

Changing Factor Market Conditions in South Africa: The Capital Market - a sectoral description of the period 1970-1997[Ⓜ]

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ABSTRACT: We explore changing conditions in South African capital markets. Noteworthy is the evidence of strong restructuring in the market during the 1990's. Whereas the 1970's and 1980's showed the strongest investment performance amongst primary commodities and sectors with strong parastatal involvement, the highest investment rates of the 1990's have been associated with the manufacturing industry. We show that the real user cost of capital and capital productivity contribute plausible determinants of investment rates in South Africa. The extent to which market forces are allowed to bring in line marginal cost and marginal return on capital, appears to influence the sustainability of investment.

KEYWORDS: Investment rates, capital markets.

JEL Classification: E22

[Ⓜ]We would like to thank the Trade & Industry Policy Secretariat for making available the data that made this project possible. The South African Department of Finance and USAID provided financial assistance for the project. Views expressed in the paper are ours, and should not be taken to reflect in anyway the views of the institutions that provided the data and financial assistance for the project.

1 Introduction

Investment rates in physical capital in South Africa have shown a downward trend for a considerable period of time. Given the centrality of investment in physical capital stock as a determinant of sustainable long run economic growth, such evidence is a legitimate source of concern.

The present paper is to be understood as a preliminary study of the determinants of investment expenditure by sector for the South African economy. Given the data problems frequently encountered on South African data, such a review of sectoral economic data has the advantage of not only identifying potential obstacles to more sophisticated analysis, but also to assess the plausibility of some simple alternative explanations of investment in South Africa on the basis of exploratory data analysis.

In what follows we argue that some useful insights do emerge from an examination of the data. While tentative, since not rigorously examined in a multivariate context, we nevertheless suggest that the findings are suggestive of some hypotheses to be examined in greater detail.

We point to only a few of the hypotheses we believe worthy of consideration by way of aiding the reader in the digestion of what will amount to a reasonably large amount of information.

First, we suggest that the evidence points to two distinct forms of structural change in the South African capital market. Relative capital usage by economic sector will be seen to have been subject to steady long-run changes over the full 1970-97 time frame, suggesting that at least some of the changing patterns of capital usage in the economy cannot be exclusively identified with the changing policy environment of the 1990's. But second, a consideration of growth rates in the real capital stock also makes it plausible to suggest that for at least some economic sectors the 1990's also mark a structural break - and the altered policy environment to which the capital market were also subject, may well have been responsible for at least some of these changes. What is most notable about the structural break associated with the 1990's, is its association with the emergence of a series of manufacturing sectors as those which maintained the highest investment rates on average over 1990-97. This marks the first time point in the 1970-97 time frame in which manufacturing sectors constituted such an unambiguous leadership position amongst South African economic sectors.

We also suggest that a possible reason for the restructuring of the South African capital markets may be declining degrees of capital market distor-

tions. What is noticeable about 1970's and 1980's investment rates, is that there is a strong presence of sectors with heavy state-led investment activity amongst sectors maintaining sustained high levels of investment expenditure. Such heavy state-led demand for investment goods may well have had distortionary impacts on the cost of capital. Those sectors with heavy reliance on state intervention show strong declines in their investment activity during the course of the 1990's, to be replaced by sectors dominated by the private sector that may well have been crowded out by state activity in earlier decades. This suggests that the increased reliance on market forces in the policy environment of the 1990's may well be stimulating a restructuring of the South African economy and capital market, and which may have the result of improving the efficiency of production in South Africa.

The data used for the calculation of the effective protection rates was provided by the Industrial Development Corporation (IDC), Statistics South Africa and the Trade and Industry Policy Secretariat (TIPS).

2 Capital stock of the economy: the employment of capital

The focus of this paper will be on the Machinery & Equipment measure of the capital stock of economic sectors in South Africa. South African statistics list three classes of capital stock on a sectoral basis: Buildings & Construction, Machinery & Equipment, and Transport Equipment. However, to the extent that one is either implicitly or explicitly concerned with the production function of the economy,¹ the strongest economic interest lies in the fixed capital stock of the economy approximated by Machinery & Equipment, since this most closely approaches the concept of the capital factor of production.

Conceptual economic considerations suggest the use of Machinery & Equipment as the most appropriate measure of capital stock. However for the majority of sectors the proportion contributed by Buildings & Construction constitutes the largest proportion of the total capital stock (greater than 50%). The only exceptions to this over the full sample period are Plastics, Radio, TV and Communications Equipment, and Construction, for which

¹Such interest may emanate either from questions concerning distribution of output between capital and labour, or questions about the long-term productive potential of sectors of the economy and the related issue of the determinants of investment expenditure.

Increasing Buildings & Construction Proportion	Increasing Machinery & Equipment Proportion	No Change in Proportions
Agriculture, Forestry & Fishing	Gold & Uranium Mining	Food
Coal Mining	Diamond & Other Mining	Footwear
Beverages	Wearing Apparel	Tobacco
Textiles	Leather & Leather Products	Wholesale & Retail Trade
Wood	Paper	Community Services
Petroleum Refining	Publishing & Printing	Transport, Storage & Communications
Basic Chemicals	Plastics	Finance, Insurance & Real Estate
Other Chemicals	Glass & Glass Products	
Other N-Met Minerals	Basic Iron & Steel	
Bas N-Ferrous Metals	Radio, TV & Comms Equip	
Fabricated Metals	Motor Vehicles	
Machinery & Apparatus	Furniture	
Electrical Machinery		
Instruments		
Transport Equipment		
Other Manufacturing		
Construction		

Figure 1: Changing Proportions of Capital Stock

Machinery & Equipment was the single most important source of capital. Moreover, for a number of sectors Machinery & Equipment became the most important source of capital during the course of the 1970-97 sample period.²

Perhaps more interesting are changes in the proportion of total capital stock contributed by the various sources of capital equipment. Figure 1 briefly reports which part of each sector's capital stock has constituted a rising proportion of total capital stock over the sample period.

We also briefly report developments in the level of capital stock in each of the available dimensions, before moving on to a more detailed analysis of the role of Machinery & Equipment on a sectoral basis. Such evidence highlights a potential difficulty arising from any consideration of the total capital stock in South Africa. Concentration on total capital stock is potentially misleading, since on occasion strong changes in one of Building & Construction (see for instance Petroleum refining)³ or Transport Equipment

²Viz: Diamond & Other Mining, Paper, Publishing & Printing, and Glass & Glass Products.

³Though we are not confident that the distinction between Machinery & Equipment and Building & Construction is always consistently applied across sectors. Particularly for mining, for instance, what may be classified as Building & Construction (such as a mineshaft), may be more appropriately viewed as capital stock in the standard sense.

may distort one's understanding of the investment performance of sectors in the South African economy. Figure 2 reports the rank of sectors in terms of their stock of Building & Construction. Little change occurs in terms of the relative size of the Building & Construction stock of the industries. In terms of the rank of the sectors, Petroleum refining (+20), Other Manufacturing (+5), Plastics (+5) are the only ones that increase their relative stock of Buildings & Construction significantly. Given the inclusion of the SASOL projects under Petroleum refining, the strong change in plant size in this sector is hardly surprising. Sectors with declining relative importance of Buildings & Construction are Textiles (-13), Fabricated Metals (-9), Wearing Apparel (-8), Non-metallic Minerals (-6) and Agriculture, Forestry & Fishing (-5), though only one sector, Wearing Apparel, had negative average annual growth rates in Buildings & Construction. While the average annual growth rate of Petroleum Refining (+32%) dominates that of all other sectors, a number of other sectors nevertheless reported average annual growth rates above 5%.

Thus if only total capital stock per sector is considered as a basis for the computation of investment, the dimension of Buildings & Construction carries strong implications for any computed sectoral investment rate. Other Manufacturing (+9.79%), Coal Mining (+9.61%), Basic Non-Ferrous Metals (+8.47%), Basic Chemicals (+7.82%), Beverages (+7.53%), Plastics (+6.63%), Manufacturing Building & Construction (+5.54%), and Motor Vehicles & Accessories (+5.07%) all showed strong increases in their Building & Construction stocks over the 1970-97 period, and if only total capital stock is considered might thus also show high investment rates without this being reflected in growth in fixed capital stock.

Figure 3 reports the rank of sectors in terms of their stock of Transport Equipment. Again, there are some strong differences between sectors in terms of the strength of investment in Transport Equipment, with resultant changes in the relative level of Transport Equipment available in those sectors. Strong increases in the stock of Transport Equipment on an average annual basis are recorded in Basic Iron & Steel (+9.12%), Motor Vehicles & Accessories (+8.60%), Other Manufacturing (+8.60%), Coal Mining (+7.10%). A number of other sectors recorded disinvestment of Transport Equipment on average: Agriculture, Forestry & Fishing (-2.22%), Footwear (-1.35%), Transport Equipment (-1.11%), Non-Metallic Minerals (-0.81%), Wearing Apparel (-0.56%), Construction (-0.53%), and Electrical Machinery (-0.15%). As in the instance of the Building & Construction category,

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	Rank	Rank	Rank	Rank	ChgRank	Avg	Rank	StdDev	Rank
High rank indicates high capital stock	1970	1980	1990	1997	1970-1997	Grwth	AvgGrwth	Grwth	StdDev
Instruments	1	1	2	3	2	4.53	28	9.17	33
Leather & Tanning	2	2	1	1	-1	1.23	5	5.60	20
Plastics	3	8	8	8	5	6.63	34	8.27	30
Footwear	4	4	3	4	0	1.71	8	4.72	13
Tobacco	5	6	4	2	-3	0.88	4	9.82	35
Radio Tv & Communi	6	5	6	5	-1	2.25	9	5.60	21
Other Maf & Recyc	7	7	9	12	5	9.79	39	40.31	39
Furniture	8	3	5	7	-1	2.77	13	8.55	31
Glass	9	10	11	9	0	4.44	27	9.23	34
Rubber	10	11	10	10	0	3.19	17	6.65	27
Petroleum Refined	11	31	31	31	20	32.16	40	105.16	40
Wood	12	14	13	13	1	3.21	18	5.53	18
Transport Equipmen	13	19	14	15	2	4.14	26	10.21	36
Wearing Apparel	14	9	7	6	-8	-1.76	1	2.63	5
Publish & Printing	15	13	12	11	-4	1.58	6	5.09	15
Construction Building & Construction	16	18	18	18	2	4.00	24	3.49	9
Electrical Machine	17	12	16	16	-1	3.36	19	6.28	24
Bas N-Ferrous Meta	18	16	17	23	5	8.47	37	12.56	37
Machinery & Appara	19	17	19	19	0	2.94	15	5.57	19
Motor Vehi & Acces	20	21	22	21	1	5.07	31	5.50	17
Beverages	21	24	25	25	4	7.53	35	8.02	29
Paper	22	22	21	20	-2	3.41	20	6.61	26
Other Chem & Fibre	23	27	23	24	1	6.16	33	6.48	25
Coal Mining Building & Construction	24	25	28	27	3	9.61	38	8.56	32
Basic Chemicals	25	23	27	26	1	7.82	36	15.06	38
Fabricated Metals	26	20	19	17	-9	1.66	7	5.96	22
Textiles & Knit	27	15	15	14	-13	0.36	2	3.50	10
Other N-Metal Minerals	28	26	24	22	-6	4.57	29	6.80	28
Food	29	28	27	28	-1	4.68	30	4.44	12
Diamond & Other Mining Building & Construction	30	29	29	27	-3	2.59	11	6.23	23
Basic Iron & Steel	31	30	30	30	-1	3.96	23	5.07	14
Gold & Uranium Ore Mining Building & Construction	32	32	34	34	2	3.49	21	3.75	11
Wholesale & Retail Trade Building & Construction	33	33	32	33	0	2.53	10	2.38	4
Electricity, Gas & Water Building & Construction	34	35	35	35	1	3.13	16	2.84	6
Mining & Quarrying Building & Construction	35	34	36	36	1	4.01	25	3.10	7
Manufacturing Building & Construction	36	37	37	38	2	5.54	32	5.22	16
Agriculture, Forest. & Fish. Building & Construction	37	36	33	32	-5	0.45	3	1.27	1
Transport, Storage & Commun. Building & Construction	38	38	38	37	-1	2.74	12	3.15	8
Finance, Insurance, Real Est Building & Construction	39	39	39	39	0	2.87	14	1.92	2
Community, Soc & Per Service Building & Construction	40	40	40	40	0	3.82	22	2.29	3

Figure 2: Buildings and Construction

therefore, these strong tendencies toward investment or disinvestment might influence investment rates considerably, and thus obscure changes in fixed capital stock.

It is potentially important therefore that any consideration of changes in the capital stock focus explicitly on the measure of capital given in Figure 4: the Machinery & Equipment measure. A number of sectors report high investment in fixed capital stock and thus high average annual growth rates in capital stock. Glass (+10.02%), Basic Non-Ferrous Metals (+9.28%), Paper (+8.14%), Coal Mining (+8.05%), Community, Social & Personal Services (+8.04%), Beverages (+7.00%), Plastics (+6.91%) and Transport Equipment (+6.70%) all show strong increases in the stock of physical capital stock over time. On the other hand, two sectors report negative average annual growth rates in physical capital stock: Textiles (-0.19%) and Agriculture, Forestry & Fishing (-0.06%). It is also noticeable that a number of sectors that demonstrated strong increases in the other two dimensions of capital stock are considerably less prominent in terms of investment in fixed capital stock as measured by Machinery & Equipment.

For the remainder of our discussion we focus discussion on as pure a measure of fixed capital stock as possible (Machinery & Equipment). Inclusion of the other categories of capital stock introduces the possibility of obscuring changes in the fixed capital stock of the economy.

2.1 The Relative Importance of South African economic sectors in the use of Machinery & Equipment

The focus of the present subsection is on the relative use of Machinery & Equipment by South African economic sectors. While this does not provide a measure of the capital intensity of production, it does provide some indication of the distribution of capital across sectors of the South African economy.

Figure 4 provides rankings of sectors in terms of capital stock as measured by Machinery & Equipment, for the years 1970, 1980, 1990 and 1997.⁴ The implication of the evidence is that the relative importance of sectors in the aggregate capital market for Machinery & Equipment has been subject to considerable change over the 1970-97 time period. Only 4 of 38 sectors

⁴Note that the evidence does not reflect yearly changes, given the use of a few benchmark time points.

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	Rank	Rank	Rank	Rank	ChgRank	Avg	Rank	StdDev	Rank
High rank indicates high capital stock	1970	1980	1990	1997	1970-1997	Grwth	AvgGrwth	Grwth	StdDev
Leather & Tanning	1	1	1	2	1	0.49	8	11.93	22
Other Maf & Recyc	2	6	6	6	4	8.6	31	15.77	33
Footwear	3	2	3	1	-2	-1.35	2	16.66	34
Instruments	4	3	4	3	-1	2.21	20	17.73	35
Glass	5	5	7	10	5	6.42	36	21.38	38
Tobacco	6	4	2	4	-2	0.65	9	19.05	37
Plastics	7	9	13	7	0	2.81	23	10.69	18
Radio Tv & Communi	8	10	5	9	1	3.49	28	13.34	29
Bas N-Ferrous Metal	9	12	12	14	5	5.01	32	18.39	36
Transport Equipment	10	7	8	5	-5	-1.11	3	13.79	31
Rubber	11	8	9	11	0	1.69	17	7.47	5
Furniture	12	13	10	16	4	4.30	29	11.74	21
Coal Mining Transport Equipment	13	17	14	22	9	7.10	38	22.64	39
Wearing Apparel	14	11	11	8	-6	-0.56	5	9.01	12
Publish & Printing	15	14	15	20	5	4.37	30	10.74	19
Paper	16	18	18	24	8	5.30	34	9.26	14
Textiles & Knit	17	15	16	13	-4	0.82	10	8.91	11
Community, Soc & Per Service Transport Equipment	18	16	17	18	0	2.43	22	7.19	4
Electrical Machine	19	22	21	12	-7	-0.15	7	12.72	26
Basic Chemicals	20	24	26	19	-1	3.14	27	13.58	30
Wood	21	20	20	15	-6	1.40	13	13.13	28
Basic Iron & Steel	22	31	19	29	7	9.12	40	27.77	40
Motor Vehi & Acces	23	23	30	34	11	8.60	39	12.23	24
Electricity, Gas & Water Transport Equipment	24	30	31	30	6	5.71	35	8.32	9
Beverages	25	28	28	28	3	5.01	33	10.97	20
Petroleum Refined	26	21	25	23	-3	1.69	16	12.28	25
Machinery & Apparat	27	27	24	21	-6	0.96	12	10.09	17
Other Chem & Fibre	28	19	23	25	-3	1.46	15	13.34	8
Other N-Metal Minerals	29	29	22	17	-12	-0.81	4	13.79	31
Fabricated Metals	30	26	27	26	-4	1.46	14	8.50	10
Gold & Uranium Ore Mining Transport Equipment	31	25	29	27	-4	0.96	11	12.01	23
Diamond & Other Mining Transport Equipment	32	32	32	33	1	2.93	25	13.04	27
Food	33	34	33	32	-1	2.35	21	10.05	16
Mining & Quarrying Transport Equipment	34	33	35	36	2	2.03	18	8.00	7
Construction Transport Equipment	35	35	34	31	-4	-0.53	6	9.23	13
Agriculture, Forest. & Fish. Transport Equipment	36	36	36	35	-1	-2.22	1	5.96	2
Manufacturing Transport Equipment	37	38	38	37	0	2.92	24	7.88	6
Wholesale & Retail Trade Transport Equipment	38	37	37	38	0	3.08	26	6.00	3
Finance, Insurance, Real Est Transport Equipment	39	39	39	39	0	6.65	37	9.39	15
Transport, Storage & Commun. Transport Equipment	40	40	40	40	0	2.07	19	3.95	1
All Economic Activities						2.56		4.15	

Figure 3: Transport Equipment

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	Rank	Rank	Rank	Rank	ChgRank	Avg	RankAvg	StdDev	Rank
High rank indicates high capital stock	1970	1980	1990	1997	1970-1997	Grwth	Grwth	Grwth	StdDev
Leather & Tanning	1	1	1	4	3	5.23	26	12.86	25
Instruments	2	2	2	1	-1	0.02	4	11.05	19
Footwear	3	4	5	5	2	1.97	8	8.68	12
Tobacco	4	5	3	2	-2	0.71	5	14.23	29
Furniture	5	3	7	6	1	5.05	24	15.79	32
Glass	6	7	9	13	7	10.02	40	28.03	39
Other Maf & Recyc	7	6	6	3	-4	-0.57	1	13.24	28
Transport Equipmen	8	9	4	10	2	6.70	33	23.49	37
Radio Tv & Communi	9	10	8	9	0	5.06	25	16.29	33
Wearing Apparel	10	11	11	7	-3	1.28	7	8.60	11
Wood	11	8	10	8	-3	2.25	9	13.04	26
Community, Soc & Per Service	12	17	21	20	8	8.04	36	11.47	21
Machinery & Equipment									
Plastics	13	14	17	18	5	6.91	34	11.54	22
Rubber	14	12	12	11	-3	3.40	15	11.04	18
Electrical Machine	15	18	14	12	-3	2.28	11	10.37	17
Publish & Printing	16	13	13	17	1	5.98	32	17.54	34
Beverages	17	16	22	23	6	7.00	35	11.65	23
Coal Mining Machinery & Equipment	18	27	28	27	9	8.05	37	18.19	36
Bas N-Ferrous Meta	19	15	15	25	6	9.28	39	30.63	40
Machinery & Appara	20	20	16	14	-6	0.94	6	9.65	15
Fabricated Metals	21	24	18	16	-5	2.25	10	8.71	13
Paper	22	19	26	28	6	8.14	38	26.10	38
Motor Vehi & Acces	23	21	24	22	-1	3.92	17	11.39	20
Other N-Metal Minerals	24	23	19	19	-5	2.94	12	15.17	30
Construction Machinery & Equipment	25	29	29	24	-1	3.81	16	9.67	16
Textiles & Knit	26	22	20	15	-11	-0.19	2	8.38	8
Basic Chemicals	27	26	23	21	-6	3.02	13	17.60	35
Other Chem & Fibre	28	28	27	26	-2	3.32	14	11.82	24
Food	29	25	25	29	0	4.33	20	9.14	14
Petroleum Refined	30	30	30	31	1	5.95	31	15.42	31
Diamond & Other Mining Machinery & Equipment	31	32	34	34	3	5.92	30	5.60	4
Gold & Uranium Ore Mining Machinery & Equipment	32	35	37	32	0	4.41	21	8.50	9
Finance, Insurance, Real Est Machinery & Equipment	33	31	35	36	3	5.55	29	5.05	2
Wholesale & Retail Trade Machinery & Equipment	34	33	32	33	-1	4.20	19	5.60	3
Basic Iron & Steel	35	34	31	37	2	5.53	28	13.21	27
Transport, Storage & Commun. Machinery & Equipment	36	36	36	35	-1	4.44	22	4.77	1
Agriculture, Forest. & Fish. Machinery & Equipment	37	37	33	30	-7	-0.06	3	8.28	7
Mining & Quarrying Machinery & Equipment	38	38	38	38	0	5.26	27	5.75	5
Electricity, Gas & Water Machinery & Equipment	39	40	40	39	0	5.03	23	8.55	10
Manufacturing Machinery & Equipment	40	39	39	40	0	4.10	18	7.10	6
All Economic Activities						4.17		4.21	

Figure 4: Machinery and Equipment

show no change in their relative importance as employers of capital in the market, and a number of sectors show very strong changes in their relative importance.

In particular, seven sectors show very dramatic increases in terms of their relative importance as employers of capital: Coal Mining (increase in rank of +9), Community, Social and Personal Services (+8), Glass & Glass Products (+7), Beverages (+6), Basic Non-Ferrous Metals (+6), and Paper & Paper Products (+6) and Plastic Products (+5), all show a rank improvement of 5 or greater. Four sectors showed very strong relative decreases in relative employment of capital (defined as a fall of 5 or greater in rank): Textiles (-11), Agriculture, Forestry & Fishing (-7), Basic Chemicals (-6), Machinery & Apparatus (-6), Fabricated Metals (-5) and Other Non-Metallic Minerals (-5).

Significantly, it is noticeable that for most of these industries the strongest change in relative importance in the capital market occurs before 1990. The implication is that the changing patterns of relative capital usage in the South African economy are thus likely to be attributable to long term structural factors, rather than to any factor that is associated with policy or circumstantial changes that occurred during the 1990's. In particular, explanations that identify single factors, such as trade liberalization for instance, as the reason for changing patterns of relative capital usage, are likely to be hard-pressed to provide the evidence, given the long run structural patterns of change noted. Only for the Glass & Glass Products and Basic Non-ferrous Metals sectors does a strong change in relative importance of capital employed emerge after 1990, and is thus plausibly associated with a policy intervention such as trade liberalization.

Indeed for a number of sectors, the likely explanation of changing patterns of relative capital usage is structural adjustment between and within sectors in the economy. For instance, for Coal Mining the strong increase in relative capital usage (+9) is also associated with a strong decrease in relative importance within the South African labour market ⁵ (a decrease in its rank of -11), suggesting that increased capital usage is due either to technological requirements, changes in relative factor prices, or other factors. For two further sectors, Other Non-Metallic Minerals,⁶ Textiles & Knitwear,⁷

⁵For a more detailed discussion of labour market developments see Fedderke, Henderson, Mariotti and Vaze (1999)

⁶A fall in rank in capital and labour markets of -5, and -8.

⁷A fall in rank in capital and labour markets of -11 and -7.

decreasing relative importance in capital markets is mirrored by strong decreases in relative importance in employment, suggesting a general decline in importance of the sectors in employment within all factor markets. Thus the sectors appear to be declining in relative importance within the economy as a whole, and have been doing so for a relatively protracted period of time. The implication is thus that the changing policy environment of the 1990's, and policy interventions such as trade liberalization in particular, while plausibly contributing to changing patterns of relative capital usage in South Africa, are perhaps also unlikely to have been the major and certainly not the sole determinant of changing relative capital usage in the South African economy.

Of course the relative importance of economic sectors as employers of capital does not give information about the absolute importance of sectors as employers of machinery and equipment, and may indeed mask important changes over time in this dimension. It is to this that we turn our attention in the following subsection.

2.2 Capital Stock, Machinery & Equipment: the absolute importance of South African economic sectors in employment of capital stock

The relative importance of sectors in employing capital does not yet capture their absolute importance as capital users.

The South African capital market is dominated by a relatively small number of sectors.⁸ Thus at the comparison years, the top ...ve sectors were:

² in 1970: Electricity, Gas & Water; Agriculture, Forestry & Fishing; Transport, Storage & Communications; Basic Iron & Steel; Wholesale & Retail Trade.

² in 1980: Electricity, Gas & Water; Agriculture, Forestry & Fishing; Transport, Storage & Communications; Gold & Uranium Ore Mining; Basic Iron & Steel.

² in 1990: Electricity, Gas & Water; Gold & Uranium Ore Mining; Transport, Storage & Communications; Finance, Insurance & Real Estate; Diamond Mining.

⁸If we ignore the dominant position of Electricity, Gas & Water, however, the preponderance of certain key sectors is perhaps not as severe as for the labour market. See Fedderke, Henderson, Mariotti & Vaze (1999).

² in 1997: Electricity, Gas & Water; Basic Iron & Steel; ; Finance, Insurance & Real Estate; Transport, Storage & Communications; Diamond Mining. Electricity, Gas & Water is consistently the single largest employer of Machinery & Equipment in the South African economy, and its lead over the closest rival was extended through the course of the 1970's and 1980's (with the strongest increase manifested during the 1980's), and only the 1990's has seen a narrowing of the gap.

A second feature of the absolute capital employment figures is that the top five capital-using sectors are generally not manufacturing sectors - the one exception being Basic Iron & Steel.⁹ Indeed, a rather surprising feature is the preponderance of service sectors amongst sectors with strong exposure to Machinery & Equipment in the South African economy. By contrast both Gold & Uranium Ore Mining, and Diamond & Other Mining show only intermittent presence amongst the top five strongest users of Machinery & Equipment in the South African economy. While this may be an accurate representation of conditions in the mining sector, an alternative explanation may lie in the fact that a considerable proportion of the mining sectors' capital stock is recorded under the Buildings & Construction category excluded from consideration for the present study. As such, the capital stock figures recorded under Machinery & Equipment for mining sectors may be biased downward.

The relative importance of sectors as employers of capital in South Africa therefore needs to be tempered by the realization that in absolute terms, changes in the four to five largest sectors in terms of the stock of Machinery & Equipment employment will have a disproportionately large impact on the level of the aggregate capital stock of the economy. By contrast, strong changes in relative terms in the manufacturing sector will simply not translate into very significant changes in the aggregate stock of Machinery & Equipment in the economy as a whole.¹⁰

⁹One important caveat is in order here. This is that our data set treats the manufacturing sector at a relatively disaggregated level, while other sectors (services, mining) are treated at a relatively high level of aggregation. Thus the comparison across sectors is placing the manufacturing sector at a disadvantage. We recognize the problem. However, to our knowledge no more disaggregated data than that employed for this study is publicly available on capital stock in non-manufacturing sectors, and we therefore have no means of improving the precision of our comparison. Moreover, this disadvantage is no longer present when considering investment rates, or growth rates of capital stock.

¹⁰Given the relatively small contribution of manufacturing sectors to the total capital

In the previous subsection we noted that evidence on the relative capital usage across economic sectors in the South African economy suggested the presence of long term structural changes in capital markets, rather than changes associated with an altered policy environment through the 1990's. However, evidence from the absolute level of capital usage as measured by Machinery & Equipment does lend some credence to the possibility that the 1990's and its changed policy environment may also have had an impact on capital usage in the South African economy. This is most evident in the declining Machinery & Equipment capital stock in Electricity, Gas & Water (-4.16%), and above all the strong increase in the usage of this category of capital by the Basic Iron & Steel (+13.58%) and Diamond Mining sectors (+5.55%). Given that the period after 1985 saw a sharp decrease in the value of the Rand without any recovery post-1990, the implication is that the increased exposure to capital in these sectors took place despite the increasing supply price of capital goods - and one plausible explanation for such changes may be the changing trade dispensation that prevailed during the 1990's.

2.3 Capital Stock, Machinery & Equipment: the relative rate of change in the capital stock of the South African Economy

An examination of the absolute employment of capital stock in the economy by sector, and changes in the absolute levels of employment of capital stock points to the importance of the proportional growth rate in the capital stock by sector. Strong proportional growth rates in Machinery & Equipment could have been maintained by various (or all) economic sectors, without any changes in the ranking of the sector in terms of capital employed.

Figure 5 provides details of the average growth rates in the real stock of Machinery & Equipment maintained by sectors, reported in terms of decade averages.¹¹

stock of the economy, it also follows that should SA's capital markets be restructuring state led investment, to private sector investment expenditure in manufacturing, high investment rates in the sectoral level would not necessarily translate into high investment rates in aggregate.

¹¹We employ decade averages since the growth rate of the capital stock is subject to strong fluctuations on an annual basis.

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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 5: Proportional Growth Rate: Machinery & Equipment

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 average¹² 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 their capital stock. 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. 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 Ore Mining, Coal) amongst the leading investors in capital stock. The 1970's show an even more marked growth in capital stock bias toward 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 Ore Mining, Coal, Diamond Mining, Community, Social & Personal Services, Basic Iron & Steel, and Other Chemicals & Fibres).

The evidence is such as to suggest the plausibility of a distortion in the South African capital markets due to the heavy reliance on 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 disappearance of a 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)

¹²Computed as an average across all sectors. It is thus unweighted for the relative size of capital stock in each of the sectors.

have shown strong growth in their capital stock.

As can be argued for the South African labour market therefore,¹³ 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 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.

If correct the encouraging implication of this reasoning 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 in the past have been prevented from increasing their capital stock due to 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 currently being maintained.

An alternative explanation of the high investment rates in manufacturing might be that relative factor prices are forcing a switch to capital in place of labour. However, since of the ten sectors with the strongest growth in capital stock, ...ve experienced negative growth rates in real per labourer remuneration over the 1970-97 period,¹⁴ and three further sectors¹⁵ experienced growth rates in labour productivity that exceeded those of the real wage, this is unlikely to constitute a general explanation of the structural change in capital employment noted.

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, and we will return to this question in later sections.

¹³See Fedderke, Henderson, Mariotti & Vaze (1999) - though for the labour markets the reasons for the restructuring are different.

¹⁴TV, Radio & Communications Equipment, Leather & Leather Products, Basic Iron & Steel, Publishing & Printing, and Transport Equipment.

¹⁵Plastics, Beverages, and Basic Non-ferrous Metals.

2.4 The Investment Rate: decomposition by economic sector

A crucial consideration for South African capital markets is what proportion of total real output is reinvested in productive capacity in the form of Machinery & Equipment. For this purpose we compute the investment rate as¹⁶

$$\frac{\text{Real Net Investment}}{\text{Real Net Output}} \quad (1)$$

for each economic sector.¹⁷

Figure 6 reports decade averages for the net investment rate, together with a ranking of economic sectors in terms of their investment rate.

We note immediately that the investment rate evidence for the economy as a whole confirms the pessimistic evidence gained from the growth in capital stock data and, if anything, darkens the picture yet further. For the economy as a whole the investment rate throughout the 1970-97 period has been poor, remaining at 2% throughout the 1970's and 1980's, and declining yet further to 1% during the course of the 1990's.¹⁸ But as for the growth in the aggregate capital stock, the picture obscures strong sectoral differences. Evidence continues to emerge that the 1990's have seen a restructuring of the South African economy in response to declining primary commodity reliance in the economy as a whole, and perhaps reduced levels of distortion emerging from government-led investment projects. As for the growth in the capital stock, what is noticeable is the emergence during the course of the 1990's of the manufacturing sector as leader in investment rates in a number of its sub-sectors. Unsurprisingly, a number of the sectors that feature in the top-ten ranking in terms of growth in the Machinery & Equipment capital stock measure, also emerge as sectors with high investment rates.¹⁹ Symmetrically,

¹⁶Net investment is corrected for depreciation

¹⁷One limitation we face is that the data is not consistently available by category for both Real Net Output and Real Net Investment for all South African economic sectors. This means that consistent investment rate ratios were computable for only 37 sectors in the economy.

¹⁸In case these rates look low by way of a final reminder, recall that our investment rate is computed purely for the Machinery & Equipment component of capital stock, not total capital stock.

¹⁹The sector that is exceptional is Coke & Refined Petroleum Products - but this may be due to a reclassification of the sector - as it was previously classed as the Refined

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high rank indicates high investment rate	1970'sAvg	1980'sAvg	1990'sAvg	Rank70's	Rank80's	Rank90's
Electricity, gas & water	0.26	0.25	-0.13	37	36	1
Gold & uranium ore mining	0.02	0.05	-0.04	22	34	2
Agriculture, forestry & fishing	0.04	-0.02	-0.02	31	2	3
Professional & scientific equipment	0.01	0.01	-0.01	15	26	4
Building construction	0.04	-0.01	-0.01	28	4	5
Other industries	-0.01	0.00	0.00	2	18	6
Electrical machinery	0.02	0.00	0.00	24	10	7
Transport, storage & communication	0.04	0.03	0.00	29	32	8
Wearing apparel	0.01	0.00	0.00	16	19	9
Machinery & equipment	0.00	0.00	0.00	7	8	10
Textiles	-0.01	0.01	0.00	1	21	11
Footwear	0.00	0.00	0.00	12	17	12
Tobacco	0.00	0.00	0.00	10	6	13
Furniture	0.00	0.01	0.01	5	25	14
Coal mining	0.04	0.03	0.01	30	33	15
Wholesale & retail trade	0.01	0.00	0.01	20	16	16
Other chemicals & man-made fibres	0.08	0.00	0.01	35	9	17
Metal products excluding machinery	0.01	0.00	0.01	18	5	18
Wood & wood products	0.00	0.00	0.01	11	20	19
Basic chemicals	0.02	0.00	0.02	23	14	20
Leather & leather products	0.00	0.00	0.02	13	15	21
Finance & insurance	0.03	0.02	0.02	27	30	22
Motor vehicles, parts & accessories	0.00	0.01	0.02	8	22	23
Television, radio & communication equipment	0.01	0.00	0.03	21	13	24
Paper & paper products	0.01	0.06	0.03	17	35	25
Non-metallic minerals	0.00	0.00	0.03	6	11	26
Printing, publishing & recorded media	0.00	0.01	0.04	3	24	27
Rubber products	0.01	0.00	0.04	14	12	28
Plastic products	0.03	0.02	0.05	26	31	29
Food	0.00	0.01	0.05	9	23	30
Other mining	0.07	0.02	0.06	33	28	31
Beverages	0.02	0.02	0.07	25	27	32
Coke & refined petroleum products	0.21	0.29	0.08	36	37	33
Glass & glass products	0.00	0.02	0.08	4	29	34
Other transport equipment	0.01	-0.01	0.09	19	3	35
Basic non-ferrous metals	0.06	0.00	0.13	32	7	36
Basic iron & steel	0.07	-0.04	0.16	34	1	37
All Economic Activity	0.02	0.02	0.01			

Figure 6: Investment Rates

a number of mining sectors (see for instance Gold & Uranium Ore Mining), and sectors with strong state-led investment (see for instance Electricity, Gas & Water) show strong declines in their investment rates during the course of the 1990's.

Indeed, for a number of manufacturing sectors the average investment rate in Machinery & Equipment, has been in excess of 6% per annum, in some cases substantially so. Thus Beverages (7%), Coke & Refined Petroleum Products (8%), Glass & Glass Products (8%), Other Transport Equipment (9%), Basic Non-ferrous Metals (13%), Basic Iron & Steel (16%) have all maintained very healthy investment rates throughout the course of the 1990's. By contrast the 1980's proved a period of exceptionally low investment rates, particularly for the manufacturing sectors, perhaps reflecting the high levels of political uncertainty that prevailed during this decade.

Once again, therefore, 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 disappearance of a 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.

The implication is again 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.

We have already noted, given that restructuring appears to be leading to high investment rates in sectors that carry low weight in the computation of aggregate investment rates, (since they have small capital stock) that current investment rates may be understating SA's investment performance.

Petroleum sector. Also, Other Mining maintains a higher investment rate ranking than it does a growth in real capital stock ranking.

2.5 Volatility of Investment Rates and Growth Rates of the Real Stock of Machinery & Equipment

Investment rates are frequently argued to be very sensitive to the confidence of investors. Since investment projects are typically such that they have long gestation periods, with pay-offs being realized at time points in the future which on occasion are very remote, the impact of expectations of what the future will bring becomes particularly important in the determination of investment decisions.

The next question we turn to therefore, is the volatility of investment rates over the three decade period which forms the focus for the present study.

Figure 7 reports the standard deviations of the investment rate in Machinery & Equipment on a decade average basis for the 1970's, 1980's and 1990's.

A number of sectors show marked increases in the volatility of their investment rates relative to the volatility of other sectors. In particular, Furniture, Textiles, Glass & Glass Products, and Paper & Paper Products all show a marked increase in the volatility of their investment rates during the 1980's and 1990's relative to the 1970's, while Other Transport Equipment experiences increased volatility of its investment rate during the 1990's.

However, only two of these sectors, Glass & Glass Products, and Other Transport Equipment are amongst the sectors with strong investment rates during the 1990's. Thus it does not appear as if the improvement in investment rates amongst manufacturing industries we have noted for the 1990's has been achieved at the cost of higher volatility in investment rates. Indeed, the correlation between the decade average investment rate and the average decade standard deviation of the investment rate declines as we move from the 1970's and 1980's into the 1990's. While the correlation is 0.82 and 0.85 for the 1970's and 1980's respectively, the correlation declines to 0.63 in the 1990's, suggesting that sectors that had high investment rates were less likely to have volatile investment rates during the 1990's than during the preceding decades.

Moreover, the strongest increase in volatility is associated with the increased political uncertainty of the 1980's, rather than the arrival of the 1990's. For the economy as a whole the volatility of the investment rate declined from the levels maintained fairly consistently during the course of the 1970's and 1980's. This suggests that for South Africa risk factors that

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High Rank indicates high volatility	1970'sSD	1980'sSD	1990'sSD	Rank70's	Rank80's	Rank90's
Machinery & equipment	0.00	0.02	0.01	1	9	1
Furniture	0.01	0.02	0.02	2	13	13
Wholesale & retail trade	0.01	0.01	0.01	3	3	3
Footwear	0.01	0.01	0.02	4	2	11
Metal products excluding machinery	0.01	0.01	0.02	5	7	6
Leather & leather products	0.01	0.02	0.03	6	10	14
Textiles	0.01	0.02	0.04	7	18	19
Tobacco	0.01	0.01	0.04	8	4	21
Gold & uranium ore mining	0.02	0.03	0.02	9	19	8
Transport, storage & communication	0.02	0.02	0.02	10	11	7
Glass & glass products	0.02	0.06	0.16	11	28	35
Building construction	0.02	0.02	0.01	12	14	2
Wearing apparel	0.02	0.01	0.01	13	5	4
Other industries	0.02	0.02	0.02	14	12	10
Motor vehicles, parts & accessories	0.03	0.04	0.04	15	24	22
Other transport equipment	0.03	0.01	0.09	16	1	33
Finance & insurance	0.03	0.01	0.02	17	8	9
Electrical machinery	0.03	0.01	0.03	18	6	15
Printing, publishing & recorded media	0.03	0.04	0.06	19	23	28
Food	0.03	0.02	0.04	20	16	23
Other mining	0.03	0.04	0.04	21	26	20
Agriculture, forestry & fishing	0.04	0.08	0.03	22	30	16
Paper & paper products	0.04	0.19	0.09	23	35	32
Wood & wood products	0.04	0.02	0.02	24	17	12
Beverages	0.05	0.04	0.06	25	22	29
Television, radio & communication equipment	0.06	0.02	0.05	26	15	24
Non-metallic minerals	0.06	0.08	0.05	27	31	25
Rubber products	0.06	0.03	0.04	28	21	18
Professional & scientific equipment	0.06	0.03	0.02	29	20	5
Coal mining	0.07	0.04	0.05	30	25	26
Plastic products	0.07	0.04	0.06	31	27	30
Other chemicals & man-made fibres	0.13	0.08	0.03	32	32	17
Basic chemicals	0.13	0.09	0.06	33	33	27
Basic non-ferrous metals	0.13	0.10	0.18	34	34	37
Basic iron & steel	0.16	0.06	0.15	35	29	34
Electricity, gas & water	0.18	0.23	0.08	36	36	31
Coke & refined petroleum products	0.35	0.76	0.18	37	37	36
Total GDP	0.01	0.02	0.02			
AVERAGE	0.06	0.06	0.05			

Figure 7: Investment Rate Standard Deviations

intruded from the political arena may well have played a significant role in the determination of at least the volatility, if not the level of investment expenditure. While this forms part of a subsequent econometric investigation into the determinants of investment expenditure in South Africa, we note that certainly for aggregate investment, and for capital flight there exists strong empirical evidence suggesting that political risk factors are of importance to the South African economy.²⁰

We also note that for a number of sectors the volatility of the investment rate decreased substantially during the 1990's relative to other sectors (Agriculture, Forestry & Fishing, Construction, Gold & Uranium Ore Mining, Other Chemicals & Man-made Fibres, Professional & Scientific Equipment).

Figure 8 reports the standard deviations of the growth rate in real Machinery & Equipment on a decade average basis for the 1970's, 1980's and 1990's.

Again, the evidence suggests a relatively wide-spread increase in the volatility of the growth rate in capital after the 1970's, with substantial increases in volatility for Textiles & Knitwear, Furniture, Agriculture, Forestry & Fishing, Machinery & Apparatus, Other Manufacturing & Recycling, Paper and Basic Non-ferrous Metals. However, of the sectors whose volatility in the growth rate of the capital stock increased during the 1990's,²¹ only one was amongst the sectors to experience strong growth in its real capital stock in Machinery & Equipment - again suggesting that the improvement in investment performance in the manufacturing sector during the course of the 1990's has not been purchased at the expense of increased volatility in investment. And again, for at least some sectors the 1990's have seen a significant decline in the volatility of investment in real capital: Instruments, Rubber, Wood, Other Chemicals & Fibres, Petroleum Refining, and Machinery & Apparatus all report decreased volatility of growth rates in their real capital stock of Machinery & Equipment.

The possibility of a structural break in capital accumulation during the 1990's, to which our earlier evidence alluded, thus certainly does not appear to be translating into a greater volatility of investment. For the economy as a whole the standard deviation of the growth rate of the real stock of Machinery & Equipment declines from 4.72 during the 1980's to 3.39 during the 1990's.

²⁰See Fedderke and Liu (1999), Fedderke, De Kadt and Luiz (1999) and Fedderke (2000)

²¹Footwear, Electrical Machinery, Tobacco, Radio, TV & Communications Equipment, and Transport Equipment.

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high rank indicates high volatility	1970'sSD	1980'sSD	1990'sSD	Rank70's	Rank80's	Rank90's
Textiles & Knit	3.58	9.30	10.00	1	22	22
Transport, Storage & Commun.	4.24	3.15	3.07	2	1	5
Furniture	4.65	20.93	15.08	3	37	31
Agriculture, Forest. & Fish.	5.02	9.15	7.66	4	21	14
Diamond & Other Mining	5.18	4.71	4.32	5	6	6
Machinery & Appara	5.61	13.15	8.91	6	31	18
Manufacturing+AJ45	5.64	7.76	6.55	7	18	11
Mining & Quarrying	5.73	4.18	1.74	8	5	1
Wholesale & Retail Trade	6.02	4.17	5.01	9	4	8
Gold & Uranium Ore Mining	6.46	6.73	2.46	10	11	4
Finance, Insurance, Real Est	6.68	4.07	4.53	11	3	7
Fabricated Metals	6.90	8.83	8.76	12	20	17
Electricity, Gas & Water	7.31	6.68	2.31	13	10	3
Other Maf & Recyc	7.71	12.03	18.91	14	28	34
Paper	8.38	39.00	15.29	15	40	32
Footwear	8.74	6.79	11.43	16	12	26
Leather & Tanning	8.89	11.24	16.07	17	24	33
Food	9.05	7.46	8.52	18	16	16
Motor Vehi & Acces	9.39	12.67	10.45	19	30	23
Glass	9.42	24.76	41.54	20	38	40
Wearing Apparel	9.59	7.15	9.71	21	14	21
Beverages	11.14	12.04	11.14	22	29	24
Construction	11.16	3.86	1.76	23	2	2
Instruments	11.38	11.52	8.22	24	26	15
Bas N-Ferrous Meta	11.38	35.65	35.35	25	39	39
Plastics	11.54	10.61	12.82	26	23	28
Electrical Machine	11.59	5.95	13.28	27	9	29
Publish & Printing	11.92	15.80	22.51	28	34	36
Rubber	12.04	11.38	7.10	29	25	13
Tobacco	13.11	7.18	20.84	30	15	35
Other N-Metal Minerals	13.39	19.03	12.65	31	36	27
Wood	13.89	14.64	9.23	32	33	19
Radio Tv & Communi	13.92	6.94	24.70	33	13	37
Other Chem & Fibre	15.04	11.94	6.21	34	27	9
Basic Iron & Steel	15.54	5.92	11.20	35	8	25
Transport Equipmen	15.60	4.91	29.16	36	7	38
Community, Soc & Per Service	16.91	7.59	6.70	37	17	12
Petroleum Refined	16.99	17.79	9.69	38	35	20
Basic Chemicals	24.90	13.67	13.81	39	32	30
Coal Mining	29.18	8.13	6.40	40	19	10
All Economic Activities	2.24	4.72	3.39			

Figure 8: Standard Deviations of Growth Rate in Real Stock of Machinery & Equipment

Similarly, the standard deviation of the investment rate in Machinery and Equipment, while it does not show a decline from that of the 1980's during the 1990's for the economy as a whole (it remains at 0.02), at least does not show evidence of an increase in the volatility of the investment rate. Again, the structural break in investment behaviour, if present, has not manifested itself in greater volatility of investment - but rather in a different distribution of investment across sectors, and in a different level of investment expenditure in sectors.

3 The Real Cost of Capital

In terms of economic analysis changes of quantity of any good, including capital stock, are at least potentially associated with changes in its price. As a consequence, we now turn to the issue of the real cost of capital, and its potential impact on changing investment rates across South Africa's economic sectors.

For the purposes of the present analysis, we define the user cost of capital as:

$$uc = (i - \pi) + d + \tau_c \quad (2)$$

where i denotes the nominal interest rate, π the inflation rate, d the depreciation rate on capital stock (defined as Machinery & Equipment), and τ_c denotes the corporate tax rate.

Ideally, τ_c should be defined as the net real effective tax rate faced by each sector, such that the tax rate reflects the impact of any tax exemptions, breaks, and subsidies faced by the economic sector. Unfortunately, for South Africa such data is not readily available, particularly since tax exemptions and subsidies are frequently defined on highly disaggregated definitions of capital stock.²²

²²Ideally, τ_c should be defined as the net real effective tax rate faced by each sector, such that the tax rate reflects the impact of any tax exemptions, breaks, and subsidies faced by the economic sector. Unfortunately, for South Africa such data is not readily available, particularly since tax exemptions and subsidies are frequently defined on highly disaggregated definitions of capital stock. While we are constrained by data limitations in this regard, we also suggest that a future topic of research in South Africa might usefully examine the tax component of the user cost of capital in greater detail, in order to develop more accurate real user cost of capital time series.

Table 9	Government Bonds: 0-3 years	Government Bonds: 3-5years	Government Bonds: 5-10 years	Government Bonds: over 10 years	eskom
Government Bonds: 0-3 years	1				
Government Bonds: 3-5years	0.86	1			
Government Bonds: 5-10 years	0.99	0.87	1		
Government Bonds: over 10 years	0.98	0.86	0.998	1	
eskom	0.85	0.72	0.86	0.86	1
loan stock	0.90	0.76	0.94	0.95	0.77

Figure 9: Correlations between alternate yield measures

The user cost of capital can also be defined in terms of a number of different definitions of the interest rate. For the purposes of the current study, we employ yields on long term government (with more than 10 years to maturity). Nevertheless, we examined the sensitivity of the definition of the user cost of capital to alternative definitions of the interest rate. Figure 9 reports the correlation coefficients between the alternative computations of the user cost of capital, based on long term government bond yields with more than 10 years to maturity, medium-term government bond yields, with either 3-5 or 5-10 years to maturity, short-term government bond yields, with 0-3 years to maturity, yields on Eskom Bonds and yields on Private Sector Bonds.

As is evident from the correlation coefficients, the use of the alternative measures of the interest rate do not generate strongly divergent computations of the user cost of capital. Our choice of the long run government bond yield is driven by the consideration that government directed investment expenditure during the course of the 1970's and 1980's potentially played a dominant role in South African capital markets, as noted in the preceding analysis.

In contrast with capital usage, relative real user cost of capital by economic sector shows greater stability over the full 1970-97 period. The correlation between the rank of economic sectors in terms of user cost of capital in 1970 and 1997 is +0.95, suggesting a high degree of stability of relative

user costs across sectors over time.

An immediate implication of this evidence is that changes in the user cost of capital are perhaps unlikely to account for changing relative capital usage between sectors, since the relative cost of capital is unlikely to vary sufficiently to account for the changing patterns of capital employment across sectors.

In Figure 10 we report the rank of economic sectors in terms of the real user cost of capital.

Very few sectors demonstrate strong increases in the user cost of capital relative to other sectors in the economy. The only exceptions are Agriculture, Forestry & Fishing (increase in rank of sector of +8), Construction (+8), Instruments (+6), and Petroleum Refined (+5). These changes are hardly surprising, given the decrease in subsidised finance to the agricultural sector after 1980, and the falling state-led investment in strategic petroleum production after the 1980's.

Similarly, few sectors show a strong decrease in the relative real user cost of capital in the South African economy. Only for Food (decrease in rank of sector of -5), Leather & Tanning (-5), Tobacco (-5) and Transport Equipment (-6) is evidence of strong decreases in the relative cost of capital at all compelling. On the other hand, it is noticeable that for all these sectors the growth rate of the capital stock during the course of the 1990's was relatively high. Thus for Transport Equipment (+26.19%), Leather & Tanning (+10.44%), Food (10.74%) and Tobacco (3.88%) the average annual growth rate in real capital stock as measured by Machinery & Equipment is always comfortably positive, and in the case of some of the sectors very substantially so.

While the current descriptive context does not readily allow for generalization, there is some evidence to suggest that the user cost of capital has formed a barrier to investment in the past for sectors of the South African economy in general. The correlation between the average real user cost of capital per sector for the 1970's, and the average investment rate for the 1970's and the average proportional growth rate in the real capital stock per sector in the 1970's is -0.45 and -0.71 respectively. Thus the higher the user cost of capital, the greater the likelihood that the investment rate and the growth rate in real capital stock would be low. Yet through the course of the 1980's the two correlations were -0.35 and -0.17, and in the 1990's they rose further to +0.20 and +0.24. The implication appears to be that the user cost of capital formed a significant constraint on investment in real capital

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high rank indicates high real user cost.	1970	1980	1990	Rank 1970	Rank 1980	Rank 1990
Diamond & Other Mining	0.52	0.53	0.53	1	2	1
Gold & Uranium Ore Mining	0.54	0.51	0.56	2	1	2
All Economic Activities	0.55	0.55	0.56	3	4	3
Electricity, Gas & Water	0.55	0.55	0.60	4	5	7
Mining & Quarrying	0.56	0.55	0.57	5	6	6
Community, Soc & Per Service	0.57	0.60	0.57	6	8	5
Transport, Storage & Commun	0.57	0.58	0.61	7	7	8
Coal Mining	0.58	0.54	0.57	8	3	4
Manufacturing	0.61	0.63	0.62	9	10	9
Finance, Insurance, Real Est	0.62	0.63	0.63	10	9	11
Basic Iron & Steel	0.62	0.69	0.63	11	14	10
Other Chem & Fibre	0.63	0.65	0.67	12	11	14
Radio Tv & Communi	0.65	0.71	0.69	13	22	17
Construction	0.65	0.70	0.70	14	17	22
Wholesale & Retail Trade	0.66	0.68	0.68	15	13	16
Petroleum Refined	0.66	0.67	0.70	16	12	21
Footwear	0.66	0.70	0.66	17	19	13
Wood	0.66	0.69	0.66	18	15	12
Agriculture, Forest. & Fish.	0.67	0.71	0.72	19	21	27
Tobacco	0.67	0.70	0.67	20	18	15
Machinery & Appara	0.68	0.70	0.70	21	20	19
Electrical Machine	0.68	0.74	0.73	22	25	29
Furniture	0.69	0.69	0.71	23	16	24
Transport Equipmen	0.69	0.79	0.69	24	35	18
Leather & Tanning	0.71	0.74	0.70	25	27	20
Wearing Apparel	0.71	0.74	0.73	26	26	28
Other Maf & Recyc	0.71	0.72	0.71	27	23	26
Food	0.72	0.75	0.70	28	28	23
Motor Vehi & Acces	0.72	0.74	0.71	29	24	25
Fabricated Metals	0.73	0.79	0.74	30	34	31
Beverages	0.74	0.78	0.74	31	32	30
Basic Chemicals	0.75	0.77	0.76	32	30	36
Paper	0.75	0.75	0.76	33	29	33
Instruments	0.76	0.77	0.79	34	31	40
Bas N-Ferrous Meta	0.76	0.82	0.75	35	40	32
Plastics	0.76	0.80	0.76	36	37	34
Textiles & Knit	0.77	0.78	0.76	37	33	35
Other N-Metal Minerals	0.78	0.81	0.80	38	39	41
Publish & Printing	0.79	0.81	0.77	39	38	37
Glass	0.79	0.80	0.78	40	36	38
Rubber	0.80	0.85	0.79	41	41	39

Figure 10: Real User Cost of Capital

stock during the course of the 1970's, but that the severity of this constraint declined during the course of the 1980's and 1990's.

To the extent that it is plausible to argue that state directed investment in South Africa may have raised the user cost of capital, and that the steady withdrawal of the state from directed investment and increased reliance on market forces over time may have lowered such distortions, the evidence may be interpreted as being consistent with the hypothesis advanced in the preceding subsections.

There is an alternative interpretation, however. This is that the negative association between magnitude and cost of investment noted for the 1970's is in line with the expectations of economic theory. And that the disappearance of this negative association is a reflection of the negative sentiment generated by the increased levels of political uncertainty that characterized the 1980's, and the political transition of the 1990's.²³

While we have already seen some evidence concerning correlations between the real user cost of capital and the two alternative measures of investment rates examined in this study, it is worth examining this link somewhat more systematically on a sectoral basis.

In Figure 11 we report the correlations between real user cost of capital and both the investment rate and the growth rate of the real capital stock of each sector, over the full 1970-97 period.

While for the economy as a whole the correlation is only -0.54 for the investment rate, and -0.53 for the growth rate in real capital stock, the majority of economic sectors demonstrate a negative correlation between user cost of capital and growth in capital stock that is stronger than the average.²⁴ In effect, the economy-wide average is lowered by the presence of a few outlier sectors.

In particular, Textiles & Knitwear, shows a positive correlation between the cost of capital and investment that would not be predicted by economic theory. All other sectors of the economy show the negative association between the marginal cost and marginal changes in the use of capital that economic theory anticipates.

²³See the discussion in Dixit and Pindyck, (1994) and Fedderke (2000) on the effect of uncertainty on investment. The implication is that uncertainty may raise the threshold below which no investment occurs - lowering the impact of the rate of return on capital and the real user cost of capital on investment.

²⁴The median for the correlation between user cost and investment rate is -0.59, and the correlation between user cost and the growth rate of the real capital stock -0.54.

	User Cost vs Investment Rate	User Cost vs Growth in Capital Stock
Agriculture, Forest. & Fish	-0.74	-0.82
Coal Mining	-0.59	-0.47
Gold & Uranium Ore Mining	-0.84	-0.79
Diamond & Other Mining	-0.41	-0.49
Food	-0.62	-0.60
Beverages	-0.64	-0.48
Tobacco	-0.30	-0.22
Textiles & Knit	0.05	0.03
Wearing Apparel	-0.53	-0.37
Leather & Tanning	-0.44	-0.42
Footwear	-0.30	-0.29
Wood	-0.60	-0.54
Paper	-0.49	-0.49
Publish & Printing	-0.62	-0.56
Petroleum Refined	-0.40	-0.37
Basic Chemicals	-0.50	-0.54
Other Chem & Fibre	-0.43	-0.28
Rubber	-0.64	-0.62
Plastics	-0.56	-0.47
Glass	-0.59	-0.57
Other N-Metal Minerals	-0.60	-0.62
Basic Iron & Steel	-0.45	-0.48
Bas N-Ferrous Meta	-0.52	-0.40
Fabricated Metals	-0.62	-0.63
Machinery & Appara	-0.56	-0.48
Electrical Machine	-0.74	-0.66
Radio Tv & Communi	-0.69	-0.67
Instruments	-0.31	-0.30
Motor Vehi & Acces	-0.57	-0.52
Transport Equipmen	-0.66	-0.70
Furniture	-0.67	-0.57
Other Maf & Recyc	-0.34	-0.48
Electricity, Gas & Water	-0.79	-0.77
Construction	-0.88	-0.84
Wholesale & Retail Trade	-0.82	-0.83
Transport, Storage & Commun.	-0.75	-0.75
Finance, Insurance, Real Est	-0.77	-0.69
All Economic Activities	-0.54	-0.53
Average	-0.57	-0.53

Figure 11: Correlations: Investment Rate and Real Growth in Capital vs Real User Cost of Capital

Indeed, in the case of a number of sectors this negative correlation is particularly strong: Construction (-0.88, -0.84), Wholesale & Retail Trade (-0.82, -0.83), Agriculture, Forestry & Fishing (-0.74, -0.82), Gold & Uranium Ore Mining (-0.84, -0.79), and Electricity, Gas & Water (-0.79, -0.77).

Thus over time, and for most sectors, the real user cost of capital does carry the potential of constituting at least one of the major determinants of investment expenditure in the South African economy - precisely as would be anticipated by economic theory.

4 Capital Productivity

One possible explanation besides changes in the real cost of capital for changing capital usage over time, are changes in capital productivity. Figure 12 reports the ratio of real GDP produced in the sector to the real stock of capital as measured by Machinery & Equipment in the sector, as a measure of total capital productivity.²⁵

4.1 Relative Capital Productivity

Relative capital productivity showed relatively strong changes over the 1970-97 period. Figure 12 reports relative capital productivity by economic sector. Twelve of the 37 sectors for which data was available report a change of rank of 10 sectors or greater, and 18 sectors report a change in rank of 7 sectors or greater, between 1970 and 1997. Moreover, the correlation between the rank of sectors in 1970, and their rank in 1997, was only +0.56,²⁶ suggesting a relative by high degree of volatility in relative capital productivity between sectors.

Sectors with strong increases in relative capital productivity include: Other Chemicals & Man-Made Fibres (+12), Basic Non-ferrous Metals (+11), Plastics (+7), Agriculture, Forestry & Fishing (+18), Basic Chemicals (+11), Finance, Insurance & Real Estate (+7), Textiles (+7), Other Manufacturing (+19), Electrical Machinery (+11), Instruments (+14), and Wearing Apparel (+9).

Of these sectors with strong growth in relative capital productivity, for Other Chemicals & Man-made Fibres, Agriculture, Forestry & Fishing, Basic

²⁵This is thus the ratio of real value added to capital stock

²⁶Contrast this for the corresponding correlation for labour productivity of +0.72.

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high rank indicates high capital productivity	1970	1980	1990	1997	Rank70	Rank80	Rank90	Rank97	ChgRank
Electricity, Gas & Water	0.41	0.28	0.27	0.46	1	2	1	2	1
Other Chem & Fibre	0.71	1.30	1.82	1.65	2	6	9	14	12
Petroleum Refined	0.88	0.16	0.66	0.40	3	1	2	1	-2
Basic Iron & Steel	0.98	0.91	0.98	0.55	4	3	4	3	-1
Bas N-Ferrous Meta	1.01	3.04	3.14	1.74	5	16	18	16	11
Plastics	1.10	2.88	2.19	1.48	6	15	12	13	7
Agriculture, Forest. & Fish.	1.31	1.12	2.24	3.01	7	4	13	25	18
Basic Chemicals	1.66	2.07	2.48	1.91	8	10	15	19	11
Diamond & Other Mining	1.74	1.12	0.99	0.81	9	5	5	4	-5
Food	1.92	3.67	2.87	1.30	10	18	17	10	0
Paper	2.00	4.15	1.51	1.18	11	22	6	7	-4
Beverages	2.08	3.68	2.70	1.05	12	19	16	6	-6
Rubber	2.18	3.62	3.31	1.41	13	17	20	11	-2
Finance, Insurance, Real Est	2.18	2.47	2.31	2.02	14	13	14	21	7
Transport, Storage & Commun.	2.37	2.01	1.53	1.77	15	9	7	17	2
Textiles & Knit	2.40	4.43	2.17	2.47	16	23	11	23	7
Other N-Metal Minerals	2.43	3.78	3.23	1.66	17	20	19	15	-2
Other Maf & Recyc	2.60	4.06	9.00	24.06	18	21	35	37	19
Electrical Machine	2.60	5.06	4.08	4.41	19	24	23	30	11
Motor Vehi & Acces	2.87	6.61	3.50	2.20	20	29	21	22	2
Instruments	3.14	2.27	4.56	6.91	21	11	24	35	14
Coal Mining	3.29	1.80	1.74	1.46	22	8	8	12	-10
Wood	3.51	8.52	5.22	4.28	23	34	25	27	4
Radio Tv & Communi	3.60	2.48	7.17	2.52	24	14	29	24	0
Publish & Printing	4.22	5.97	5.33	1.79	25	26	26	18	-7
Glass	4.56	6.04	3.50	1.01	26	27	22	5	-21
Wearing Apparel	5.20	7.14	8.12	8.17	27	32	32	36	9
Fabricated Metals	5.68	6.76	6.87	4.69	28	31	28	31	3
Construction	6.03	1.73	2.12	2.00	29	7	10	20	-9
Furniture	6.31	12.61	7.46	4.41	30	36	31	29	-1
Wholesale & Retail Trade	6.37	5.15	6.04	4.31	31	25	27	28	-3
Transport Equipmen	7.78	6.67	10.90	1.20	32	30	37	8	-24
Tobacco	7.80	6.44	7.43	5.19	33	28	30	32	-1
Gold & Uranium Ore Mining	8.10	2.36	0.98	1.27	34	12	3	9	-25
Machinery & Appara	8.66	13.07	9.72	6.87	35	37	36	34	-1
Leather & Tanning	9.44	7.33	8.17	3.90	36	33	34	26	-10
Footwear	9.58	9.38	8.15	5.39	37	35	33	33	-4

Figure 12: Capital Productivity: RGDP/Real Stock of Machinery & Equipment

Chemicals, and Electrical Machinery the strongest growth in capital stock (as measured either in terms of the growth in the real capital stock, or the investment rate) took place during the 1970's. It is noticeable that the improvement in capital productivity for these sectors took place after the capital stock for the sector had shown strong growth, viz. particularly during the 1980's with the improved capital productivity being maintained during the course of the 1990's. See the evidence of Figure.12 One possible interpretation would be that the investment in new capital stock was such as to introduce new technology, thereby improving the productivity of production.

Moreover, the fact that Other Chemicals & Man-made Fibres experienced both positive growth rates in labour employment, and strong relative increases in labour productivity over the 1970-97 period suggests that technological change for this sector may have had elements of factor neutrality - enhancing the productivity of both factors of production.

But note that it is difficult to argue that improving capital productivity led to higher investment rates in these sectors by contrast. For Basic Non-ferrous Metals and Plastics growth in capital stock (again as measured either in terms of the growth in the real capital stock, or the investment rate) is concentrated in the 1990's, while for Basic Chemicals there was a revival of the strong investment performance of the 1970's after a lull during the course of the 1980's. For these sectors improvement in capital productivity predates the acceleration in investment activity. Improving capital productivity in perfect capital markets would translate into improvements in the rate of return to capital (a topic to which we turn in the next section of the paper). For these sectors capital productivity may thus be the explanation for changing investment activity, whereas for the preceding group investment and associated technological advances may well have led the improvements in capital productivity.

We also note that for a number of the sectors with strong relative improvements in capital productivity no strong temporal patterns are detectable in investment behaviour. Thus, for Finance, Insurance & Real Estate investment was consistently relatively strong, and no strong distinction exists between investment in the 1970's, 1980's and 1990's. Textiles, Other Manufacturing, Instruments, and Wearing Apparel all manifest relatively undistinguished investment rates, without great variation between decades. Reasons for the relative change in capital productivity thus cannot be reduced to investment patterns (or visa versa) that are accessible at the level of aggregation presented in our data.

A number of sectors also experienced strong declines in relative capital productivity. Coal Mining (-10), Publishing & Printing (-7), Glass (-21), Construction (-9), Transport Equipment (-24), Gold & Uranium Ore Mining (-25) and Leather & Tanning (-10) all showed strong decreases in relative capital productivity.

While for Coal Mining, Construction and Gold & Uranium Ore Mining the decline in capital productivity has been a long term trend, consistently present since the 1970's, this is not true of the other sectors. For all of the manufacturing sectors, Publishing & Printing, Glass, Transport Equipment and Leather & Tanning the decrease in capital productivity occurs during the course of the 1990's (See Figure 13). Moreover, for all of these sectors the decline in capital productivity in the 1990's is not only marked, but occurs on relatively high levels in absolute terms (see again Figure 12).

What is noticeable is that for all of the manufacturing sectors with strong declines in relative capital productivity during the 1990's, the growth rate of the real capital stock (as measured by Machinery & Equipment) was amongst the highest in the economy. Thus Publishing & Printing (14.15%), Glass (20.38%), Transport Equipment (26.19%) and Leather & Tanning (10.44%) all demonstrate very healthy average proportional increases in real capital stock.

One interpretation of the evidence on the manufacturing sectors is to suggest that since all sectors began from relatively high levels of capital productivity at the end of the 1980's, the impetus to investment in these sectors came from high capital productivity, and presumed associated high rates of return on capital. If so, the strong declines in the productivity of capital associated with the strong increases in capital stock are not surprising, given standard expectations concerning marginal productivity of factors of production. But the decline in the productivity of capital also suggests that the impetus to strong investment performance in these sectors is also on the wane, raising the possibility that the strong contribution to the aggregate investment rate of the economy from these sectors may decline over time.

4.2 Absolute Capital Productivity

As throughout, relative capital productivity gives little indication of absolute levels of capital productivity by sector.

The divergence between most and least productive capital stock in the economy at first sight appears to have been widening over time. The ratio

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high rank indicates high growth rate	Grw70	Grw80	Grw90	Grw70-97	Rank70	Rank80	Rank90	Rank70-97
Gold & Uranium Ore Mining	-9.96	-11.62	5.21	-6.08	3	1	33	1
Transport Equipmen	-1.57	7.59	-20.66	-3.83	12	31	1	2
Construction	-12.94	2.27	-0.36	-3.58	1	21	28	3
Glass	3.56	-2.82	-10.92	-3.09	20	4	4	4
Leather & Tanning	-2.88	4.10	-9.35	-2.21	8	30	6	5
Diamond & Other Mining	-4.68	1.93	-4.33	-2.13	5	20	19	6
Footwear	-0.22	0.27	-5.30	-1.54	15	11	16	7
Publish & Printing	4.01	1.36	-11.28	-1.50	23	16	3	8
Coal Mining	-2.59	0.44	-2.14	-1.34	9	12	24	9
Wholesale & Retail Trade	-3.30	2.54	-3.88	-1.31	7	23	20	10
Basic Iron & Steel	-0.40	3.44	-8.18	-1.29	14	27	7	11
Beverages	5.24	1.89	-12.42	-1.23	26	19	2	12
Transport, Storage & Commun.	-2.20	-2.30	2.28	-0.91	11	7	29	13
Food	7.05	-2.38	-8.01	-0.90	28	6	8	14
Rubber	3.88	3.96	-10.37	-0.31	22	28	5	15
Fabricated Metals	0.92	2.53	-4.93	-0.22	16	22	17	16
Finance, Insurance, Real Est	1.10	0.64	-2.47	-0.13	18	13	23	17
Other N-Metal Minerals	3.75	1.63	-6.37	-0.03	21	17	12	18
Furniture	4.34	0.96	-5.67	0.12	25	14	15	19
Paper	8.62	-4.26	-3.79	0.17	33	3	21	20
Machinery & Appara	4.27	-5.31	2.77	0.28	24	2	31	21
Radio Tv & Communi	-7.54	14.19	-7.99	0.37	4	36	9	22
Tobacco	0.97	4.09	-4.33	0.56	17	29	18	23
Electricity, Gas & Water	-3.36	-1.23	7.56	0.66	6	9	36	24
Petroleum Refined	-11.19	17.14	-6.20	0.78	2	37	13	25
Motor Vehi & Acces	8.14	1.65	-7.85	1.00	32	18	10	26
Textiles & Knit	7.66	-2.40	-1.69	1.16	30	5	26	27
Wood	10.01	-0.36	-3.40	2.20	36	10	22	28
Basic Chemicals	5.59	2.81	-1.98	2.32	27	24	25	29
Plastics	9.39	3.38	-6.46	2.47	35	26	11	30
Wearing Apparel	3.39	1.02	3.56	2.56	19	15	32	31
Electrical Machine	7.72	-1.67	2.54	2.71	31	8	30	32
Other Chem & Fibre	9.09	3.00	-1.45	3.71	34	25	27	33
Agriculture, Forest. & Fish.	-0.94	8.30	5.31	4.34	13	33	34	34
Instruments	-2.37	9.33	6.55	4.60	10	34	35	35
Bas N-Ferrous Meta	13.17	7.75	-5.88	5.52	37	32	14	36
Other Maf & Recyc	7.34	13.83	16.11	12.34	29	35	37	37

Figure 13: Average Growth Rates in Capital Productivity

of the highest to lowest capital-output ratio moves from 23.37 in 1970, to 81.69 in 1980, 40.37 in 1990, and 60.15 in 1997. However, the 1997 figure is misleading, since it depends on a strong increase in capital productivity in Other Manufacturing & Recycling, which achieved the increase in capital productivity while maintaining a negative growth rate in real capital stock (-4.95%) on average during the course of the 1980's. The increase in capital productivity is thus based on a shedding of capital stock, and productivity gains in the sector may well prove unsustainable over time. By contrast, the ratio of the capital productivity of the second-ranked sector to the lowest ranked sector in the economy is 20.43. Hence, where the Other Manufacturing & Recycling outlier is removed from the sample, the ratio of most to least capital productivity in the economy has been on a steady downward trend.

One interpretation of this evidence is that it is consistent with the argument of earlier subsections of this paper, of a decrease in market distortions in South African capital markets. While the 1970's and 1980's showed strong distortions in the distribution of capital across sectors in the economy, such that the productivity of capital was strongly differentiated across sectors, subsequent reallocation of capital stock in the economy has served to equalize the productivity of capital across sectors. Economic theory would anticipate that perfect capital markets would serve to equalize the marginal product of capital across sectors, thereby generating the most efficient allocation of capital stock. While we have advanced evidence concerning the average product of capital, nevertheless the implication is at least potentially that the reallocation of capital has been such as to achieve at least an improved use of scarce capital resources in the economy. Whatever the source of the reallocation, therefore, capital market developments during the course of the 1990's continue to show features of a desirable restructuring in the allocation of capital stock. In this sense, the evidence of the present section continues to confirm the evidence of earlier subsections that the severity of past capital market distortions has been on a downward trend since 1990.

4.3 Links between capital productivity, real cost of capital and capital usage

Economic theory would anticipate a link between real capital productivity and the real user cost of capital. Figure 14 reports the correlation between real capital productivity and the real user cost of capital by economic sector

for which the relevant data is available. It is noticeable that for most sectors the correlation between the productivity of capital and the real user cost is not only positive, but frequently very strong. For one sector²⁷ the correlation lies above +0.9, for six²⁸ sectors above +0.8, for seven²⁹ above +0.7, and for fourteen³⁰ is equal to or above +0.50. Thus for 28 out of 37 sectors for which the requisite data is available, the correlation conforms not only to economic theory, but is reasonably strong - if it is borne in mind that economic theory assumes all other influences on the real user cost to be held constant in predicting a positive correlation between the productivity and the cost of factors of production.

For only ...ve³¹ sectors does the correlation lie between 0 and +0.5, and is the link predicted by economic theory thus relatively weak - and ...ve³² more sectors had the negative correlation between capital productivity and the real user cost contradicting economic theory.

Noteworthy is the distinct performance of these groupings of economic sectors in terms of investment rates. The grouping of sectors with the strongest correlation between the real user cost of capital and capital productivity, viz. in excess of +0.8, also shows the highest average growth rate in real capital stock over the 1970-97 period. However, the average 1970-97 growth rate in real capital stock does not unambiguously decline as we move to sectoral groupings with lower correlations between real user cost of capital and capital productivity.

In this context it is worth recalling that the analysis of the preceding sections has suggested that market distortions in South African capital markets appear to have been falling over time, leading to a reallocation of capital stock. If so, the effect of the theoretically appropriate relationship between

²⁷Basic Non-ferrous Metals.

²⁸In declining order: Publishing & Printing, Transport Equipment, Beverages, Food, Other Chemicals & Man-made Fibres, Leather & Tanning.

²⁹In declining order: Rubber, Wood, Footwear, Fabricated Metals, Other Manufacturing & Recycling, Plastics, Instruments.

³⁰In declining order: Other Non-metallic Minerals, Basic Iron & Steel, Basic Chemicals, Furniture, Motor Vehicles & Accessories, Coal Mining, Glass, Textiles & Knit, Agriculture, Forestry & Fishing, Radio, TV & Communications Equipment, Electrical Machinery, Wearing Apparel, Petroleum Refined, Electricity, Gas & Water.

³¹In declining order: Tobacco, Wholesale & Retail Trade, Paper, Finance, Insurance, Real Estate.

³²In declining order: Diamond & Other Mining, Transport, Storage & Communications, Gold & Uranium Ore Mining, Machinery & Apparatus, Construction.

	Cor: uc vs Y/k	Average Investment Rate: 1970-97	Average Investment Rate: 1990-97	Average Growth in Real Capital 1970-97	Average Growth in Real Capital: 1970-97
Bas N-Ferrous Metal	0.92	0.06	0.13	0.09	0.26
Publish & Printing	0.87	0.02	0.04	0.06	0.14
Transport Equipmen	0.84	0.03	0.09	0.07	0.27
Beverages	0.84	0.03	0.07	0.07	0.12
Food	0.84	0.02	0.05	0.04	0.11
Other Chem & Fibre	0.81	0.03	0.01	0.03	0.02
Leather & Tanning	0.80	0.01	0.02	0.05	0.13
Rubber	0.79	0.01	0.04	0.03	0.10
Wood	0.78	0.01	0.01	0.02	0.06
Footwear	0.75	0.00	0.00	0.02	0.03
Fabricated Metals	0.75	0.00	0.01	0.02	0.06
Other Maf & Recyc	0.74	0.00	0.00	-0.01	-0.04
Plastics	0.73	0.03	0.05	0.07	0.11
Instruments	0.70	0.00	-0.01	0.00	-0.06
Other N-Metal Minerals	0.67	0.01	0.03	0.03	0.07
Basic Iron & Steel	0.65	0.06	0.16	0.06	0.14
Basic Chemicals	0.59	0.01	0.02	0.03	0.04
Furniture	0.58	0.01	0.01	0.05	0.06
Motor Vehi & Acces	0.58	0.01	0.02	0.04	0.08
Coal Mining	0.56	0.03	0.01	0.08	0.02
Glass	0.54	0.03	0.08	0.10	0.21
Textiles & Knit	0.54	0.00	0.00	0.00	0.01
Agriculture, Forest. & Fish.	0.53	0.00	-0.02	0.00	-0.03
Radio Tv & Communi	0.52	0.01	0.03	0.05	0.11
Electrical Machine	0.52	0.01	0.00	0.02	0.00
Wearing Apparel	0.52	0.00	0.00	0.01	-0.01
Petroleum Refined	0.52	0.20	0.08	0.06	0.04
Electricity, Gas & Water	0.50	0.14	-0.13	0.05	-0.04
Tobacco	0.49	0.00	0.00	0.01	0.05
Wholesale & Retail Trade	0.47	0.01	0.01	0.04	0.06
Paper	0.35	0.03	0.03	0.08	0.05
Finance, Insurance, Real Est	0.28	0.02	0.02	0.06	0.05
Diamond & Other Mining	-0.04	0.05	0.06	0.06	0.06
Transport, Storage & Commun.	-0.05	0.02	0.00	0.04	0.00
Gold & Uranium Ore Mining	-0.08	0.01	-0.04	0.04	-0.05
Machinery & Appara	-0.50	0.00	0.00	0.01	-0.01
Construction	-0.56	0.01	-0.01	0.04	-0.01

Figure 14: Correlations

user cost of capital and capital productivity should have had desirable impacts on the investment rate and the average growth rate in the real capital stock in later time periods rather than earlier ones. This is indeed borne out by the evidence: see Figure 15.

With the exception of perhaps only the sector grouping with a correlation between +0.7 and +0.8, the evidence appears to suggest the presence of declining investment rates in sectors as they conform less closely to the dictates of standard economic theory. Where the real user cost of capital is less closely linked to real capital productivity, the growth in capital also tends to be lower.

Two implications appear to flow from such evidence. The first is that for purposes of policy intervention in South African capital markets, "well-functioning" capital markets, defined as those that link factor rewards to factor productivity in accordance with the requisites of economic theory, appear to be more likely to generate higher investment rates at least during the 1990's. But second, the point raised a number of times through the course of the discussion in this paper, viz. that South African capital markets may well have been subject to distortions that may have declined over time, again is consistent with the evidence presented above.

5 The Rate of Return on Capital

The final consideration in our discussion of South African capital markets concerns the rate of return on capital stock by economic sector. In terms of economic theory, the rate of return on capital stock should again be a possible determinant of investment expenditure, representing as it does the "reward" for committing to a capital project.

We compute the rate of return on capital as:

$$\frac{\text{Real gross operating surplus}}{\text{Real stock of machinery \& equipment}} \quad (3)$$

Our choice of capital stock variable is dictated by the uncertainties surrounding the accuracy of other capital stock figures, particularly the Building & Construction time series. We also employ gross operating surplus data since no net operating surplus data was available.³³

³³Gross Operating Surplus is defined as the sum of Profit, Interest Paid, Interest Re-

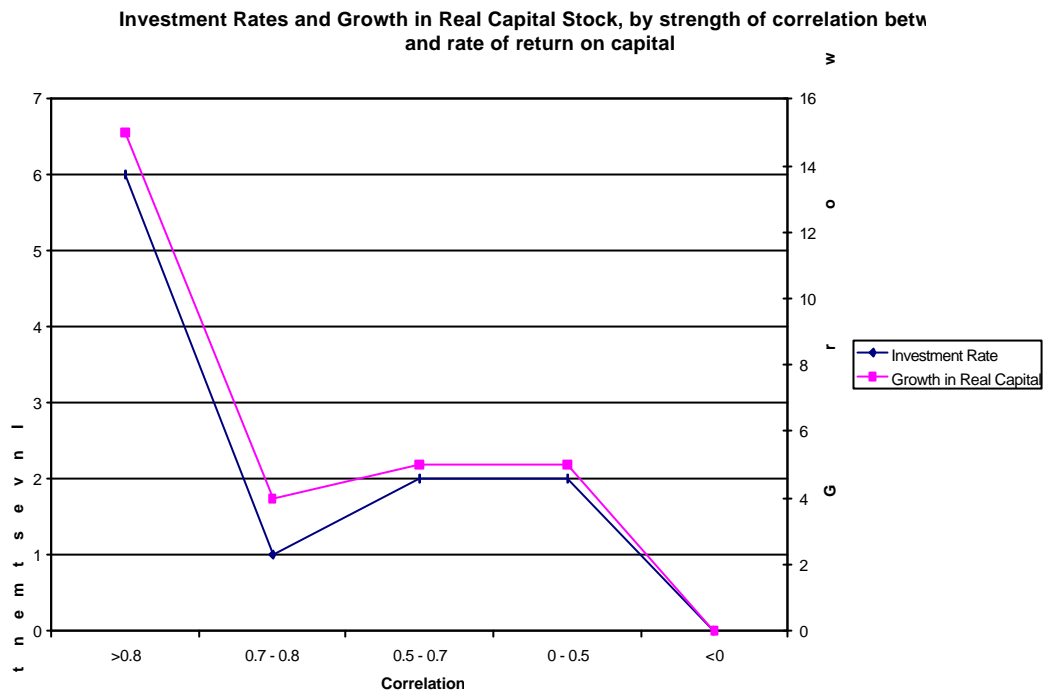


Figure 15: Investment Rates and Growth in Real Capital Stock

Both data choices will have the tendency to bias upward the measure of the rate of return on capital stock that we compute. However, since we are concerned with trends in the real rate of return as long as the bias in the measure is consistent over time, the measure should be suitable for our purposes.

Figure 16 reports the relative rate of return on capital across sectors, together with average growth in the rate of return on capital over the 1970-97 period, and the volatility of this growth rate.

In addition Figure 17 reports average rates of return on capital on a decade basis, with the associated average growth rates per decade, and Figure 18 reports correlations between the rate of return on capital and the growth rate in capital.

A number of sectors experienced strong increases in the relative rate of return on their capital stock. Thus Basic Non-ferrous Metals (+16), Other Manufacturing & Recycling (+31), Motor Vehicles & Accessories (+12), Electrical Machinery (+12), Basic Chemicals (+10) Finance, Insurance & Real Estate (+11), and Agriculture, Forestry & Fishing (+19) all improved their relative ranking considerably. By contrast, Diamond & Other Mining (-15), Beverages (-13), Glass (-21), Transport Equipment (-31), and Gold & Uranium Ore Mining (-31) all showed strong decreases in their relative rate of return on capital as measured by their industry rank.

We note that these strong relative changes are not distributed evenly over time. Basic Non-ferrous Metals, Motor Vehicles & Accessories, Electrical Machinery, Transport Equipment and Diamond & Other Mining experienced the relative rate of return change during the 1980's. By contrast, Basic Chemicals, Finance, Insurance & Real Estate, Beverages, Glass, and Gold & Uranium Ore Mining had the impact of their relative rate of return change strike them during the course of the 1990's.

It is also worth noting that a number of the sectors with strong improvements in their relative real rate of return on capital, experienced strong growth in their real capital stock in periods corresponding to the rate of return improvements. Thus, Basic Chemicals (4.08%), Basic Non-ferrous Metals (25.87%), Motor Vehicles & Accessories (7.51%), Finance, Insurance & Real Estate (4.90%) all showed strong real growth in capital stock. Gold &

ceived and Other. We do not currently have the individual series to be able to compute the Pro...t time series we need to compute accurate net real rate of return ...gures on the capital stock of sectors.

Changing Capital Market Conditions in South Africa, 1970-97 40

High rank indicates a high rate of return	Rank 1970	Rank 1980	Rank 1990	Rank 1997	ChgRank 1997-1970	Avg Grwth	Rank AvgGrwth	StdDev Grwth	Rank StdDevGrwth
Electricity, Gas & Water	1	2	2	2	1	0.47	15	6.87	1
Basic Iron & Steel	2	3	4	4	2	0.72	17	14.25	10
Other Chem & Fibre	3	4	9	10	7	2.56	27	11.85	6
Plastics	4	13	12	13	9	4.05	32	22.15	26
Bas N-Ferrous Meta	5	25	20	21	16	7.02	37	28.09	33
Petroleum Refined	6	1	3	3	-3	1.53	21	31.88	35
Other Maf & Recyc	7	15	37	38	31	13.90	38	31.27	34
Transport, Storage & Commun.	8	8	16	17	9	0.55	16	7.38	2
Paper	9	27	15	16	7	2.32	25	22.03	25
Motor Vehi & Acces	10	30	21	22	12	6.50	36	34.53	36
Food	11	18	10	11	0	-0.93	7	11.30	5
Electrical Machine	12	22	23	24	12	2.34	26	17.05	15
Basic Chemicals	13	11	22	23	10	2.89	29	20.25	24
Rubber	14	19	8	9	-5	-0.48	9	19.67	21
Finance, Insurance, Real Est	15	12	25	26	11	1.57	22	10.51	3
Agriculture, Forest. & Fish.	16	10	34	35	19	5.33	34	19.14	20
Textiles & Knit	17	23	18	19	2	0.38	13	16.83	14
Construction	18	6	14	15	-3	-0.74	8	13.41	8
Furniture	19	33	26	27	8	6.21	35	36.75	37
Other N-Metal	20	20	19	20	0	0.79	18	18.66	19
Minerals									
Diamond & Other Mining	21	7	6	6	-15	-1.79	4	17.36	16
Radio Tv & Communi	22	9	24	25	3	1.89	23	19.71	22
Publish & Printing	23	17	13	14	-9	0.89	19	25.33	32
Wood	24	37	28	29	5	3.76	31	25.03	31
Beverages	25	28	11	12	-13	-1.05	6	18.26	17
Wearing Apparel	26	16	29	30	4	3.45	30	23.43	28
Coal Mining	27	14	17	18	-9	0.42	14	24.48	29
Fabricated Metals	28	26	27	28	0	1.32	20	16.51	13
Glass	29	35	7	8	-21	-1.18	5	24.70	30
Footwear	30	31	33	34	4	2.10	24	19.85	23
Machinery & Appara	31	34	35	36	5	2.64	28	18.52	18
Transport Equipmen	32	5	1	1	-31	-5.50	2	67.52	38
Wholesale & Retail Trade	33	24	30	31	-2	-0.27	11	13.84	9
Leather & Tanning	34	29	31	32	-2	0.37	12	15.46	12
Instruments	35	32	36	37	2	4.44	33	15.19	11
Gold & Uranium Ore Mining	36	21	5	5	-31	-7.81	1	12.88	7
Tobacco	37	36	32	33	-4	-0.39	10	23.35	27

Figure 16: Real GOS/K

Changing Capital Market Conditions in South Africa, 1970-97 41

	ROT	ROT	ROT	GwthROT	GwthROT	GwthROT
	Avg70's	Avg80's	Avg90's	Avg70's	Avg80's	Avg90's
Electricity, Gas & Water	0.29	0.18	0.25	-2.25	-2.28	7.89
Basic Iron & Steel	0.30	0.42	0.42	1.05	5.54	-6.61
Petroleum Refined	0.46	0.35	0.42	-10.49	17.47	-5.81
Plastics	0.49	1.11	0.93	11.38	5.07	-6.85
Other Chem & Fibre	0.52	0.61	0.76	7.48	3.21	-4.68
Transport, Storage & Commun.	0.74	0.67	0.71	1.14	-1.63	2.91
Wearing Apparel	0.81	1.38	2.07	1.77	5.48	2.71
Radio Tv & Communi	0.83	1.22	2.33	-7.30	15.53	-5.80
Publish & Printing	0.85	1.27	1.30	4.41	4.38	-8.62
Rubber	0.87	1.60	0.94	4.76	3.76	-13.26
Diamond & Other Mining	0.91	0.67	0.46	-3.60	1.83	-4.64
Bas N-Ferrous Meta	0.92	1.98	1.33	16.84	9.50	-9.14
Transport Equipmen	0.94	1.27	0.67	1.06	10.12	-36.25
Motor Vehi & Acces	0.95	1.35	1.23	9.78	13.46	-7.65
Agriculture, Forest. & Fish.	0.96	1.04	2.09	-0.48	9.59	6.73
Furniture	0.98	1.52	1.68	8.85	9.16	-1.40
Basic Chemicals	0.99	0.84	1.33	5.11	3.47	-0.79
Construction	0.99	0.59	0.69	-6.19	3.04	0.85
Other N-Metal Minerals	1.00	1.24	1.29	3.69	2.50	-5.36
Finance, Insurance, Real Est	1.06	1.39	1.31	3.89	1.98	-1.99
Food	1.07	1.33	0.94	6.83	-2.59	-8.54
Wood	1.11	2.30	1.93	11.34	3.18	-5.15
Electrical Machine	1.14	1.52	1.75	7.53	-0.68	-0.01
Paper	1.16	1.08	1.00	11.50	-1.37	-4.23
Textiles & Knit	1.22	1.42	1.05	7.06	-2.36	-4.29
Beverages	1.24	1.82	0.92	4.67	3.12	-14.35
Other Maf & Recyc	1.30	2.30	4.60	11.32	17.20	12.52
Fabricated Metals	1.36	1.82	1.65	0.74	4.63	-2.67
Footwear	1.48	2.47	2.47	2.55	5.05	-2.72
Glass	1.71	1.80	1.73	7.49	-0.40	-13.45
Coal Mining	1.76	1.08	0.69	2.40	-0.62	-0.65
Leather & Tanning	1.85	3.13	2.69	-1.72	9.38	-9.82
Wholesale & Retail Trade	1.99	1.81	1.96	-5.75	5.81	-1.90
Machinery & Appara	2.41	2.09	3.21	2.25	-1.51	9.05
Instruments	2.50	3.83	7.40	-3.30	11.25	4.68
Gold & Uranium Ore Mining	3.48	0.94	0.53	-7.57	-14.88	1.99
Tobacco	4.94	4.50	2.33	-0.49	5.94	-9.31

Figure 17: Real Gos/K

Correlation: Rate of Return on Capital vs Growth rate in Real Capital Stock

Construction	0.91
Wholesale & Retail Trade	0.59
Furniture	0.58
Diamond & Other Mining	0.57
Motor Vehi & Acces	0.52
Textiles & Knit	0.47
Gold & Uranium Ore Mining	0.39
Wood	0.37
Machinery & Appara	0.34
Other N-Metal Minerals	0.31
Coal Mining	0.30
Plastics	0.27
Publish & Printing	0.22
Glass	0.21
Paper	0.21
Transport, Storage & Commun.	0.19
Electricity, Gas & Water	0.18
Fabricated Metals	0.17
Footwear	0.16
Basic Chemicals	0.16
Bas N-Ferrous Meta	0.16
Wearing Apparel	0.15
Leather & Tanning	0.08
Beverages	0.08
Basic Iron & Steel	0.07
Tobacco	0.05
Rubber	0.04
Radio Tv & Communi	0.00
Other Chem & Fibre	-0.01
Transport Equipmen	-0.05
Electrical Machine	-0.06
Other Maf & Recyc	-0.08
Agriculture, Forest. & Fish.	-0.10
Finance, Insurance, Real Es	-0.19
Food	-0.20
Instruments	-0.32
Petroleum Refined	-0.36

Figure 18: Correlations

Uranium Ore Mining constitutes a symmetrical but opposite case, marrying strong declines in the relative rate of return on capital with low growth in real capital stock (-5.39%).

However, for a number of other sectors this intuitively appealing association no longer holds. For Diamond & Other Mining (5.55%), Beverages (12.24%), Glass (20.38%), and Transport Equipment (26.19%) growth in the real capital stock was comfortably positive and strong, while the relative rate of return on capital stock was falling. For some sectors (Glass, Beverages), a partial explanation may lie in the fact that the absolute level of the rate of return of capital remained high, despite the falling relative rates of return - see the evidence of Figure 16. For Diamond & Other Mining the explanation may lie in the fact that it has consistently experienced the lowest (or second lowest during the course of the 1980's) user cost of capital of any sector in the South African economy (by way of contrast, Beverages and Glass faced amongst the highest real user costs). Similarly, Transport Equipment experienced a strong decline in its relative real user cost of capital from the 1980's to the 1990's, which may again provide a partial explanation of its growth in real capital stock despite falling rates of return on capital.

Nevertheless, the evidence of Figure 17 shows that any adequate explanation of investment in real capital stock will have to consider evidence besides the real rate of return on capital stock. The correlation between the real rate of return and the growth rate in real capital stock across South African economic sectors ranges from +0.91 to -0.36. On the other hand, since we know investment expenditure to have a multivariate explanation, and *ceteris* is not *paribus* in the current context, such variation is not entirely surprising.

6 Conclusions

We conclude by reiterating some of the main findings of the preceding analysis. While advancing a series of hypotheses, we are aware of the fact that the exploratory data analysis undertaken cannot provide definitive answers to some of the questions posed. Greater clarity will have to wait on more detailed econometric work.

Nevertheless, the results of the descriptive analysis showed some interesting findings, some of which were expected and some not. We bear in mind that since a narrow focus on total capital stock is potentially misleading, the descriptive analysis here is therefore undertaken in terms of the asset type

Machinery & Equipment.

Sectoral growth rates in the capital stock of Machinery & Equipment suggest a bias in the South African capital markets due to the heavy reliance on the mining of primary commodities during earlier phases of development of the economy, and the presence of substantial government-led investment in capital stock of a number of core sectors (Electricity, Gas & Water, Petroleum Refining). The gradual reversal of these earlier trends appears to have triggered a restructuring of the South African capital market. In particular, sectors whose access to capital might have been limited due to the demand originating from resource based and state sectors during the earlier decades of our period of review, have shown strong growth in their capital stock during the 1990's. The implication is that investment expenditure in South Africa, both in absolute terms as well as relative to value added, may currently be at such low levels because 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 biases in the economy's capital markets.

The 1990's and its changed policy environment may have had an impact on capital usage in the South African economy. This is most evident in the declining investment in Machinery & Equipment capital stock in Electricity, Gas & Water, and above all the strong increase in the usage of this category of capital by the Basic Iron & Steel and Diamond and Other Mining sectors. Given that the period after 1985 saw a sharp decrease in the value of the Rand without any recovery post-1990, the implication is that the increased exposure to capital in these sectors took place despite the increasing supply price of capital goods - and one plausible explanation for such changes may be the changes in the trade dispensation that occurred during the 1990's.

The possibility of a structural break in capital accumulation during the 1990's does not appear to be translating into a greater volatility of investment. For the economy as a whole the standard deviation of the growth rate of the real stock of Machinery & Equipment declines during the 1980's and the 1990's. Therefore, the structural break in investment behaviour, if present, has not manifested itself in greater volatility of investment - but rather in a different distribution of investment across sectors, and in a different level of investment expenditure in sectors.

Correlation coefficients between user costs of capital and capital usage (as embodied in the investment rate and growth in capital stock of Machinery & Equipment) suggest that over time, and for most sectors, the real user cost of

capital seems to carry the potential of constituting at least one of the major determinants of investment expenditure in the South African economy - as would be anticipated by economic theory.

The user cost of capital appears to have formed a significant constraint on investment in real capital stock during the course of the 1970's, but the severity of this constraint declined during the course of the 1980's and 1990's. It could therefore be argued that the state in its effort to direct investment in South Africa may have raised the user cost of capital, and that the steady withdrawal of the state from the capital markets and increased reliance on market forces over time may have lowered such distortions. The disappearance of this negative association may also be a reflection of the negative sentiment generated by the increased levels of political uncertainty that has characterised the 1980's, and the political transition of the 1990's. In other words, the importance of the real user costs of capital as an explanatory variable of investment behaviour may to some degree have been eroded by a political uncertainty factor.

The descriptive analysis of capital productivity, defined here as the ratio of value added and capital stock of Machinery & Equipment, suggests that while the 1970's and 1980's showed strong deviations in the distribution of capital across sectors in the economy, such that the productivity of capital was strongly differentiated across sectors, subsequent reallocation of capital stock in the economy appears to have equalised the productivity of capital across sectors. From a theoretical point we would anticipate that more perfect capital markets would serve to equalise the marginal product of capital across sectors, thereby generating more efficient allocation of capital stock.

Examination of correlation coefficients between real user costs of capital and various measures of capital stock growth suggest the presence of declining investment rates in sectors as they conform less closely to the dictates of standard economic theory. In other words, where the real user cost of capital is less closely linked to real capital productivity, the growth in capital also tends to be lower.

For purposes of policy intervention in South African capital markets, "well-functioning" capital markets, defined as those that more closely link factor rewards to factor productivity, are those that are likely to realize strong and sustainable investment performance. It is left to subsequent, detailed econometric work to explore these relations in greater detail.

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