been increases in wage demands not mandated by technology and globalization effects.

Let us be clear about what is being said here. Wage rates matter for employment in South African labour markets. This is not to deny that there are not additional problems in South African labour markets. Without doubt informational asymmetries, segmentation of the labour market, poor skills distributions, and many other factors complicate the story. But in the first instance there is no evidence that I know of that could explain how these factors can account for the ever and consistently worsening employment creation capacity of the

South African economy since 1970. Moreover, even should such evidence emerge, such factors are long term structural constraints. There is no excuse for continuing to hold up reforms on those factors that might make an immediate difference - and the price of labour is first and foremost amongst these.

- Nor are inefficiencies restricted to labour markets in South Africa. Output or product markets appear to be associated with considerable pricing power on the part of producers. Fedderke and Schaling (2000) suggest that the mark-up over unit labour cost in South Africa is several orders of magnitude greater than that found in similar studies for the US. If correct, the strength of the mark-up is such as create problems not only for the successful conduct of macroeconomic stabilization policy (inflation targeting in particular - see the discussion in Fedderke and Schaling 2000), it also creates scope for continued mispricing of labour through inappropriate forms of wage settlement between big business and organized labour in the economy, with the attendant employment implications. But the presence of pricing power in South African output markets also suggests that the level of competitive pressure in output markets is not sufficiently high, lowering the competitiveness of South African production internationally.

The significance of the discussion in this section is that it suggests that the market mechanism in South Africa is by no means as healthy as it should be in order for resource allocation to be optimal for the production and augmentation of output over time. Furthermore, the suggestion is that rigidities are wide-spread, covering not only the often cited labour market inflexibilities, but extending to output markets in the economy, as well as the opportunities and incentives to trade in the economy.

Efficiency losses generated by imperfectly functioning markets translate into foregone growth opportunities. Further trade liberalization, lowering labour market rigidities, and ensuring proper competitive pressure is exerted on producers in the economy all emerge as appropriate policy concerns for the future.

4 Innovation, Human Capital, and their Relevance to the South African Context

Modern growth theory has come to place increased emphasis on innovation as a long-term driver of economic growth, with explicit attention focussing on the source of technological innovation in the economy.

What is common to many approaches to endogenous growth theory is the presumption that innovation is the outcome of an explicit devotion of resources to technological advance. Where contributions differ is in their identification of the nature and impact of such resources. For Romer (1986)-type models the source of innovation are spill-overs attaching to investment in physical capital stock. For the Lucas (1988)-variant the spill-overs can be argued to emanate from investment in human rather than physical capital stock. Finally, in variants of the Schumpeterian approach to long run growth, innovation is the explicit outcome of the devotion of resources to technical advance, rather than the production of final output.[47]

4.1 The Impact of Endogenous Growth Processes in South Africa

The crucial questions for our purposes must first be whether endogenous growth processes are present in South Arica, and secondly what form such endogenous growth processes might take. The latter is crucial given the divergent policy implications that the alternative conceptions carry. Fedderke (2001g) addresses this set of questions econometrically.[48]

Estimation is of:

$$TFP = \frac{\dot{A}}{A} + \beta\frac{\dot{X}}{X} + \sum_{i=1}^{m} \gamma_i Z_i \tag{5}$$

where $\frac{\dot{A}}{A}$ denotes exogenous technological change, $\frac{\dot{X}}{X}$ denotes either growth in physical capital stock (for the Romer (1986) type of approach), growth in human capital (for the Lucas (1988) type of approach), or growth in intermediate inputs or quality ladders (under Romer (1990) or Grossman and

[47] For a non-technical discussion of the generic approaches to endogenous growth theory, see Fedderke (2001e).

[48] The methodology applies dynamic heterogeneous panel analysis to the South African manufacturing sectors.

Helpman (1992) type approaches), and Z_i denotes a range of additional regressors suggested by the literature.[49]

Here we skip the range of estimation issues that arise, and proceed to salient estimation results directly. Since the results are symmetrical, we present only the results for the spill-over specification in Table 7. More detailed discussion of these results, as well as for the Schupeterian case can be found in Fedderke (2001g). WENROL denotes the primary and secondary school enrolment rate for "whites", TOTENROL the primary and secondary school enrolment rate for all population groups, MATHPRP the proportion of matriculants sitting mathematics, DEGREE the total number of degrees issued by universities, NESDEG the number of degrees issued in the natural, engineering and mathematical sciences (NES), NESDEGPRP the proportion of NES degrees issued, APPCAP the per capita apprenticeship contracts issued, PATENT the number of patents registered, and PROPERTY denotes a property rights index.

While the results confirm the presence of spill-over effects for South African manufacturing, it is important to note that the confirmation is not unconditional. In the first instance we should note that to the extent that spill-over effects are corroborated, they take the form suggested by Lucas (1988) rather than Romer (1986). The coefficient on the growth rate of the capital stock is consistently negative (even where we control for investment in human as well as physical capital) and statistically significant. Since the coefficient of the capital growth rate should control for the positive contribution of capital stock over and above that implied by its income share due to spill-overs, this constitutes a rejection of Romer-type spill-over effects in South African manufacturing industry.

On the other hand, Lucas-type spill-over effects do find some support, in the sense that at least some of the human capital investment variables prove to have positive and significant coefficients. However, even here the support for Lucas spill-overs is circumscribed. In particular, only very specific types of investment in human capital contribute positively to productivity growth. The proportion of matriculation students sitting mathematics, and the proportion of NES degrees in total degrees are the only two human capital variables that provide a positive and significant contribution to productivity growth in South African manufacturing industry over the 1970-97 period.

By contrast, the total school enrollment rate, and the total number of

[49] Fedderke (2001g) elaborates.

Dependent Variable: Growth in Total Factor Productivity	
Regressors	
$\frac{\dot{K}}{K}$	-0.004^* (.000)
WENROL	-0.03 (0.34)
TOTENROL	-0.12^* (0.04)
MATHPRP	0.11^* (0.04)
DEGREE	$-0.1 \times 10^{-4*}$ (0.1×10^{-5})
NESDEG	0.00 (0.00)
NESDEGPRP	0.79^* (0.32)
APPCAP	13.82 (15.13)
lnPATENT	0.01^* (0.004)

Table 7: Testing for Spill Over Effects, Figures in round parentheses denote standard errors, * denotes significance

degrees issued by South African universities, while significant, contributed negatively to total factor productivity growth, while the white school enrollment rate, the total number of NES degrees, and the number of apprenticeship contracts per capita prove to be insignificant.

What counts for purposes of the innovative activity that is coupled to long run output growth in South African manufacturing, is not so much the production of human capital *per sê*, but the production of quality human capital, as proxied by the math and NES degree proportions. And there are at least two good reasons that make this finding plausible. The first is that quality human capital is simply more likely to have the positive spill-over effects identified by Lucas (1988), while poor quality human capital does not. A second interpretation of the evidence might point to an improved quality of screening by the educational system (both primary and secondary, and tertiary) with rising math and NES degree proportions. This is turn might be hypothesized to reduce the risk faced by producers wishing to hire human capital for purposes of innovative activity.

The results of estimations testing the Schumpeterian hypothesis confirm the presence of a positive impact of R&D expenditure on growth in total factor productivity, as postulated by Schumpeterian theory. Thus the findings confirm the presence of the positive impact on output growth of innovative R&D activity undertaken by the private sector. Results from the range of human capital indicators again point to the possibility of a positive impact of human capital spill-overs on productivity growth. However, just as for the spill-over results, the particular dimension of human capital investment controlled for proves to be crucial. The positive impact on productivity growth emerges from the NES degree proportion variable (as it did for the spill-over discussion), while a number of human capital variables prove to be negative and significant (WENROL, APPCAP) or insignificant. The interpretation of this evidence remains much the same as for the spill-over results above. While the human capital dimension can legitimately be argued to have a positive impact on long run productivity growth, it is above all the *quality* dimension of human capital that exercises this effect rather than the quantity of human capital.

The empirical evidence from South African manufacturing industry thus appears to point to a positive impact from both explicit R&D activity, as well as the human capital dimension, particularly the quality dimension of the latter.

4.2 South Africa's legacy of human capital creation

We have seen that human capital creation makes a difference to economic growth prospects in South Africa. In addition we have seen that it matters what *sort* of human capital investment is undertaken. It is not just a matter of the quantity of human capital generated - the quality of the human capital is of the essence. In this section we consider the legacy of South Africa's human capital creation. Just how good has it been - or perhaps more appropriately, just how bad, given the findings above on what does and what does not make a difference?

Needless to say the issue of South Africa's legacy of human capital creation is a vexed one. It was one of the principal vehicles through which the policy of apartheid significantly skewed the opportunities facing its citizens, and thereby seriously damaged the long term developmental capacity of the economy. It is here perhaps more than anywhere else in the present study that the legacy of apartheid is not only evident historically, but continues to exercise its influence to the present day.

In the discussion that follows we focus on the educational system in South

Africa, and its performance. This is not to say that the other dimensions of human capital are less significant. The focus is merely determined by data availability considerations.

The discussion that follows draws substantially on earlier published findings on the South African educational system.[50] In the earlier work we addressed the performance both of South Africa's schooling system, as well as various components of its tertiary educational system. In the discussion that follows we simply highlight some of the more salient features that emerge from the data.

4.2.1 A characterization of the performance of South Africa's schooling system

That all is not well with South Africa's schooling system is not news. The performance or lack of it in various parts of the schooling system forms the focus of much anecdotal evidence, and debate surrounding the issue intensifies annually on publication of matriculation pass rates.

But it is possible to be precise about the nature of the schooling system's performance.[51] In Figure 7 we report the matriculation pass rates in the South African schooling system, distinguishing between "white" and "black" matriculation pass rates.[52]

While the white matriculation pass rate (**WPasRat**) shows an unambiguous trend improvement over the entire 1911-93 sample period, for black matriculation the evidence is far more mixed. While black pass rates (**BPasRat**) increase from 1955 through to 1976, they then decline steadily through 1993. In the period for which we have separate figures for both black and white pass rates (1963 - 1993), with the singular exception of 1976 when the black matriculation pass rate approaches the white, the black rate consistently falls below the white rate by a very considerable degree. During this period the white pass rate stays within the 75% -95% range, while the black pass rate - with few exceptions - falls below 60%. The difference, in the worst years for black education, lies in the region of 60 percentage points.

[50] See Fedderke, De Kadt and Luiz (2000, 2001b).

[51] For a fuller discussion of these results see Fedderke, De Kadt and Luiz (2000).

[52] For purposes of precision and consistency we have followed the classificatory conventions deployed by the South African authorities during both the pre-Apartheid and Apartheid periods.

A further distinguishing feature of the two pass rates is that the black pass rate fluctuates wildly. By contrast, the white pass rate fluctuates in an almost equivalently wild fashion only during the very early period of political and societal consolidation after Union (1910 - 1923).[53] The black schooling system thus not only produced pass rates which prove to lie considerably below those of the white system, but the black system also appears to have been far more prone to either a series of shocks, or did not serve as a consistent screening mechanism - or both. Either reason for the fluctuations in pass rates is likely to have proved damaging for any positive incentive mechanisms present for black pupils - lowering the likelihood that what human capital accumulation was on offer to pupils in the black schooling system would be absorbed.

Raw matriculation pass rates form a legitimate standard of comparison of the alternative schooling systems only if the two examination standards are comparable. Anecdotal evidence if nothing else makes this assertion questionable. We therefore weight the matriculation pass rates of white and blacks by the proportion of total matriculation candidates sitting mathematics (in either higher or standard grade).[54] In Figure 7 we report the results as **AdjWTotPasRat** and **AdjBTotPasRat** for white and black candidates respectively. The implication of weighting the pass rates is that the divergence between the measures of white and black schooling system output is further exacerbated. At no point in time does the weighted black pass rate approach the weighted white pass rates - with the minimum differential at approximately 30 percentage points.

The weighted pass rates for whites further suggests that the improvement in the white schooling system has been considerably less dramatic than implied by the unweighted rate. Indeed, while there is some improvement in the weighted pass rate post-1975, the 1930-75 period does not manifest any consistent trend. Moreover, weighted black pass rates also manifest some-

[53]The distinction becomes evident from a comparison of the standard deviation which attaches to the percentage change in matriculation pass rates for whites and blacks: 8.85 and 16.57 respectively.

[54]We choose mathematics for the following reasons: mathematics has as clearly identifiable objective performance standards as any subject available to matriculation candidates. Application of subjective standards of assessments are therefore minimized. Moreover, we consider mathematics to be foundational to a wide range of cognitive activities and vocational skills. Lastly, mathematics (and science) was used as the central indicator of the quality of the educational system in the Hanushek and Kim (1995) growth study - and proved a more significant predictor of long run economic performance than the quantity of education.

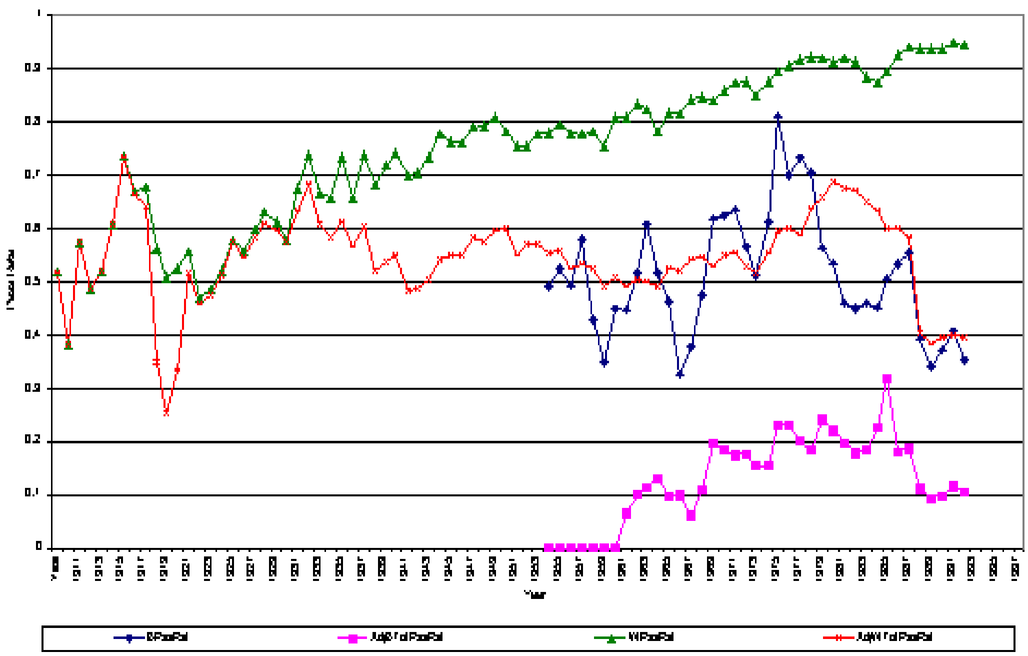

Figure 7: Matric Pass Rates. Source: Fedderke, De Kadt and Luiz (2000).

what different trend patterns from the unweighted series. The improvement in weighted pass rates runs through the late 1980's, declining thereafter to the end of the sample period. Thus the decline sets in a decade later than implied by the unweighted pass rates.

The maths-weighted matriculation pass rates further prove to manifest considerably higher volatility for both whites and blacks. In the case of blacks the standard deviation of the percentage change of the pass rate increases from 16.57 to 30.37, while for whites the increase is from 8.85 to 13.09.

In terms of weighted pass rates even the best schooling system in South Africa is thus subject to severe quality constraints. Indeed, a consideration of the proportion of black and white pupils taking mathematics in either higher or standard grade reinforces the point. For whites the proportion of total matriculation candidates sitting mathematics has been in steady decline since the 1930's - accelerating during the course of the 1980's, to reach a low of 40% of all white matriculation candidates - see Figure 8. By contrast the proportion of black candidates writing maths rose until the late 1980's, though the trend has been reversed since, and has come to lie at the 30% level in 1993.

So the performance of the schooling system in South Africa is poorer than we might wish for. But can we provide some insight as to why this might be the case?

Part of the answer lies with the nature of the inputs into the schooling system. Where inputs into the human capital creation process are poor, it is hardly surprising that the output will suffer in terms of its quality also.

Evidence that inputs into the schooling process have suffered from poor quality emerges in at least three distinct dimensions.

First, a comparison between pupil-teacher ratios in white and black schooling suggests that the educational opportunities in the two schooling systems were not equal. Figure 9 reports the pupil teacher ratios for both public and private schools for whites and blacks.[55] The most salient point to emerge from an examination of the data is that white educational opportunity, regardless of whether the opportunity arose in public or private schools, is consistently and considerably better than black educational opportunity. White public school pupil-teacher ratios (**WPubPupTch**) never rise above the mid-20 level (the very highest ratio is 24.06 in 1952), while the best black pupil-teacher ratio is provided by the private schooling system (**BPvtPupTch**)

[55] Again, for a fuller discussion of these results see Fedderke, De Kadt and Luiz (2000).

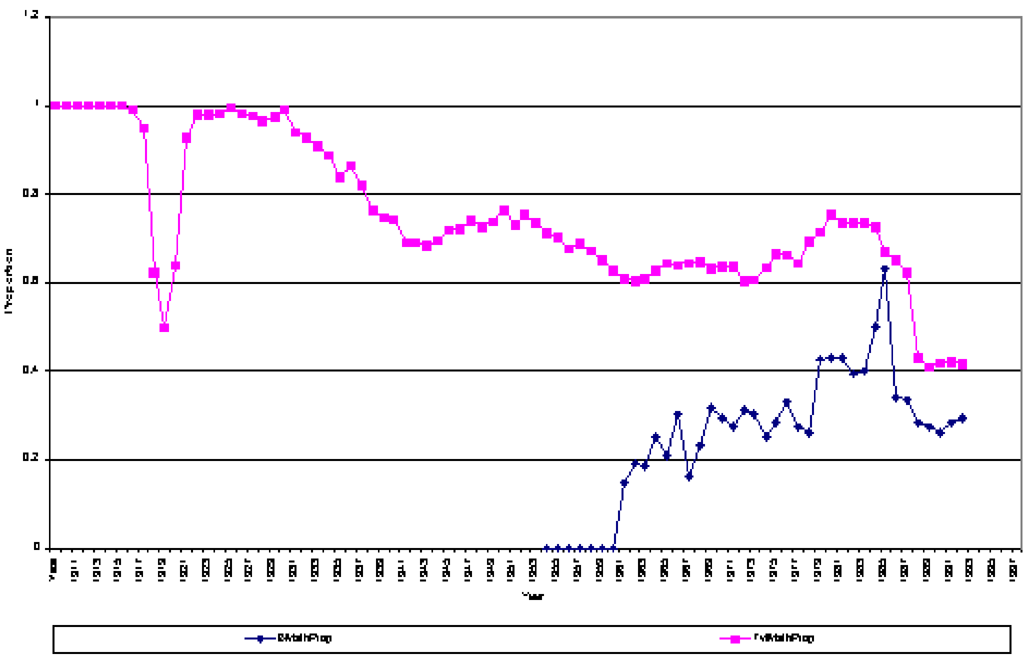

Figure 8: Proportiuon of Matric Candidates with Maths. Source: Fedderke, De Kadt and Luiz (2000).

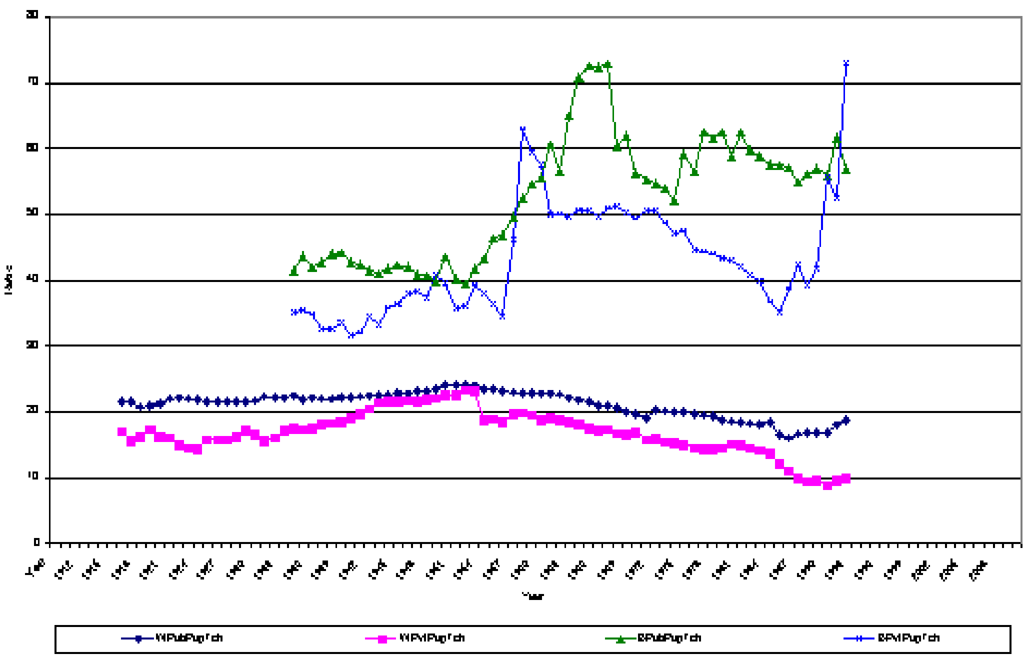

Figure 9: Pupil-Teacher Ratios for Black and White Public and Private Schools. Source: Fedderke, De Kadt and Luiz (2000).

in 1941 at a ratio of 31.61. Case and Deaton (1999), on the basis of cross sectional survey evidence from South Africa, note that while differences in pupil-teacher ratios in the 10:1 to 40:1 range may not significantly determine the educational performance of pupils, an increase in pupil-teacher ratios from 30:1 to 60:1 is a statistically significant determinant of educational performance. In this context it is noteworthy that the pupil-teacher ratio for black public schooling (**BPubPupTch**) remained in the range from 50:1 to 70:1 for a protracted period from 1957 to 1993, while black private schooling over the same period did not do significantly better.

Second, real expenditure per pupil showed wide disparities between the racially defined schooling systems. In Figure 10 we report the per capita expenditure figures by racial grouping. While in absolute terms real expenditure on black schooling increased dramatically throughout the 1980's, this did not translate into a strong increase in real per capita expenditure per pupil. On these figures white per pupil expenditure (**RealWperCap**) remains at least at seven times the level of that for blacks (**RealBPerCap**), and almost twice that for Coloureds and Asians (**RealC&APerCap**). Thus the rapid increase in real expenditure on black education has not allowed black schooling to eliminate the backlog with white education. Moreover, a closer examination of black per pupil expenditure suggests that over the 1983-93 period per pupil expenditure remained virtually stagnant in real terms.

The implication of the present section is thus that the divergence of quality between the white and black schooling systems is potentially even more dramatic than suggested by the pupil teacher ratios examined above. The ratio of seven to one on real per pupil expenditure is several orders of magnitude greater than the ratio of two to one we reported with respect to pupil-teacher ratios.

Third, differentials in teacher qualifications similarly point to the presence of large disparities in the quality of inputs into the schooling process between black and white schooling. We consider the percentage of teachers in public schools who fall into one of two limiting categories. The first, which we label **iUNQLRAT**, denotes the proportion of the total teacher body for the racial category i which holds a Matric qualification or less. The second, which we label **iSPUQLRAT**, denotes the proportion of the total teacher body for the racial category i which holds a tertiary qualification. They represent respectively "under"-qualified and "super"-qualified teachers.[56] Figure 11 reports both categories of teachers for both white and black racial groups. Surprisingly the **iUNQLRAT** category of teachers is fairly similar between the white and black schooling systems, with approximately 20% of teachers proving to be unqualified. The only significant difference to emerge is that the proportion falls to approximately 10% for the white schooling system almost a decade earlier than it does for the black schooling system.

Thus in a number of crucial dimensions we find that the quality of inputs into the educational process in white and black schooling are sufficiently large to serve as plausible explanations of the differential performance we observe

[56] "Tertiary" education denotes either a degree or a diploma.

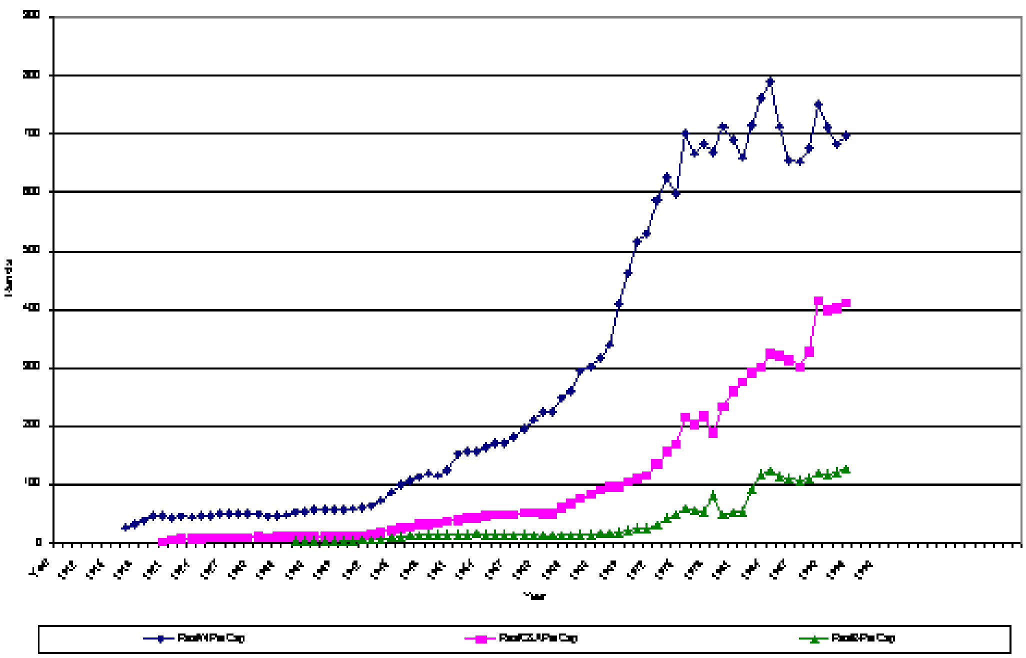

Figure 10: Real Per Pupil Expenditure by Race. Source: Fedderke, De Kadt and Luiz (2000).

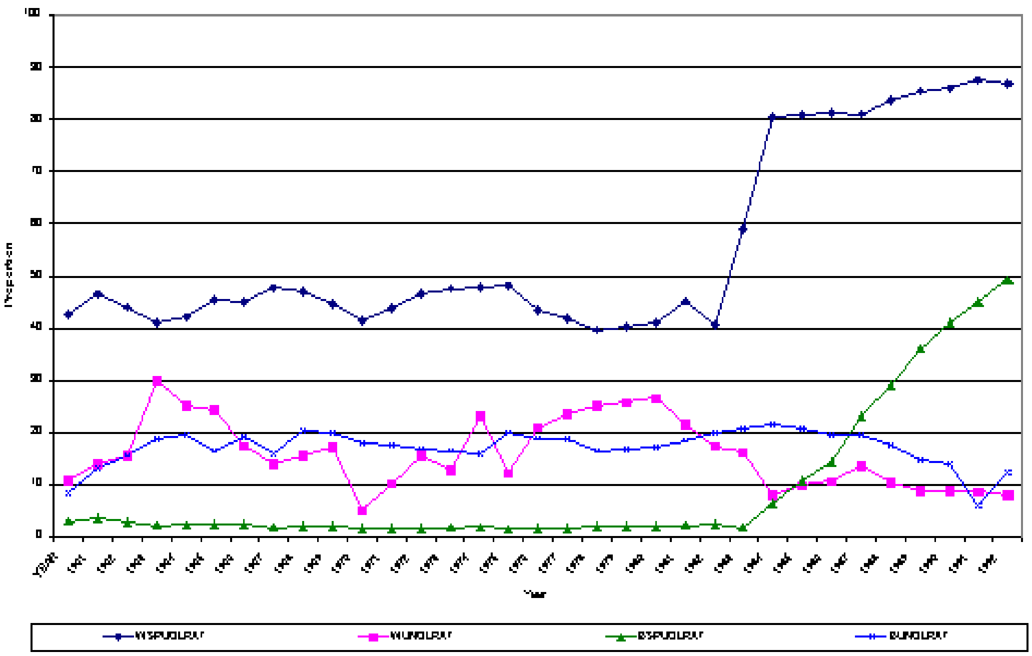

Figure 11: Teacher Qualifications. Source: Fedderke, De Kadt and Luiz (2000).

in the white and black schooling systems.[57]

For South Africa's schooling system the evidence is of large quality differentials in the output of the schooling system attributable to poor inputs into the schooling process, and to inappropriate governance structures. And recall that the evidence suggests that even the best parts of the system could be doing better.

The upside of the evidence is that at least we know what is going wrong (though we need even more information for appropriate intervention), and therefore what the appropriate forms of policy intervention should be if we wish to improve schooling performance.

4.2.2 A characterization of the performance of South Africa's tertiary educational system

The next question to ask is whether the poor schooling system in South Africa has translated into a poor tertiary educational system, and whether the patterns that were evident at the schooling level have been reproduced for tertiary institutions?

The data considered in this section covers only the university system in South Africa.[58]

In tertiary education we find the patterns of performance to be somewhat different from those we found for schooling. For universities the distinction between the historically white universities, and universities historically designated for other race groups, is not in terms of the quality of inputs as measured by student-lecturer ratios, or by expenditure per student.[59] In-

[57] In a more detailed econometric exploration, Fedderke and Luiz (2001) confirm that the inputs into education matter for educational attainment, though the institutional constraints on educational deliver turn out to matter also.

[58] In this case we draw substantially from Fedderke, De Kadt and Luiz (2001c), which is also concerned with the technikon, teacher college, and apprenticeship contract data for South Africa. The restriction to the university sector in the current context is because it is the most significant tertiary educational sector both in terms of student numbers, and in terms of its anticipated innovative capacity. Since it is the supposed pinnacle of the tertiary system, it is also held to be indicative of the health of the sector as a whole. Fedderke, De Kadt and Luiz (2000c) note some crucial differences between the various parts of the tertiary system, however.

[59] We note at the outset that for universities the distinction between "white" and "black" makes less sense than elsewhere in the educational system. Since student bodies always tended to be mixed, the designation cannot be taken to reflect the racial composition of

deed, real expenditure per student for universities was higher in the black universities than it was for whites. Nevertheless, our findings show that the quality of output of black universities in terms of both the degrees they issued and their research output lay considerably below that of the universities designated white.

Only the teacher training college system emulates the results we found for South African schooling. Here again, inputs as well as outputs of the teacher colleges prove to be of considerably lower quality for blacks than for whites.[60]

In technical training, the differential between whites and blacks emerges primarily in the form of poor access to such training by blacks, rather than in the form of poor inputs into black technical training as measured by student -lecturer ratios and real per student expenditure. A more general finding to emerge from our data on technical education in South Africa is that significant under-investment in technical forms of human capital has been maintained over the sample period, and for all population groups.[61]

In the university system student-staff ratios show relatively little variation across race groups - see the evidence of Figure 12. Indeed, during the course of the 1960's and 1970's the student-staff ratios at the black, coloured and Asian (BCA) institutions lay below that maintained in the white university system.[62] This pattern only changes after 1980, when the student-staff ratio of all parts of the university system begins to demonstrate an upward trend. During the course of the 1980's the student-staff ratio of both the Coloured and Asian universities is of essentially the same order as of the white universities, though there also appears to be greater cyclical variability in Asian and Coloured student-lecturer ratios. However, the strongest change during the course of the 1980's, concerns the student-staff ratio in black universities, which rises dramatically during the 1980's, to approximately double

the institutions being referred to so much as a series of historically determined labels. For reasons that will become clear from the ensuing discussion, "historically advantaged" and "historically disadvantaged" is also misleading. All labels in the current context are thus misleading, and we therefore stick to the historical ones. At least these give a sense of continuity and contiguity with past usage.

[60] The full results are available in Fedderke, De Kadt and Luiz (2001c).

[61] The full results are available in Fedderke, De Kadt and Luiz (2001c).

[62] This is true even where we employ the white university student enrolment figures which do not count the students of other races attending these universities. Where the adjusted student enrolments for white universities are employed, there is a further though marginal upward adjustment in the student-lecturer ratio at white universities.

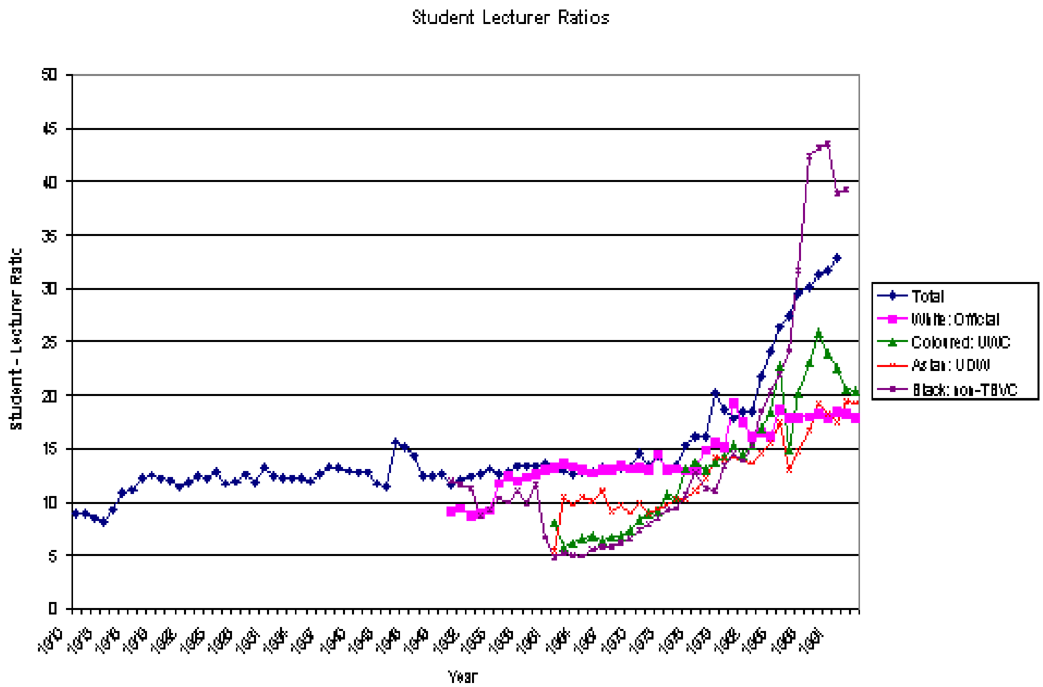

Figure 12: Student-Lecturer Ratios: Universities. Source: Fedderke, De Kadt and Luiz (2001b).

that which prevails in the white university system.

There are three immediate and important implications that emerge from the evidence provided by student-lecturer ratios. First, the low student-lecturer ratios in BCA-universities during the pre-1980 sample is likely to be influenced by the poor performance of the BCA-schooling systems, detailed above. Thus the ability of the BCA-tertiary education system to attract sufficient student intake is likely to have suffered from a supply-side constraint, making it difficult to attract students in sufficient numbers.

Second, it becomes likely that student-staff ratios for universities may well not be a reliable indicator of quality of learning environment,[63] particularly

[63]The ratio of students to lecturers does not control in any way for the quality of the

since we know the student intake to have been poorly prepared for tertiary education. This is thus quite unlike the case for the South African schooling system, where pupil teacher ratios were found to show strong variation across the racially defined schooling systems, and this variation was found to exert strong influence on educational attainment.

A third implication of this evidence is that the development of separate university systems for the distinct ethnic groupings of South Africa's population was an extraordinarily inefficient use of scarce resources. Universities are notoriously expensive in terms of start up costs. To develop entirely new universities with a student body generally poorly prepared, and with low student-staff ratios, may well have prevented the already existent universities from improving their quality. A more rational approach to the development of the tertiary educational system would have been to take advantage of economies of scale in incorporating BCA students into their historic student body.[64]

The real expenditure per student data further strengthens the patterns observed in Figure 12. We present the data in Figure 13. For historically white universities, real per student expenditure has remained essentially constant over the full 1910 to 1993 period, though the 1980's and early 1990's have seen some decline from the height of per student expenditure achieved during the course of the 1970's. For all other racial groupings in the university system, per student expenditure during the course of the 1960's and 1970's was higher than for the white university system, though the 1980's has seen convergence between the expenditure figures for the various sections of the university system. The black university system did not differ from Coloured and Asian universities in this respect. For black universities real per student expenditure consistently lay above that for the white university system during the 1960's and 1970's, and it is only the sharp increase in student numbers at black universities during the 1980's that drives down per student expenditure below that of other parts of the university system.

A number of explanations account for these data patterns - and a number of implications follow. First, the high per student expenditure figures in the BCA-universities can be accounted for in terms of the start-up costs of

lecturing staff employed in the respective sets of institutions. Ideally, the ratio should be appropriately weighted for the quality of lecturing input. Unfortunately, no ready statistics were available to enable such a quality adjustment.

[64] This is a point that generalises across the tertiary educational system in the Apartheid era in South Africa.

any new university system. Again, consistent with our suggestions emerging under the discussion of the student-lecturer ratio, the difficulty likely to have been experienced by the BCA universities is the recruitment of a suitable student body. Thus, the investment in infrastructure and in the high level human capital required to start up a new set of universities was for a small student body, who were in consequence funded to a disproportionately high level on a per capita basis. Only during the course of the 1980's does a quality differential come to be indicated in per student expenditure levels at universities.

This evidence is once again corroborates that the educational system imposed by the apartheid ideology was wasteful of scarce resources.

The resources expended in developing an entirely new university sector in parallel with an already existing system might have been far more efficiently employed in expanding the capacity of the existing system, with the associated economies of scale that might have been realized in the process. As it was, the educational system was starved of a large body of resources, that might have been more appropriately employed in improving the quality of the primary and secondary schooling system feeding the universities, or in expanding existing universities.

So the evidence on inputs into the university system suggests that the patterns of inequality that characterized schooling in South Africa, and which in turn issued in large differentials in performance by pupils in schools, are not repeated for the university system in South Africa. The question now must be whether the more equal allocation of resourcing in the university system managed to produce a university system of an undifferentiated level of excellence throughout.

Anecdotal evidence suggests that this was not the case, but what does the hard data tell us?

Figure 14 reports the absolute output of university degrees in South Africa. Absolute output measures of the university system suggest a steady and, since 1960, sometimes steep increase in the total degrees granted by universities. The evidence suggests that the white universities dominate the university system as a whole in output terms, despite the growing degree output of black universities particularly during the course of the 1980's.

While the absolute output of degrees suggests that black universities were expanding their output as the number of students entering the system increased during the 1980's, absolute numbers of degrees do not yet control for the quality of the output being generated.

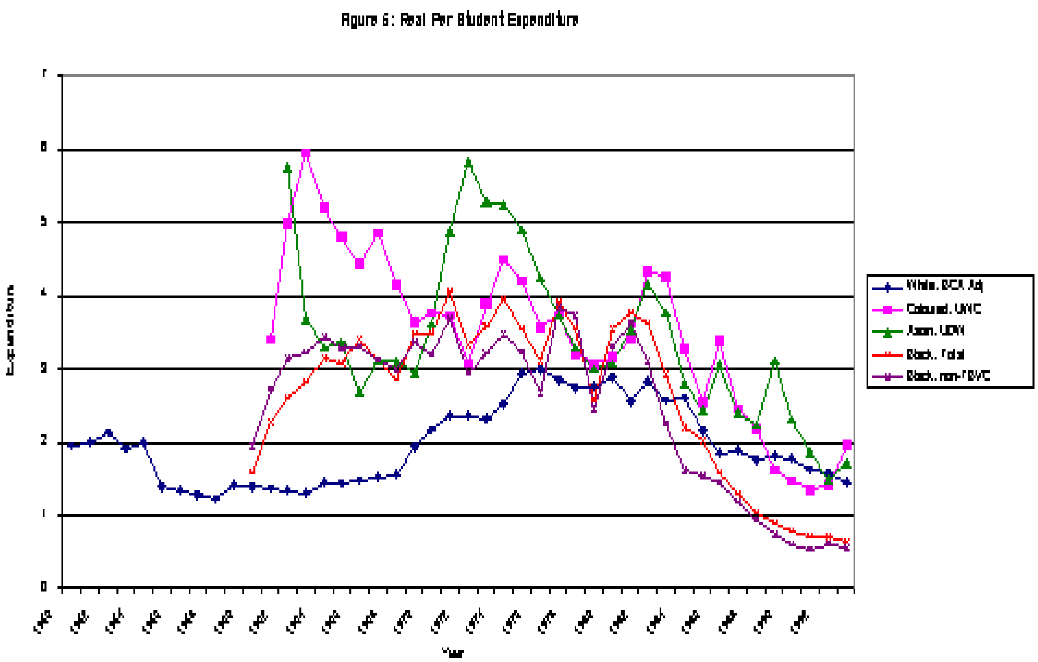

Figure 13: Real Per Student Expenditure: Universities. Source: Fedderke, De Kadt and Luiz (2001b).

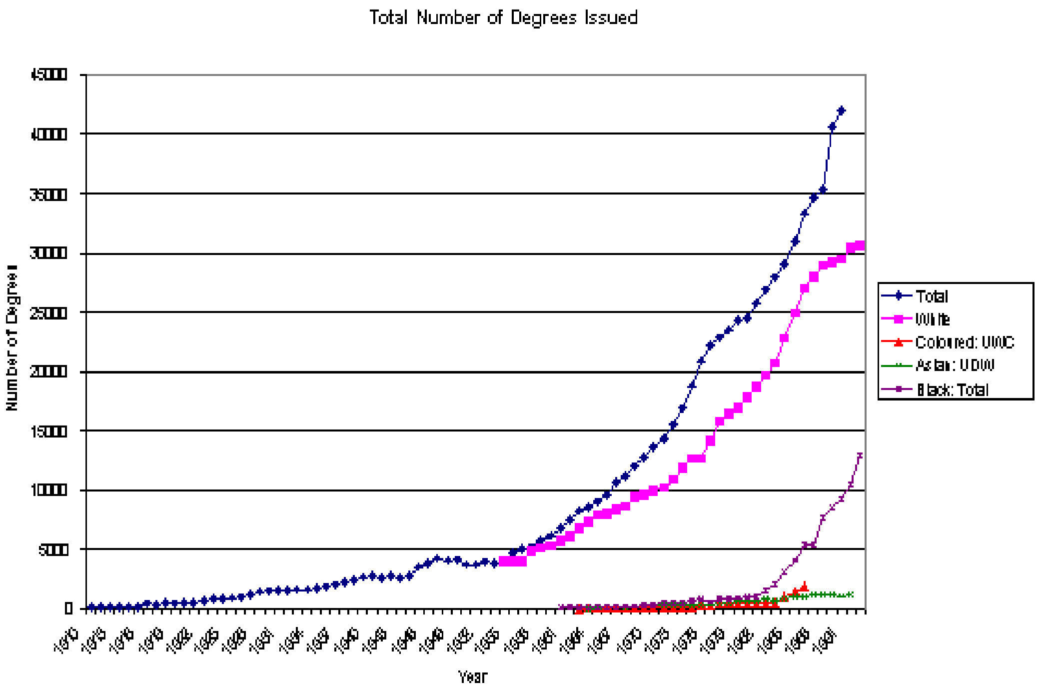

Figure 14: Total Number of Degrees Issued: Universities. Source: Fedderke, De Kadt and Luiz (2001b).

In Figure 15 we report the proportion of total degrees issued by the various university systems that emerge in the natural and engineering sciences (NES). For the white and Asian university systems, the proportion of NES degrees falls from a high point of 20% in the mid 1960's, to a little under 10% in the early 1990's. While the black university system initially had a similar proportion of NES degrees conferred, during the course of the 1980's at precisely the time when student enrolments were expanding rapidly, the NES proportion fell rapidly, and by 1993 had reached a low of 2%. While the trend for both systems has been downward, the performance of the black universities in producing science graduates is far poorer than that of the white university system. Moreover, while the strong increase in student numbers in the black university system in the early 1980's was matched by an increasing conferral of degrees this was clearly achieved by an expansion of students reading toward degrees other than science degrees. Figure 15 demonstrates a sharp decline in the proportion of science graduates precisely at the point at which both student numbers and total degrees conferred were experiencing sharp growth.

This evidence carries the implication that the black university system, while beginning to absorb increasing numbers of black students emerging from the black schooling system, was unable to translate the increased enrolment into NES graduates with the same facility as the rest of the university system - though recall that even the "good" part of the university system does so with poor facility. While this may point to the poorly prepared student intake that the black university system had to contend with, it is also indicative of a low capacity within the black university system to generate NES graduates.

Similar implications emerge from student throughput rates, and real expenditure per degree data. All sections of the university system saw an increase in the cost per degree produced over the course of the 1980's. However, the increase has been the most dramatic in the black university system, to the extent that the cost per degree in the black university system in 1993 had reached 1.5 the level maintained in the white universities.

White and black university systems also have significantly different throughput rates. For white universities approximately 17% of the total student body in 1993 was receiving a degree, and the trend for the white university system was upward. By contrast, black universities while sharing an upward trend in the total degree throughput rate since the early 1980's, had reached a throughput rate of only 10% in 1993, significantly below that of white uni-

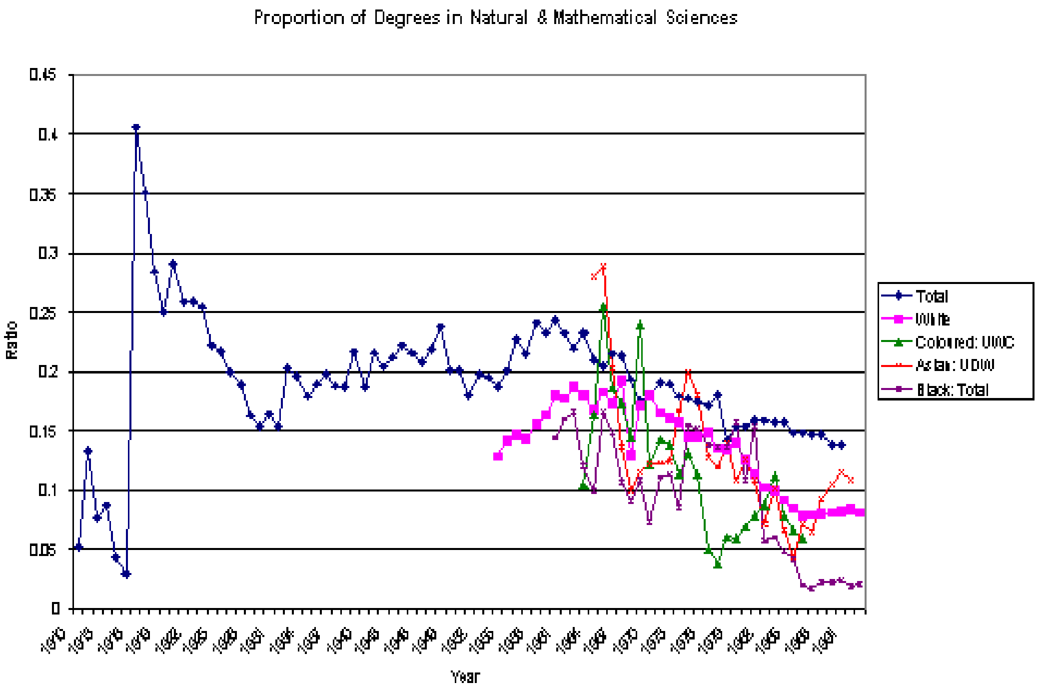

Figure 15: Proportion of Degrees in Natural and Mathematical Sciences: Universities. Source: Fedderke, De Kadt and Luiz (2001b).

versities. In the case of the throughput of NES degrees black universities reported close to 0.002 in 1992, while white universities reported 0.01. While particularly the NES throughput rate is poor for both university systems therefore, it is evident that matters have been far worse in the BCA university system. The sharp uptake in additional students through the 1980's has not been translated into an improved university sector performance.

There is a final but perhaps also most important indicator of the differential quality of South African universities. Universities are distinguished from other forms of tertiary educational institutions by virtue of the expectation that they be engaged not purely in teaching activity, but that they contribute to the advancement of knowledge through the publication of original research. And given our discussion of endogenous growth theory, and the empirical findings we have already shown on the growth impact of R&D, this feature of the university system attains additional significance. In Figure 16 we report both the absolute level of research unit output of the racially categorized universities, as well as their per lecturer research unit output. The evidence confirms the suggested quality differential that we have already established as existing between the "white" universities and BCA universities. Not only is the absolute level of research output in white universities considerably higher than in BCA universities, but this is translated into considerably higher per capita research output also.

But again, while BCA universities essentially produce no research output to speak of at all, note that even the white university system produces less than one publication per lecturer per annum. Something is amiss even in the "good" part of the system.

Moreover, we note that even the best part of the university system in South Africa has at the very least manifested declining quality over time. First, the white university research output has ceased to increase in absolute terms from the late 1980's, and in per lecturer output terms the output declined through to the early 1990's, though it has since stabilized.. Also - most research in South Africa is done in a very small number of universities. See Figures 17 and 18.

The declining per lecturer and static absolute levels of research output during the late 1980's and 1990's may well be attributable to the increased resources devoted to the development of the BCA university system. In the preceding discussion, we have already suggested that the expenditure on BCA universities proved to be an expensive way of obtaining relatively low quality degree output. The evidence on research output, suggests that an additional

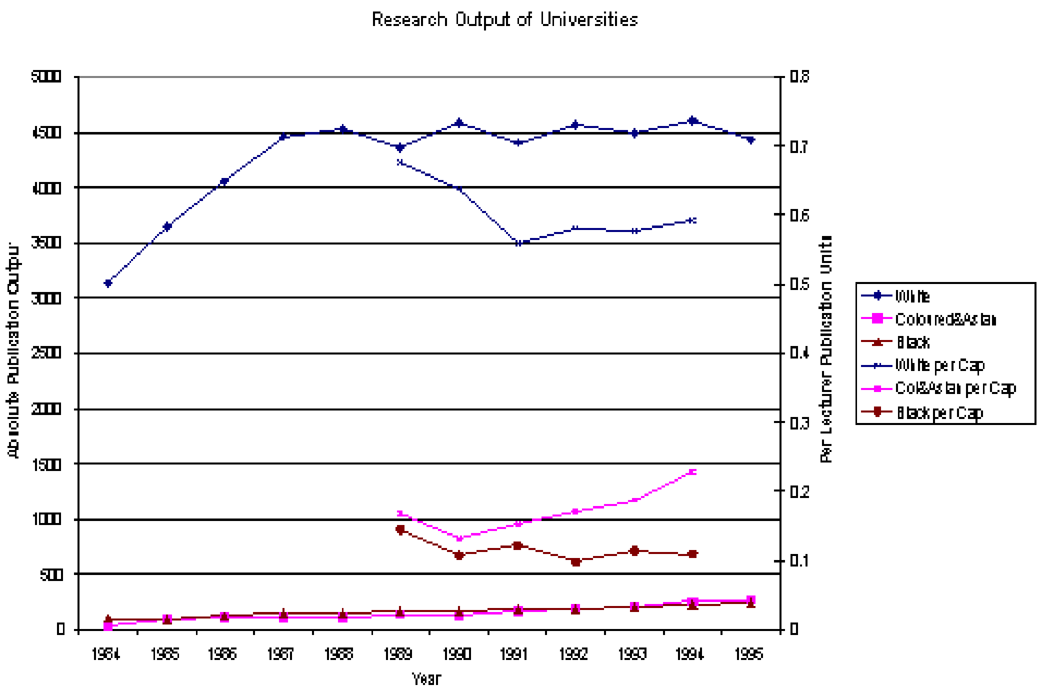

Figure 16: Research Output of Universities. Source: Fedderke, De Kadt and Luiz (2001b).

	1989	1990	1991	1992	1993	1994	Rank1989	Rank1994
Wits	1.17	1.09	0.78	0.83	0.74	0.84	1	3
Cape Town	1.04	0.98	0.93	0.93	0.89	0.91	2	1
RAU	0.92	0.82	0.71	1.03	1.00	0.89	3	2
Natal	0.68	0.59	0.58	0.49	0.65	0.56	4	5
Rhodes	0.59	0.56	0.49	0.47	0.43	0.47	5	6
Stellenbosch	0.55	0.49	0.45	0.51	0.50	0.65	6	4
Pretoria	0.51	0.50	0.43	0.47	0.48	0.45	7	7
Free State	0.41	0.43	0.41	0.37	0.40	0.39	8	8
Potch	0.40	0.45	0.35	0.41	0.36	0.36	9	9
UPE	0.38	0.29	0.34	0.33	0.22	0.28	10	10
Medunsa	0.26	0.14	0.23	0.07	0.16	0.12	11	15
UNISA	0.24	0.25	0.24	0.25	0.23	0.25	12	11
UDW	0.20	0.19	0.21	0.22	0.18	0.24	13	12
Vista	0.15	0.10	0.11	0.11	0.09	0.09	14	17
UWC	0.14	0.09	0.11	0.13	0.20	0.22	15	13
Zululand	0.14	0.08	0.12	0.14	0.12	0.16	16	14
North	0.10	0.11	0.08	0.08	0.11	0.10	17	16

Figure 17: Per Capita Publication Unit Output by University, 1989-94.

Top Ranked: Per Lecturer	Mid Ranked: Per Lecturer	Bottom Ranked: Per Lecturer
Cape Town	Stellenbosch	Port Elizabeth
RAU	Natal	UNISA
Wits	Rhodes	Durban-Westville
	Pretoria	Western Cape
	Free State	Zululand
	Potchefstroom	Vista
Top Ranked: Absolute Output	**Mid Ranked: Absolute Output**	**Bottom Ranked: Absolute Output**
Wits	Stellenbosch	Rhodes
Pretoria	Natal	Potchefstroom
Cape Town	UNISA	Western Cape
	RAU	Durban-Westville
	Free State	Port Elizabeth
		North
		MEDUNSA
		Vista
		Zululand
		Fort Hare

Figure 18: Ranking of Universities in Terms of Research Output

cost may well have been a declining capacity of the front ranking research universities in South Africa to continue to fulfil their vital research function. The reallocation of funds to the development of the BCA university system therefore had opportunity costs not only in terms of foregone development opportunities in the already existent university system, but potentially also in preventing the resourcing of growing research capacity in the South African university system.

Again in the light of the wider evidence on the importance of R&D on growth presented in a preceding section, this finding is of particular concern for South Africa.

In a broader developmental context, it raises the important question of whether it is desirable for a society to concentrate solely on devoting resources to a broad based mass tertiary educational system premised on the lowest common quality denominator. Or whether it is not desirable to have at least some tertiary education devoted to the production of both high quality degrees, as well as world quality research. If the latter route is chosen (and the experience of the East Asian countries may be taken to at least suggest that it is not entirely unfruitful - as long as the right type of educational output is emphasized), the implication would be for the identification of a small number of core institutions, properly funded, and with appropriate incentive structures designed to encourage greater attention to research activity.

Finally, in this regard it is possible to identify a strong inter-institutional difference in terms of research output between white universities. The evidence suggests the presence of a three tier structure to the university system, as suggested in Figure 18.

Such a structure might provide some guidance as to how a functional differentiation between universities might come to be structured. The three-tier system might be identified with "ivy league" research universities, state universities or liberal arts colleges, and finally community colleges. The concern here is not to identify which university should fulfil which of these functions. Nor is it to denigrate any one of the three functions. Instead the suggestion is that the existing capacity within the university system is not such as to place all universities on an equal footing, and that it may therefore be sensible to develop the existing structures into institutions that fulfil different pedagogical functions, all of which are important. As the evidence makes clear, the system as it is in any event has strong functional differences - we might as well recognize them, and reward them appropriately.

In concert with the earlier evidence presented on the South African university system, therefore, the implication of the present section is that the black university system proved not only to generate output that was of poor quality, but that it proved to be poor output that was expensive. While the poor preparation of pupils passing through the black schooling system is sure to have played its role, the poor design and implementation of a duplicate black university system intended to run in parallel with the white, is likely to have contributed not insignificantly in its own right.

What is more the suggestion above has been that the development of the human capital creating institutions in South Africa has been such as to inhibit the development of a strong capacity to stimulate the R&D activity so vital to long run economic growth.

4.3 Some Final Synoptic Remarks on the Innovation - Human Capital Nexus

Section 4 of this paper has perhaps been a long haul, so it is perhaps worth while to remind ourselves of the central points to have emerged during its course. We noted at the outset that econometric evidence on South Africa establishes that there exists a growth impact that attaches to investment in human capital. What was also evident from the evidence, was that the growth impact attaches to investment in quality human capital rather than human capital in general.

What emerges from the rest of the discussion in this section is a considerable weight of evidence that the educational system in South Africa has placed full weight on widening access, and very little emphasis on improving the quality of the training that it provides. Regardless of whether we are talking of the schooling or the university system in South Africa, even the supposedly "best" part of the system performs relatively poorly in generating the sorts of output that come to count in the long run economic development stakes.

Historically, therefore, the educational systems design in South Africa has not been optimally geared as part of the South African economic developmental challenges. Indeed, the evidence suggests that not only was the output of the educational system poorly suited to growth needs, but the means of achieving what output there was, in the case of the university system at least proved to be expensive both in direct resource requirements as well as in at least some implied foregone opportunities for improvement in what excellence there was in the university system.

But finally, what is perhaps most worrying of all, is that current policy directions in education appear to be doing little to address and correct the fundamental problems identified above in the delivery of the core competencies required for long run development. It is high time that South Africa began to think of education as an integral part of its long run economic strategy.

5 Conclusions & Evaluation

It has been a very long exposition. Despite this the implications that emerge from the preceding discussion can be grouped into a number of clear propositions.

First, we know from growth-theory and evidence that accumulation of physical capital stock is core to long run economic development. One of the central reasons for South Africa's structurally declining growth rate is its declining investment rate in fixed capital. In section 2 of this paper we emphasized that South Africa's investment rate was not something extraordinary. It assumed the same structure that can be found elsewhere in the world. First, it responds to the rate of return on and the real user cost of capital, providing policy makers with some immediate policy levers. But what proves to be central to investment expenditure is uncertainty, and uncertainty that arises from institutional dispensations. In particular, uncertainty in South Africa proved to be crucial not only to investment in physical capital stock, but also to the capital flows that are required to meet the short-fall of private sector savings relative to private sector investment expenditure. It is also worth noting that the impact of uncertainty is not only directly on investment, but also such as to lower the effectiveness of the policy levers that the rate of return on capital and the user cost of capital provide.

Second, we noted that market distortions in the South African economy can be shown to be present in capital, labour and output markets, and that distortions continue to be prevalent in the South African trade dispensation also. The prevalence of such distortions suggests that a great deal remains to be done in improving microeconomic policy directions designed to improve the efficiency of resource allocation in the South African economy. The continued level of protectionism in the economy, the size of the mark-up over marginal cost of production gives considerable cause for concern if South

African production is to become globally competitive. But perhaps the most enduring concern has to attach to the now well-documented distortions that attach to South African labour markets. Mispricing and inflexibility in labour markets is coming to carry a long term developmental opportunity cost that requires urgent redress.

Third, the paper recalled evidence suggesting that endogenous growth processes, particularly positive growth impacts from investment in human capital, are present in South Africa. Unfortunately these positive impacts attach particularly to the quality dimension of human capital investment - and the evidence considered in this paper demonstrates that in these dimensions the South African educational system is poor. Even the best parts of the schooling and university systems do not produce the sort of educational output required for long term economic growth, and yet it does so at relatively high cost.

The evidence presented in this paper thus identifies three fundamental structural challenges that underlie the growth conundrum confronting us in South Africa. There is little point in pretending that these are easy challenges. But it is also worth reminding ourselves of the opening paragraph of this paper, and to be conscious of the fact that we have achieved much over the past decade - not least of which is the macroeconomic stabilization we know to be one of the crucial building blocks of a long run growth strategy. And the good news is that none of the obstacles to growth identified is insurmountable. They just require work and clear-headed thinking.

> *[W]e are living in a dessert age. We want things to be sweet; too many of us work to live and live to be happy. Nothing wrong with that; it just does not promote high productivity. You want high productivity? Then you should live to work and get happiness as a by-product.*
>
> *Not easy. The people who live to work are a small and fortunate elite. But it is an elite open to newcomers, self-selected, the kind of people who accentuate the positive. In this world, the optimists have it, not because they are always right, but because they are positive. Even when wrong, they are positive, and that is the way of achievement, correction, improvement, and success. Educated, eyes-open optimism pays; pessimism can only offer the empty consolation of being right.* Landes (1998: 523-4)

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