σαeru Southern African Econometric Research Unit

The Structure of Growth in the Manufacturing Sector of the Western Cape, 1970 -1996

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Executive Summary

This report details the findings of research into the nature and extent of growth in the Western Cape manufacturing sector for the period 1970 to 1996, using official Censuses of Manufacturing data.

The study examines evidence both for the magisterial district level of geographical disaggregation (for the 33 magisterial districts of the Western Cape) for manufacturing sector output as a whole, and for three digit manufacturing sectors at the statistical region level of geographical disaggregation (24 sectors for nine statistical regions).

The sample period covered by the study is 1970 – 1996, the period over which the manufacturing censuses were available for the Western Cape.

In terms of general conclusions, the study finds that:

1. The manufacturing sector during the 1990's experienced significant contraction.
2. For magisterial districts, districts contributing large proportions of total Western Cape manufacturing output, have steadily moved to an increased reliance on capital accumulation as a source of growth, shed labour (though mid-sized magisterial districts have expanded employment), and experienced efficiency losses.
3. Symmetrically, the manufacturing sectors that contribute a large proportion of total manufacturing output of the Western Cape, have consistently relied on capital accumulation as a growth driver, have increasingly shed labour (particularly during the 1990's), and have realized efficiency gains in production throughout the sample period.
4. The manufacturing sector in the Western Cape is predominantly located in statistical region 1, and is dominated by the Food three digit sector.

In real terms, the fastest growing magisterial districts have experienced a deceleration from 15.3, to 12.8 to 5.1 per cent in real output growth, while the slowest growing districts have contracted at an accelerating rate over the three decades.

The central implication of the evidence is that growth in the manufacturing sector in the Western Cape has historically been driven by factor accumulation. This is particularly true of the 1970's and the 1980's, but for the entire sample period also. For the Western Cape, output growth has relied both on capital and labour accumulation, though in the case of labour the 1990's has seen a declining contribution to output growth. Increasing reliance on capital accumulation particularly in the 1990's for output growth in manufacturing has also been noted at the national level. While the declining contribution of labour to output growth is also present for the national evidence, in the Western Cape the negative contribution of labour is perhaps somewhat more muted.

What differs between the Western Cape and the national evidence is that the strong positive contributions of technological progress in the 1970's and the 1980's, that is evident in the national data, is difficult to find in the Western Cape.

The evidence on the growth experience by manufacturing sector carries a number of additional implications.

The value of manufacturing output in the Western Cape is dominated by the Food sector. In the 1970's the food sector accounted for 28% of value added in the province. The Textiles, Fabricated Metal Products and Other Manufacturing Industries sectors were the next largest contributing sectors in the 1970's. The Printing and Other Chemical Products sectors followed closely.

In the 1980's the contribution of the Food sector had increased and Other Chemical Products held onto its proportion. The Textile sector's proportional contribution to manufacturing output dropped while that of the Clothing sector increased. The decline in importance of the Fabricated Metal Products and Printing sectors commenced in the 1980's and deepened in the 1990´s.

The 1990's saw the Food sector's importance shrink slightly. The Other Manufacturing Industries sector saw remarkable increase. The study remarks repeatedly on the likelihood that this is a reflection of problems of data classification. Readers should note that sectoral evidence of manufacturing activity therefore may reflect measurement error, due to classification problems in the Manufacturing Census.

The Textile sector's proportional contribution to manufacturing output continued to fall in the 1990's while that of the Clothing sector held steady. The most dramatic falloff was seen in the Other Chemical Products sector.

In terms of the contribution of the capital factor of production, for the 1970's, 1980's and 1990's the pattern is consistently that the strongest value added output growth attaches to the manufacturing sectors that contribute the largest proportion of total manufacturing value added in the Western Cape. Simultaneously, it is sectors in the mid-range size distribution in terms of their relative contribution to value added, that are engaged in disinvestment, and therefore contribute negatively to total value added growth in manufacturing.

The Food and Clothing sectors have consistently contributed positively to total value added growth through the expansion of their capital stock, while the Textiles sector engaged in disinvestment from the 1980's continuing into the 1990's.

Labour's contribution to value added output growth shows little distinct pattern in the 1970´s in terms of the growth contributions of manufacturing sectors by size distribution. The experience of the 1980's and 1990's sees some contrast. While during the 1980's the positive growth contributions through job-creation were located in sectors with a large relative contribution to cumulative value added in manufacturing, in the 1990's the positive contributions through job-creation came from mid-sized sectors, while large sectors came to contribute negatively to output growth through job-losses.

The Food sector contributed positively to output growth through job creation during the 1970's and 1980's, though job losses during the 1990's led to a negative contribution to output growth from this sector. Clothing again proves to consistently contribute positively to output growth through job creation. By contrast, the Textiles sector has positive contributions to output growth from labour inputs during the 1970's and 1990's, but a negative contribution during the 1980's. These sector-specific findings obtained for Clothing and Textiles are mirrored in the evidence for TFP-led growth.

In the 1970's and 1990's the large manufacturing sectors all had positive growth contributions emerging from efficiency gains. The 1980's results are similar, though some of the larger sectors were subject to efficiency losses. In particular, this is true for Textiles, Fabricated Metal Products and Printing.

1.0 Introduction

To ensure government economic policy is effective at creating the environment for increased economic growth, it is necessary to understand the foundations of growth. On the back of established economic growth theory this study aims to unpack the growth experience in the Western Cape manufacturing sector since 1970 to see what lessons can be learnt by policy-makers.

Based on theoretical foundations and using manufacturing census data from 1970 to 1996 the study commences by analysing the link between the growth in manufacturing output and the utilisation of factors of production labour and capital and the existence of technological innovation. In the first phase of the study we aim to answer questions such as: What does the growth experience in the Western Cape look like - by magisterial district and by manufacturing sector? Which magisterial districts have been absorbing and which have been shedding capital and/or labour? How have manufacturing sectors performed relative to one another on this score? What has the trend in technological change been? Based on international evidence what can we learn from these trends – what conclusions can be drawn?

In section 2 we set out the theoretical and empirical foundations of the research. We outline developments in growth theory over time to place the model underpinning our study in theoretical perspective. In section 3 we provide historical evidence of growth in the manufacturing sector nationally and follow in sections 4 to 6 with the details of the results of the first phase of the current research. The data utilised in the study is described and discussion on the issue of the use of nominal or real variables is also provided. The results are then unpacked by magisterial district and by the three digit manufacturing sectors. The research considers the relative size of output by magisterial district and by three digit manufacturing sector, detailing average growth rates across time. Value added growth performance is also decomposed to identify factor input contributions to growth. This exercise is completed by magisterial district and manufacturing sector. The relative importance of capital, labour and technological progress to manufacturing sector growth completes the study.

2.0 Theoretical and Empirical Foundations of the Research

2.1 Core Developments in the Theory of Economic Growth[1]

Modern economic growth theory starts with contributions by Harrod (1939) and Domar (1946). They used a fixed proportions production function with no possibility of substitution between capital and labour. Except in a special ('knife edge') case, growth has the consequence of perpetual increases in either unemployed workers or unemployed machines.

However, the reference point of post-war growth theory is provided by two independent contributions by Solow (1956) and Swan (1956), which came to shift the terms of the debate. Whereas the 1930's posed pressing questions surrounding the possibility of growth and accumulation in the presence of the unemployment of at least some factors of production, the post-war focus shifted to the conditions for balanced economic growth, in the presence of full employment of all factors of production.

The elegant simplicity of the Solow-Swan theory is one explanation for its continuing influence. Another is that the model illustrates clearly the three core building blocks of any theory of economic growth, viz. accumulation of physical capital, employment of labour, and technological progress.

Subsequent contributions to the theory of economic growth can be understood either as variations on our understanding of these three contributors to economic growth, or as extensions of the growth framework in order to incorporate additional determinants of economic development.

2.1.1 Placing Investment in Physical Capital Stock Centre Stage

The departure point of the Solow-Swan model was the observation that a number of core growth rates and ratios in developed economies remained remarkably constant over long periods of time. The proportional growth rates of labour hours and of the capital stock both appeared constant over the long run. Since the growth rate in capital exceeded that of labour hours by a small constant magnitude, labour productivity in turn manifested a stable upward trend (subject to cyclical displacement), while the capital-output ratio and the profit rate remained constant over time.

Such empirical regularities over the sample of developed economies for which data was available were not compatible with the Harrod-Domar framework. Under the Harrod-Domar conception of growth the balance between factors of production and output observed by Solow-Swan would have been achieved by mere chance. The resolution of this apparent puzzle under the Solow-Swan approach was achieved by the abandonment of the crucial

[1] The discussion that follows draws on a number of sources, notably Fedderke (1997, 2002). The authors thank *Theoria* for the permission to use the material for the current purpose.

Harrod-Domar assumption that factors of production could be combined only in fixed proportions. Instead, capital and labour were deemed substitutable under technology that manifested constant returns to scale, and diminishing marginal returns to all factors of production. Given only a constant exogenously determined growth rate in the labour force (due to relevant demographic mechanisms, say),[2] and savings proportional to output that are necessarily invested in physical capital stock (due to the presence of a financial sector intermediating between savers and investors),[3] it then follows that the economy will manifest a steady state toward which it will necessarily converge. At low levels of physical capital accumulation, a high marginal productivity of capital creates an incentive to invest, thus raising the capital-labour ratio and labour productivity. Falling marginal product of capital ensures both a rise in the capital-output ratio, and a declining incentive to invest, until a point is reached at which the full savings (and hence investment) generated by the economy are employed simply in order to supply new labour hours entering the workforce with the same capital intensity as existing previous labour hours available for production.

In this steady state or equilibrium growth path of the economy the capital-labour ratio and labour productivity (per capita output) would become constant, and capital, labour and output would all come to grow at the constant natural growth rate predicted by the growth rate in labour hours, and the economy would manifest the stylized facts that motivated the Solow-Swan theoretical departure from Harrod-Domar in the first instance.

What should be clear is that the long run development of an economy is essentially attributable to the capital accumulation that is realized. More capital translates into higher labour productivity, though at a declining rate. Even in the modern growth literature which has come to explore more diverse drivers of economic growth, there remain strong proponents of the position that investment in physical capital stock remains the heart of the matter.[4]

Only three means would enable an economy to alter the Solow-Swan constants of long run economic development. First, raising the savings rate of the economy would raise the proportion of output available for capital accumulation, and would enable a higher capital-labour ratio to be attained, with the attendant realization of a higher per capita output.

[2] One complication for the theory is that over the course of economic development the growth rate of the labour force may come to decline. Empirical evidence suggests that the demographic transition is related to the level of per capital output – see for instance Maddison (1987). The implication is that the economy may face multiple equilibrium growth paths, of which some may constitute low-level equilibrium traps. Full discussion of this issue is beyond the scope of our report.

[3] The assumption of a proportional savings rate may appear to imply a crude theory of savings that would carry the need for strong qualifications of the steady state behaviour of the Solow-Swan model. It is possible to show that this is not the case. Under assumptions of classical savings behaviour such that savings are a function of the profit rate (see Branson (1989)), or Kaldor (1955-56, 1963) savings under which "capitalists" and "workers" maintain differential savings rates, or Ando-Modigliani (1963) life cycle savings behaviour, it is possible to show that the steady state characteristics of the economy are unchanged except in some extreme (and hence unlikely) instances.

[4] Good illustrations are provided by De Long and Summers (1991, 1993). Easterly (2001) infers from the Solow-Swan model that *only* technological progress is relevant to long run growth. But this is true only if all economies are in steady state. During the period of transition of an economy to steady state, the rate of capital accumulation remains important.

Second, a lower growth rate of the labour force would allow the use of investment for the purposes of capital deepening rather than capital widening, and again the consequence would be a rising capital-labour ratio and higher labour productivity.

Both changes in the savings rate and changes in the growth rate of the labour force would only result in a temporary change in the growth rate of output, as the economy moves to the new steady state defined by the new savings rate or labour force growth rate. In steady state the natural growth rate of the economy would again prevail. The only means of permanently accelerating the growth rate of output under the Solow-Swan model is through technological progress. Where innovation is consistently able to improve the productivity with which existing capital and labour time is employed in the generation of output, per capita output is able to grow indefinitely also.

2.1.2 The Impact and Determinants of Technological Progress: Exogeneity vs. Endogeneity

The central role of technological progress in economic growth was recognized both empirically[5] and theoretically[6] from the outset in the post-war debate. Early treatment of technological progress treated the innovation process as exogenous (or at least as beyond the scope of economic analysis), and focused instead either on the innovation's impact on factor intensity (labour-saving, capital-saving, or neutral), or on the implications of the embodiment of technological innovation in new investment instead of the entire stock of capital in the economy.[7]

Of course, as long as the source of technological progress is treated as exogenous to economic analysis, there is little to add to it. Such an outcome is vexing particularly where it is found that innovation is an important contributor to economic growth over and above capital accumulation. The upshot would be that economics has less to add to our understanding of growth than one might have thought. The embarrassment is even more acute when one notes that the empirical data that became available over the post-1960 period on the economic performance of a wide range of newly independent developing nations appears to point to the importance of technological progress.[8] One response to the

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[5] Abramovitz (1956) famously established that employing the growth accounting framework implied by Solow-Swan, would leave approximately 75% of output growth unaccounted for by factor accumulation, and hence by implication due to technological progress. While the work of Denison (1962), Jorgenson et al (1967, 1987, 1988), Grilliches (1979) amongst numerous others lowered the growth attributable to technical change, the point remained germane.

[6] See for instance Solow (1957, 1959).

[7] See Solow (1959) and Nelson (1964). Hulten (1992) provides a more modern perspective including on the empirical importance on the embodiment debate.

[8] See for instance the synoptic discussion in Romer (1994). The point is that one of the empirical implications of the Solow-Swan model is that once differences in investment and labour force growth rates between countries have been taken into account, they should converge to a common per capita level of output. While the empirics are contested, it turns out that at least arguably economies are diverging, even when a whole range of additional growth determinants have been accounted for. The famous explanation of Romer (1986) is that this is due to the fact that the technology of production is subject to increasing rather than decreasing returns to scale. Variations on the theme are now myriad.

embarrassment is to endogenize technological progress, rendering economic theory more comprehensive.

A large number of contributions to endogenous technological progress have emerged since the reinvigoration of the growth debate in the mid 1980's. In presenting these contributions we aim to structure one's understanding of the endogenous growth literature. Before doing so, it is useful to bear in mind two qualifiers. First, the central idea that underlies all of the endogenous growth literature is fairly straightforward. It rests on the proposition that technological progress takes place because resources are devoted to it – either intentionally in the case of Schumpeterian approaches, or inadvertently through knowledge spillover processes. Second, one should bear in mind that while endogenous technological progress came to prominence in the 1980's, a number of earlier contributions to the literature on economic growth had advanced similar propositions, and explored their implications in some detail.[9] For a fuller non-technical discussion of new growth theory and its relation to human capital investment see Fedderke (2002).

2.1.3 Endogenous Technological Change: Knowledge Spillover Effects, or Learning by Doing

New growth theory received perhaps its most often cited impetus through the work of Paul Romer. The argument presented in Romer (1986) introduced the possibility that the very process of being engaged in a productive activity generates learning effects, by allowing those who are engaged in productive tasks to become more efficient at performing them.[10]

The Romer-1986 proposition in fact has two important components: the process of learning-by-doing, and the view that such learning will be available to all firms in an industry. To the existence of learning-by-doing is added the additional presumption that any knowledge gains obtained from the process of production and investment cannot be internalised by the firm in which that knowledge-creation takes place. Thus the learning spills over to become available to all labour, and all producers in the economy.[11] With spillover effects, the suggestion is that knowledge production is an inadvertent side-product of all production and investment activity, and would thus take place whether firms wish to undertake it or not, as long as they are engaged in their standard productive activity.

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[9] Besides the classic contributions of Schumpeter (see for instance the beautifully concise 1943: Chapter VII, and also 1912), Arrow (1962) effectively provides the theoretical foundation to Romer (1986), which in turn arguably sparked the endogenous growth debate. Further important contributions came from Shell (see for instance 1966) amongst others.

[10] For some useful reflections on some potential limitations that attach to Romer's twist on Arrow (1962), see Solow (1997). Solow extends the discussion to a case in which learning by doing is bounded. On a prior approach to bounded learning by doing see Young (1993).

[11] An illustration of the potential significance of spillovers is given by Landes (2000). Contrast the strong attempts to control the dispersion of knowledge concerning the construction of time pieces in China (2000:30), and the effects of the strong guilds in much of Europe (2000:222ff), with the relatively free circulation of ideas and expertise in Britain (2000:231f). Britain won the ensuing contest.

The effect of knowledge spillover is to ensure that the efficiency of the labour input at the social level will improve. The consequence of this is that the production function comes to show increasing returns to scale at the social level (because of constant social returns to capital).

The crucial difference between the Romer-1986 growth model and traditional growth models relates to the nature of the capital stock in the economy. Once social returns to scale in capital are constant, it immediately follows that the marginal product of capital becomes constant also. As a consequence, in the Romer model the incentive to invest does not change with a rising capital labour ratio, since the marginal product of capital and hence the profit rate is constant. As a consequence, there is no reason for economic growth to ever "slow down" once it has started. This stands in stark contrast to the depiction of the growth process under Solow-Swan we encountered above.

One advantage of the Romer model is that it is able to account for the failure of poor countries to catch up with rich countries. Since the incentive to invest does not decline with rising per capita capital stock the growth rate of the capital labour ratio and of per capita output does not change either. As a consequence, there is no reason why countries which have high per capita output should grow any slower than countries which have low per capita output, such that there is no inherent tendency toward catch-up as is present in traditional growth models – indeed the absolute gap between rich and poor countries may increase over time.

However, it is important to realize that the source of the non-declining incentive to invest in Romer-1986 models arises due to knowledge spillovers, which ensure a non-declining marginal product of capital. Such a perfect public good characteristic of technology is a strong assumption to invoke – and as Dasgupta and Stiglitz (1988) demonstrate, even partial excludability of the knowledge spillover effects has the effect of destroying the unbounded growth result. Moreover, not only are knowledge spillovers *within* countries potentially imperfect, but Barro and Sala-i-Martin (1995) demonstrate that while capital and technology may move between regions, the rate of diffusion is not instantaneous, but takes time. Hence the public good characteristic of technology on which the central Romer-1986 result relies, is at least questionable.

A second limitation of the Romer-1986 approach is that technological progress, while technically endogenous to the model, remains essentially unexplained as an intentional activity on the part of economic agents. What has changed from traditional growth theory is that technological change has an explicit origin (in investment in physical capital stock). But in another sense technological change continues to "just happen" as a by-product of intentional activity directed not at technological change itself, but at a quite different productive activity. The expectation is of a reward not from technological change *per se*, but from the act of investment in physical capital. Even the most cursory consideration devoted to the advancement and transmission of knowledge both by the public sector (see universities for instance) and the private sector (R&D expenditure of pharmaceutical and software companies, for instance) is an indication of the fact that such an understanding of the source of technological progress must have strong limitations. Indeed, any pure public goods conception of knowledge will struggle to account for intentional private sector allocation of resources to the advancement of knowledge.

Nevertheless, to the extent that Romer-1986 is accepted, it carries with it the clear policy implication that private investment requires government subsidy. Since private investors cannot internalise knowledge spillovers, private marginal returns to investment will be lower than the social marginal return, such that private investors will under-invest in physical capital from a social perspective.

2.1.4 Endogenous Technological Change: The Intentional Creation of New Knowledge Through Research and Development

The obvious question to ask is: how to treat the production of new technology as an intentional human activity? One answer to this question is the theme of the Schumpeterian tradition in economic growth theory.[12] There exist a number of important contributions within this broad approach, including those by Romer (1990), Grossman and Helpman (1991), and Aghion and Howitt (1992). Here we follow Romer (1990), since it serves to illustrate some important generic features of such models.

The crucial theoretical move is that knowledge is no longer treated as a (pure) public good. Instead, knowledge is treated as a mixed good, with both public and private good characteristics. The assumption is now that technological change has Schumpeterian characteristics, in the sense that agents consciously engage in technological change and innovation, responding to market incentives as they do so, and the only reason they do so, is that they are now in a position to internalize positive net marginal benefits from undertaking innovative activity.

On the other hand, knowledge is not held to be a pure private good either, in the sense that to some extent it will be non-rival.[13] Once it exists, the marginal cost of allowing another agent to use that knowledge would be zero. However, since access to knowledge is excludable, agents who have control over knowledge will no longer be price-takers, but have monopoly power over the innovations they initiate. In effect we will have monopolistically competitive markets in the economy. The consequence is that the social marginal return to knowledge will exceed the social marginal cost of knowledge, and again the private sector will under-invest in knowledge. In contrast to the knowledge spillover

[12] See Schumpeter (1943: Chapter VII) as an often cited starting point.

[13] In order to understand why knowledge might have both private and public good characteristics, we can distinguish between two different forms of knowledge. The first, *human capital*, is both rival and excludable, hence strictly private. The second, *technological design*, is non-rival, since once created a design could be made available to other potential users at zero cost. On the other hand it is excludable, in the sense that private, profit-maximizing firms will seek to keep exclusive use of any design innovations they have funded. Such excludability may take the form of trade secrets guarded from industrial espionage, and more formally patents forcing any user of a design innovation to pay for its use.

model though, where the policy prescription was for production and investment subsidies, here the policy implication will be for subsidies to the production of knowledge.

In the full Romer (1990) model the economy produces research output, intermediate goods (capital) as well as final output for the purpose of consumption. For long term growth purposes we can focus on the relatively simple process governing the production of research output. Production of design output (new technology) uses simply human capital and the accumulated stock of human knowledge, the sum of all previous designs in existence. We can "know" patents, and in particular the principles and insights that they embody, even where we are excluded from actively using them in production. As such, the principles and insights embodied in patents are available to researchers to further their production of knowledge.

Production of knowledge then depends simply on the accumulated stock of already existing knowledge, the human capital devoted to research, and a research success coefficient.

We should note two important elements to this statement. The first is the explicit use of human capital in knowledge creation. The second is that this human capital is explicitly devoted *to* knowledge creation, rather than inadvertently as a by-product of some other undertaking (such as final goods production). As the Romer model makes explicit, the human capital resources could equally well have been used for the purposes of producing final output. Knowledge accumulation depends *both* on agglomeration effects (in already existing knowledge) *and* on the resources (of the specific human capital variety) devoted to knowledge accumulation. Technological advance takes place not because of "money" being thrown at the problem. The requirement is for focused deployment of the very specific resource of human capital being devoted to it.

The model goes on to demonstrate that under these circumstances, the growth in output in the long run will come to equal the growth rate in technology. Since human capital can be used either in the production of new technology or in the production of final output, this implies that the more human capital is employed in final goods production rather than "research" into the advancement of knowledge, the lower will be the long run growth rate of output in the economy. Long run growth depends immediately on the stock of accumulated knowledge, on the human capital devoted to research, and on the effectiveness of the human capital engaged in the research.

2.1.5 Providing a Counterpoint to Endogenous Growth Theory by Extending Solow-Swan: A Direct Impact of Human Capital?

One of the implications of the endogenous growth literature is the introduction of human capital into the analysis, particularly through its contribution to the innovative activity of the research sector of the economy. One advantage of the introduction of human capital is that increasing returns to scale in production technology can be realized, and hence the possibility of unbounded growth provides an explanation of the empirical observation of divergence between rich and poor countries.

An alternative approach to the role of human capital in growth is to introduce human capital directly into the production function as an additional factor of production, while maintaining constant returns to scale in production technology. Under these circumstances the introduction of human capital does not have unbounded growth as a consequence. Mankiw, Romer and Weil (1992) suggest that the introduction of human capital into a Solow model is justifiable, indeed desirable, since by 1969 in excess of 50% of the capital stock of the USA took the form of human rather than physical capital stock. Moreover, they argue that the introduction of human capital into the Solow model successfully enhances its explanatory power to such a degree as to preclude the necessity of resorting to endogenous growth models.

The implication Mankiw et al draw from their empirical results is that the human capital augmented Solow-model, despite its simplicity, accounts for a significant proportion of cross-country variation in per capita output. They argue that the strength of the empirical evidence has to be accepted as forceful evidence in favour of the model - and that recourse to endogenous growth theory, given all the complexity it often introduces, may simply not be necessary. Differences in per capita output between countries on this explanation would be due simply to differences in their endowments of physical and human capital.

2.1.6 Further Reflections on Endogenous Growth Theory

In an extension of the spillover approach to endogenous growth, Lucas (1988) proposed a production function in which production is constant returns to scale, but in which the possibility of increasing returns is introduced through the impact of the generally available human capital. In a Lucas model one can show that the final growth rate of the economy will be determined by the rate of growth of human capital creation. Moreover, growth will turn out to be unbounded even in the absence of increasing returns to scale, because of the implied growth in the effective labour force of the economy due to investment in human capital. The result is analogous to the unbounded growth due to technological progress in traditional theories of economic growth, but now with an explicit recognition that the motor force behind this growth is human capital formation.

Where we also have increasing returns to scale in production an additional implication is that the rate of return to human capital will prove to be highest where it is most abundant. In the presence of labour mobility, the implication is that labour well endowed with human capital will migrate to centres already intensive in human capital, because the rewards of doing so are large.

The policy implications for developing countries are profound. It implies that if a country is behind in the accumulation of human capital it is likely to remain forever behind. Countries ahead in the growth race will steadily out-accelerate any lagging country due to the increasing returns in human capital. Worse, if a developing country tries to rectify matters by improving investment in human capital, such human capital is simply likely to emigrate. The situation for poor countries is doubly perverse. They are poorly endowed with human capital. But the policy intervention designed to rectify the situation – increasing saving in order to be able to invest in education - merely serves to benefit the already rich.

Thus if human capital matters for growth, and if increasing returns to human capital are present, poor countries face the tough task of having to keep the environment for skilled people at home even more attractive than otherwise would have been the case. Policy intervention must be conscious of the need to improve the incentive for human capital to stay, rather than leave.

Increasing returns to scale in human capital may lead to perverse international allocation of human capital. But this unfortunate international allocation of human capital may well be exacerbated by a further counterproductive intra-national human capital allocation. Under the Romer (1990) conception of the interaction between growth and technology, we have a sector dedicated to the creation of knowledge using human capital as an input, but with human capital also used in the production of final output. The difficulty for developing countries is that at low levels of human capital accumulation, there may simply not be the critical mass of human capital to generate sufficient returns from the pursuit of new knowledge. As a consequence human capital will come to migrate to final goods production rather than new knowledge production, because the return to human capital in final goods production is higher. The net result is a permanent decrease in the developing country growth rate, while developed nations with higher agglomerations of human capital will be able to take advantage of higher growth rates due to their ability to create new knowledge on the back of higher concentrations of human capital devoted to knowledge creation.

Thus developing nations are potentially caught in two vicious cycles that result from the impact of human capital on long run economic performance. The one results in an unfavourable international allocation of human capital away from developing nations to developed nations. The other ensures that what human capital remains in developing nations may not be allocated to where it has the most dramatic long term impact.

2.1.7 Why Growth Accounting is Neutral to Growth Theory

Growth accounting is not theory driven. It is not constructed on the basis of any one of the theoretical approaches to economic growth. This is reflected in the use of completely general functional forms in the growth decompositions used in growth analysis.

Such an approach has both strengths and weaknesses. The most important strength is that the decomposition is not dependent on any theoretical construct for purposes of interpretation. The decomposition merely identifies what proportion of growth is due to capital and labour accumulation, hence what proportion is left over and must therefore be attributed to efficiency gains. In this sense it is neutral to traditional and endogenous growth theory.

The weakness is that the efficiency gain, termed total factor productivity growth (TFP) is a complex composite of many different factors, which one cannot untangle short of additional econometric effort. One such attempt for the aggregate South African case is given by Fedderke (2001). For instance, the efficiency gain could be exogenous, and if exogenous either embodied or augmenting; if augmenting, it could be Hicks-, Harrod- or Solow-neutral, without the decomposition identifying which of these cases applies. But the efficiency gain could also be endogenous, either due to the learning effects that in fact attach to labour hours due to Romer-type spillover effects, or due to Schumpeterian quality ladders or increasingly differentiated intermediate (capital) goods. Equally, the efficiency gains could be due to economy of scale, catch-up, improved market efficiency, and other factors that impact on production efficiency.

But the point is simply that one cannot identify precisely the origin of the efficiency gain. What growth accounting does do is to identify the *existence* of efficiency gains if they are present. And for policy purposes this is itself an important step. Knowing that efficiency gains are a significant contributor to growth, is the first step toward understanding what might be done to further enhance the underlying mechanisms in support of growth.

In the following section we provide both a more precise account of the growth accounting methodology, and identify in greater detail some of the limitations that attach to it.

2.2 The Growth Accounting Methodology and its Limitations

The most basic approach to the computation of total factor productivity (TFP) was established in Solow (1957), Kendrick (1961), Denison (1962) and Jorgenson and Griliches (1967).[14] It begins with the neoclassical production function:

$$Y = F\left(A, K, L\right) \tag{2.1}$$

with A denoting the level of technology, Y output, K capital stock, and L labour. Differentiation with respect to time and division by Y gives the decomposition of output growth:

$$\frac{dY/dt}{Y} = \left(\frac{F_A A}{Y}\right)\left(\frac{dA/dt}{A}\right) + \left(\frac{F_K K}{Y}\right)\left(\frac{dK/dt}{K}\right) + \left(\frac{F_L L}{Y}\right)\left(\frac{dL/dt}{L}\right) \tag{2.2}$$

where F_K, F_L, provide the factor social marginal products.[15] The rate of technological progress or TFP, under the assumption that observed factor prices measure social marginal product, can then be computed by the standard primal estimate or (Solow) residual:

[14] For a useful overview of the developments see Barro (1998), which provides a more elaborate treatment of the condensed material that follows here. An alternative methodology, combining the insights from new growth and new trade theory, is given by Anderton (1999). Unfortunately data limitations for South Africa preclude its use.
[15] Note that under Hicks-neutrality the term for technological progress reduces to dA/dt. See Solow (1957).

$$TFP = \frac{dY/dt}{Y} - s_K \frac{dK/dt}{K} - s_L \frac{dL/dt}{L} \qquad (2.3)$$

where s_K = RK/Y and s_L = wL/Y, with R denoting the rental price of capital and w the wage rate. Hence s_K and s_L are the shares of capital and labour in output respectively. The standard primal decomposition of output growth proceeds not by estimation, but on the basis of time series data on dY/dt, dK/dt, dL/dt, s_K and s_L. With discrete data, growth rates generally are measured following Thörnqvist (1936) as log differences in the levels between t+1 and t. The Thörnqvist procedure is exact under translog production technology.[16] Factor shares are arithmetic averages for t+1 and t.

A dual version of the primal growth accounting approach starts from:[17]

$$Y = RK + wL \qquad (2.4)$$

and with differentiation with respect to time and division by Y we obtain:

$$\frac{dY/dt}{Y} = s_K\left(\frac{dR/dt}{R} + \frac{dK/dt}{K}\right) + s_L\left(\frac{dw/dt}{w} + \frac{dL/dt}{L}\right)$$

$$TFP = \frac{dY/dt}{Y} - s_K\left(\frac{dK/dt}{K}\right) - s_L\left(\frac{dL/dt}{L}\right)$$

$$= s_K\left(\frac{dR/dt}{R}\right) + s_L\left(\frac{dw/dt}{w}\right) \qquad (2.5)$$

which will correspond to the primal measure as long as equation 2.4 holds.[18]

An immediate limitation of the simple primal decomposition is that it fails to account for quality differentials in factor inputs. Jorgenson and Grilliches (1967) and Jorgenson, Gollop and Fraumeni (1987) demonstrate the importance of accounting for the quality of inputs. The implication is that:

$$TFP = \frac{dY/dt}{Y} - \sum_i s_{Ki}\left(\frac{dK_i/dt}{K_i}\right) - \sum_j s_{Lj}\left(\frac{dL_j/dt}{L_j}\right) \qquad (2.6)$$

where we allow for i classes of capital inputs (distinguished by age, for instance) and j classes of labour inputs (distinguished by education, age, sex, etc.).[19] Failure to account for input quality is likely to bias the TFP measure upward.

This will remain a consideration for this report throughout, given that publicly available South African data currently does not allow for the quality-decomposition of factor inputs. Fedderke (2002) demonstrates that on aggregate data the improvement in the labour factor input made a significant difference for manufacturing sector TFP decompositions, though not for other sectors of the economy. Unfortunately at the regional level no data

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[16] See Diewert (1976).

[17] See the discussion in Hulten (1986) and Jorgenson and Grilliches (1967).

[18] The condition that Y = RK + wL may not hold in open economies, which would serve to drive a wedge between primal and dual estimates of TFP.

[19] Mutatis mutandis for the dual approach.

exists to correct the TFP decomposition. Readers should therefore bear in mind that the computed TFP growth measures reported below will contain an upward bias.

A second source of concern is that the decomposition proceeds on the assumption that factor prices reflect factor marginal products, thus presupposing a degree of perfection in factor markets that may be inappropriate - particularly in South Africa. One means of responding is to avoid this restrictive assumption by estimating:

$$\frac{dY/dt}{Y} = \beta_0 + \beta_1\left(\frac{dK/dt}{K}\right) + \beta_2\left(\frac{dL/dt}{L}\right) \qquad (2.7)$$

with β_0 providing the TFP measure. While dispensing with the limitation presented by assumptions regarding factor pricing, the regression approach to TFP measurement faces serious limitations in its own right. First, dK/dt and dL/dt cannot be assumed to be exogenous with respect to TFP, so that correlated variation in unobservable technological change would be attributed to factor input growth rates, biasing downward the measurement of the impact of technological progress.[20] Second, both dK/dt and dL/dt are subject to measurement error, particularly given the impact of variations in capacity utilization of the capital stock.[21] Where capacity utilization has a significant impact, the result is often a downward bias on the contribution of the capital stock, and an upward bias on the contribution of technology to output growth. Given these limitations, the convention has generally been to employ the decomposition rather than the regression approach.

Where deviations from perfectly competitive pricing is believed to be pervasive, one alternative would be the use of Malmqvist indices which do not require the use of input share data.[22] Malmqvist indices are not without difficulties in their own right, however.[23] A

[20] Unfortunately reliable instrumentation is particularly fraught in this context, making instrumental variable estimation difficult.

[21] The degree to which variation in capacity utilization is important is a matter of some dispute. Hall (1988), Caballero and Lyons (1992) argue for its unimportance. Basu (1995) dissents. Oliveira Martins and Scarpetta (1999) provides an extension to the debate and methodology. Burnside, Eichenbaum and Rebelo (1993) extend the argument to labour hoarding over the business cycle. One should also bear in mind that one strand of the debate emphasizes that less than full capacity utilization is itself a sign of inefficiency. Fluctuations in TFP measurement due to fluctuations in capacity utilization would thus be interpretable as changes in efficiency. See for instance Domar (1961: 715 fn1).

[22] or a South African application see the discussion in Thirtle, Van Zyl and Vink (2001).

[23] Malmqvist indexes decompose productivity changes into changes in technical efficiency and an index of technical change. Change in technical efficiency is meant to capture relative efficiency (whether a sector is moving closer to or further away from best practice) while technical change is meant to measure changes in best practice. In effect, it distinguishes "catch-up" from "true" technological advance. Reliable implementation does require the identification of best practice, however, with both parametric (econometric) and nonparametric (programming) approaches being used in the literature. Results depend on the assumption that (some) observed data points reflect best practice. In parametric approaches results are sensitive to assumptions concerning the functional form of technology. In programming approaches, results are sensitive to measurement error while the absence of assumptions regarding functional form precludes the use of diagnostic tests to evaluate results. Both approaches are also unable to identify the contribution of factor inputs to production, information that is valuable in its own right. Discussions of Malmqvist indexes can be found in Charnes, Cooper and Rhodes (1978), Seiford and Thrall (1990), Fried, Lovell and Schmidt (1993), and Ten Raa and Mohnen (2000).

second option is to allow explicitly for a departure from perfect competition, estimating mark-ups over marginal cost and their impact on the magnitude of the Solow residual.[24]

Further serious difficulties arise once the contributions of modern growth theory are taken into account. In particular, recognition of increasing returns to scale, of knowledge spillovers[25] and the possibility of Schumpeterian growth (either with increasing varieties or quality-ladders of inputs)[26] will render the computation of TFP biased. Under the spillover/increasing returns literature, the contribution of capital stock accumulation comes to be underestimated, while TFP growth comes to incorporate both exogenous technical change as well as the growth effect due to increasing returns and spillover. Similar implications follow for the Schumpeterian models, except that TFP growth comes to incorporate output growth due to increasing varieties or qualities of inputs as well as exogenous technological progress.[27]

Both deviations from perfectly competitive factor pricing and the impact of knowledge spillover or Schumpeterian growth carry potentially serious limitations for conventional growth accounting. Nevertheless, this study proceeds with the conventional decomposition of output growth as implied by equation 2.3 above for two reasons. First, we explicitly deal with the question of the impact of imperfectly competitive pricing on the Solow residual at some length in a separate report, while the impact of increasing returns to scale and Schumpeterian growth would have to be the subject of a separate research project. Both issues require the development and application of a methodology that merit full and separate treatment. Second, both the explicit treatment of the impact of imperfectly competitive markets and the impact of endogenous technological change require the computation of standard TFP measures as a benchmark. While this report does not belittle the importance of the pricing and the endogenous technological change issues, conventional TFP measures are a necessary foundation to any debate concerning the structure of economic growth, and it is these that the present research seeks to supply.[28]

In the analysis that follows we will also be concerned with the computation of TFP on a sectoral level. This raises two last methodological issues that need to be addressed. First, when computing TFP growth for the economy in aggregate, net output or value added is the appropriate outcome variable, since national accounts are based on net values. By contrast, within industries use of net output measures may serve to bias the TFP measures upward, since part of output growth may be due to efficiency gains the industry imports in

[24] See Hall (1990), Roeger (1995), and Oliveira Martins and Scarpetta (1999) for discussions of this approach.
[25] The now standard references are Griliches (1979), Romer (1986) and Lucas (1988).
[26] See Romer (1990), Grossman and Helpman (1991: ch3), Aghion and Howitt (1992) and Grossman and Helpman (1991: ch4).
[27] A full discussion of the detail can be found in Barro (1998).
[28] The use of decompositions analogous to those used in this paper continues in the literature, though ideally the distinction between types of factor inputs is taken into account. Examples from the literature include Young (1995) for East Asian countries, Christenson, Cummings and Jorgenson (1980) for the OECD, Elias (1990) for Latin America. For a more encompassing view see Maddison (1987), and see also the discussion in Jorgenson (1988) and Fagerberg. (1994).

the form of inputs from other sectors.[29] In effect, we stand in danger of double-counting TFP. We will nevertheless persist with the use of the value added measure for a number of reasons. The worst is that the use of the value added measure is not unique to this study.[30] More pertinent are data limitations. The choice is dictated by the infrequency with which South African input-output tables are published, providing one with poor information concerning relevant cross-industry inputs. Given a choice between measurement error with uncertain effects, and an aggregation procedure with clearly understood bias, we chose the latter. That said, further work on this matter is clearly desirable in order to improve our understanding of TFP growth in South Africa. Readers should therefore treat the sectoral TFP estimates with care, and recognize their potential upward bias.[31]

The second methodological issue arises from an application of the comparison of industry TFP's suggested by Harberger (1998). Computing TFP growth by means of the dual equation 2.5 across a range of industries, Harberger computes what he terms "real cost reduction" (RCR). RCR computes the change in real value added due to TFP growth on an industry by industry basis as $y_{oi}(\exp \tau_i T\text{-}1)$ where y_o denotes value added in the starting period, and τ_i the average TFP growth maintained by industry i over the interval (O,T].[32] Consideration of the structure of TFP growth between n industries is then by means of the index:

$$\overline{A} = \overline{A} = \left[\sum^{n} y_{0,i} \left(\exp \tau_i T - 1 \right) \right] / \left[\max \sum^{n} y_{0,i} \left(\exp \tau_i T - 1 \right) \right] \quad \forall i \qquad (2.8)$$

which can then be compared to an index of value added by industry.

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[29] See Leontieff (1953).

[30] See for instance Harberger (1998), Roeger (1995), Oliveira Martins and Scarpetta (1999).

[31] Domar (1961:724f) shows that the TFP computed on value added will be a multiple of the "true" TFP. Domar also points out that the magnitude of the TFP measured on gross output recognizing the impact of intermediate inputs, may simply reflect what he terms the "thinness" or "thickness" of the industry, viz. the extent to which inputs are transformed within the production processes of the industry. Use of the gross output TFP measure would therefore introduce another source of cross-industry variation in TFP not reflecting technical change properly understood.

[32] Since RCR is generated on the additional value added generated in each industry, its attraction is that it enables additive aggregation. The process of aggregation avoids the problems highlighted by Domar (1961:717ff), since the concern is not with the computation of an aggregate growth rate of TFP, but with the aggregate gain in output due to TFP growth industry by industry.

3.0 Prior Findings for South Africa

South Africa's aggregate experience mirrors that of many developing countries. Table 1 illustrates that the contribution of growth in total factor productivity to South African growth in aggregate output has been steadily rising since the 1970's. The 1970's and 1980's saw growth that was heavily led by growth in capital and labour inputs, with very little contribution by technology. In the 1990's the situation is reversed. In the 1990's growth in the labour force input contributed negatively, and growth in the capital input contributed relatively weakly to growth in GDP. Instead, the single strongest contributor to output growth during the course of the 1990's is a strong augmentation in technology.

Table 1: Decomposition of growth in real GDP into the contribution of factors of production and technological progress

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

Figures are in percent, Source: Fedderke (2001)

Thus the evidence suggests the presence of a strong structural break in the South African economy. While in the 1970's and 1980's output growth in the economy as a whole was driven by growth in factor inputs, the 1990's have seen a growing reliance on technological improvements and efficiency gains in the economy. Part of the reason for this evidence is that the 1990's saw a decline in formal sector employment.[33], such that growth in labour inputs could not possibly have added to the growth in real output of the economy. The declining contribution of capital to the growth performance of the South African economy is due to the declining investment rate that South Africa has experienced.[34] We are thus left with a finding that the contribution of technological progress to South African growth in aggregate has been steadily rising since the 1970's - though admittedly it has contributed a rising share to a declining growth rate in output.

The aggregate evidence hides strong sectoral differences, however. We report the summary evidence in Table 2. The implication of the evidence is that the principal South African economic sectors show strong differences in terms of the decomposition of their output growth. The only consistent feature across all four principal sectors of the South African economy is that the contribution of the labour factor input toward output growth has been on a downward trend from the 1970's through to the 1990's. In terms of the contribution of growth in capital stock, we find that in the agricultural sectors, the mining industry and the service industries capital has been of declining importance as a contributor toward output growth, while for manufacturing industry it has assumed increasing importance.[35]

[33] See the more detailed discussion in Fedderke, Henderson, Mariotti and Vaze (2000).
[34] See the more detailed discussion in Fedderke (2001a), and Fedderke, Henderson, Kayemba, Mariotti and Vaze (2001).
[35] This is consistent with the evidence contained in Fedderke, Henderson, Kayemba, Mariotti and Vaze (2001).

Table 2: Decomposition of growth in real output into the contribution of factors of production and technological progress; Evidence by principal economic sectors

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

Figures are in percent; Source Fedderke (2002)

Finally, in terms of the contribution of technological progress, the strongest efficiency improvements have consistently been evident in the agricultural sectors, though the contribution declined during the 1990's. Mining by contrast, while coming off a low growth rate of technological progress, has been on an upward trend, as has the service industry. The manufacturing industry has shown the weakest performance in terms of technological progress in the South African economy [36] - at least during the course of the 1990's.[37]

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[36] The exceptional behaviour of the manufacturing sector deserves a little closer comment. The correlation between output growth and the contribution to output growth by the three sources of output growth changes dramatically from 1970 to 1997. In the 1970's and 1980's, the strongest correlation is between output growth and the TFP measure. In the 1990's the strongest correlation is between output growth and the growth rate of capital stock. The implication is that in the first two decades sectors that experienced high growth rates in output, were also likely to have a strong track record of technological innovation. In the 1990's, by contrast, this association has become less prevalent. Instead, strong output growth has become associated with a strong growth rate in physical capital stock. A number of explanations are possible for this transformation. The first is the evidence now accumulating that capital markets in South Africa underwent restructuring during the course of the 1990's (see for instance the discussion in Fedderke, Henderson, Kayemba, Mariotti and Vaze (2001)). The liberalization of the policy environment saw changed incentives and rates of return to investment activity, such that capital came to be reallocated from sectors with strong state involvement, to manufacturing industry. A further potential explanation for the changing profile in manufacturing sector output growth arises from the likely impact of the period of international isolation South Africa faced during the 1970's and 1980's. The period of isolation may have made access to international advances more costly, increasing the incentive for domestic innovation.

[37] In the more detailed evidence of Fedderke (2002) we also present evidence on real cost reduction contributed by each economic sector, following the methodology of Harberger (1998). The implication of the findings is that technological progress in the manufacturing sectors is highly concentrated in individual sectors, rather than generalized across all manufacturing sectors. Moreover, the sectors contributing most significantly to economic growth prove too volatile across time, making the targeting of innovation incentives by policy makers difficult.

One important point to note is that the TFP decomposition as presented here represents a potential upper bound. This is due to the fact that the decomposition does not capture quality improvements in the two factor inputs. In Fedderke (2002) evidence on the likely magnitude of any bias is examined with respect to the labour input. The one two digit sector in which the bias was found to be significant was manufacturing. In the present study, we can disaggregate workers only into production workers and administrative workers – an unreliable indicator of skills distributions, though it is one that is on occasion employed in the literature on manufacturing. Moreover, the disaggregation on the basis of the manufacturing census is feasible only after 1988, giving only 8 data points. As a consequence the correction for the contribution of an increasing skills input into labour was not feasible for the present study. Readers therefore should see the TFP contribution to growth as an upper bound value.

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

4.0 Data Sources, Limitations and Notes

4.1 Data Issues

4.1.1 Introduction

All data for the current study was obtained from Statistics South Africa's Censuses of Manufacturing on a regional basis for the Western Cape for all census years since 1970, namely 1970, 1972, 1976, 1979, 1982, 1985, 1988, 1991, 1993 and 1996.

Over the years there have been a number of changes in the nature of the data collected and the categorization thereof. In order to deal with these changes a number of decisions had to be taken to ensure the data was accurate and consistent across the years and between regions and districts. These decisions are set out below.

4.1.2 Regional and District Distinctions

The following is a comprehensive list of geographical regions as identified in the most recent Western Cape regional census, 1996. The regional Manufacturing Census divides the Western Cape into nine statistical regions, each with varying numbers of districts.

Region:		Region:	
1	Cape Wynberg Simon'sTown Goodwood Bellville Mitchells Plain	5	Oudtshoorn Calitzdorp Ladismith Uniondale
2	Stellenbosch Kuils River Somerset West Strand Paarl Wellington	6	Worcester Ceres Tulbagh Robertson Montagu
3	Caledon Hermanus Swellendam Bredasdorp Heidelberg	7	Malmesbury Piketberg Vredenburg Hopefield Moorreesburg
4	Knysna George Mossel Bay Riversdale	8	Clanwilliam Vredendal Vanrhynsdorp
		9	Beaufort West Murraysburg Laingsburg Prince Albert

Appendix A tabulates the statistical region breakdowns over the period of the data used in the current study.

4.1.3 Dealing with Data Changes

Mitchells Plain was only identified as a separate district in Statistical Region 1 in the 1993 census, not prior to this date or in the 1996 census. Given its proximity geographically, and for purposes of consistency, all 1993 data for Mitchells Plain was incorporated into the Bellville magisterial district.

Region 5 showed much change over the years and to ensure consistency within the changes, Calitzdorp and Ladismith were aggregated into Oudtshoorn for all variables and for all years. Data for Uniondale has also been included in various different regions over time. Uniondale's data has also been added to that of Oudtshoorn and as a result Region 5 is identified as consisting of Oudtshoorn only.

Hopefield in Region 7 has been dealt with in the same manner, being incorporated into Moorreesburg.

Region 9 is represented in the final analysis by Beaufort West only. Fraserburg, Laingsburg, Prince Albert and Murraysburg are all included under Beaufort West because over time the data for these districts was treated differently. Amalgamating all districts into Beaufort West for all years ensured data accuracy and consistency as it did away with the need to split data in different ways in different years.

In some years Bredasdorp and Heidelberg were treated as a single entities and in other years not. To ensure accuracy and consistency over time Heidelberg was incorporated into Bredasdorp.

In 1982 the following municipal areas were not accounted for in the census.

Beaufort West	Hopefield	Calitzdorp	Bredasdorp
Murraysburg	Moorreesburg	Ladismith	Heidelberg
Laingsburg	Prince Albert	Uniondale	Piketberg

In 1985 the following municipal areas were not accounted for in the census.

Bredasdorp	Calitzdorp	Piketberg	Vanrhynsdorp
Heidelberg	Ladismith	Hopefield	Laingsburg
Clanwilliam	Uniondale	Moorreesburg	Prince Albert

4.1.4 Final Listing

After making the necessary simplifying decisions and aggregating districts as described above, the following list of regions and districts was compiled. Data analysis was carried out on this final listing of 33 statistical districts and nine regions.

Region	
1	Cape Wynberg Simon'sTown Goodwood Bellville
2	Stellenbosch Kuils River Somerset West Strand Paarl Wellington
3	Caledon Hermanus Swellendam Bredasdorp
4	Knysna George Mossel Bay Riversdale
5	Oudtshoorn
6	Worcester Ceres Tulbagh Robertson Montagu
7	Malmesbury Piketberg Vredenburg Moorreesburg
8	Clanwilliam Vredendal Vanrhynsdorp
9	Beaufort West

4.1.5 Data Manipulation

Once the raw data had been extracted from the censuses a number of rounds of manipulation commenced. Data for intra-census years had to be calculated. A smoothed average interpolation method was utilised. Where data was not recorded for a district for a particular year the interpolation also covered the missing year/s as applicable per case.

In the 1993 Census Statistical Regions 4 and 5 were combined and in addition fixed asset data for Oudtshoorn, Calitzdorp, Ladismith and Uniondale as well as Mossel Bay were not provided by district, only the aggregate for the combined regions.

Our decision (as set out above) to combine Calitzdorp, Ladismith and Uniondale with Oudtshoorn simplified the issue somewhat but still left us with a decision on how much value to allocate to Oudtshoorn and how much to Mossel Bay. Given that the Mossgas refinery investment was taking place at that time it was decided to smooth data for Oudtshoorn as done for all other years and variables and allocate all remaining value to Mossel Bay. This decision does, however, cause enormous fluctuation in this year from preceding and subsequent years. This, we believe, would in any case not be far from reality. In Sections 4 to 6 where we analyse the data and results, recurring reference is made to the inconsistencies brought about by the enormous, once off investment in the Mossgas project.

4.1.6 Additional Date Restrictions and Permutations

A study such as the current one relies entirely on the availability of reliable data. It is unfortunate that the most recent on the manufacturing sector is eight years old. More recent data would throw light on the fruits of government policies in the ten years of democracy. It will be interesting to update the study when such data does become available.

The basic growth equation was not only estimated for nominal and real variables but also for two measures of capital. To commence the variable consisted of a measure of plant and machinery (P&M) only and thereafter further estimations were carried out using a variable named total fixed assets (TFA) which is a summation of assets measured in the census in the categories vehicles, plant and machinery and buildings and works.

The permutations of the variables mean results are potentially classified in four ways – nominal, real, total fixed assets (TFA) and plant and machinery (P&M).

While all research results have been obtained for the TFA measure as well as the plant and machinery measure, the primary focus is on the measures based on plant and machinery. A number of motivations underlie this choice. First, the P&M measure is more intimately related to the productive processes in manufacturing industry than the TFA measure, while the productive contribution of land and buildings is more tenuous. Second, the land and buildings component of the capital stock introduces greater capacity of measurement error into the compilation of an aggregate capital stock series – beyond what is already notoriously present in the measurement of capital stock. Third, concerns with measurement error in relation to the TFA measure of capital stock are empirically evident in the Western Cape. We thus have a prior preference for the P&M measures of capital stock, and the implied TFP measure in order to remove the impact of measurement error and since the productive contribution of land and buildings is unlikely to be substantial in general.

4.2 Methodological Issues

Using equation 2.3 it is possible to identify growth patterns in the Western Cape manufacturing sector across time and for identified magisterial districts. Specifically, which magisterial districts have seen manufacturing output grow fastest and which slowest; and how these patterns of output growth have changed over time between and across districts is able to be gauged. Similar analysis is performed on data for the variables labour, capital and total factor productivity.

An important question concerns the use of real or nominal data. StatsSA does not currently publish price indices disaggregated at the regional level. As a consequence converting Value Added (Net Output), Labour Remuneration and Capital Stock series to real magnitudes becomes non-trivial. It goes without saying that the unavailability of regional price indexes is sub-optimal. But their absence necessitates the development of a workaround.

Our approach to the problem was two-fold. We undertook the growth decomposition exercise in both nominal and real terms.[38] For the real computation, the deflation of nominal data series was undertaken on the basis of the relevant sectoral GDP deflator obtained from the nationally aggregated manufacturing series, base year 1990. There is of course no guarantee that the price index that applies nationally is relevant for the Western Cape. This is especially so since the preponderance of manufacturing activity in South Africa is concentrated in Gauteng, and hence Gauteng would carry disproportionately more weight in the construction of the price series than the Western Cape.

Two considerations suggest that the bias introduced by employing national price indices would be limited. Price arbitraging between regions would ensure that price divergence between major regional centres would tend to be restricted to transport and transaction costs. As long as transport and transactions costs have a trend structure that is not markedly different to the price indices in the manufacturing sectors, this would introduce a systematic bias to the computed real magnitudes downward, not a time-varying pattern that is impossible to control for. Hence, conclusions concerning trends in output growth and its determinants over time would remain unaffected.

In the final instance such questions are however empirical. We have at our disposal an immediate check of the impact of the use of the national price indices, rather than the use of regional price indexes, by examining the statistical similarity of the results obtained under the use of nominal and real data. This represents the starting point of our empirical analysis.

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[38] For a comparison of the real and nominal approaches to growth decompositions see Roeger (1995).

Consideration of the evidence provided by the real and nominal data suggests that the use of the aggregate national price indices does not introduce substantial bias to the analysis – with the exception of a few regions, and a few time periods under consideration. Use of real or nominal data therefore does not generate substantive differences in results, though we continue to use both real and nominal magnitudes throughout the study. They do not produce substantively different results, and in what follows, we note the occasions where such differences occur explicitly.[39]

Table 3 reports the correlations between the real and nominal value added growth rates. We consider evidence from the individual magisterial districts of the Western Cape, for the whole time period under consideration by this study (1970-1996), as well as the three decades covered by the study individually (the 1970's, 1980's, 1990's). Tables 4 and 5 repeat for capital and total factor productivity respectively.

How do we interpret these correlations? All statistics are in some sense imprecise measures – suffering from sampling error, collection problems of numerous sorts, processing errors, amongst other difficulties. Hence each measure, from output, to capital, to total factor productivity suffers from (unknown) measurement error. One way of structuring one's thinking about the reported correlations is to recall that for normally distributed data, an observed correlation between two variables is equal to the "true" correlation between the variables if perfectly measured times the square root of the product of the reliability coefficients for each variable.[40] Suppose two variables are each measured with a reliability of 0.8, and we observe a correlation of 0.6 between them. Our best guess of the "true" correlation is the observed correlation divided by the square root of the product of the reliability coefficients, or 0.6/0.8 = 0.75. For many data, reliability is not above 0.8 to 0.9. Thus observed correlation coefficients of 0.6 to 0.8 are high, given the unreliability of measurement. Putting it another way, we would be hard-pressed to say that these highly correlated variables are measuring very different things.

[39] A further consideration is that as the results of subsequent sections will show, manufacturing industry in the Western Cape is concentrated in the Food, Beverages and Wood sectors. Since the market for these products is very homogenous, it is thus relatively unlikely that substantial wedges between national and regional prices would arise. Note however, that our results in no way are contingent on this consideration, given the empirical evidence presented above.

[40] A reliability coefficient of 1.0 would indicate perfect agreement and no measurement error; 0 would indicate pure measurement error and no agreement.

Table 3: Correlations of Results of Nominal Compared to Real Variable: Value added

	Average	1970´s	1980´s	1990´s
Cape	0.86	0.71	0.82	0.99
Wynberg	0.88	0.85	0.90	0.88
Simons Town	0.96	0.82	0.94	1.00
Goodwood	0.97	0.93	0.94	0.93
Bellville	0.83	0.48	0.87	0.95
Stellenbosch	0.98	0.98	0.98	1.00
Kuils River	0.97	1.00	0.95	0.18
Somerset West	0.96	-0.09	0.97	0.97
Strand	0.94	0.92	0.70	0.98
Paarl	0.55	0.30	0.59	-0.48
Wellington	0.93	0.94	0.91	0.13
Caledon	0.95	0.95	0.96	0.99
Hermanus	1.00	1.00	1.00	0.95
Swellendam	0.92	0.76	0.94	0.87
Bredasdorp	0.97	0.99	0.97	0.99
Knysna	0.92	0.95	0.81	0.83
George	0.91	0.89	0.67	0.98
Mossel Bay	0.99	0.92	0.90	1.00
Riversdale	1.00	1.00	0.77	0.95
Oudtshoorn	0.95	0.96	0.95	0.92
Worcester	0.91	0.94	0.87	0.99
Ceres	0.99	0.80	0.99	1.00
Tulbagh	0.93	0.90	0.92	0.99
Robertson	0.99	0.90	0.90	1.00
Montagu	0.96	0.54	0.98	0.95
Malmesbury	0.98	0.49	0.99	0.98
Piketberg	0.99	1.00	0.63	0.94
Vredenburg	0.89	0.87	0.91	0.81
Moorreesburg	0.98	N/A	N/A	0.97
Clanwilliam	0.96	0.96	0.87	1.00
Vredendal	0.85	0.75	0.89	0.97
Vanrhynsdorp	0.95	0.98	0.88	0.87
Beaufort West	0.96	0.94	0.97	0.98

Table 4: Correlations of Results of Nominal Compared to Real Variable: Capital

	Total Fixed Assets				Plant and machinery			
	Average	1970´s	1980´s	1990´s	Average	1970´s	1980´s	1990´s
CAPE	0.82	0.90	0.84	0.77	0.90	0.95	0.86	0.85
WYNBERG	0.95	0.94	0.97	0.92	0.96	0.95	0.97	0.91
SIMONS TOWN	0.99	0.93	1.00	1.00	1.00	0.92	1.00	1.00
GOODWOOD	0.97	0.99	0.94	0.87	0.97	0.98	0.95	0.65
BELLVILLE	0.92	0.79	0.95	0.92	0.94	0.87	0.96	0.95
STELLENBOSCH	0.87	0.98	0.01	0.96	0.90	0.98	-0.42	0.97
KUILS RIVER	0.98	0.99	0.94	0.99	0.99	0.99	0.98	0.99
SOMERSET WEST	1.00	0.99	1.00	0.97	1.00	1.00	1.00	0.98
STRAND	0.89	0.83	0.87	0.94	0.89	0.89	0.88	0.92
PAARL	0.84	-0.03	0.86	0.93	0.95	0.84	0.97	0.94
WELLINGTON	0.84	0.88	0.89	0.87	0.85	0.77	0.89	0.89
CALEDON	0.92	0.78	0.95	0.98	0.96	0.87	0.98	0.99
HERMANUS	0.99	1.00	0.97	0.97	0.99	1.00	0.97	0.97
SWELLENDAM	0.93	0.88	0.93	0.99	0.97	0.93	0.98	0.99
BREDASDORP	0.97	0.85	0.96	0.99	0.97	0.84	0.96	0.99
KNYSNA	0.85	0.84	0.91	0.62	0.95	0.96	0.98	0.78
GEORGE	0.72	0.65	0.51	0.45	0.94	0.88	0.94	0.63
MOSSEL BAY	1.00	0.97	0.99	1.00	1.00	0.95	0.99	1.00
RIVERSDALE	1.00	1.00	0.95	1.00	1.00	1.00	0.97	1.00
OUDTSHOORN	0.98	0.93	0.99	0.97	0.96	0.97	0.98	0.99
WORCESTER	0.95	0.89	0.96	0.97	0.96	0.98	0.96	0.96
CERES	0.99	0.99	1.00	0.82	1.00	1.00	0.99	0.94
TULBAGH	0.99	0.89	0.99	1.00	0.99	0.94	0.99	1.00
ROBERTSON	0.98	0.95	0.33	1.00	0.98	0.92	0.51	1.00
MONTAGU	0.90	0.94	0.95	0.96	0.91	0.95	0.96	0.99
MALMESBURY	0.98	0.89	0.99	0.95	0.99	0.96	0.99	0.96
PIKETBERG	1.00	1.00	0.79	0.92	1.00	1.00	0.80	0.91
VREDENBURG	0.95	0.80	0.91	0.99	0.97	0.93	0.93	0.96
MOORREESBURG	1.00	N/A	N/A	1.00	1.00	N/A	N/A	1.00
CLANWILLIAM	0.91	0.90	0.67	0.96	0.96	0.97	0.65	0.99
VREDENDAL	0.86	0.83	0.88	0.91	0.93	0.91	0.95	0.96
VANRHYNSDORP	0.96	0.95	0.96	0.83	0.98	0.99	0.96	0.95
BEAUFORT WEST	0.88	0.92	0.80	0.97	0.97	0.97	0.98	0.98

Table 5: Correlations of Results of Nominal Compared to Real Variable: Total Factor Productivity

	Total Fixed Assets					Plant and Machinery			
	Average	1970´s	1980´s	1990´s		Average	1970´s	1980´s	1990´s
CAPE	0.96	0.94	0.86	0.99		0.97	0.96	0.89	1.00
WYNBERG	0.93	0.89	0.93	0.98		0.94	0.90	0.95	0.92
SIMONS TOWN	0.99	0.89	1.00	1.00		1.00	0.97	1.00	1.00
GOODWOOD	0.95	0.95	0.92	0.99		0.95	0.79	0.93	0.99
BELLVILLE	0.96	0.93	0.92	1.00		0.98	0.95	0.95	1.00
STELLENBOSCH	0.98	0.99	0.98	1.00		0.98	0.99	0.98	1.00
KUILS RIVER	0.98	1.00	0.88	1.00		0.99	1.00	0.98	1.00
SOMERSET WEST	1.00	0.99	1.00	0.99		1.00	0.99	1.00	0.99
STRAND	0.97	0.96	0.83	1.00		0.97	0.94	0.91	0.99
PAARL	0.91	0.87	0.90	0.98		0.96	0.95	0.97	0.98
WELLINGTON	0.98	0.98	0.98	0.98		0.98	0.98	0.98	0.99
CALEDON	0.99	1.00	0.98	1.00		0.99	1.00	0.99	1.00
HERMANUS	1.00	0.99	1.00	1.00		1.00	1.00	1.00	1.00
SWELLENDAM	0.99	0.99	0.99	1.00		0.99	1.00	0.99	1.00
BREDASDORP	0.97	0.99	0.96	0.95		0.97	1.00	0.97	0.99
KNYSNA	0.94	0.95	0.54	0.97		0.96	0.96	0.95	0.98
GEORGE	0.96	0.91	0.86	0.99		0.97	0.80	0.97	0.99
MOSSEL BAY	1.00	1.00	1.00	1.00		1.00	0.97	1.00	1.00
RIVERSDALE	1.00	1.00	0.98	1.00		1.00	1.00	0.99	1.00
OUDTSHOORN	0.99	0.95	0.99	1.00		0.99	0.83	0.99	1.00
WORCESTER	0.98	0.88	0.92	1.00		0.98	0.97	0.92	1.00
CERES	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
TULBAGH	1.00	0.99	1.00	1.00		1.00	0.99	1.00	1.00
ROBERTSON	1.00	0.99	0.99	1.00		0.99	1.00	0.99	1.00
MONTAGU	0.99	0.99	0.99	0.98		0.99	0.99	0.99	0.99
MALMESBURY	0.92	0.97	0.90	1.00		0.95	0.99	0.92	1.00
PIKETBERG	1.00	1.00	0.80	0.99		1.00	1.00	0.82	0.99
VREDENBURG	0.99	0.93	0.97	1.00		0.99	0.79	0.99	1.00
MOORREESBURG	1.00	N/A	N/A	1.00		1.00	N/A	N/A	1.00
CLANWILLIAM	1.00	1.00	0.99	1.00		1.00	1.00	0.99	1.00
VREDENDAL	0.98	0.98	0.99	0.99		0.99	0.99	0.99	0.99
VANRHYNSDORP	0.99	0.99	0.94	1.00		0.99	0.98	0.89	1.00
BEAUFORT WEST	0.98	0.96	0.98	1.00		0.99	0.98	0.99	1.00

We set a stringent requirement for the comparability of the results from the real and nominal data. Specifically, we note explicitly below the instances where we may wish to raise concerns about the comparability of the real and nominal results. We do so for all instances where correlations lie below 0.6, bearing in mind that for an associated reliability of 0.8 of the measures the "true" implied correlation remains high at 0.75. Note again, that the standard is thus very stringent indeed.

What emerges from a consideration of the evidence is that:

- Divergences between real and nominal results arise for: Bellville, George, Knysna, Kuils River, Malmesbury, Montagu, Paarl, Robertson, Somerset West, Stellenbosch and Wellington.
- On value added growth, divergences between real and nominal growth rates arise for Bellville and Somerset West in the 1970's, and Kuils River and Wellington in the 1990's.
- On capital, divergences arise only for the Total Fixed Asset computation of the capital stock, not on the Plant and Machinery capital computations. Divergences arise for Stellenbosch in the 1980's, George in the 1980's and 1990's, and Robertson in the 1980's. Note therefore that our prior that the Plant and Machinery measure of capital is more reliable than the Total Fixed Asset measure,[41] finds confirmation.
- On the Total Factor Productivity, there is no divergence between real and nominal measures, regardless of whether the computation is on the Total Fixed Asset capital measure, or the Plant and Machinery capital measure.
- We note the case of two magisterial districts explicitly. For Paarl, the correlations between real and nominal value added growth measures are consistently poor, regardless of time period. For Stellenbosch there was a strong period of reported disinvestment during the 1980's. In addition, Stellenbosch reported negative net profit results more often than it reported positive results. The common element between the two magisterial districts is the preponderance of the beverage (wine) industry. The implication is that the data quality for these two magisterial districts is questionable- and this should be borne in mind in the interpretation of any results reported for the two districts. To make complete sense of the situation in the Paarl and Stellenbosch magisterial districts an investigation into factors such as tax treatments over the period is recommended. Special tax treatments may have induced non-conforming behaviour amongst manufacturers, which would perhaps explain the patterns we see in the data.

While there is thus cause for some concern on data quality, and about the difficulties arising from deflation of nominal magnitudes to real values, the empirical consistency check we have presented suggests that the extent of any bias is limited to a few magisterial districts, and that it is restricted substantially to the early part of our sample period (the 1970's). This does not remove the cause for concern, but it does suggest that the difficulty is not terminal.

We proceed on the basis of a consideration of both real and nominal evidence in what follows, noting any divergence that arises, and specifying unreliability of results where appropriate.

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[41] As already noted in Fedderke (2002).

5.0 Research Results: Aggregate Manufacturing by Magisterial District

This section is concerned with the presentation of results for manufacturing output at the magisterial level in the Western Cape. Results are presented at the magisterial level, but for output across all manufacturing sectors. The reason for the lack of sectoral decomposition at the magisterial district level is that Statistics SA does not release data at that level of disaggregation. Sectorally disaggregated results are available only for the nine statistical regions of the Western Cape. Symmetrical results to those presented in the present section are presented in section 6 of the report, for the three digit manufacturing sectors represented in the Western Cape.

5.1 Comparing the Relative Size of Magisterial Districts

Before moving on to the evidence on growth rates in value added, we consider briefly the relative contribution of the magisterial districts of the Western Cape to manufacturing value added.

Table 6 and Figures 1 through 5 summarize the evidence. Over the sample period of this study, real value added in manufacturing in the Western Cape grew from R6469363 million in 1971-75, to R9351757 million in 1991-96, an overall real growth of 45%. In addition to the following discussion, Appendices B and C provide details of growth in value added in nominal and real terms respectively by five year periods.

The implication of the evidence is two-fold. First, as expected manufacturing output in the Western Cape is heavily concentrated in a small number of magisterial districts. Throughout the sample period of this study, 80% of real value added in manufacturing was contributed by at most 7 magisterial districts. During the 1971 to 1975 period approximately the same proportion of value added was contributed by only 4 magisterial districts.

The second salient feature of the evidence is that the proportion of manufacturing value added contributed by mid-size regions in the hinterland of Cape Town, has been increasing over time. This has been primarily at the relative (not absolute) cost of the Cape magisterial district[42] - which declines from a relative contribution of manufacturing value added of 39.16% of total manufacturing value added in the Western Cape in 1971-75, to 27.11% of total manufacturing value added in the Western Cape in 1991-96. In absolute terms, Cape's manufacturing output rose over the 1970-85 period, from R2533515 million in 1971-75, to R2938184 million, but subsequently it declined to R2535396 million in 1991-96. Cape was thus approximately producing as much manufacturing output in 1991-96 as it was in 1971-75.

[42] In all instances where reference is made to Cape or the Cape we mean the magisterial district denoted "Cape", as found in Statistical Region 1.

The most dramatic gains in the relative contribution to manufacturing output have come from Malmesbury (rising from 1.3% of total Western Cape manufacturing output in 1970-75, to 5.29% of total Western Cape manufacturing output in 1991-96), Mossel Bay (rising from 0.98% of total Western Cape manufacturing output in 1970-75, to 3.48% of total Western Cape manufacturing output in 1991-96), Vredenburg (rising from 1.89% of total Western Cape manufacturing output in 1970-75, to 2.08% of total Western Cape manufacturing output in 1991-96) and George (rising from 0.7% of total Western Cape manufacturing output in 1970-75, to 1.38% of total Western Cape manufacturing output in 1991-96). In the case of Malmesbury the growth is in private sector food processing related sectors (e.g. Bokomo). By contrast, in the case of Mossel Bay the growth was led by heavy state investment in Mossgas (we return to this in the discussion which follows below), and for Vredenburg in Iscor in Saldanha Steel.

Besides the Cape, the most dramatic relative decline emerged for Stellenbosch (falling from 6.77% of total Western Cape manufacturing output in 1970-75, to 1.51% of total Western Cape manufacturing output in 1991-96). This reflected an absolute decline in real value added from R437779 million in 1970-75, to R141440 million in 1991-96, a 75% fall in real value added output over the sample period.

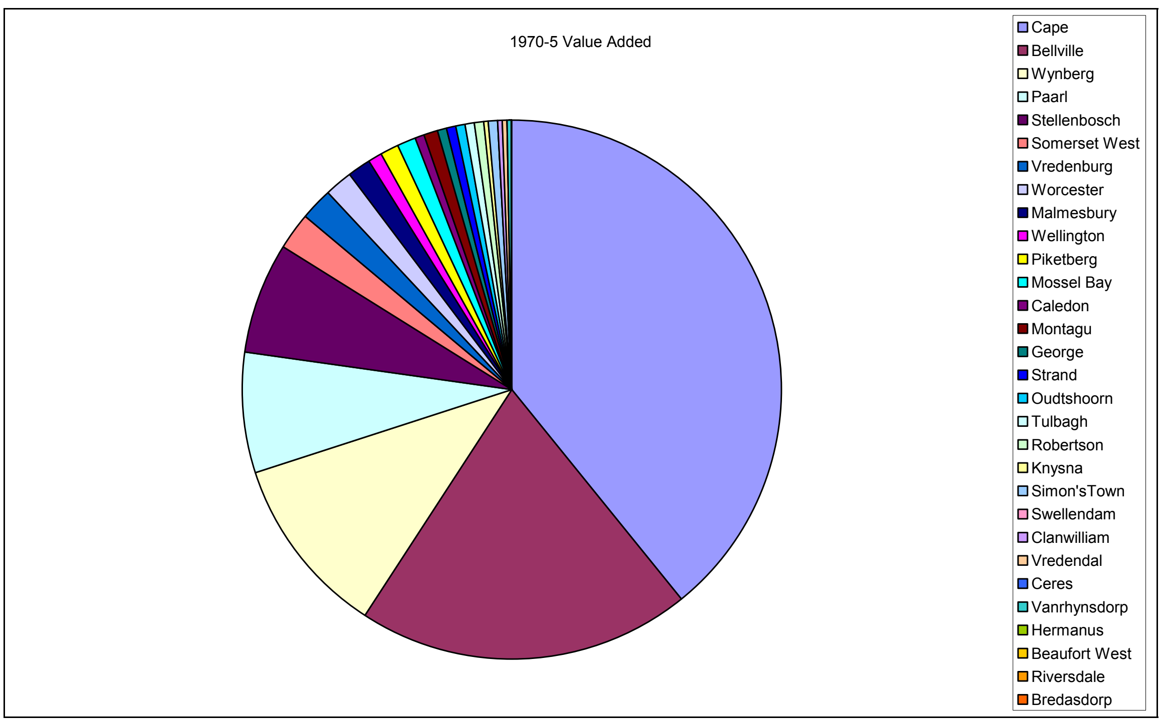

Figure 1: 1970-75 Value Added by Magisterial District

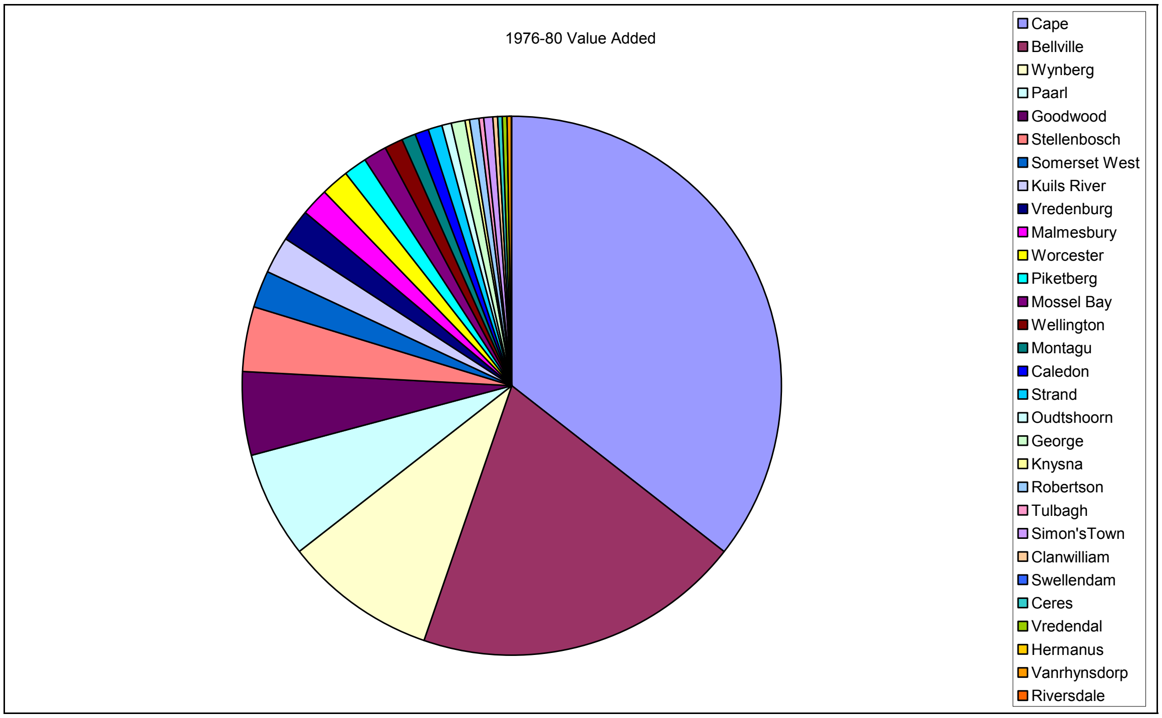

Figure 2: 1976-80 Value Added by Magisterial District

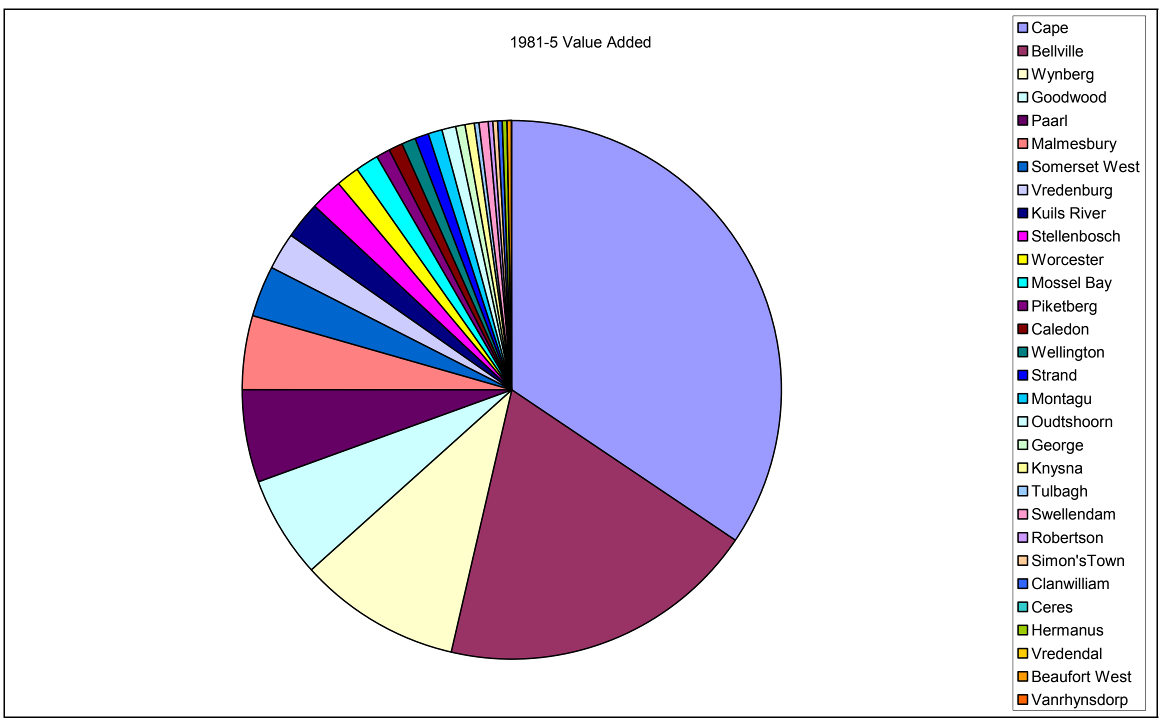

Figure 3: 1981-85 Value Added by Magisterial District

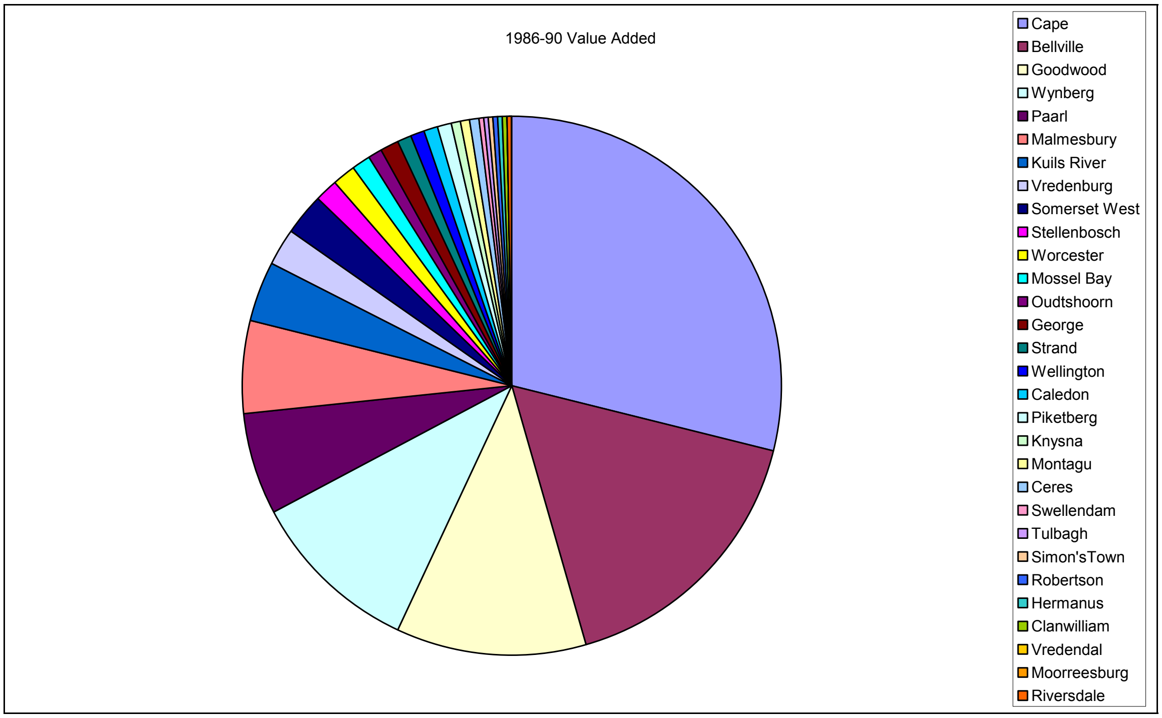

Figure 4: 1986-90 Value Added by Magisterial District

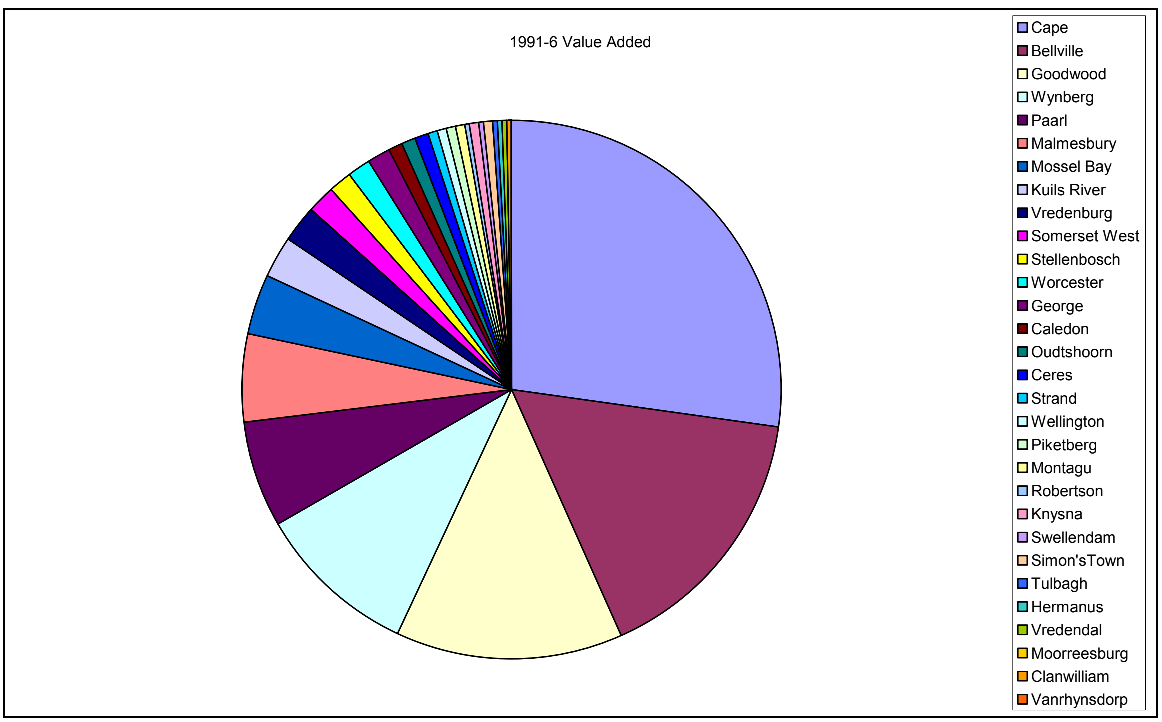

Figure 5: 1991-96 Value Added by Magisterial District

Table 6: Absolute Value Added (in Rand millions)

	1970-1975	1976-1980	1981-1985	1986-1990	1991-1996
Cape	2533515	2527348	2938184	2686592	2535396
Wynberg	696274	666645	835087	946661	901511
Simon'sTown	25284	23487	24205	25495	39096
Goodwood	0	351536	530306	1053892	1274602
Bellville	1293834	1399609	1647782	1522953	1512433
Stellenbosch	437779	278521	169110	132507	141440
Kuils River	0	150648	192444	316815	240000
Somerset West	147260	166680	250135	221320	155000
Strand	36743	52525	67004	90597	65402
Paarl	467148	451744	477560	587266	619212
Wellington	65371	78361	70897	79611	51224
Caledon	47173	55489	77481	78189	84462
Hermanus	3313	10214	11621	17465	22698
Swellendam	14916	18337	34763	40457	39709
Bredasdorp	1295	1626	2856	2851	2462
Knysna	25632	36597	40057	51798	42214
George	45262	47746	59816	92311	128575
Mossel Bay	63649	98782	109100	97201	325548
Riversdale	1716	3596	3794	4482	4069
Oudtshoorn	35610	50439	60168	93579	66284
Worcester	107739	115565	114675	121895	132426
Ceres	8705	16025	15845	47536	66125
Tulbagh	32919	27460	36728	34687	33470
Robertson	29752	30653	25309	25194	43202
Montagu	46870	59986	64738	47556	44057
Malmesbury	84542	130104	375042	512561	494642
Piketberg	64096	100002	80632	59676	48080
Vredenburg	122540	133013	203644	223430	194961
Moorreesburg				5745	13251
Clanwilliam	13090	20058	24065	16814	10266
Vredendal	11417	10833	9152	11683	13568
Vanrhynsdorp	3637	4764	4068	4340	4465
Beaufort West	2282	2573	4529	3485	1907

5.1.1 Size Distribution of Growth in Real Value Added

The changing relative distribution of real value added by magisterial district over time in the Western Cape is reflected in the size distribution of growth in value added.

In Figures 6 through 10 we summarize the evidence of growth in real value added by five year sub-sample period. In the figures the two vertical axes detail the growth rate in real value added and the horizontal axis provides the cumulative real value added of the Western Cape.

The line graph (in red) details the point distribution of growth in real value added corresponding to the respective cumulative value added depicted on the horizontal axis. The bar graph (in blue) details the cumulative average growth rate in real value added against the level of cumulative value added by magisterial district, read from left to right. The bar graph can thus be read as a smoothed representation of the line graph.

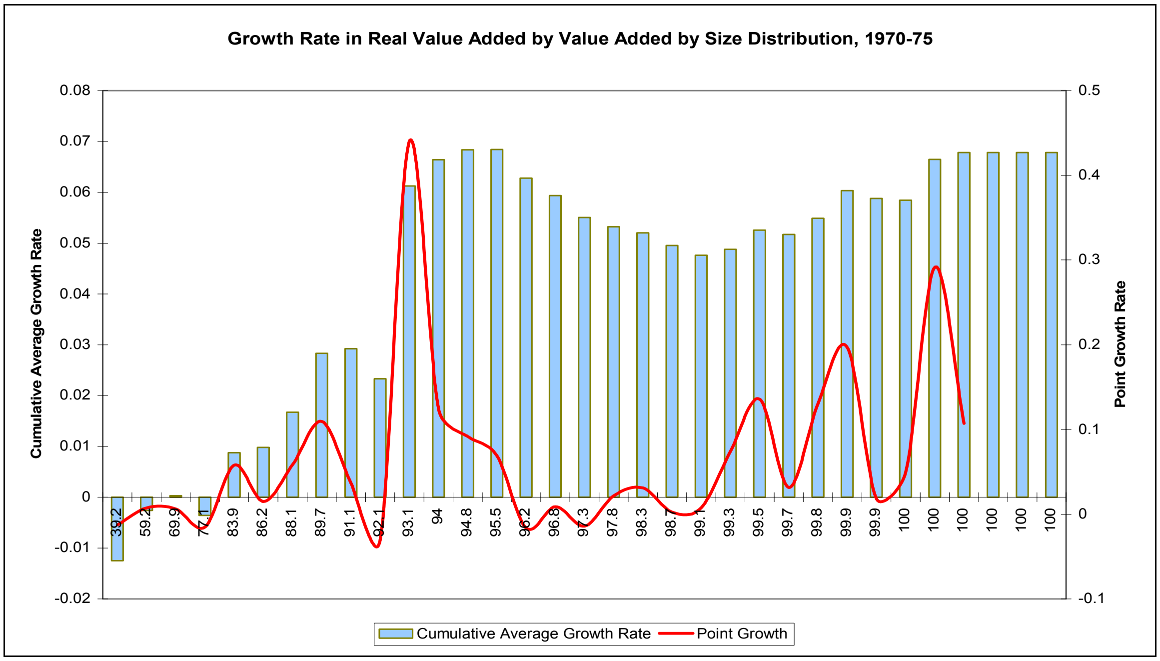

Figure 6: Growth Rate in Real Value Added by Size Distribution, 1970-75.

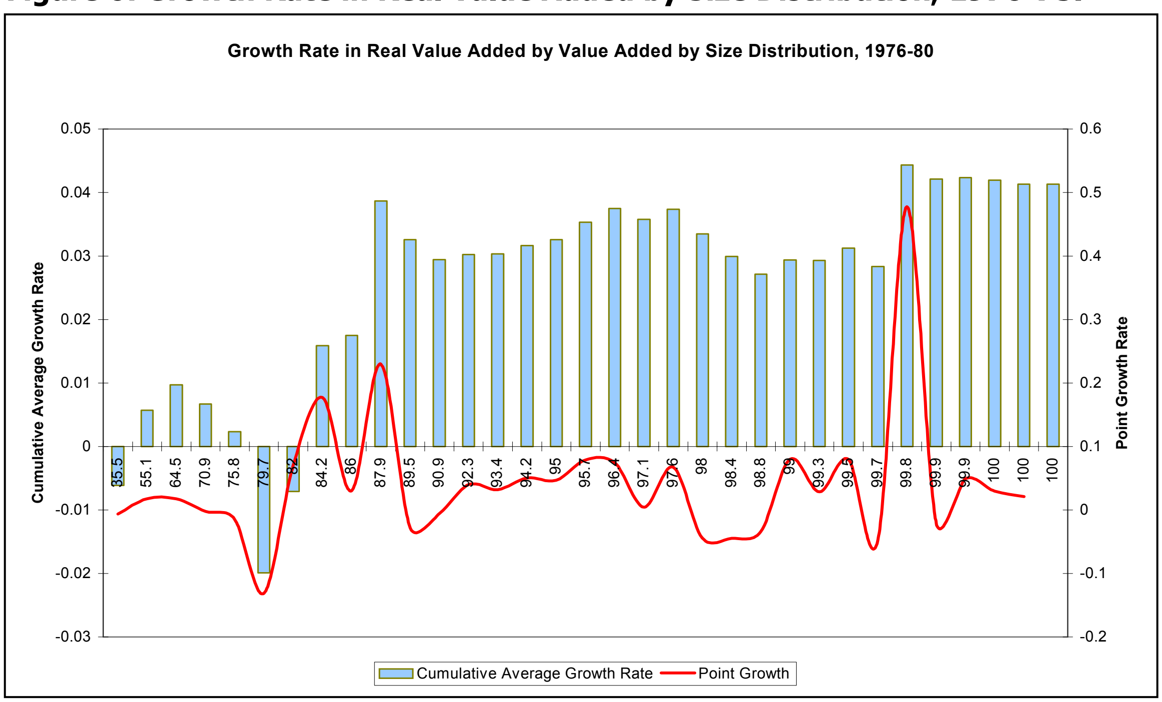

Figure 7: Growth Rate in Real Value Added by Size Distribution, 1976-80.

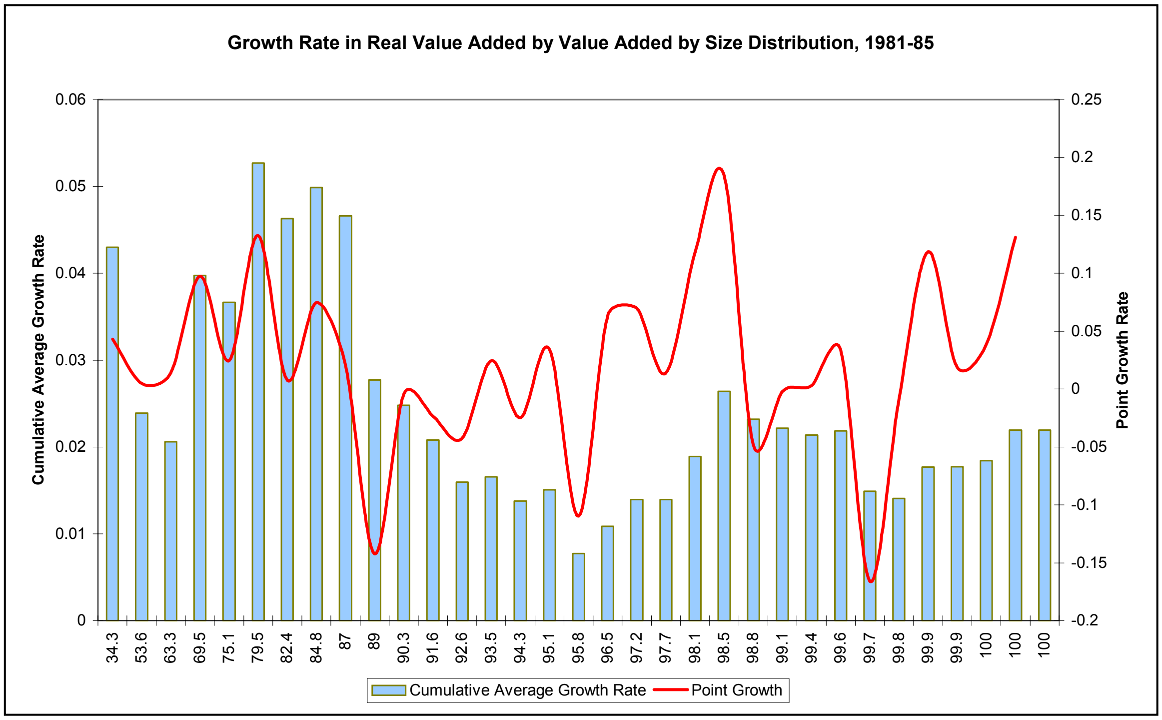

Figure 8: Growth Rate in Real Value Added by Size Distribution, 1981-85.

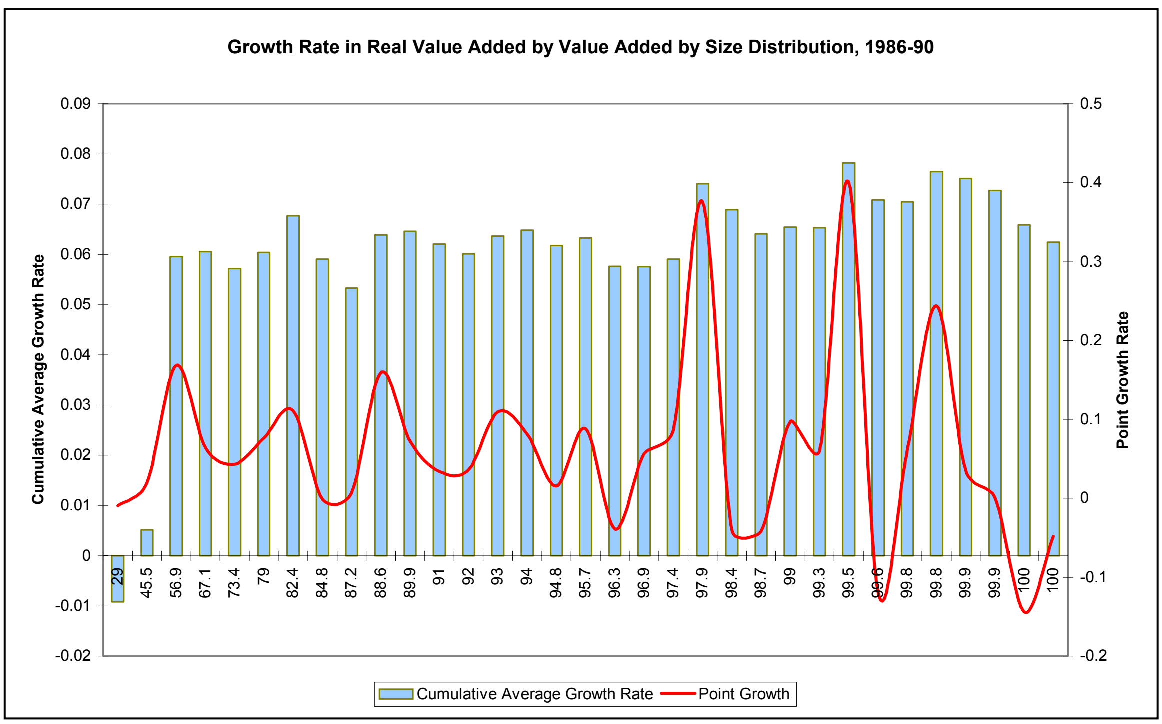

Figure 9: Growth Rate in Real Value Added by Size Distribution, 1986-90.

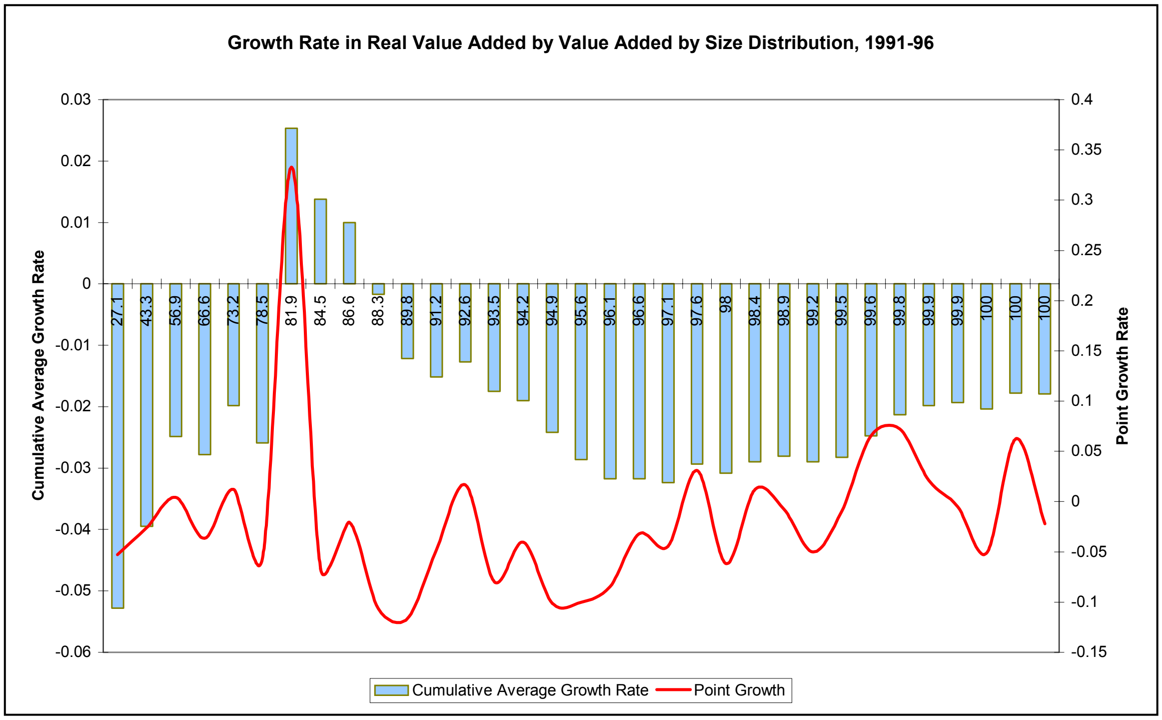

Figure 10: Growth Rate in Real Value Added by Size Distribution, 1991-96.

The evidence demonstrates that growth in real value added in the Western Cape has shown quite distinct patterns over the sample period.

In particular it is evident in Figure 6 that over the 1970-75 period, growth in real value added in the magisterial districts contributing the largest proportion of total value added in the Western Cape was negative. Strong positive growth occurred only in magisterial districts of mid-sized and very small contributions to manufacturing total value added in the Western Cape. Moreover, there is a very wide dispersion of growth rates for the magisterial districts contributing very small proportions to total value added, even though the average growth rate for these districts is relatively large. The rand values of this growth are provided in Appendix C.

For the 1976-80 period the strongest growth in real value added occurred in magisterial districts of mid-sized contributions to manufacturing total value added in the Western Cape. Magisterial districts with large contributions to value added had negative growth rates, while the magisterial districts with small contributions to total manufacturing had positive but relatively small positive growth rates in real value added (with one exception: Hermanus). The evidence is summarized in Figure 7.

The 1981-85 period is unusual in the sample period, since positive growth occurs predominantly in the magisterial districts with large contributions to manufacturing total value added. By contrast, the magisterial districts of mid-sized and small contributions to manufacturing total value added experienced either relatively low or negative growth in value added. See the evidence of Figure 8.

Over 1986-90, growth in magisterial sectors with large contributions to manufacturing total value added reverted back to negative growth rates in real value added, with the remaining magisterial districts manifesting a relatively uniform growth rate in real value added. See Figure 9 for the summary evidence.

Finally, 1991-96 shows negative growth rates in real value added across the size distribution, with the strongest contraction occurring for magisterial districts with large contributions to manufacturing total value added. The only exception is provided by the Mossel Bay magisterial district, reflecting the contribution of the Mossgas project.

The growth patterns of the magisterial districts thus show relatively diverse patterns over time. A more detailed examination of the reasons for the diverse patterns must be postponed to the sections dealing with the factor contribution to growth in real value added, and those dealing with the sectoral breakdown of manufacturing performance in the statistical regions of the Western Cape. Nevertheless, we note a number of possibilities for further consideration in the discussion which follows. First, the consistently poor performance of the magisterial districts with large contributions to manufacturing total value added is consistent with an increased dispersion of manufacturing activity in the Western Cape over time. Nevertheless, the negative growth rates in manufacturing value added, often over sustained periods of time, suggest that the region is not taking advantage of agglomeration effects in the core location of the manufacturing sector in the region. Secondly, the Western Cape has not identified areas of comparative advantage in manufacturing, enabling it to grow its manufacturing base relative to Gauteng in particular. The evidence of the sectoral distribution of manufacturing activity will provide further detail in this regard.

In section 5.2 we provide more detailed evidence on the growth in value added by magisterial district and by sub-sample period.

5.2 Evidence on Output Growth Patterns by Magisterial District in the Western Cape

Growth in manufacturing output (measured as value added) was calculated for four periods; an average over the entire period 1970 to 1996 and for each of the decades 1970’s, 1980’s and 1990’s.

We classify the growth performance of the magisterial districts into three categories, fast, intermediate and slow. These are endogenously defined within the sample. The fast growing districts are defined as such simply by virtue of being the 11 top ranked districts in the relevant period. Slow growers by contrast are the 11 districts that grow most slowly, and the intermediate districts are the 11 sectors distributed between fast and slow growers.

We also append remarks on magisterial district growth relative to the absolute sizes of the growth rates that emerge.

The results are discussed separately for the distinct time periods in the following sections.

5.2.1 Average Growth 1970 to 1996

The average growth in value added output amongst the fastest growers is 22.2 per cent nominal and 8 per cent real (annualized) whilst the slowest growers averaged 12.8 and 0.3 per cent (annualized) growth for the nominal and real output measures respectively. The districts with intermediate growth rates report 15.6 and 2.3 percent (annualized) growth for nominal and real output respectively. Tables 7 and 8 report the detailed results for the individual magisterial districts explicitly.

On average over the full period under consideration output in the Hermanus magisterial district showed the highest average growth in both nominal and real variable formats. Mossel Bay and Moorreesburg also returned positive strong output growth results. The list of eleven magisterial districts with the fastest output growth is completed by (alphabetically) Bredasdorp, Ceres, Goodwood, Kuils River, Malmesbury, Piketberg, Riversdale and Swellendam.

The fastest growing districts are spread across the regions in the province with the exception of the northern regions of the west coast and northern-most region in the province Beaufort West.[43] The peninsula heartland districts (Statistical Regions 1 and 2, in and around Cape Town) are not well represented, though the southern Cape region along the coast from Hermanus to Mossel Bay has a strong presence.

Amongst the slow growing districts are the peninsula heartland districts which almost without exception are found to have exhibited on average the lowest output growth since 1970.[44] Goodwood and Kuils River are found in the fastest growth category and Strand is in the lower end of the intermediate growth category, but apart from these three districts all other eight magisterial districts in Regions 1 and 2 performed poorly on output growth measures.

For the real value added output growth computation, Cape, Somerset West, Stellenbosch, Tulbagh and Wellington exhibit negative growth. Stellenbosch has unambiguously been the worst performing district in terms output growth.

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[43] The fast growing districts are: Hermanus; Moorreesburg; Mossel Bay; Ceres; Malmesbury; Riversdale; Goodwood; Piketberg; Bredasdorp; Swellendam; Kuils River.

[44] The districts with the slowest average output growth are: Cape; Wynberg; Simon'sTown; Bellville; Somerset West; Paarl; Wellington; Stellenbosch; Montagu; Tulbagh; Robertson; Beaufort West.

Note that the four slowest growing districts are all clustered around the industrial centre, closest to all infrastructures.

Table 7: Value Added Output Growth Percentage (Real) by Identified Category for Three Decades

Average		1970's		1980's		1990's	
Fast							
Hermanus	13.8	Hermanus	27.4	Moorreesburg	32.6	Mossel Bay	29.1
Moorreesburg	11.5	Piketberg	25.6	Malmesbury	19.2	Moorreesburg	8.5
Mossel Bay	11.0	Kuils River	25.0	Goodwood	15.6	Vredendal	5.0
Ceres	9.6	Riversdale	20.1	Ceres	15.5	Bredasdorp	4.1
Malmesbury	7.8	Ceres	13.7	Hermanus	10.8	Robertson	3.0
Riversdale	6.8	Montagu	13.6	Bredasdorp	9.7	George	2.6
Goodwood	6.5	Clanwilliam	12.0	Swellendam	9.4	Simon'sTown	1.4
Piketberg	6.1	Vanrhynsdorp	11.6	George	8.3	Paarl	0.8
Bredasdorp	5.5	Mossel Bay	8.5	Kuils River	6.9	Goodwood	0.7
Swellendam	5.0	Caledon	5.6	Vredenburg	6.5	Hermanus	0.6
Kuils River	4.8	Strand	4.9	Caledon	5.9	Swellendam	0.4
AVERAGE	**8.0**		**15.3**		**12.8**		**5.1**
Intermediate							
Vanrhynsdorp	3.6	Malmesbury	4.9	Strand	5.5	Vanrhynsdorp	-0.3
George	3.6	Knysna	4.8	Oudtshoorn	5.5	Clanwilliam	-1.0
Caledon	3.0	Oudtshoorn	4.6	Wynberg	5.0	Bellville	-1.9
Vredenburg	2.6	Worcester	4.3	Beaufort West	4.8	Piketberg	-2.7
Clanwilliam	2.4	Swellendam	3.8	Somerset West	4.8	Vredenburg	-2.7
Vredendal	2.2	Vredenburg	2.5	Tulbagh	4.2	Worcester	-2.9
Oudtshoorn	2.2	Bredasdorp	1.9	Simon'sTown	4.0	Wynberg	-3.0
Worcester	1.7	Wellington	1.5	Paarl	3.0	Riversdale	-3.7
Strand	1.6	Somerset West	1.1	Knysna	2.9	Tulbagh	-3.8
Knysna	1.3	Bellville	0.5	Worcester	2.6	Cape	-3.8
Paarl	1.2	Vredendal	0.3	Riversdale	2.2	Ceres	-4.2
AVERAGE	**2.3**		**2.7**		**4.0**		**-2.7**
Slow							
Simon'sTown	1.2	Beaufort West	0.2	Vredendal	2.0	Montagu	-4.4
Wynberg	1.1	Wynberg	-0.1	Bellville	1.8	Caledon	-4.5
Montagu	0.8	Robertson	-0.3	Cape	1.4	Malmesbury	-4.6
Robertson	0.7	Paarl	-0.4	Montagu	1.2	Beaufort West	-5.2
Beaufort West	0.5	George	-0.8	Mossel Bay	0.7	Oudtshoorn	-5.6
Bellville	0.3	Cape	-1.2	Stellenbosch	0.0	Knysna	-5.6
Tulbagh	-0.1	Tulbagh	-2.1	Robertson	0.0	Kuils River	-6.8
Somerset West	-0.5	Simon'sTown	-2.3	Wellington	-0.5	Strand	-8.1
Cape	-0.9	Goodwood	-3.5	Vanrhynsdorp	-0.8	Stellenbosch	-8.3
Wellington	-2.1	Stellenbosch	-4.4	Clanwilliam	-3.8	Wellington	-8.9
Stellenbosch	-3.8	Moorreesburg	N/A	Piketberg	-5.4	Somerset West	-10.2
AVERAGE	**-0.3**		**-1.5**		**-0.3**		**-6.6**

Table 8: Value Added Output Growth Percentage (Nominal) by Identified Category for Three Decades

Average		1970's		1980's		1990's	
Fast							
Hermanus	28.5	Hermanus	42.0	Moorreesburg	53.8	Mossel Bay	44.6
Mossel Bay	25.6	Kuils River	40.2	Malmesbury	38.0	Moorreesburg	20.9
Moorreesburg	25.0	Piketberg	39.6	Goodwood	33.3	Vredendal	16.8
Ceres	24.0	Riversdale	36.2	Ceres	32.9	Bredasdorp	15.6
Malmesbury	22.4	Ceres	27.2	Hermanus	27.8	Robertson	15.5
Riversdale	21.3	Clanwilliam	25.0	Bredasdorp	26.6	George	14.5
Goodwood	21.0	Vanrhynsdorp	24.6	Swellendam	26.0	Simon'sTown	13.4
Bredasdorp	19.5	Mossel Bay	21.6	George	24.7	Paarl	12.4
Piketberg	19.4	Caledon	17.9	Kuils River	23.0	Goodwood	12.3
Kuils River	18.9	Strand	17.5	Vredenburg	22.8	Hermanus	12.2
Swellendam	18.8	Knysna	17.4	Caledon	22.1	Swellendam	11.9
AVERAGE	**22.2**		**28.1**		**30.1**		**17.3**
Intermediate							
George	17.2	Malmesbury	17.3	Strand	21.4	Vanrhynsdorp	11.2
Vanrhynsdorp	16.9	Oudtshoorn	17.2	Oudtshoorn	21.3	Clanwilliam	9.9
Caledon	16.5	Montagu	16.9	Wynberg	20.9	Bellville	9.4
Vredenburg	16.1	Worcester	16.5	Beaufort West	20.9	Worcester	8.5
Oudtshoorn	15.5	Swellendam	16.1	Somerset West	20.9	Piketberg	8.4
Clanwilliam	15.4	Vredenburg	14.6	Tulbagh	19.9	Vredenburg	8.4
Vredendal	15.4	Bredasdorp	14.5	Simon'sTown	19.8	Wynberg	8.2
Worcester	15.0	Wellington	13.8	Paarl	18.5	Tulbagh	7.4
Strand	15.0	Somerset West	13.1	Knysna	18.5	Riversdale	7.4
Knysna	14.5	Bellville	12.4	Worcester	18.1	Cape	7.3
Simon'sTown	14.5	Beaufort West	12.2	Riversdale	17.6	Ceres	7.2
AVERAGE	**15.6**		**15.0**		**19.8**		**8.5**
Slow							
Paarl	14.4	Vredendal	12.1	Vredendal	17.4	Caledon	6.7
Wynberg	14.3	Wynberg	11.7	Bellville	17.3	Montagu	6.6
Montagu	14.1	Robertson	11.7	Cape	16.7	Malmesbury	6.5
Robertson	14.0	Paarl	11.4	Montagu	16.7	Beaufort West	5.5
Beaufort West	13.8	George	11.1	Mossel Bay	16.0	Knysna	5.2
Bellville	13.5	Cape	10.6	Stellenbosch	15.3	Oudtshoorn	5.1
Tulbagh	12.9	Tulbagh	9.4	Robertson	15.1	Kuils River	3.8
Somerset West	12.6	Simon'sTown	9.4	Wellington	14.4	Stellenbosch	2.5
Cape	12.1	Stellenbosch	6.6	Vanrhynsdorp	14.1	Strand	2.4
Wellington	10.7	Goodwood	0.3	Clanwilliam	10.7	Wellington	1.5
Stellenbosch	8.8	Moorreesburg	N/A	Piketberg	8.8	Somerset West	0.2
AVERAGE	**12.8**		**9.4**		**14.8**		**4.2**

The slow and negative, in some instances, rate of growth in output in districts around the industrial centre is of concern in the South African economy which relies to a large degree on small and medium enterprises for economic growth and job creation. Economic growth literature documenting international experience suggests that firms do not move far from the industrial centre (Lee 1992). The accessibility to the local input and product markets and commuting distance of production workers are the most important factors in the location choice of small manufacturing firms. Large export-oriented firms requiring more space for production technology consider the availability of lower cost land and plant space in outer areas more important than access to local markets. The particular infrastructure requirements of individual firms will depend on the types of product and the size of their operations. Small firms rely heavily on the agglomeration economies in the town or city centres.

Apart from the concerning spatial dimension of output growth, note further that the average growth rates of both the fastest, as well as the slowest growing districts have been on a steady downward trajectory over the three decade period that is being considered for this study.[45] Summary data is provided in Table 9. In real terms, the fastest growing districts have experienced a decline from 15.3, to 12.8 to 5.1 per cent in real output growth, while the slowest growing districts have contracted at an accelerating rate over the three decades.

Table 9: Average Growth per Category

	1970's		1980's		1990's	
	Fastest	Slowest	Fastest	Slowest	Fastest	Slowest
Nominal	28.1%	9.4%	30.1%	14.8%	17.3%	4.2%
Real	15.3%	-1.5%	12.8%	-0.3%	5.1%	-6.6%

It is tempting to infer that the findings of the growth slow-down are consistent with standard economic growth theory (see again Section 2). Strictly, this is correct, since neo-classical growth theory in its classical rather than its modern garb predicts the existence of a steady state. Transition into steady state predicts a falling growth rate of output, provided only that one begins with a level of output that lies below steady state. The evidence presented above backs the prediction of a gradual slowing of growth observed over the 1970-1996 period. Output in magisterial districts further away from the industrial centre of the province also confirms growth theory predictions.

Two factors are cause for considerable concern. First, the evidence above suggests that steady state (if it exists), has *fallen* at least for the most developed regions of the Western Cape, such that the implied growth rate in output is now negative as we adjust to the new lower level of steady state output.

The second cause for concern is that the negative growth rates in real output in the 1990's are very pervasive. Only the districts that belong to the 11 fastest growing districts have reported positive growth rates in real value added output – while both intermediate and slow growing districts uniformly report negative growth rates in value added output.

[45] The only exception to this finding is that nominal growth of the fastest growing districts rises in the 1980's, before declining substantially during the 1990's. However, this is in part an artefact of the introduction of the Moorreesburg district, with associated initial high growth rates.

It is worth noting that this finding is very unlikely to be an artefact of an excessively aggressive deflation of nominal magnitudes. Even in nominal terms, average annual growth in value added output amongst the slow growing districts was only 4.2 per cent per annum over the 1990's. Simple comparison with the average annual inflation rate of the 1990's, measured in PPI, headline CPI, or CPIX terms (7.44, 8.52, 8.86 respectively),[46] gives an immediate indication that such a nominal growth rate is unlikely to translate into a positive real growth rate.

5.2.2 Growth in the Sub-periods of Time

In Appendices D and E we graph growth in value added in five year averages by magisterial district, in real and nominal terms respectively. The discussion which follows provides a summary of the findings which emerge from the graphs, read together with the data provided in Tables 7 and 8 above.

5.2.2.1 General Growth Patterns in Value Added by Magisterial District

A number of general growth patterns in real value added emerge across the magisterial districts:

1. Bredasdorp, Hermanus, Mossel Bay, Swellendam and Vredendal experienced positive real value added growth throughout the three decades. Moorreesburg´s record is identical for the two decades for which we have recorded data.
2. Magisterial districts conforming to a pattern of positive growth in value added in the 1970's and 1980's, with negative growth in the 1990's include: Beaufort West, Bellville, Caledon, Ceres, Knysna, Kuils River, Malmesbury, Montagu, Oudtshoorn, Riversdale, Somerset West, Strand, Vredenburg and Worcester.
3. In Clanwilliam, Piketberg. Vanrhynsdorp and Wellington positive real output growth recorded in the 1970´s turned negative for both the 1980´s and 1990´s.
4. Negative growth in value added in the 1970's, with positive growth in the 1980's and 1990's was found in the magisterial districts of George, Goodwood, Paarl, Robertson and Simon's Town.
5. Negative growth in real value added output in the 1970's and 1990's, with positive growth in the 1980's occurred in the magisterial districts of Cape, Stellenbosch, Tulbagh and Wynberg.

Nominal output growth values mirror the growth and contraction patterns reflected above in real terms.

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[46] Computation is from StatsSA records.

5.2.2.2 Growth in 1970's and 1980's

Additional nuance emerges from a consideration of changes in output growth patterns from the 1970's to the 1990's.

Where Clanwilliam, Montagu, Mossel Bay, Piketberg, Riversdale and Vanrhynsdorp were all relatively fast growers in the 1970's this was not the experience in the 1980's where their growth performance dropped significantly relative to other districts in the region.

Considering inter-district ranking, some districts moved from the fast grower category down to being classified amongst the lowest third growers. Only Caledon, Ceres, Hermanus and Kuils River held on to their fastest grower status over both the 1970's and 1980's.

Goodwood showed the largest improvement in ranking over the two decades, with George and Bredasdorp also recording impressive moves up the interdistrict scales. Tulbagh and Simon's Town commenced movements up the growth ranking.

5.2.2.3 Growth in the 1990's

What is immediately evident is the continued decrease in the average growth in output over the three decades under review. Table 9 summarises average growth rates for the three decades.

Mossel Bay stands out as a fast grower and this would make sense since the government's fuel from gas project Mossgas ensured massive infrastructural growth in the district in the eighties and early nineties. Robertson and Vredendal also exhibited vast rank shift between the 1980's and 1990's. Simon's Town and Paarl moved up from intermediate growers in the 1980's to amongst the fastest in the 1990's whilst Bredasdorp, George, Goodwood, Hermanus, Moorreesburg and Swellendam all retained their fast grower status.

Bellville, Clanwilliam, Piketberg and Vanrhynsdorp all moved up from the category of slowest growers in the 1980's to the intermediate category in the 1990's. In all cases the rank shifts were significant. The only consistent fast grower in the three decades was Hermanus; however, its ranking amongst the fast growers fell over time.

The disappointing non-achievers include Beaufort West, Caledon, Kuils River, Malmesbury, Oudtshoorn, Somerset West and Strand which all lost significant ground in ranking falling at least a category and in the case of Caledon, Kuils River and Malmesbury two categories.

Montagu, Stellenbosch and Wellington spent both the 1980's and the 1990's classified as slowest growers, with Stellenbosch classified slow and even slowest grower throughout the period under review. Robertson's improved growth in the 1990's rescued it from a similar classification to Stellenbosch.

5.3 Decomposing the Value Added Growth Performance: Identifying Factor Input Contributions by Magisterial District

We now turn to the question of the decomposition of the value added growth performance of the magisterial districts of the Western Cape. The object of the decomposition is to employ the growth accounting approach of section 2, in order to identify whether growth in magisterial districts is due to capital or labour accumulation, or efficiency gains in production.

Appendices F and G report the average value added growth performance finding for the 1970-1996 period, as well as the three decade average decompositions, in real and nominal terms respectively, employing the plant and machinery definition of capital stock. Appendices H and I repeat the exercise for the total fixed asset definition of capital stock.

Tables 10 and 11 provide summary representations of the evidence by magisterial district, in order to identify the relative contribution of the factor inputs and technological innovation over time, as well as the trend structure of these growth inputs. In addition, in Table 12 we detail the results from the growth decomposition, specifying real value added growth, the contribution of capital (as measured by plant and machinery, rather than total fixed assets) to real value added growth, as well as the contribution of labour and total factor productivity growth. Results are provided by magisterial district, for the 1970-96 period, as well as the 1970's, 1980's and 1990's sub-periods in the sample.

The central implication of the evidence is that growth in the manufacturing sector in the Western Cape has historically been driven by factor accumulation. This is particularly true of the 1970's and the 1980's, but for the entire sample period also. It is evidence by the fact that for most magisterial districts, for most periods, both investment in plant and machinery as well as employment increases have contributed positively to manufacturing output growth.

Important nuance is present in the evidence, however. The contribution of labour to output growth has declined during the 1990's, with labour contributing negatively to output growth in a greater proportion of magisterial districts. By contrast, capital has become increasingly important relatively speaking in keeping growth in real value added positive.

On the face of the evidence, of the two factor inputs into production, capital has consistently appeared to contribute more strongly to output growth. More magisterial districts show a positive growth contribution of capital. There is a preponderance of magisterial districts in which capital stock contributions to output growth have been on a rising trend over time, though for a few districts there was an interruption of this trend during the course of the 1980's. Finally, for some magisterial districts there has been evidence of a slow-down in the rising contribution of capital to output growth (see the districts categorised "inverted-U" in Table 10).

In the case of labour's contribution to value added growth, few magisterial districts have shown an increasing trend, more districts than in the case of capital have reported a decreasing trend, and the evidence of a slow-down in labour's contribution to output growth is more pervasive. Furthermore, fewer districts report a pick-up in labour's contribution to output growth in the 1990's. Importantly, all of the magisterial districts contributing a large proportion of total value added in the Western Cape show a declining trend in labour's contribution to output growth, or a slow-down in labour's contribution in the 1990's.[47] The only exception is Bellville which reports some pick-up of labour's contribution to output growth during the 1990's.

For the majority of magisterial districts the contribution of total factor productivity to output growth has been on a declining trend over the sample period of this study, or it has been subject to a slow-down (often dramatically so) during the 1990's. Note the relatively large number of magisterial districts with positive TFP contributions in the 1970's and 1980's, and the strong switch to a negative contribution of TFP growth in the 1990's (notably Cape). For other magisterial districts contributing large proportions to the total value added of the Western Cape namely Wynberg and Bellville, a decreasing trend in TFP is evident. Paarl is the only exception amongst the economically large magisterial districts with some pick-up in TFP growth during the 1990's. See the summary evidence of Table 10.

A final point to note with respect to TFP growth is the presence of churning in magisterial districts over time. This is readily demonstrated by a consideration of the evidence for economically large districts. During the 1970's Wynberg and Bellville experienced positive TFP growth, the Cape and Paarl negative TFP growth. During the 1980's the Cape and Bellville experienced positive TFP growth, Paarl and Wynberg negative TFP growth. During the 1990's only Paarl experienced positive, Cape, Bellville and Wynberg negative TFP growth. Little by way of consistent growth patterns emerge from this evidence – indeed, the evidence suggests considerable instability in the pattern of efficiency gains that are present across sectors.

In broad terms this evidence has significant commonalities with the national evidence reported in Fedderke (2002), though some differences also emerge. The increasing reliance on capital accumulation particularly in the 1990's for output growth in manufacturing was noted by Fedderke (2002) also. The declining contribution of labour to output growth is also present for the national evidence, though in the Western Cape the negative contribution of labour is perhaps somewhat more muted. What differs between the Western Cape and the national evidence is that the strong positive contributions of technological progress in the 1970's and the 1980's, that is evident in the national data, is difficult to find in the Western Cape. Note, however, that the declining trend in the contribution of technological progress to output growth in the national data is evident in

[47] See the evidence for Cape, Paarl, and Wynberg.

the Western Cape also. Specifically, the Cape magisterial district (the largest Western Cape district) conforms to the national growth patterns relatively closely.

The obvious hypothesis to be examined in the following section is that the absence of strong technological contributions to growth in the Western Cape is that the sectoral composition of manufacturing production is such that TFP contributions to growth were circumscribed.

Table 10: Structural Changes to Variables

	Increasing Trend	**Decreasing Trend**	**U-shaped trend**	**Inverted-U-shaped trend**
Capital	Simons Town Bellville Stellenbosch Strand Caledon Bredasdorp Mossel Bay Oudtshoorn Tulbagh Vredenburg Moorreesburg Clanwilliam	Hermanus* Piketberg* Swellendam Ceres Beaufort West	Cape Riversdale Worcester Robertson Montagu Vredendal Vanrhynsdorp	Wynberg Goodwood Kuils River Somerset West Paarl Wellington Knysna George Malmesbury
Labour	Hermanus Tulbagh Robertson Vredendal Vanrhynsdorp	Cape Strand Paarl Wellington Caledon Worcester Moorreesburg Piketberg	Bellville Stellenbosch Mossel Bay Oudtshoorn Montagu Clanwilliam	Wynberg Simons Town Goodwood Kuils River Somerset West Stellenbosch Bredasdorp Knysna George Riversdale Ceres Malmesbury Vredenburg Beaufort West
TFP	Piketberg Beaufort West	Wynberg Goodwood Bellville Strand Wellington Caledon Bredasdorp George Mossel Bay Tulbagh Malmesbury Vredenburg Moorreesburg Clanwilliam	Kuils River Somerset West Paarl Knysna	Cape Simons Town Stellenbosch Hermanus Swellendam Riversdale Oudtshoorn Worcester Ceres Robertson Montagu Vredendal Vanrhynsdorp

Table 11: General Growth Structure by Decade

	1970's		1980's		1990's	
	>0	<0	>0	<0	>0	<0
Capital	Cape Simons Town Kuils River Somerset West Paarl Caledon Hermanus Swellendam Knysna Mossel Bay Riversdale Oudtshoorn Worcester Ceres Robertson Montagu Piketberg Vredendal Vanrhynsdorp Beaufort West	Wynberg Goodwood Bellville Stellenbosch Strand Wellington Bredasdorp George Tulbagh Malmesbury Vredenburg Clanwilliam	Wynberg Simons Town Goodwood Bellville Kuils River Somerset West Strand Paarl Wellington Caledon Hermanus Swellendam Bredasdorp Knysna George Mossel Bay Oudtshoorn Ceres Tulbagh Malmesbury Vredenburg Beaufort West	Cape Stellenbosch Riversdale Worcester Robertson Montagu Piketberg Moorreesburg Clanwilliam Vredendal Vanrhynsdorp	Cape Wynberg Simons Town Goodwood Bellville Stellenbosch Strand Paarl Caledon Hermanus Bredasdorp George Mossel Bay Riversdale Oudtshoorn Worcester Ceres Tulbagh Robertson Montagu Malmesbury Vredenburg Moorreesburg Clanwilliam Vredendal Vanrhynsdorp	Kuils River Somerset West Wellington Swellendam Knysna Piketberg Beaufort West
Labour	Wynberg Bellville Kuils River Strand Paarl Wellington Caledon Hermanus Knysna Mossel Bay Riversdale Oudtshoorn Worcester Ceres Tulbagh Montagu Malmesbury Piketberg Vredenburg Clanwilliam Vredendal Vanrhynsdorp	Cape Simons Town Goodwood Stellenbosch Somerset West Bredasdorp George Robertson Beaufort West	Wynberg Simons Town Goodwood Bellville Kuils River Somerset West Strand Paarl Caledon Hermanus Swellendam Bredasdorp Knysna George Mossel Bay Riversdale Ceres Tulbagh Robertson Malmesbury Piketberg Vredenburg Moorreesburg Vredendal Vanrhynsdorp Beaufort West	Cape Stellenbosch Wellington Oudtshoorn Worcester Montagu Clanwilliam	Simons Town Goodwood Bellville Stellenbosch Hermanus Swellendam Bredasdorp George Mossel Bay Oudtshoorn Tulbagh Robertson Montagu Piketberg Vredenburg Moorreesburg Clanwilliam Vredendal Vanrhynsdorp	Cape Wynberg Kuils River Somerset West Strand Paarl Wellington Caledon Knysna Riversdale Worcester Ceres Malmesbury Beaufort West

TFP	Wynberg Goodwood Bellville Kuils River Strand Wellington Caledon Hermanus Bredasdorp Knysna George Mossel Bay Tulbagh Montagu Malmesbury Vredenburg Clanwilliam Vanrhynsdorp Beaufort West	Cape Simons Town Stellenbosch Somerset West Paarl Swellendam Riversdale Oudtshoorn Worcester Ceres Robertson Piketberg Vredendal	Cape Bellville Stellenbosch Strand Caledon Hermanus Swellendam George Mossel Bay Riversdale Oudtshoorn Worcester Ceres Robertson Montagu Vredenburg Moorreesburg Vredendal Vanrhynsdorp Beaufort West	Wynberg Simons Town Goodwood Kuils River Somerset West Paarl Wellington Bredasdorp Knysna Tulbagh Malmesbury Piketberg	Kuils River Somerset West Paarl Swellendam Moorreesburg Beaufort West	Cape Wynberg Simons Town Goodwood Bellville Stellenbosch Strand Wellington Caledon Hermanus Bredasdorp Knysna George Mossel Bay Riversdale Oudtshoorn Worcester Ceres Tulbagh Robertson Montagu Malmesbury Piketberg Vredenburg Clanwilliam Vredendal Vanrhynsdorp

Table 12: Growth Accounting Decomposition by Magisterial District and Sample Sub-period

	1970-96	1970's	1980's	1990's		1970-96	1970's	1980's	1990's		1970-96	1970's	1980's	1990's
CAPE					**CALEDON**					**TULBAGH**				
Value Added Growth	-0.93	-1.25	1.38	-3.82	Value Added Growth	2.98	5.56	5.93	-4.55	Value Added Growth	-0.13	-2.07	4.17	-3.79
Capital	0.16	1.59	-2.43	2.01	Capital	3.02	0.33	2.37	7.40	Capital	4.33	-7.38	4.10	19.72
Labour	-0.35	-0.25	-0.04	-0.90	Labour	0.51	1.07	0.79	-0.60	Labour	3.11	0.53	2.65	7.09
TFP	-0.74	-2.58	3.85	-4.92	TFP	-0.55	4.17	2.76	-11.35	TFP	-7.57	4.79	-2.58	-30.60
WYNBERG					**HERMANUS**					**ROBERTSON**				
Value Added Growth	1.10	-0.02	4.98	-2.99	Value Added Growth	13.81	27.35	10.84	0.63	Value Added Growth	0.72	-0.26	0.01	2.98
Capital	1.19	-3.32	4.63	2.07	Capital	7.73	21.66	0.37	0.34	Capital	3.96	5.27	-0.82	9.10
Labour	0.85	0.96	1.62	-0.39	Labour	2.48	1.84	2.29	3.59	Labour	0.53	-0.14	0.25	1.78
TFP	-0.94	2.33	-1.27	-4.67	TFP	3.59	3.85	8.18	-3.30	TFP	-3.77	-5.39	0.58	-7.90
SIMONS TOWN					**SWELLENDAM**					**MONTAGU**				
Value Added Growth	1.15	-2.26	4.02	1.45	Value Added Growth	5.03	3.78	9.38	0.41	Value Added Growth	0.83	4.52	1.16	-4.41
Capital	3.28	2.43	2.38	5.67	Capital	2.48	4.82	2.48	-0.53	Capital	0.09	2.01	-2.75	1.70
Labour	1.05	-0.97	2.97	0.90	Labour	1.43	1.01	2.35	0.65	Labour	0.42	1.40	-0.73	0.79
TFP	-3.18	-3.71	-1.33	-5.12	TFP	1.12	-2.06	4.55	0.29	TFP	0.31	1.11	4.64	-6.90
GOODWOOD					**BREDASDORP**					**MALMESBURY**				
Value Added Growth	6.48	-10.59	15.65	0.69	Value Added Growth	5.50	1.95	9.69	4.08	Value Added Growth	7.85	4.86	19.23	-4.57
Capital	4.91	-10.23	9.89	4.29	Capital	1.99	-5.33	4.34	8.05	Capital	3.00	-3.24	10.18	0.77
Labour	2.61	-5.99	6.33	0.97	Labour	2.28	-1.85	7.16	0.62	Labour	4.14	2.95	9.53	-2.01
TFP	-1.04	5.63	-0.57	-4.57	TFP	1.22	9.12	-1.82	-4.59	TFP	0.70	5.15	-0.48	-3.33
BELLVILLE					**KNYSNA**					**PIKETBERG**				
Value Added Growth	0.34	0.46	1.82	-1.92	Value Added Growth	1.27	4.78	2.95	-5.63	Value Added Growth	6.06	25.58	-5.40	-2.68
Capital	0.94	-1.31	1.42	3.17	Capital	0.19	0.85	2.54	-4.01	Capital	12.99	42.77	-3.32	-1.99
Labour	0.53	0.81	0.15	0.71	Labour	0.70	0.85	1.89	-1.21	Labour	1.26	1.40	1.26	1.10
TFP	-1.13	0.96	0.25	-5.80	TFP	0.39	3.08	-1.48	-0.41	TFP	-8.20	-18.59	-3.34	-1.79
STELLENBOSCH					**GEORGE**					**VREDENBURG**				
Value Added Growth	-3.77	-4.45	0.03	-8.33	Value Added Growth	3.61	-0.82	8.34	2.57	Value Added Growth	2.65	2.52	6.53	-2.75
Capital	0.14	-1.45	-1.31	4.25	Capital	1.59	-3.95	5.24	3.52	Capital	-0.28	-13.35	2.44	12.64
Labour	-1.17	-1.61	-2.86	1.78	Labour	0.99	-0.51	2.81	0.33	Labour	1.33	0.80	2.41	0.48
TFP	-2.73	-1.39	4.20	-14.36	TFP	1.03	3.64	0.30	-1.29	TFP	1.59	15.07	1.68	-15.87

KUILS RIVER					**MOSSEL BAY**					**MOORREESBURG**				
Value Added Growth	4.82	25.05	6.90	-6.81	Value Added Growth	11.03	8.49	0.69	29.06	Value Added Growth	11.50	-	32.57	8.49
Capital	1.92	4.39	7.62	-7.28	Capital	203.07	2.57	1.42	748.91	Capital	0.73	-	-13.20	2.72
Labour	2.81	3.39	5.01	-0.57	Labour	1.71	2.21	0.63	2.62	Labour	4.00	-	5.25	3.82
TFP	0.09	17.27	-5.73	1.04	TFP	-193.75	3.71	-1.36	-722.48	TFP	6.77	-	40.52	1.95
SOMERSET WEST					**RIVERSDALE**					**CLANWILLIAM**				
Value Added Growth	-0.54	1.05	4.80	-10.22	Value Added Growth	6.81	20.11	2.19	-3.67	Value Added Growth	2.39	11.97	-3.83	-1.03
Capital	5.37	4.35	15.40	-7.64	Capital	11.78	26.22	-2.79	14.03	Capital	0.23	-3.91	-2.61	9.61
Labour	0.10	-0.19	3.26	-4.03	Labour	1.60	1.07	3.83	-0.90	Labour	1.37	1.24	-1.22	5.24
TFP	-6.02	-3.11	-13.87	1.45	TFP	-6.57	-7.19	1.15	-16.80	TFP	0.79	14.64	0.01	-15.88
STRAND					**OUDTSHOORN**					**VREDENDAL**				
Value Added Growth	1.62	4.89	5.50	-8.13	Value Added Growth	2.16	4.56	5.46	-5.63	Value Added Growth	2.20	0.26	2.00	4.98
Capital	0.10	-1.68	0.17	2.28	Capital	3.53	1.31	3.82	5.98	Capital	1.77	4.15	-2.35	4.58
Labour	1.31	2.18	1.84	-0.58	Labour	1.17	3.78	-1.45	1.54	Labour	2.04	1.26	1.59	3.71
TFP	0.21	4.39	3.48	-9.83	TFP	-2.54	-0.53	3.09	-13.15	TFP	-1.61	-5.15	2.76	-3.31
PAARL					**WORCESTER**					**VANRHYNSDORP**				
Value Added Growth	1.25	-0.35	2.98	0.84	Value Added Growth	1.73	4.34	2.60	-2.85	Value Added Growth	3.65	11.63	-0.79	-0.28
Capital	1.90	0.09	4.39	0.65	Capital	1.65	2.93	-0.21	2.67	Capital	2.24	7.69	-7.09	8.58
Labour	0.17	0.76	0.29	-0.75	Labour	0.46	1.75	-0.12	-0.36	Labour	1.55	0.06	1.64	3.35
TFP	-0.82	-1.19	-1.70	0.94	TFP	-0.38	-0.34	2.92	-5.16	TFP	-0.15	3.88	4.67	-12.21
WELLINGTON					**CERES**					**BEAUFORT WEST**				
Value Added Growth	-2.09	1.51	-0.53	-8.95	Value Added Growth	9.59	13.72	15.52	-4.20	Value Added Growth	0.52	0.17	4.82	-5.16
Capital	-1.01	-1.39	0.60	-2.81	Capital	9.17	19.52	5.88	0.56	Capital	-0.63	0.38	0.44	-3.45
Labour	-1.02	0.36	-0.87	-3.01	Labour	2.82	3.67	4.73	-1.01	Labour	0.74	-0.48	4.08	-2.44
TFP	-0.07	2.54	-0.27	-3.12	TFP	-2.40	-9.47	4.91	-3.75	TFP	0.41	0.28	0.30	0.73

To conclude the discussion of the present section, we consider two final pieces of evidence.

In Tables 13 and 14 we report cross sectional regression evidence that summarizes the growth pattern in real value added, and the relative factor contributions to output growth by time period.[48]

Table 13: Cross Magisterial Contribution of Capital and Labour Accumulation to Growth in Real Value Added

	Dependent Variable: Growth in Real Value Added			
	Constant	Capital	Labour	Adj-R^2
1970-96	-0.0003 (0.006)	0.037* (0.012)	2.319* (0.345)	0.66
1970's	0.023* (0.010)	0.509* (0.088)	1.834* (0.525)	0.69
1980's	0.016 (0.012)	-0.271 (0.189)	2.080* (0.373)	0.51
1990's	-0.030* (0.007)	0.040* (0.005)	0.892* (0.284)	0.73

Table 14: Cross Magisterial Contribution Interaction Between Capital, Labour and TFP Contributions to Growth in Real Value Added

	Dependent Variable: Growth Contribution of Physical Capital			
	Constant	Labour	TFP	Diagnostics
1970-96	1.71e-005 (0.006)	1.375* (0.357)	-1.034* (0.013)	0.995
1970's	0.032* (0.014)	1.828* (0.724)	-1.049* (0.189)	0.57
1980's	0.008 (0.007)	0.799* (0.212)	-0.473* (0.070)	0.65
1990's	-0.031 (0.007)	-0.104 (0.295)	-1.040* (0.006)	0.999

Table 13 reports the results of regressions of average value added growth rates, on the contribution of capital and labour to value added growth rates. We estimate:

$$\left(\frac{dY/dt}{Y}\right)_i = a_0 + a_K\left(s_K\frac{dK/dt}{K}\right)_i + a_L\left(s_L\frac{dL/dt}{L}\right)_i + \varepsilon_i, \quad i = 1...33 \qquad (5.1)$$

following the notational conventions of section 2 of the paper. Estimation is across the i magisterial districts included in the study. It is important to understand the interpretation of the two coefficients, a_K, a_L, to be estimated. The *larger* the estimated coefficient, the *smaller* the relative contribution of the factor input to the growth in real

[48] Readers need to note that the regression evidence requires careful interpretation. The evidence requires interpretation as identifying summary characteristics across magisterial districts, rather than in causal terms.

value added, since the a_j coefficient is effectively capturing the multiple of total value added growth of the value added growth contributed by factor j. Alternatively, we might interpret the ratio a_L/a_K as an approximation of the relative importance of capital to labour in their contribution toward output growth. Yet a third way of interpreting the coefficient is that the inverse of the estimated coefficients, $1/a_K$, and $1/a_L$, represent the growth multipliers of the two factors of production.

The evidence of Table 13 consistently suggests that capital has been more important than labour in driving growth in real value added. The contribution of capital to output growth increased dramatically from the 1970's to the 1980's (with a fall in the a_K coefficient from 0.51 to -0.27),[49] with some decline in the 1990's (with an increase in the a_K coefficient from -0.27 to 0.04). The implied growth multipliers are 1.23, 34.48, and 2.94 over the 1970's, 1980's and 1990's. By contrast, the labour contribution to output growth decreased from the 1970's to 1980's (with an increase in the a_L coefficient from 1.83 to 2.08), though it has recovered in some measure during the 1990's, (with a decrease in the a_L coefficient from 2.08 to 0.89). The implied growth multipliers are 0.47, 0.42, and 0.84 over the 1970's, 1980's and 1990's.

In relative terms, therefore, capital was 2.64, 82.07, and 3.51 more effective in generating output growth over the 1970's, 1980's and 1990's respectively.

Table 14 reports estimations of:

$$\left(s_K \frac{dK/dt}{K} \right)_i = b_0 + b_L \left(s_L \frac{dL/dt}{L} \right)_i + b_{TFP} TFP_i + \upsilon_i, \quad i = 1 \ldots 33 \qquad (5.2)$$

Again the notation is that employed in section 2. Again, estimation is across the i magisterial districts included in the study. The interpretation of equation (5.2) is more straightforward than for equation (5.1). The larger the estimated b_j coefficient, the greater the contribution of capital to output growth associated with any given contribution to output growth by the factor j. While the expectation is that $b_{TFP}<0$ by construction,[50] it is feasible that $b_L \gtreqless 0$ conditional on the two factor inputs being complements or substitutes in production respectively.

The findings of Table 14 are that labour and capital were treated as complements by manufacturing industry during the 1970's and 1980's, though in declining measure (the b_L coefficient declines from 1.83 to 0.80). In the 1990's capital and labour prove to be substitutes in their contribution to output growth (the b_L coefficient declines from 0.80 to -0.10). As expected, total factor productivity growth and the contribution of capital to output growth are negatively related.

[49] Note that zero is arbitrary on the implied scale.
[50] Since by definition TFP growth is that output growth not explained by labour and capital accumulation.

5.4 The Relative Importance of the Contributions of Capital, Labour and Technological Progress to Manufacturing Sector Growth by Magisterial District in the Western Cape

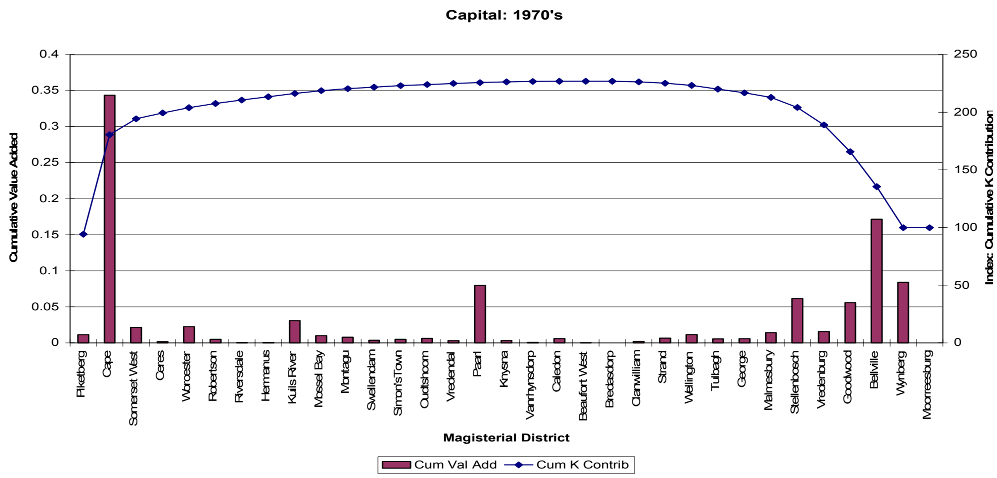
As a final step in the analysis of the growth by magisterial district in the Western Cape, we consider the relative contribution of the two factor inputs, and technological progress to total manufacturing growth in the Western Cape. Thus far the analysis has pointed out the relative contributions of capital, labour and technological progress in each magisterial district. The analysis has not been able to assess the relative importance of the growth that has occurred in each magisterial district due to the three contributing factors to output growth, for the manufacturing sector growth in aggregate in the Western Cape.

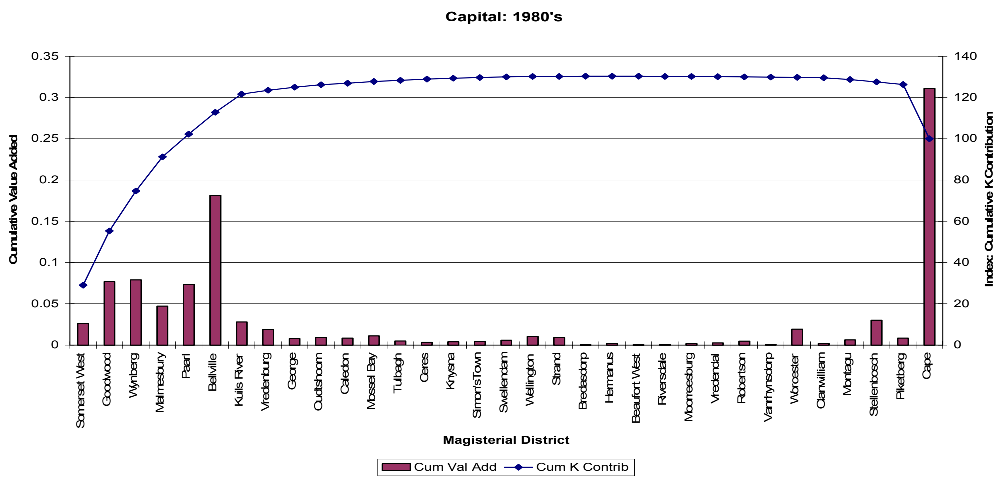
The point here is that while the relative contribution of any one of the three building blocks to growth in any one magisterial district may have been either small or large in any given period, this in and of itself tells us very little about the contribution of the growth to Western Cape performance as a whole. A small magisterial district, that is receiving a strong growth impetus from capital accumulation, may be contributing very little to manufacturing growth as a whole. Similarly, a large sector that is growing relatively slowly due to additional employment, may nevertheless be contributing a relatively large amount to manufacturing growth in the Western Cape as a whole.

The analysis of the present section allows us to weight the output growth contribution by factor input or technological progress by the value added contribution of the magisterial district.

Figures 11, 12 and 13 present the evidence for capital, labour and total factor productivity respectively, breaking the evidence down by decade. Appendix J provides the same evidence, in larger format for ease of reference.

Figure 11: Capital Contribution to Value Added Growth





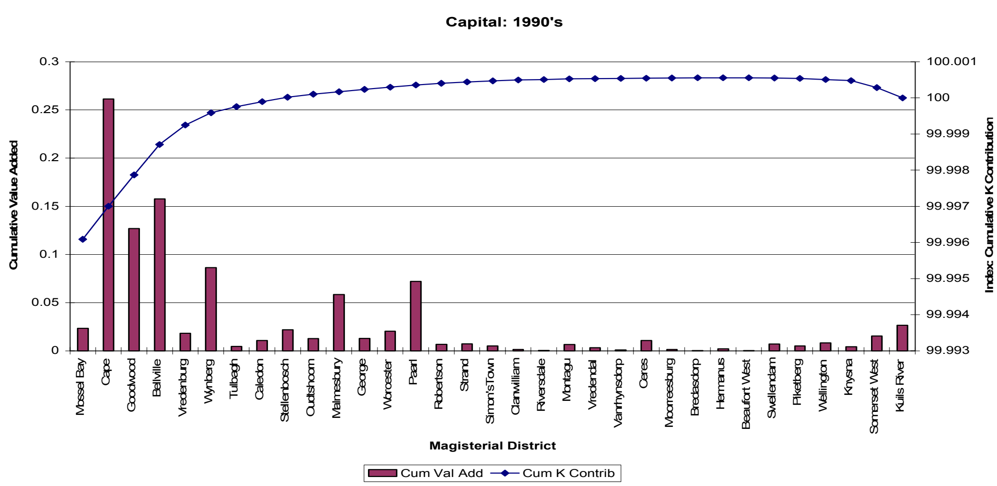
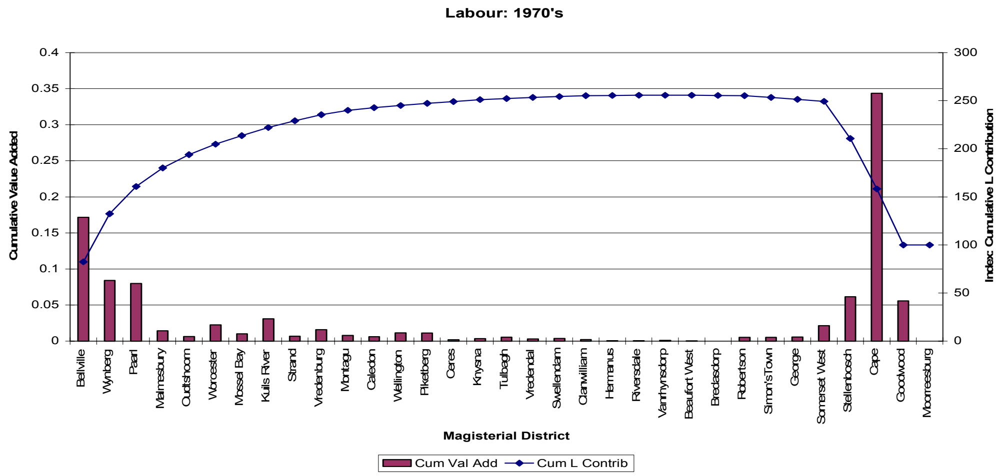
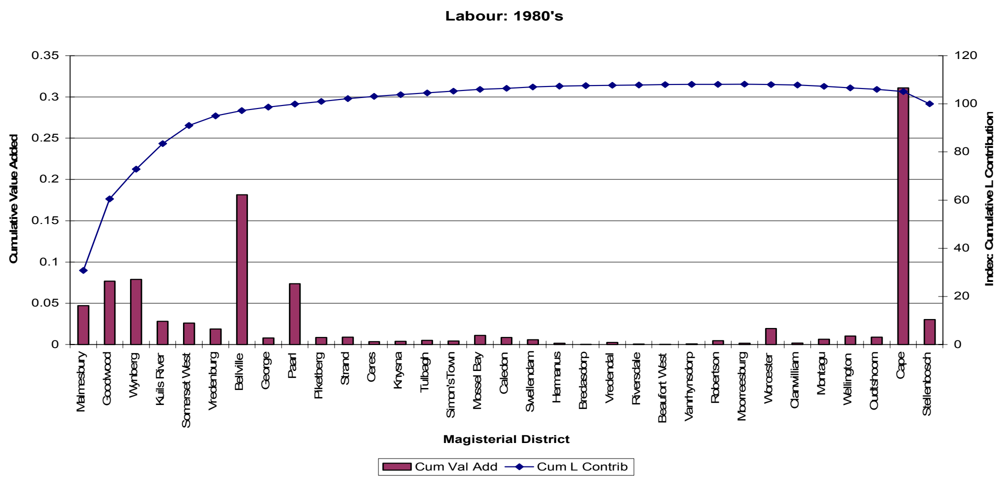


Figure 12: Labour Contribution to Value Added Growth





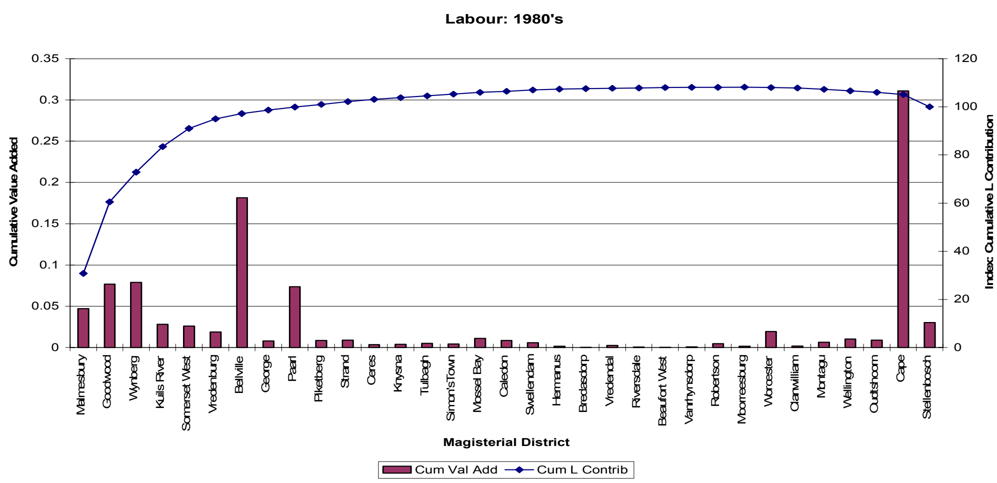
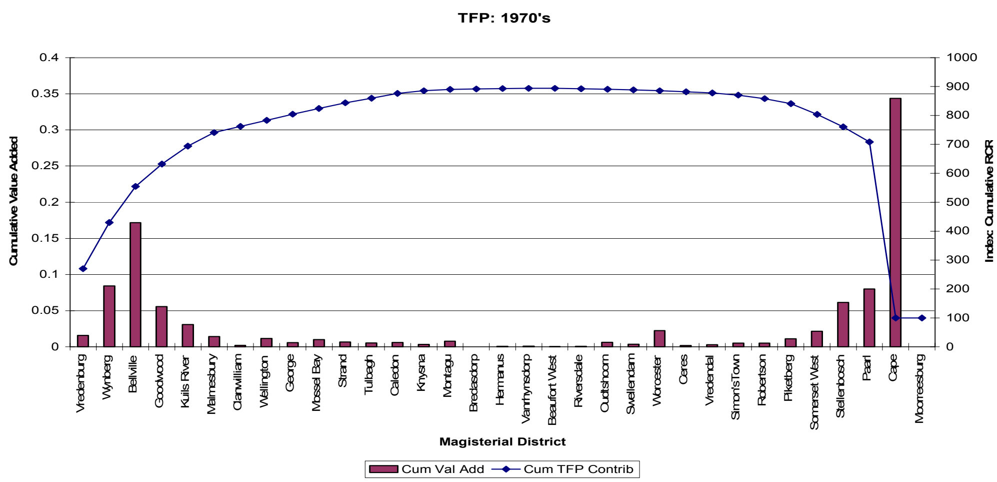
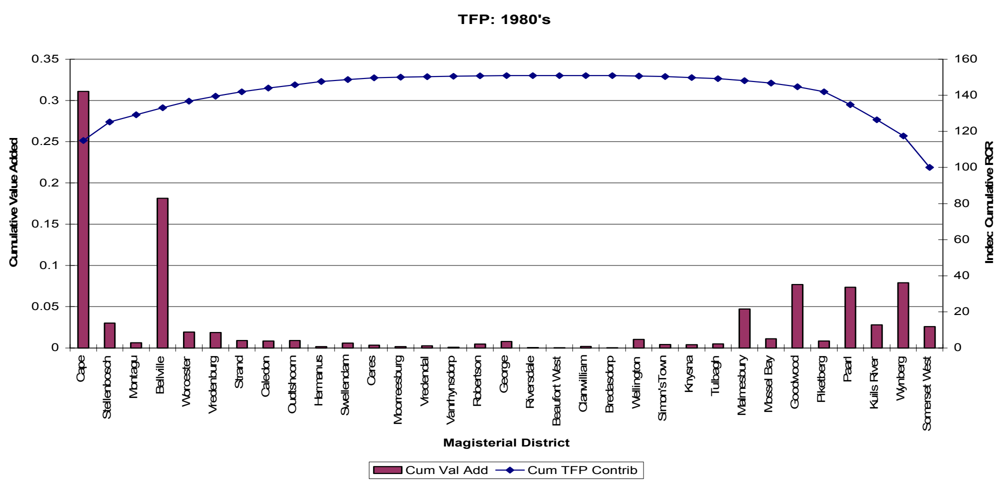
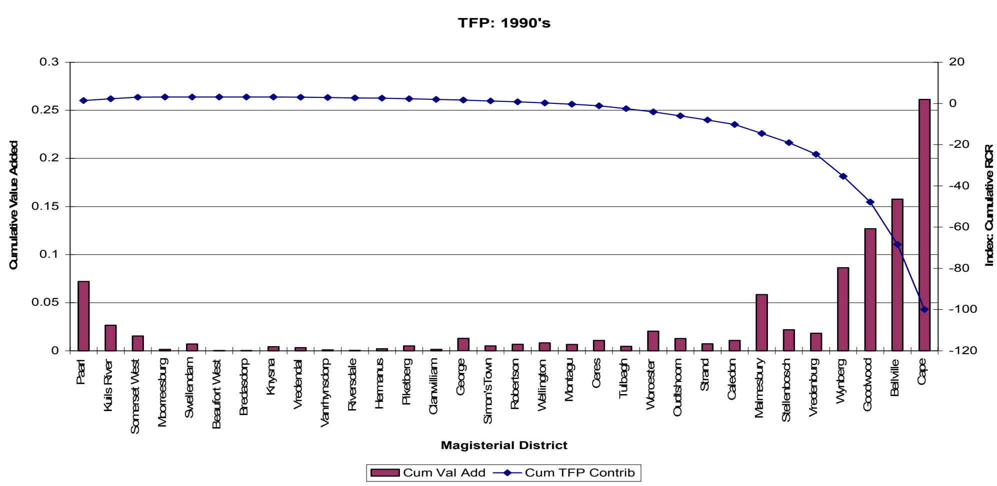


Figure 13: TFP Contribution to Real Cost Reduction







The contribution of each factor of production and of technology to output growth is indexed to 100. The contribution to value added expansion of each factor is computed for each magisterial district over the decade in question, with the total contribution indexed to 100 in the event of a positive contribution, or -100 in the event of a negative impact on value added. The index value of each magisterial district reflects its contribution to the increase in value added relative to the final increase in value added across all magisterial districts.

A number of important additional insights follow from the evidence.

In terms of the contribution of capital to value added growth in the Western Cape, patterns for the three decades are quite distinct. During the 1970's the positive growth contribution of capital to output growth in the Western Cape was dominated by the Piketberg magisterial district, with a secondary contribution coming from the Cape magisterial district.[51] The Piketberg expansion was primarily due to the expansion of deciduous fruit processing – an expansion that did not prove to be sustained over the subsequent two decades. By contrast, all the other economically large magisterial districts (Bellville, Goodwood, Wynberg, and Stellenbosch) were disinvesting over the course of the decade. Note also that Vredenburg (site of the ISCOR-led minerals beneficiation developments) showed, if anything, negative capital contributions to output growth in the Western Cape.

During the 1980's the geographically contribution of capital to output growth was reversed. All of the economically large magisterial districts manifest capital-accumulation led output growth, with the sole exception of the Cape magisterial district which disinvested over the decade.

The 1990's report the same pattern in the Western Cape that Fedderke et al (2001) report for South Africa as a whole. In particular, output growth in the manufacturing sector comes to be led heavily by capital investment. Output growth in all of the economically large magisterial districts is led by capital accumulation. It needs to be noted, however, that the main contribution of capital to output growth in the region is concentrated in a single magisterial district – Mossel Bay – and associated with a single state-led investment project – Mossgas. The state's investment in the Iscor plant at Vredenburg also shows signs of impact in the 1990´s.

With respect to labour, the experience of the three decades is once again quite distinct.

During the 1970's, the economically large magisterial districts are spilt between those for whom labour was contributing significantly to output growth, and those in which it contributed negatively. In Bellville, Wynberg and Paarl the impact was positive (hiring), for Stellenbosch, Cape and Goodwood the impact was negative (firing). Of these, the

[51] Note that Moorreesburg was only created as a district during the course of the 1980's.

impact of Bellville, Stellenbosch, Cape and Goodwood on output growth through the contribution of labour was particularly dramatic.

As for capital, the 1980's saw a wide spread positive contribution of labour to output growth – across virtually all the economically large magisterial districts. Thus for Bellville, Wynberg, Paarl, Goodwood and Malmesbury the contribution of labour to output growth was not only positive, but substantial. Only for the Cape and Stellenbosch magisterial districts did the contribution of labour to output growth prove negative.

The impact of labour on output growth during the 1990's tells a particularly dramatic story. Of the economically large magisterial districts, only Goodwood and Bellville saw labour continue to contribute positively to output growth. In all the remaining economically large magisterial districts, the contribution of labour to output growth was negative (see Wynberg, Paarl, Malmesbury, Cape) – and substantially so. Note further that in contrast to the results for all three decades for capital, and the 1980's and 1970's for labour, the net contribution of labour to output growth in the Western Cape across all magisterial districts was negative. (final index = -100).

Once again, the story for total factor productivity is one of decade effects. During the 1970's there is a strong distinction between the economically large magisterial districts of the Western Cape. Vredenburg, Wynberg, Bellville and Goodwood all report large contributions of efficiency gains in production to output growth. Cape, Paarl and Stellenbosch all have efficiency losses diminishing output growth. In the case of Vredenburg and Cape the effects are particularly large.

During the 1980's, strong efficiency gains in production in the Cape and Bellville magisterial districts contributed positively to output growth, efficiency losses in Goodwood, Paarl and Wynberg had a negative, but also relatively mild impact in reducing output growth.

Finally, during the 1990's the net effect of efficiency gains across the Western Cape reduced output growth significantly, sufficiently so to render TFP growth in the 1990's a negative contributor to output growth.[52] In this, the evidence of the Western Cape mirrors the national evidence – see Fedderke (2002). All of the economically large magisterial districts report significant efficiency losses, with only Paarl proving an exception. For Wynberg, Goodwood, Bellville and Cape the efficiency loss impact on output growth proves to be large.

[52] Note that we have excluded Mossel Bay from the TFP evidence during the 1990's. The very large scale of investment in the magisterial district distorts the evidence significantly – and completely dominates the evidence to emerge from all other magisterial districts. As a consequence we have suppressed the Mossel Bay data in the graphical representation of the data, in order to allow insight into the development in the province as a whole.

Together these findings carry further important policy implications. First, the net effect of the contributions of labour and capital to output growth in the 1970's and 1990's is that growth in these decades was led by increasing capital intensity of production. By contrast, the 1980's saw a period of factor expansion in both capital and labour dimensions.

This raises two important questions for further study in subsequent work. First, what led to the changing patterns of relative labour and capital usage over time in the Western Cape? Second, the strong expansion during the period of relative international closure during the 1980's in both capital and labour led growth and the relative importance of state-led investment (Vredenburg, Mossel Bay) raises the issue of whether such investment was sustainable in the longer run. Part of the poor manufacturing performance of the 1990's may be a reflection of the impact of increased competitive pressure emerging with the reintegration of South Africa into world markets during the 1990's. The expansion of the 1980's was feasible only under the implicit protection afforded by international isolation. Similarly, the state-led investment in Iscor and Mossgas has not yet led to appreciable further expansion of manufacturing activity in the Western Cape. Future data may shed additional light on this question.

6.0 Results by Three Digit Manufacturing Sector – for the Nine Statistical Regions of the Western Cape

Thus far we have explored in some detail the growth performance of the manufacturing sector by the magisterial districts of the Western Cape. This has allowed as fine grained a geographical decomposition of manufacturing sector growth in the Western Cape as is feasible given the official data sources in the public domain. What the data structure does not allow is for the decomposition of the manufacturing sector growth performance by more detailed sectoral classification within the magisterial district classification.

We now turn to an identification of the sources of the manufacturing sector growth performance as we have detailed in section 5, by manufacturing sector at the three digit SIC classification.

This again raises a number of critical data considerations. We note immediately that the three-digit manufacturing sector information is not available for magisterial districts. The most disaggregated geographical decomposition is at the level of nine statistical regions that comprise the Western Cape. The detail of magisterial district and Statistical Region classification and the research decisions required to ensure data consistency by classification, is provided in section 4 as well as in Appendix A.

6.1 Data Issues and Peculiarities

Over time since 1970 the classification of sectors has changed. In order to deal with these sectoral changes and maintain data rigor we worked backwards from the most recent census – which classified sectors in the greatest detail – aggregating to accommodate less detailed classifications of earlier censuses. Table 16 summarises the aggregation process. The left hand column specifies the classificatory convention employed in what follows. The right hand column specifies earlier classificatory conventions, where appropriate.

Table 15: Reclassification of Sectors for Consistency.

Classificatory convention followed in this report	Earlier classification, if similar
Production, processing and preservation of meat, fish, fruit, vegetables, oils, fats *plus* Dairy products *plus* Grain mill products, starches and starch products and prepared animal feeds *plus* Other food products	
Equals: **Food**	
Beverage Industries	Beverages
Spinning, weaving and finishing of textiles *plus* Other textiles	
Equals: **Textiles**	
Knitted/crocheted fabrics and articles *plus* Wearing apparel incl. Dressing and dyeing of fur and articles of fur	
Equals**: Clothing, except footwear**	
Leather, leather products, leather substitutes and fur	Leather and leather products
Footwear	
Saw milling and planting of wood *plus* Wood, cork and straw products	
Equals: **Wood and wood and cork products, except furniture**	
Furniture and fixtures, except primarily of metal	
Paper and paper products	
Publishing *plus* Printing incl. Reproduction of recorded media	
Equals: **Printing, publishing and allied industries**	
Industrial chemicals	Basic chemicals
Other chemical products	Other chemical products including man-made fibres
Rubber Products	
Plastic products, not elsewhere classified	Plastic products
Pottery, china and earthenware *plus* Glass and glass products *plus* Non-metallic mineral products not elsewhere classified	
Equals: **Other non-metallic mineral products**	
Iron and Steel basic industries	Basic iron and steel
Non-ferrous metal basic industries	Basic precious and non-ferrous metals
Structural metal products, tanks, reservoirs and steam generators *plus* Other fabricated metal products, metalwork service activities	
Equals: **Fabricated metal products**	
General purpose machinery *plus* Special purpose machinery	
Equals: **Machinery, except electrical machinery**	
Household appliances not elsewhere classified *plus* Other electrical equipment not elsewhere classified *plus* Television and radio receivers, sound or video recording or reproducing apparatus and associated goods *plus* Medical appliances and instruments and appliances for measuring, checking, testing and other purposes	
Equals: **Electrical machinery, apparatus, appliances and supplies**	
Motor vehicles *plus* Bodies (coachwork) for motor vehicles, trailers and semi-trailers *plus* Parts and accessories for motor vehicles and their engines	
Equals: **Motor vehicles, parts and accessories**	
Transport equipment	Building and repairing of ships and boats
Professional, scientific and photographic equipment	
Other industries *plus* Recycling	
Equals: **Other manufacturing industries**	

The Pottery, China and Earthenware sector has been included in the Non Metallic Mineral Products sector as in the earlier years of the sample Pottery, China and Earthenware was not distinguished from Glass and Other Non-metallic Products.

The data would suggest that during the 1970´s and again during the 1990´s many categories of manufacturing output were simply grouped under the sector Other Manufacturing Industries. This point will receive repeated comment in the analysis which follows. It is clear that if this is the case the classification will affect results both by under-reporting changes in sectors to which activity has not been allocated, and over-reporting Other Manufacturing Industries activity.

In the 1993 census sectoral data for Regions 4 and 5 was combined in one statistical region. The 1996 census results were used as base to separate the data into the two regions. 1993 data was divided between Regions 4 and 5 in the proportion reflected in the 1996 census.

One important caveat in interpreting the results reported in the growth rate data of Section 6 needs to be noted at the outset. For a number of sectors, the manufacturing census reported industry start up during the sample period. This applies specifically to the Leather, Iron and Steel Basic Industries, and Electrical Machinery sectors. For a number of other sectors, SIC reclassification meant that the sector reported production separately only from an in-sample starting date. This applies to the Industrial Chemicals, Rubber, and Plastics sectors. Under both circumstances, the implied growth rate at the start-up date would be infinitely large, rendering summary statistics meaningless.

Readers should note that the apparent in-sample industry start-up might be due to data reporting errors on the part of Statistics South Africa. In particular, in the case of Leather, Paper, Iron and Steel Basic Industries, Electrical Machinery, Motor, and Transport Equipment the 1972 manufacturing census reports activity in these industry classifications. In the 1972 census, Statistical Region 1 is identifiable in the data. The absence of reported manufacturing activity in these sectors in the 1976 and 1979 censuses is therefore at least potentially a reporting error. Unfortunately, Statistical Regions 2 and 6 are merged in the 1972 census, making a similar reconstruction for these regions as was carried out for Region 1, and described below, more difficult. However, the 1972 census does not report any activity in the sectors for which we have reported in-sample start-up, and hence the start-up implied by the data may be genuine rather than reporting error.

We have dealt with this limitation in two ways. First, in reporting growth rates, we have resorted to the convention of zero-restricting instances in which growth rate are infinite. This is indicated in the relevant evidence reported in the sections on the growth performance of the manufacturing sector below. Readers should note that since the growth rates do not reflect any start-ups, the reported growth rates are therefore downward biased in the affected sectors. In reporting results below, we reflect on the significance of this downward bias where appropriate.

Second, we have recomputed value added output growth rates in the light of additional output data obtained from the 1972 manufacturing census. The implication is of relatively long time periods of interpolation of data, which of course introduces a separate and new source of unknown bias to the value added output data series. Given the information obtained from the 1972 census, only the growth rates of Statistical Region 1 and for the Western Cape as a whole are subject to modification under this approach.

6.2 Comparing the Size of the Manufacturing Sectors in the Western Cape

We begin with a consideration of the size of the various manufacturing sectors in the Western Cape. The evidence is presented in terms of:

1. The absolute magnitude of the value added by manufacturing sector across the nine statistical regions.
2. The distribution of manufacturing output across sectors in each of the nine statistical regions.
3. The contribution of sectoral manufacturing activity in each of the nine statistical regions to total manufacturing activity in the Western Cape.
4. The contribution of sectoral manufacturing activity in each of the nine statistical regions to total manufacturing activity within that manufacturing sector in the Western Cape.

6.2.1 The Absolute Size of Manufacturing Sectors in the Western Cape

In Table 16 we provide the evidence of the extent of absolute value added by three digit manufacturing sector, by statistical region. It is clear that the value of manufacturing output in the Western Cape is dominated by the Food sector. In the 1970's the food sector accounted for 28% of value added in the province. The Textiles, Fabricated Metal Products and Other Manufacturing Industries sectors were the next largest contributing sectors in the 1970's, each accounting for 9% of output. The Printing and Other Chemical Products sectors followed closely at 8% each.

In the 1980's the contribution of the Food sector had increased to 32% and Other Chemical Products held onto its proportion of 9%. The Textile sector's proportional contribution to manufacturing output dropped to 7% while that of the Clothing sector increased to 8% from 7% in the 1970's. The decline in importance of the Fabricated Metal Products and Printing sectors commenced in the 1980's and deepened in the 1990's with the sectors' proportional contributions to provincial manufacturing output each falling to 6% in the 1980's and to 4% and 5% respectively in the 1990's.

The 1990's saw the Food sector's importance shrink slightly to 30%. The Other Manufacturing Industries sector saw remarkable increase to 18% from the previous decade's 6%. This could, however, be ascribed to re-classification of sectors, an issue which is of concern to the study but about which no certainty can be gleaned.

The Textile sector's proportional contribution to manufacturing output continued to fall in the 1990's (4%) while that of the Clothing sector held steady at 8%. The most dramatic falloff was seen in the Other Chemical Products sector where contribution to output fell to 4% from the previous decade's 9%, the 1980's second highest contributing sector.

Table 16: Absolute Value Added by Three Digit Manufacturing Sector and Statistical Region in the Western Cape

	Statistical region 1			Statistical region 2			Statistical region 3			Statistical region 4			Statistical region 5			Statistical region 6			Statistical region 7			Statistical region 8			Statistical region 9			Western Cape		
	70´s	80´s	90´s	70´s	80´s	90´s	70´s	80´s	90´s	70´s	80´s	90´s	70´s	80´s	90´s	70´s	80´s	90´s	70´s	80´s	90´s	70´s	80´s	90´s	70´s	80´s	90´s	70's	80's	90's
Food	1164083	1637282	1771226	413407	484628	360456	104990	217899	161898	178126	250059	218452	23178	58295	38095	306064	401001	311520	306432	642983	513679	46496	57837	25654	2161	2578	0	2544937	3752561	3400981
Beverage	79314	110834	283642	258772	166654	224619	11217	22028	38206	0	0	0	0	0	0	36451	35112	48900	5431	8524	7573	8558	8317	10181	0	0	0	399743	351469	613120
Textiles	686801	632674	386460	139688	138451	67245	0	0	0	0	971	908	0	0	0	0	0	1239	2204	41326	42234	0	0	0	0	0	0	828693	813422	498086
Clothing	651806	875656	887091	2015	5656	7715	0	0	0	0	0	0	0	0	0	15	261	461	1555	14318	8445	0	0	0	0	0	0	655392	895891	903710
Leather	0	44736	39729	0	6725	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	51460	39729
Footwear	173312	153426	121008	10244	6475	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	183556	159901	121008
Wood	69488	68686	61266	51922	61872	51474	10201	9062	3619	63220	61246	63376	13242	13152	0	6348	2675	375	577	7596	5392	0	0	0	0	0	0	214998	224289	185502
Furniture	121055	154761	151755	2108	13400	17840	476	986	1172	5758	9306	10559	0	917	222	3577	8263	7175	0	5230	15279	0	0	0	165	1172	0	133139	194035	204003
Paper	76735	364578	332205	0	10524	39059	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	76735	375102	371264
Printing	673045	685131	542188	12591	14992	18067	1353	1188	672	2003	3056	3552	0	0	0	4647	4574	3340	0	0	2357	0	0	0	0	0	0	693640	708939	570176
Ind. Chems.	0	213781	204072	0	20979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	234760	204072
Oth. Chem Prods	601996	824926	345489	136015	176342	112249	0	0	0	0	0	0	0	0	0	0	0	0	0	1353	8671	0	0	0	0	0	0	738010	1002621	466409
Rubber	0	8261	14773	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8261	14773
Plastic	44252	192536	277535	0	44895	102309	0	0	0	0	0	0	0	0	0	0	0	0	0	33676	78977	0	0	0	0	0	0	44252	271106	458821
Pottery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ONMMP	208088	149670	94383	142521	134832	103797	2341	2783	3342	3771	11510	16989	3889	3548	1666	5726	6768	7183	153933	149488	81677	646	1919	2735	92	522	326	521008	461040	312097
ISBI	0	22763	11712	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22763	11712
NFBMI	34984	26884	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34984	26884	0
FMP	692615	518047	382217	89524	122841	68611	1131	1620	975	675	4320	6716	181	657	0	4317	1758	1695	9699	10932	21028	0	0	0	0	0	0	798143	660174	481242
Machinery	200736	217005	121001	15747	32983	42896	0	276	1720	0	700	1596	0	0	0	2460	2615	4870	470	3961	3012	0	0	0	0	0	0	219413	257540	175095
Elect. Mach.	0	179732	124505	0	4164	7267	0	0	0	0	168	278	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	184063	132051
Motor	0	131721	95073	0	36097	5321	0	703	430	3469	4052	2158	0	0	0	4401	4590	2916	2286	30098	26220	0	0	0	0	0	0	10156	207260	132117
Trans. Equip.	0	80903	72375	0	0	0	0	0	0	0	712	1115	0	0	0	0	0	0	1348	6443	3646	0	0	0	0	0	0	1348	88058	77136
PSPE	11408	18548	7117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11408	18548	7117
OMI	548657	207800	1077709	133794	172391	334794	3283	1475	24519	64567	28393	255073	22194	39489	49518	18994	24612	73262	31406	210616	299422	1198	1824	11108	1080	1625	1756	825173	688226	2127162
Total	6038377	7520339	7404532	1408346	1654899	1563721	134994	258020	236553	321590	374492	580772	62684	116058	89502	393000	492228	462935	515341	1166544	1117611	56899	69897	49678	3499	5898	2082	8934729	11658374	11507385

6.2.2 The Distribution of Manufacturing Activity by Sector, Across the Statistical Regions

We begin by examining the distribution of manufacturing activity across three digit manufacturing sectors for the nine statistical regions of the Western Cape. Our concern here is simply with the relative importance of each manufacturing sector within each of the statistical regions. Thus the focus is not on the absolute size of the activity, but simply whether any given manufacturing sector in a specific statistical region is important relative to total manufacturing activity that takes place in the same statistical region.

Table 17 summarizes the evidence for the 1970's, 1980's, and 1990's. Appendix K provides the relevant graphical representation of the evidence by decade, for each statistical region.

The evidence carries a number of overarching implications.

First, very few of the statistical regions of the Western Cape show a diversified manufacturing sector structure. Only Statistical Regions 1 and 2 show manufacturing sector diversification. By diversification we mean that the total manufacturing sector output of the statistical region is not dominated by one or two three digit manufacturing sectors.

In Statistical Region 1, we find that Food processing is the most important single sector, and maintains its importance relative to other manufacturing sectors over time. Other sectors that maintain their relative importance are Fabricated Metal Products and Clothing. Paper and Industrial Chemicals both see an expansion in their relative importance during the 1980's but little further relative gain during the 1990's. Beverages and Plastics have gained relative importance, though they remain small as a proportion of total manufacturing output of Statistical Region 1. The manufacturing sectors experiencing significant losses in relative importance over time are Textiles, Other Chemical Products, and Fabricated Metal Products. A number of manufacturing sectors entered Statistical Region 1 either by entry or classificatory convention for the first time during the 1980's. These include Industrial Chemicals, Rubber, Leather, Electrical Machinery, and Transport Equipment. Equally, one manufacturing sector, Non-ferrous Metal Products, exited Statistical Region 1 during the 1990's. The declining sectors mirror the findings outlined above in the analysis of changing real value added.

For Statistical Region 2, the notable feature is the decline in the relative importance of Food, Beverages and Textiles from the 1970's through the 1990's. There is a marginal increase in the relative importance of Plastics, while Footwear exits the statistical region in the 1990's.

For the majority of the remaining statistical regions manufacturing activity is dominated by the Food sector. This is particularly true for Statistical Regions 3, 6 and 8. In the case of Region 6, Beverages also constitutes a significant proportion of manufacturing sector activity. In the case of Statistical Region 3 the contribution of Beverages has been on an increasing trend. For Regions 4 and 5, Other Manufacturing Industries is the second significant sector other than Food. In Statistical Region 4 Wood is also of some relative importance, though it has declined marginally in relative importance to the region during the course of the 1990's. In Statistical Region 5, Wood exits entirely during the course of the 1990's, from a position of some relative importance.

Statistical Region 7 shows significant changes over time. While the region starts with significant Food and Other Manufacturing Industry dominance in the 1970's, it does show some entry of additional manufacturing sectors particularly during the course of the 1990's. The increased relative importance of the Motor Industry reflects the impact of the assembly and related plants at Atlantis. The relative growth of Plastics at the expense of Other Non-metallic Mineral Products may well reflect classificatory rather than real changes. The joint contribution of the two sectors however is on a declining trend over the three decades.

Finally, for Statistical Region 9 manufacturing sector activity is classified predominantly under Other Manufacturing Industries. Over the three decades, the Food sector exits entirely, while Other Non-metallic Mineral Products assumes increased importance.

Table 17: Proportion of Manufacturing Activity in Statistical Regions across Manufacturing Sectors

	Statistical Region 1			Statistical Region 2			Statistical Region 3			Statistical Region 4			Statistical Region 5			Statistical Region 6			Statistical Region 7			Statistical Region 8		
	1970's	1980's	1990's	1970's	1980's	1990's	1970's	1980's	1990's	1970's	1980's	1990's	1970's	1980's	1990's	1970's	1980's	1990's	1970's	1980's	1990's	1970's	1980's	1990's
Food	15.24	21.15	23.74	29.14	29.36	22.51	77.30	84.20	65.83	55.77	66.76	39.86	41.04	50.39	38.42	77.86	81.43	64.66	60.10	55.48	45.70	81.44	82.04	50.89
Beverage Industries	1.04	1.43	3.89	18.63	10.20	14.11	8.47	8.70	16.71	0.00	0.00	0.00	0.00	0.00	0.00	9.30	7.15	11.10	1.05	0.76	0.68	15.27	12.38	21.07
Textiles	8.96	8.14	5.17	9.92	8.48	4.20	0.00	0.00	0.00	0.00	0.25	0.16	0.00	0.00	0.00	0.00	0.00	0.34	0.37	3.30	3.81	0.00	0.00	0.00
Clothing, except footwear	8.54	11.29	12.07	0.14	0.34	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.08	0.26	1.24	0.78	0.00	0.00	0.00
Leather, leather products, leather substitutes and fur	0.99	0.76	0.53	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Footwear	2.26	1.98	1.63	0.72	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wood and wood and cork products, except furniture	0.91	0.89	0.84	3.69	3.77	3.40	7.70	3.57	1.44	19.75	16.42	11.52	12.40	11.68	0.00	1.61	0.54	0.06	0.10	0.65	0.42	0.00	0.00	0.00
Furniture and fixtures, except primarily of metal	1.59	2.00	2.04	0.15	0.80	1.14	0.36	0.38	0.53	1.81	2.49	1.94	0.00	0.80	0.25	0.91	1.68	1.48	0.00	0.39	1.45	0.00	0.00	0.00
Paper and paper products	3.94	4.70	4.47	0.00	0.58	2.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Printing, publishing and allied industries	8.85	8.83	7.35	0.89	0.91	1.21	1.02	0.46	0.29	0.62	0.82	0.64	0.00	0.00	0.00	1.19	0.94	0.75	0.00	0.00	0.23	0.00	0.00	0.00
Industrial chemicals	4.66	3.63	2.70	0.00	1.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other chemical products	7.95	10.64	4.66	9.68	10.71	7.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.79	0.00	0.00	0.00
Rubber Products	0.13	0.17	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Plastic products, not elsewhere classified	2.15	2.48	3.80	0.00	2.62	6.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.57	7.15	0.00	0.00	0.00
Pottery, china and earthenware	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other non-metallic mineral products	2.73	1.92	1.32	9.96	8.22	6.67	1.80	1.09	1.47	1.17	3.06	3.14	7.12	3.11	1.89	1.46	1.37	1.76	29.56	13.63	7.59	1.01	2.82	5.68
Iron and Steel basic industries	0.69	0.42	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-ferrous metal basic industries	0.45	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fabricated metal products	9.07	6.66	5.18	6.39	7.37	4.42	0.83	0.64	0.41	0.23	1.15	1.23	0.17	0.60	0.00	1.09	0.36	0.42	1.95	0.94	1.96	0.00	0.00	0.00
Machinery, except electrical machinery	2.64	2.79	1.61	1.11	2.00	2.87	0.00	0.11	0.76	0.00	0.18	0.29	0.00	0.00	0.00	0.63	0.53	1.17	0.08	0.34	0.28	0.00	0.00	0.00
Electrical machinery, apparatus, appliances and supplies	2.96	2.89	1.67	0.00	0.23	0.45	0.00	0.00	0.00	0.00	0.04	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Motor vehicles, parts and accessories	3.94	2.43	1.28	0.00	2.17	0.34	0.00	0.27	0.14	1.08	1.08	0.42	0.00	0.00	0.00	1.12	0.94	0.64	0.46	2.36	2.33	0.00	0.00	0.00
Transport equipment	2.93	1.55	0.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.59	0.34	0.00	0.00	0.00
Professional, scientific and photographic equipment	0.15	0.24	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other manufacturing industries	7.19	2.68	14.63	9.57	10.21	21.85	2.53	0.58	12.40	19.55	7.56	40.53	39.27	33.41	59.44	4.83	5.01	17.54	5.84	17.64	26.49	2.29	2.75	22.36
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

6.2.3 The Distribution of Statistical Region Manufacturing Sectors to Total Western Cape Manufacturing Output

We have explored the relative importance of manufacturing sectors within each of the statistical regions. In this section we examine the importance of each of the manufacturing sectors of the individual statistical regions, to the manufacturing output of the Western Cape as a whole. This gives some indication of the importance of production by statistical region and by manufacturing sector.

The evidence is summarized in Table 18, while Appendix L provides the graphical representation of the tabular evidence.

The evidence shows the significant extent of geographical concentration of manufacturing activity in the Western Cape. Statistical Region 1 consistently contributes more than 60% of the manufacturing output of the Western Cape, with Statistical Region 2 being the only other significant contributor.

In Statistical Region 1 a number of sectors have consistently contributed more than 4% of total Western Cape manufacturing output. These include Food, Clothing, and Printing over all three in-sample decades. Textiles and Other Chemical Products contributed 4% or more of total Western Cape manufacturing output in the 1970's and 1980's, but fell below this benchmark during the 1990's. Fabricated Metal Products and Other Manufacturing Industries only contributed more than 4% of total Western Cape manufacturing output in the 1970's, though Other Manufacturing Industries returned to this position of relative importance during the 1990's. Strong relative expansion took place in Beverages (1990's), Paper (1980's) and Plastics (1980's and 1990's), while Electrical Machinery experienced contraction during the 1980's in its relative contribution to Western Cape manufacturing output.

Nevertheless, the evidence of Table 18 and of Appendix L for Statistical Region 1 confirms that by the 1990's, most manufacturing sectors were at least represented. This again reflects the relative diversification of Statistical Region 1, relative to other statistical regions in the province.

For the second most important statistical region, no single sector ever contributed more than 4% of total Western Cape manufacturing output over the in-sample period of this study. In addition, the statistical region is also less diversified in terms of the representation of a range of different manufacturing sectors present, than is Statistical Region 1. However, from the 1970's through the 1990's the extent of diversification has increased in Statistical Region 2. Most important of the sectors in Statistical Region 2 are Food, Beverages, Textiles, Other Chemical Products, Other Non-metallic Mineral Products, and Other Manufacturing Industries.

All remaining statistical regions simply do not have manufacturing industries that contribute a sizeable proportion of total manufacturing output of the Western Cape. Nevertheless, we briefly list the sectors that are of greatest relative significance in each of the remaining statistical regions. Readers should note that in a number of these cases the contribution is a very small proportion of total Western Cape manufacturing output. Precise contributions are easily verified from Table 18. Details by region are as follows:

- Statistical region 3: Food, Beverages, Wood, and Other Manufacturing Industries.
- Statistical region 4: Food, Wood, Other Non-metallic Mineral Products and Other Manufacturing Industries.
- Statistical region 5: Food, Other Non-metallic Mineral Products, and Other Manufacturing Industries.
- Statistical region 6: Food, Beverages, and Other Manufacturing Industries.
- Statistical region 7: Food, Other Non-metallic Mineral Products, and Other Manufacturing Industries. Plastics, Textiles, Motor Industries show some sign of an increasing relative contribution to total Western Cape manufacturing output over time.
- Statistical region 8: Food, Beverages, Other Non-metallic Mineral Products, Other Manufacturing Industries show some sign of an increasing relative contribution to total Western Cape manufacturing output over time.
- Statistical region 9: Food (except 1990's) and Other Manufacturing Industries.

Table 18: Proportion of Total Western Cape Manufacturing Activity by Statistical Region and Manufacturing Sector

	Statistical Region 1			Statistical Region 2			Statistical Region 3			Statistical Region 4			Statistical Region 5			Statistical Region 6			Statistical Region 7			Statistical Region 8			Stat
	1970's	1980's	1990's	1970's	1980's	1990's	1970's	1980's	1990's	1970's	1980's	1990's	1970's	1980's	1990's	1970's	1980's	1990's	1970's	1980's	1990's	1970's	1980's	1990's	1970's
Food	11.05	13.74	15.29	3.90	4.07	3.06	0.99	1.83	1.37	1.69	2.10	1.88	0.22	0.49	0.31	2.92	3.37	2.62	2.90	5.40	4.41	0.44	0.49	0.22	0.02
Beverage Industries	0.76	0.93	2.52	2.48	1.40	1.91	0.11	0.18	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.30	0.42	0.05	0.07	0.07	0.08	0.07	0.09	0.00
Textiles	6.49	5.33	3.32	1.33	1.17	0.57	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.35	0.37	0.00	0.00	0.00	0.00
Clothing, except footwear	6.19	7.36	7.80	0.02	0.05	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.12	0.07	0.00	0.00	0.00	0.00
Leather, leather products, leather substitutes and fur	0.72	0.50	0.34	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Footwear	1.64	1.29	1.05	0.10	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wood and wood and cork products, except furniture	0.66	0.58	0.55	0.49	0.52	0.46	0.10	0.08	0.03	0.60	0.52	0.56	0.12	0.11	0.00	0.06	0.02	0.00	0.01	0.06	0.04	0.00	0.00	0.00	0.00
Furniture and fixtures, except primarily of metal	1.15	1.30	1.31	0.02	0.11	0.15	0.00	0.01	0.01	0.05	0.08	0.09	0.00	0.01	0.00	0.03	0.07	0.06	0.00	0.04	0.13	0.00	0.00	0.00	0.00
Paper and paper products	2.86	3.06	2.88	0.00	0.09	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Printing, publishing and allied industries	6.42	5.76	4.74	0.12	0.13	0.16	0.01	0.01	0.01	0.02	0.03	0.03	0.00	0.00	0.00	0.04	0.04	0.03	0.00	0.00	0.02	0.00	0.00	0.00	0.00
Industrial chemicals	3.38	2.37	1.73	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other chemical products	5.77	6.94	3.01	1.29	1.48	0.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.08	0.00	0.00	0.00	0.00
Rubber Products	0.10	0.11	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Plastic products, not elsewhere classified	1.56	1.62	2.46	0.00	0.37	0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.68	0.00	0.00	0.00	0.00
Pottery, china and earthenware	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other non-metallic mineral products	1.98	1.26	0.86	1.34	1.14	0.90	0.02	0.02	0.03	0.04	0.10	0.15	0.04	0.03	0.01	0.05	0.06	0.06	1.45	1.26	0.72	0.01	0.02	0.02	0.00
Iron and Steel basic industries	0.50	0.27	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-ferrous metal basic industries	0.32	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fabricated metal products	6.57	4.37	3.34	0.85	1.03	0.60	0.01	0.01	0.01	0.01	0.04	0.06	0.00	0.01	0.00	0.04	0.01	0.02	0.09	0.09	0.19	0.00	0.00	0.00	0.00
Machinery, except electrical machinery	1.91	1.83	1.03	0.15	0.28	0.38	0.00	0.00	0.02	0.00	0.01	0.01	0.00	0.00	0.00	0.02	0.02	0.04	0.00	0.03	0.03	0.00	0.00	0.00	0.00
Electrical machinery, apparatus, appliances and supplies	2.15	1.88	1.07	0.00	0.03	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Motor vehicles, parts and accessories	2.86	1.61	0.83	0.00	0.30	0.05	0.00	0.01	0.00	0.03	0.03	0.02	0.00	0.00	0.00	0.04	0.04	0.03	0.02	0.25	0.22	0.00	0.00	0.00	0.00
Transport equipment	2.13	1.02	0.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.05	0.03	0.00	0.00	0.00	0.00
Professional, scientific and photographic equipment	0.11	0.16	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other manufacturing industries	5.22	1.75	9.48	1.28	1.44	2.97	0.03	0.01	0.23	0.63	0.24	2.27	0.21	0.33	0.44	0.18	0.21	0.65	0.29	1.76	2.57	0.01	0.02	0.10	0.01
TOTAL	72.51	65.26	64.52	13.37	13.90	13.55	1.28	2.17	2.03	3.07	3.15	5.10	0.59	0.98	0.77	3.75	4.13	3.95	4.87	9.79	9.63	0.54	0.59	0.43	0.03

6.2.4 Proportion of Manufacturing Industry Production Located in each Statistical Region

We have demonstrated both the distribution of statistical region manufacturing output across three digit manufacturing sectors, as well as the proportion of total Western Cape manufacturing output located in the three digit manufacturing sectors of each statistical region.

In this section, we detail the proportion of the three digit manufacturing sector output located in the Western Cape, located within each of the statistical regions.

The evidence is summarized in Table 19, while Appendix M provides the graphical representation of the tabular evidence.

The evidence reinforces the finding of the preceding sections; namely, that for most manufacturing sectors, the overwhelming majority of manufacturing activity is located in Statistical Region 1, and to a significantly lesser extent, Region 2.

For a significant number of three digit manufacturing sectors, more than 70% of the output produced in that sector in the Western Cape is located in Statistical Region 1. This is true of Textiles, Clothing, Footwear, Furniture, Printing, Other Chemical Products, Non-ferrous Metal Basic Industries, Fabricated Metal Products, Machinery, and Professional, Scientific and Photographic Equipment during the 1970's. Paper, Plastics, and Transport Equipment during the 1980's, and Leather, Industrial Chemicals, Rubber, Electrical Machinery and Motor Vehicles during the 1990's further join these industries. Conversely, Plastics falls below the 70% benchmark during the 1990's, while Non-ferrous Metal Basic Industries completely exits the region during the 1980's, as did Professional, Scientific and Photographic Equipment during the 1990´s.

In Statistical Region 2, which carries the second greatest manufacturing industry concentration in the Western Cape, the individual industry contribution is already considerably lower than for Statistical Region 1. Notable is the strong contribution of Beverages, starting with a contribution of more than 60% of Western Cape output in the sector, though the Statistical Region 2 contribution in the sector declines to approximately 36% by the 1990's. The remaining sectors of any relative importance (defined as contributing more than 20% of the relevant industry output in the Western Cape) are Wood and Other Non-metallic Mineral Products in the 1970's, which were joined by Plastics, Other Chemical Products, and Machinery by the 1990's.

All other statistical regions are very small contributors to industry output. In what follows we specify only the most important sectors by statistical region, though we note throughout the small contribution that the sectors provide to total industry output of the Western Cape. Relevant details are:

- For Statistical Region 3, only Food, Beverages and Wood contribute more than 4% of their relevant total Western Cape industry outputs. Wood's contribution falls to a mere 2% in the 1990´s.
- For Statistical Region 4, only Wood contributes more than 30% of its total Western Cape industry output. The Motor industry starts with a greater than 30% share of the total Western Cape industry output, though by the 1990's this had declined to a contribution of less than 2%.
- For Statistical Region 5, only Wood and Other Manufacturing Industries ever contribute more than 4% of their relevant total Western Cape industry outputs and Wood even exists the region in the 1990´s.
- For Statistical Region 6, Food and Beverages consistently contribute approximately 10% of their respective total Western Cape industry outputs. During the 1970's, the Motor industry contributed approximately 40% of the Western Cape industry output, though this had declined to less than 3% by the 1990's (this is likely to have been in specialized farming equipment).
- For Statistical Region 7, the strongest contributors are Other Non-metallic Mineral Products, and Motor industry production consistently with approximately 20% of the regional industrial production, with Transport Equipment and Other Manufacturing Industry assuming a similar importance during the 1980's, and Plastics during the 1990's. Food consistently contributes approximately 10% of its industry production in the Western Cape.
- For Statistical Regions 8 and 9, no industry contributes more than 3% of the Western Cape industry output.

Table 19: Proportion of Total Western Cape Three Digit Manufacturing Sector Output by Statistical Region

	Statistical Region 1			Statistical Region 2			Statistical Region 3			Statistical Region 4			Statistical Region 5			Statistical Region 6			Statistical Region 7			Statistical Region 8			Statistical Region 9		
	1970's	1980's	1990's	1970's	1980's	1990's	1970's	1980's	1990's	1970's	1980's	1990's	1970's	1980's	1990's	1970's	1980's	1990's	1970's	1980's	1990's	1970's	1980's	1990's	1970's	1980's	1990's
Food	45.83	43.58	52.87	16.13	12.97	10.39	4.10	5.80	4.58	6.98	6.70	6.48	0.91	1.54	1.00	12.11	10.73	8.78	12.03	17.05	15.15	1.82	1.56	0.75	0.09	0.07	0.00
Beverage Industries	19.93	32.12	47.07	64.52	46.84	35.78	2.82	6.20	6.26	0.00	0.00	0.00	0.00	0.00	0.00	9.18	9.96	7.96	1.38	2.47	1.24	2.16	2.40	1.69	0.00	0.00	0.00
Textiles	82.71	77.60	77.65	17.06	16.93	13.25	0.00	0.00	0.00	0.00	0.12	0.20	0.00	0.00	0.00	0.00	0.00	0.30	0.23	5.36	8.60	0.00	0.00	0.00	0.00	0.00	0.00
Clothing, except footwear	99.48	97.75	98.16	0.29	0.63	0.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.05	0.22	1.59	0.94	0.00	0.00	0.00	0.00	0.00	0.00
Leather, leather products, leather substitutes and fur	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Footwear	94.43	96.16	100.00	5.57	3.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wood and wood and cork products, except furniture	32.73	30.94	32.87	24.28	27.81	27.74	4.80	4.05	2.01	29.57	27.58	34.12	5.32	4.95	0.00	3.05	1.16	0.22	0.23	3.50	3.04	0.00	0.00	0.00	0.00	0.00	0.00
Furniture and fixtures, except primarily of metal	90.95	80.04	74.20	1.58	6.83	8.78	0.36	0.50	0.59	4.31	4.79	5.22	0.00	0.48	0.11	2.68	4.31	3.37	0.00	2.42	7.74	0.00	0.00	0.00	0.12	0.64	0.00
Paper and paper products	0.00	97.63	89.46	0.00	2.37	10.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Printing, publishing and allied industries	97.03	96.61	95.06	1.82	2.14	3.21	0.20	0.17	0.12	0.29	0.44	0.62	0.00	0.00	0.00	0.67	0.65	0.58	0.00	0.00	0.42	0.00	0.00	0.00	0.00	0.00	0.00
Industrial chemicals	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other chemical products	81.34	81.81	74.25	18.66	18.02	23.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	1.87	0.00	0.00	0.00	0.00	0.00	0.00
Rubber Products	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Plastic products, not elsewhere classified	0.00	74.17	60.54	0.00	15.22	22.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.61	17.18	0.00	0.00	0.00	0.00	0.00	0.00
Pottery, china and earthenware	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other non-metallic mineral products	40.83	31.63	29.82	26.68	29.85	33.58	0.47	0.63	1.08	0.75	2.73	5.49	0.76	0.77	0.54	1.15	1.46	2.30	29.24	32.39	26.21	0.11	0.43	0.88	0.02	0.11	0.10
Iron and Steel basic industries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-ferrous metal basic industries	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fabricated metal products	86.70	78.14	79.43	11.27	18.90	14.22	0.14	0.25	0.20	0.08	0.66	1.40	0.02	0.10	0.00	0.56	0.27	0.36	1.23	1.69	4.40	0.00	0.00	0.00	0.00	0.00	0.00
Machinery, except electrical machinery	91.52	84.04	66.28	7.15	12.96	26.90	0.00	0.13	1.02	0.00	0.30	0.97	0.00	0.00	0.00	1.12	1.01	3.01	0.21	1.57	1.82	0.00	0.00	0.00	0.00	0.00	0.00
Electrical machinery, apparatus, appliances and supplies	0.00	0.00	94.46	0.00	0.00	5.38	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Motor vehicles, parts and accessories	0.00	51.50	72.35	0.00	11.47	4.03	0.00	0.35	0.28	34.03	7.88	1.60	0.00	0.00	0.00	43.31	11.01	2.18	22.66	17.78	19.56	0.00	0.00	0.00	0.00	0.00	0.00
Transport equipment	0.00	74.71	93.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.87	1.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.42	4.80	0.00	0.00	0.00	0.00	0.00	0.00
Professional, scientific and photographic equipment	100.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other manufacturing industries	66.57	29.40	50.21	16.20	24.38	16.40	0.40	0.25	1.10	7.70	4.05	11.38	2.70	5.82	2.36	2.31	3.76	3.43	3.85	31.82	14.51	0.14	0.26	0.53	0.13	0.25	0.08

6.3 Evidence on Output Growth Patterns by Manufacturing Sector in the Western Cape

In our discussion of manufacturing sector growth in the magisterial districts of the Western Cape, we noted that the 1990's saw a dramatic reduction in the growth rates of the sector. Moreover, the strong negative performance of manufacturing during the 1990's was virtually uniform across all magisterial districts.

The major finding to emerge from the evidence from three digit manufacturing sectors is that the strong negative growth rates of the 1990's that were observed for magisterial districts at the aggregate manufacturing sector level are strongly confirmed at the three-digit manufacturing sector level, for all statistical regions of the Western Cape, with few exceptions.

6.3.1 Average Growth, 1976 - 1996

A first indication of this finding emerges even when one considers average growth rates over the twenty-year period from 1976-96. During the 1970's, growth across all manufacturing sectors across all nine statistical regions declined from an annual average of 6.06%, to 2.87% and -3.93% from the 1970's, 1980's and 1990's respectively, indicating the dramatic slow-down in manufacturing activity over the sample period.

More detailed summary statistics by statistical region, as well as for the Western Cape as a whole are reported in Table 20. In Section 6.1 we detailed the important caveat in interpreting the results reported in the growth rate data. On the basis of the data restrictions we report both the growth rates which zero restrict the infinite growth rates under reported start-ups (columns headed Statistical region 1 A and Western Cape A), and the growth rates under interpolation from 1972 for Statistical Region 1 (columns headed Statistical Region 1 B and Western Cape B).

Commencing with discussion on the zero restricted start up data, the striking feature of the evidence provided is that in real terms many of the manufacturing sectors have reported negative real growth rates on average over the 20 year period. In particular, Textiles, Leather, Footwear, Paper, Printing, Industrial Chemicals, Other Chemical Products, Other Non-metallic Mineral Products, Iron and Steel Basic Industries, Fabricated Metal Products, Machinery, Electrical Machinery and Professional, Scientific and Photographic Equipment all report negative average growth rates in real value added for the Western Cape as a whole. In the case of Leather (-6.12% growth per annum), Industrial Chemicals (-7.59% growth per annum), Iron and Steel Basic Industries (-15.49% growth per annum), and Electrical Machinery (-4.46% growth per annum) the loss in output is particularly dramatic.

By contrast, only two sectors report a very strong positive growth rate – the Motor industry (188.57% growth per annum) and Transport Equipment (124.06% growth per annum). In the case of the Motor industry this is a reflection of start-up activity in Statistical Regions 1 and 2, in the case of Transport Equipment start-up activity in Regions 1 and 2 in the 1982 census. These start ups will result in upward bias in the results as discussed below.

The only remaining growth performance of note was in Other Manufacturing Industry (6.04% per annum), Plastics (5.81% growth per annum), Non-ferrous Basic Metal Industry (4.52% growth per annum), and Rubber (3.21% growth per annum).

Table 20: Average Growth Rate in Real Value Added, 1976-1996

	Statistical region 1 A	Statistical region 1 B	Statistical region 2	Statistical region 3	Statistical region 4	Statistical region 5	Statistical region 6	Statistical region 7	Statistical region 8	Statistical region 9	**Western Cape A**	**Western Cape B**
Food	1.36	1.36	-1.47	1.98	0.68	-2.47	-2.07	2.55	-2.65‡	-4.91	**0.62**	**0.62**
Beverage	8.07	8.07	-3.41	8.38			1.14	2.66	2.58		**1.55**	**1.55**
Textiles	-2.77	-2.77	-5.49		-4.16†		-15.68	10.49†			**-2.72**	**-2.72**
Clothing	1.94	1.94	80.34				38.16†‡	2.99†			**2.04**	**2.04**
Leather	-6.43†	-4.68	-14.92†‡								**-6.12†**	**-4.46**
Footwear	-1.67	-1.67	-5.64‡								**-1.93**	**-1.93**
Wood	0.47	0.47	0.96	-9.99	1.24	-30.33†‡	-16.54‡	4.71†‡			**0.39**	**0.39**
Furniture	0.25	0.25	15.89	5.34	4.00	5.32†	0.29	6.35†		-8.33†‡	**1.31**	**1.31**
Paper	-0.87†	-0.34	-6.24†								**-0.12†**	**0.30**
Printing	-1.51	-1.51	4.37	-4.34	1.60		-2.24	-4.48†			**-1.34**	**-1.34**
Ind. Chems.	-6.57†	-4.26	-17.72†‡								**-7.59†**	**-4.09**
Oth. Chem Prods	-3.46	-3.46	-1.87					1.70†			**-3.26**	**-3.26**
Rubber	3.21†	1.42									**3.21†**	**1.42**
Plastic	3.17†	3.76	5.75†					18.49†			**5.81†**	**6.01**
Pottery												
ONMMP	0.15	0.15	1.18	0.77	6.73	-4.85	4.36	-0.57	1.84†	0.60†	**-0.46**	**-0.46**
ISBI	-15.49†‡	-10.48									**-15.49†**	**-10.48**
NFBMI	4.52‡	4.52									**4.52**	**4.52**
FMP	-2.40	-2.40	-0.42	0.19	5.47†	-8.60†‡	-0.19	8.93			**-2.20**	**-2.20**
Machinery	-3.06	-3.06	8.78	8.04†	11.13†		6.44	3.21†			**-0.93**	**-0.93**
Elect. Mach.	-4.96†	-2.77	-16.16†		-18.78†‡						**-4.46†**	**-2.43**
Motor	-7.96†	-5.53	-14.32†	-13.59†‡	-3.65		-3.91	55.94			**188.57†**	**-4.05**
Trans. Equip.	-6.87†	-5.56			-0.61†			1.40†			**124.06†**	**-5.19**
PSPE	-0.06‡	-0.06									**-0.06**	**-0.06**
OMI	9.41	9.41	8.50	80.49	21.06	7.95	8.86	21.51	33.95	2.30	**6.04**	**6.04**

† Denotes instances in which an infinite growth rate is present, but has been zero-restricted.
‡ Denotes an industry exit.

For three manufacturing sectors the Western Cape growth rate is determined entirely by the growth rate of the sector in Statistical Region 1 (Iron and Steel Basic Industries, Non-ferrous Basic Metal Industries, Professional, Scientific and Photographic

Equipment), and in a further 4 sectors by the growth rates in Statistical Regions 1 and 2 (Leather, Footwear, Paper, Industrial Chemicals). This again reflects the strong concentration of manufacturing activity in these two statistical regions.

In Statistical Region 1, strong positive growth emerges for only three sectors, Beverages (8.07% growth per annum), Non-ferrous Basic Metal Industries (4.52% growth per annum), and Other Manufacturing Industry (9.41% growth per annum). However, in the case of Non-ferrous Basic Metal Industries the strong growth is located entirely in the 1970's, and the industry subsequently exited Statistical Region 1 and by definition the Western Cape entirely. As for the province as a whole, the notable feature of manufacturing sector growth in Statistical Region 1 is the presence of numerous sectors with strong negative growth performances. Defining strong negative growth as an average per annum real growth of -4% or less, Leather, Industrial Chemicals, Iron and Steel Basic Industries, Electrical Machinery, Motor, and Transport Equipment all experience strong negative growth in Statistical Region 1.

The second largest statistical region of the Western Cape in manufacturing terms, Region 2, has both stronger negative, but also stronger positive growth rates over the full sample period than Region 1. Strong positive growth rates are present in Clothing (80.34% growth per annum), Furniture (15.89% growth per annum), Machinery (8,78% growth per annum), Other Manufacturing Industry (8.50 growth per annum), Plastics (5.75% growth per annum), and Printing (4.37% growth per annum). Strong negative growth rates emerge for Industrial Chemicals (-17.72% growth per annum), Electrical Machinery (-16.16% growth per annum), Leather (-14.92% growth per annum), Motor (-14.32% growth per annum), Paper (-6.24% growth per annum), Footwear (-5.64% growth per annum), and Textiles (-5.49% growth per annum).

As noted from the outset of the present subsection, it does of course remain true that for at least some of particularly the poor growth rates reported for Statistical Regions 1 and 2, but also for the Western Cape as a whole, the poor performance hides the presence of significant start-up activity. This is true particularly for Leather, Paper, Industrial Chemicals, Iron and Steel Basic Industries, Electrical Machinery, Motor and Transport Equipment. This remains a valid concern with the presentation of the results as they stand. But the objection is also of limited reach. The negative growth rates in the sectors that did start up in the Western Cape, and in the case of Leather and Iron and Steel Basic Industries the exit from at least some statistical regions, point to the fact that the initial start-up investment simply proved unsustainable, leading to subsequent industry shrinkage.

Reference to growth rates based on the interpolated series from the 1972 manufacturing census in general change these findings only marginally. Specifically, for a number of sectors the growth rates reported under Western Cape A, decline marginally in absolute terms (i.e. move closer to zero) – see the results reported under

Western Cape B.[53] For sectors with negative growth rates this is the case for Leather, Industrial Chemicals, Iron and Steel Basic Industries, and Electrical Machinery, and for sectors with positive growth rates this holds for Rubber. For four sectors the reported growth rates do report more dramatic changes, however. Paper under the interpolated series changes from a negative, to a small positive annual real growth rate. Plastics shows an increase in its positive growth rate. Most dramatically of all, the Motor and Transport Equipment sectors change from a dramatically strong positive growth rate, to a negative growth rate.[54] In the case of Statistical Region 1, results under the interpolated output series from the 1972 census reported in Statistical region 1 B consistently are marginally lower in absolute terms than under the results reported in Statistical region 1 A.

Thus the general findings reported above for Statistical Region 1 hold. Indeed, the finding of poor manufacturing sector growth in the Western Cape is strengthened under the data correction exercise reported in Western Cape B, since the only two very strong growth rates reported under Western Cape A revert to negative growth rates.

While the strong negative growth rates in manufacturing sectors noted is something of an overstatement, it also points to strong, and real concerns concerning the viability of manufacturing industry in a wide range of sectors in the Western Cape. This point is driven home by the fact that two additional industries (Rubber, Plastics) experienced start-up within the sample period also, without subsequent shrinkage. Indeed, in the case of Plastics, growth performance was relatively strong.

The remaining statistical regions of the Western Cape are relatively small in terms of their contribution to manufacturing output in the province. Nevertheless, we draw attention briefly to noteworthy features of growth in these regions, classified by manufacturing sector:

- In Food and Beverages Statistical Region 3, and to a lesser extent 7 had strong growth performances; Statistical Regions 2, 5, 6, 8 and 9 had poor performance in the food sector. The Beverage sector fared less badly with only Region 2 in negative growth territory.
- In Textiles, but for Statistical Region 7, which had a strong growth performance, regions 2, 4 and 6 had poor growth performances.
- In Clothing, Statistical Regions 2, 6 and 7 had strong growth performances (though region 6 also experienced exit); no region experienced very poor growth.
- Footwear and Leather both experienced poor growth performance in Regions 1 and 2.

[53] Of course, small changes in cumulative growth rates do carry substantial long-term implications in absolute terms.
[54] The reason for this is that the previous start-up increases in Statistical Region 1's Motor and Transport Equipment industries now disappear, such that the strong positive growth rate in these sector's output in the early 1980's now is no longer present.

- Furniture experienced strong growth performance is Statistical Regions 2, 3, 4, 5 and 7, and poor growth performance in Region 9.
- Wood reported strong growth only in Statistical Region 7, and poor growth in Regions 3, 5 and 6. Regions 5 and 6 saw industry exits.
- Paper had a poor growth performance in Statistical Regions 1 and 2.
- Printing had strong growth in Statistical Region 2, but poor growth in Regions 3, 6 and 7.
- Industrial Chemicals had poor growth in both regions it is represented in the province namely Statistical Regions 1 and 2.
- No notable growth performance stood out for Other Chemical Products, and Professional, Scientific and Photographic Equipment; while Rubber, Iron and Steel Basic Industries, Non-ferrous Basic Metal Industry, and Transport Equipment has been dealt with in the discussion of Statistical Regions 1 and 2.
- Plastics had sound growth performance in Statistical Regions 2 and 7.
- Other Non-metal Mineral Products experienced sound growth in Statistical Regions 4 and 6, poor growth in region 5.
- Fabricated Metal Products reported sound growth in Statistical Regions 4 and 7, poor growth in Region 5.
- Machinery reported sound growth in Statistical Regions 2, 3, 4, 6 and 7, with only Region 1 spoiling this record with poor growth.
- Electrical Machinery reports poor growth in all regions -Regions 1,2 and 4.
- Motor industry reports healthy growth only in Statistical Region 7, and poor growth in Regions 1, 2 and 3.
- Other Manufacturing Industry shows outstanding growth in Statistical Regions 1, 2, 3, 4, 5, 6, 7 and 8 and less impressive, yet still positive, growth in Region 9.

Four generic features emerge from this evidence.

First, sectors that have shown relatively widespread growth in terms of geographical coverage are restricted to Furniture, Machinery, and Other Manufacturing Industry.

Second, sectors that have reported overwhelmingly positive growth performance and little contraction are restricted to Beverages, Plastics, and Other Manufacturing Industry.

Third, the pervasive sound performance of Other Manufacturing Industry raises the concern that data collection for manufacturing sectors may have been poor over the sample period. A distinct possibility is that new manufacturing activity was simply classified under "other" rather than receiving proper classification in relevant industry groupings.

Fourth, a number of sectors appear to have fared particularly poorly in the longer term. This is noteworthy particularly with respect to Motor, Electrical Machinery, and the minerals-related sectors (Other Non-metal Mineral Products, Iron and Steel Basic

Industry, Non-ferrous Basic Metal Industry). While the relative remoteness of mineral extraction may explain the latter case, reasons for the relatively poor performance of Motor and Electrical Machinery are less clear. This would be especially true to the extent that these two sectors may be relatively human capital intensive in production, and the Western Cape has a strong concentration of human capital present.

6.3.2 Growth disaggregated by Time Period: the 1970's, 1980's and 1990's

It remains for us to consider the time profile of manufacturing sector growth by statistical region.

Table 21 reports the average growth rates by manufacturing sector, and by statistical region, for the 1970's, 1980's, and 1990's. As for the previous subsection, we note an important caveat in interpreting the results reported in the growth rate data at the outset. Again see section 6.1 for the discussion on how these data issues were dealt with. In the table we again report both the growth rates that zero restrict the infinite growth rates under reported start-ups (Statistical region 1 A, Western Cape A), and the growth rates under interpolation from 1972 for statistical region 1 (Statistical region 1 B, Western Cape B).

We note immediately that the pattern of a steady slow-down of growth from the 1970's onward, that we observed for the manufacturing sector as a whole in the Western Cape, emerges for the large majority of three digit manufacturing sectors also. In particular, we find that the steady growth deceleration applies to Food, Textiles, Clothing, Leather, Footwear, Paper, Industrial Chemicals, Rubber, Plastics, Iron and Steel Basic Industries, Non-ferrous Basic Metal Industries, Fabricated Metal Products, Machinery, Electrical Machinery and Transport Equipment.

Note, however, that the implication of a monotonic decline is modulated for a number of sectors where the data interpolated from the 1972 manufacturing census is employed. In particular, for Leather, Paper and Rubber on the "corrected" data, these sectors show a growth peak during the 1980's, with both the 1970's and 1990's reporting a poorer growth performance.

A number of other sectors report a growth peak during the 1980's. Specifically, Beverages, Furniture, Printing, Other Chemical Products, Motor, Professional, Scientific and Photographic Equipment and Other Manufacturing Industry all show their strongest growth during the course of the 1980's. Where the data interpolated from the 1972 manufacturing census is employed, Motor's growth performance is reversed.

Finally, two sectors in the Western Cape experience a growth trough during the 1980's – Wood and Other Non-metallic Mineral Products both report their weakest growth rates during the 1980's.

The time profile of manufacturing industry growth rates is reported in Table 21 for reader's convenience. The general growth pattern by statistical region mirrors that of the Western Cape as a whole, with a growth slow-down from the 1970's through the course of the 1980's and the 1990's.

A number of other features of manufacturing growth in the statistical regions are noteworthy:

1. The strong growth in Clothing in Statistical Region 2 during the 1970's is off a very low base. The strong growth in the region largely reflects relocation and diversion of manufacturing activity from Statistical Region 1.
2. The generally strong growth performance noted for Beverages over the full sample period is in part a reflection of the strong Statistical Region 1 performance of Beverages during the 1990's.
3. Plastics, while also subject to slow-down during the 1990's, at least maintains an average annual growth rate above 3% during the course of the 1990's in Statistical Region 1. In Statistical Region 7, Plastics show strong growth during the 1980's, but shows a reversal of fortunes during the 1990's.
4. The strong growth performance of Other Manufacturing Industries already remarked on during the previous sub-section, is once again present across a wide range of statistical regions, and over virtually all time periods. The concerns already voiced in the preceding subsection concerning the possibility of poor classification of new business ventures, therefore carries over to the more temporally disaggregated data.
5. The growth rate of Machinery remains very sound through the 1990's in a number of statistical regions: specifically Regions 2, 3 and 6.
6. Note specifically the strong peak associated with the Motor Industry in Statistical Region 7 during the 1980's.

Table 21: Output Growth by Three Digit Sector and Statistical Region

	Statistical region 1 A			Statistical region 1 B			Statistical region 2			Statistical region 3			Statistical region 4			Statistical region 5			Statistical region 6			Statistical region 7			Statistical region 8			Statistical region 9			Western Cape A			Western Cape B		
	70´s	80´s	90´s	70´s	80´s	90´s	70´s	80´s	90´s	70´s	80´s	90´s	70´s	80´s	90´s	70´s	80´s	90´s	70´s	80´s	90´s	70´s	80´s	90´s	70´s	80´s	90´s	70´s	80´s	90´s	70's	80's	90's	70's	80's	90's
Food	4.55	5.19	-5.49	4.55	5.19	-5.49	16.16	0.76	-12.19	16.57	7.17	-11.69	9.89	2.69	-6.12	12.70	10.98	-28.18	-1.45	4.77	-12.11	7.74	8.60	-8.32	15.09	-2.21	-10.88	-11.71	-2.88‡		6.98	4.72	-7.98	6.98	4.72	-7.98
Beverage	-2.18	11.31	7.83	-2.18	11.31	7.83	-10.51	1.98	-8.06	-1.73	18.29	-1.43							0.73	4.39	-3.32	15.91	4.08	-5.05	2.76	4.09	0.36				-7.08	4.92	0.42	-7.08	4.92	0.42
Textiles	15.88	-3.96	-9.05	15.88	-3.96	-9.05	6.68	-3.90	-12.98					-14.84	6.53						-15.68		24.56	-9.61							14.56	-3.11	-9.55	14.56	-3.11	-9.55
Clothing	5.51	2.80	-0.82	5.51	2.80	-0.82	507.12	6.03	3.60											65.93	-17.40‡		7.95	-4.10							6.00	2.87	-0.84	6.00	2.87	-0.84
Leather		-2.56†	-10.30	-3.43	-1.12	-10.30		-14.92†‡																								-1.94†	-10.30	-3.43	-0.69	-10.30
Footwear	11.51	-1.94	-6.92	11.51	-1.94	-6.92	13.45	-13.82‡																							11.62	-2.50	-6.92	11.62	-2.50	-6.92
Wood	-3.77	0.27	2.57	-3.77	0.27	2.57	4.45	-0.65	1.76	-2.65	-3.48	-22.44	4.25	-1.23	3.47		-30.33†‡		-24.16	-7.86	-37.86‡		16.69	-19.26‡							8.85	-2.70	1.18	8.85	-2.70	1.18
Furniture	0.75	4.93	-6.65	0.75	4.93	-6.65	-0.72	34.48	-3.54	-1.47	11.09	0.03	17.38	5.84	-4.37		19.32†	-8.68	13.65	10.24	-19.66		10.10	4.21					-8.33†‡		1.85	6.39	-6.16	1.85	6.39	-6.16
Paper		2.74†	-6.04	2.68	2.74	-6.04		-4.46†	-6.50																							4.07†	-6.10	2.68	4.07	-6.10
Printing	-1.32	-0.49	-3.06	-1.32	-0.49	-3.06	9.56	2.04	5.46	1.17	-3.36	-8.11	-3.91	10.05	-8.12				6.47	0.06	-9.25			-4.48							-1.08	-0.41	-2.79	-1.08	-0.41	-2.79
Ind. Chems.		0.70†	-13.83	8.83	-1.49	-13.83		-17.72†‡																								-1.36†	-13.83	8.83	-1.15	-13.83
Oth. Chem Prods	-10.58	2.44	-8.84	-10.58	2.44	-8.84	3.49	2.51	-10.43														25.29	-1.67							-8.14	2.37	-9.21	-8.14	2.37	-9.21
Rubber		30.10†	-12.15	7.75	9.03	-12.15																										30.10†	-12.15	7.75	9.03	-12.15
Plastic		3.12†	3.23	7.10	3.12	3.23		10.98†	0.53														42.97	-5.99								9.13†	1.07	7.10	9.13	1.07
Pottery																																				
ONMMP	1.96	-7.51	10.32	1.96	-7.51	10.32	35.25	-3.59	-6.60	-13.43	7.04	-2.08	-2.95	19.44	-7.28	0.99	-3.54	-9.22	-8.43	4.06	10.25	22.90	-5.47	-3.64		0.62	3.58		0.59	0.61	15.42	-5.01	-0.77	15.42	-5.01	-0.77
ISBI		-6.77†	-27.69‡	5.24	-6.60	-27.69‡																										-6.77†	-27.69	5.24	-6.60	-27.69‡
NFBMI	78.20	-27.06‡		78.20	-27.06‡																										78.20	-27.06		78.20	-27.06	
FMP	6.97	-4.96	-2.75	6.97	-4.96	-2.75	-1.32	6.48	-9.89	17.07	4.56	-13.30		9.74	-0.62		-8.60†‡		-31.25	2.13	9.81	-6.51	19.55	0.39							5.71	-3.32	-3.98	5.71	-3.32	-3.98
Machinery	0.70	-0.20	-8.76	0.70	-0.20	-8.76	19.83	6.75	6.95		39.74	3.51		21.47	0.79				-5.98	8.13	9.35		8.18	-3.91							2.11	0.82	-4.73	2.11	0.82	-4.73
Elect. Mach.		0.38†	-10.29	10.40	-1.46	-10.29		-27.56†	-14.54					11.56	-28.90‡																	1.72†	-10.64	10.40	-0.52	-10.64
Motor		-11.24†	-4.69	7.30	-9.96	-4.69		-29.02†	0.38		0.02	-31.73‡	-11.05	3.55	-10.75				-8.14	0.71	-8.69	-0.47	120.15	-11.62							-7.49	383.86	-6.41	6.77	-5.64	-6.41
Trans. Equip.		-11.08†	-2.66	3.65	-10.35	-2.66								13.20	-8.51								-2.57	7.08								212.53†	-2.32	4.41	-10.08	-2.32
PSPE	4.23	10.42	-39.25‡	4.23	10.42	-39.25‡																									4.23	10.42	-39.25	4.23	10.42	-39.25‡
OMI	2.00	9.63	12.27	2.00	9.63	12.27	-4.20	12.16	8.72	-16.47	-5.96	245.54	-46.10	14.01	59.92	15.41	9.65	2.32	6.62	9.15	9.39	65.72	27.19	-5.54	-37.18	72.21	9.79	-27.39	14.68	-2.68	-2.00	7.75	7.03	-2.00	7.75	7.03

† Denotes instances in which an infinite growth rate is present, but has been zero-restricted.
‡ Denotes an industry exit.

6.4 Decomposing the Value Added Growth Performance: Identifying Factor Input Contributions by Manufacturing Sector

We now turn to the question of the decomposition of the value added growth performance of the manufacturing sectors of the Western Cape. The object of the decomposition is to employ the growth accounting approach of section 2, in order to identify whether growth in manufacturing sectors is due to capital or labour accumulation, or efficiency gains in production.

In Appendix N we detail the results from the growth decomposition, specifying real value added growth, the contribution of capital (as measured by plant and machinery, rather than total fixed assets) to real value added growth, as well as the contribution of labour and total factor productivity growth. Results are provided by manufacturing sector, for the 1976-96 period, as well as the three 1970's, 1980's and 1990's sub-periods in the sample.

As in the previous two subsections, we had to deal with the data anomaly given by the apparent industry start-ups in-sample, that appeared to stand at odds with earlier manufacturing censuses – 1972 in particular. In Tables 22 and 23 we provide summary representations of the evidence by manufacturing sector presented in Appendix N, in order to identify the relative contribution of the factor inputs and technological innovation over time, as well as the trend structure of these growth inputs.

Readers may recall that for manufacturing sector output in aggregate, magisterial district level evidence suggested a preponderance of output growth based on factor accumulation. The evidence from manufacturing sector level evidence adds additional nuance, since during the 1970's particularly, and to a lesser extent during the 1980's TFP growth was positive for a substantial number of sectors also. What does remain true, is that factor accumulation in both capital and labour was a substantial driver of value added output growth during these periods also.

In further interpreting the evidence, consider first the evidence to emerge for the Western Cape as a whole, by manufacturing sector.

The most striking finding from the evidence presented is that for all three drivers of value added growth, an ever increasing number of manufacturing sectors have seen the contribution of the growth driver switching from positive, to negative – whether the driver be capital, labour or TFP growth.

This is immediately consistent with earlier findings of dwindling growth rates in manufacturing output for a wide range of sectors. What is startling, however, is that the declining growth rates are due not to any single factor alone, but appear to emerge for the contributions of capital, labour as well as efficiency gains in production. While the shift in manufacturing sectors toward a negative contribution by capital to value added output growth began noticeably during the course of the 1980's, the most marked change was reserved for the 1990's in all three determinants of growth: labour, capital and TFP. The 1990's shift is particularly marked in the case of both labour and TFP.

Sectors in which the negative growth consequences of job losses have been particularly strong include Leather, Industrial Chemicals, Rubber, Iron and Steel Basic Industries, Electrical (for this sector all three growth drivers were strongly negative), and Professional, Scientific and Photographic Equipment.

We also, however, that a number of sectors whose long term growth performance we have noted as having at least some indication of robustness in the preceding sections, show evidence of leading such growth through factor accumulation. This is noticeable specifically in the case of Plastics (regardless of how we treat the data issues presented by the apparent industry start-up), Other Manufacturing Industry, Beverages and Furniture, all of who show positive contributions of factor accumulation to output growth into the 1990's.

The concern voiced in preceding sections raised by the Other Manufacturing Industry performance resurfaces again in the growth accounting exercise. The very dramatic growth rates implied by capital accumulation in this sector raises the prospect that increasing manufacturing activity was inaccurately classified in the OMI sector, rather than appropriately allocated to industry grouping by Statistics South Africa.

A number of minerals-based sectors show a positive growth contribution arising from factor accumulation in the Western Cape. This is particularly true of Other Non-metallic Mineral Products, and Fabricated Metal Products. Note however, that the factor accumulation of the 1990's in these sectors has not translated into positive growth in value added. On the contrary, output growth remained negative in real terms during the course of the 1990's.

Note also that positive efficiency gains contributing toward output growth during the 1990's were substantially concentrated in the chemicals sectors, and in Transport Equipment. At the same time, these sectors were engaged in substantial disinvestment in their Western Cape operations, with associated strong negative real growth rates in output. The efficiency gains identified by the growth decomposition thus appear to have been largely defensive measures, designed to prevent even greater output loss than implied by the job losses and disinvestment of the sectors, rather than strong output growth inducing innovation.

For the majority of manufacturing sectors the contribution of total factor productivity to output growth has been on a declining trend over the sample period of this study, or it has been subject to a slow-down (often dramatically so) during the 1990's.

Finally, we note a number of features to emerge from the growth accounting particularly for the 1990's that are sectorally specific:

1. The performance of the Food sector shows strong contributions from capital accumulation in Statistical Regions 1, 7 and 8, without any related improvement in value added output growth. The one strong positive growth performance, in Statistical Region 9, is driven largely by efficiency gains.
2. The relatively positive growth performance of Beverages in the Western Cape, specifically during the 1990's, is substantially driven by capital accumulation in Statistical Region 1.
3. In Textiles, the poor growth performance of the sector is one that is led by both job and efficiency losses. This is particularly striking in Statistical Regions 2 and 6, where the losses in labour and efficiency offset substantial capital expansion in the latter region.
4. In the Clothing sector, while Statistical Regions 1 and 2 showed relatively strong growth contributions from capital accumulation, Statistical Region 6 also had a very strong contribution from labour. In both Statistical Regions 2 and 6 output growth was correspondingly relatively strongly positive.
5. In the Western Cape the Leather industry is effectively restricted to Statistical Region. The poor growth performance of the 1990's is driven by poor contributions by labour and efficiency gains.
6. In Footwear, poor output growth is due primarily to efficiency losses in both Statistical Regions 1 and 2, and as a secondary contributor some capital disinvestment in Statistical Region 1.
7. The Wood industry is one of the most geographically diverse in the sample. Statistical regions with positive growth performances depended on job creation (Statistical Region 1), capital accumulation (Statistical Region 4), and both capital and labour accumulation (Statistical Region 2). Statistical Region 3 had negative growth performance due to both disinvestment and job losses, while for Region 6 poor growth was due to disinvestment and efficiency losses. In Statistical Region 7 the positive growth contribution of investment was offset by job losses.
8. In the Furniture sector, efficiency losses in Statistical Regions 1, 2, 4 and 5 led to poor growth performance in the sector, while for Statistical Region 6 capital, labour and TFP all contributed negatively to output growth. Only Statistical Region 7 had strong output growth, led by capital accumulation.
9. Poor output growth in the Paper sector is due to efficiency losses during the course of the 1990's.
10. For Printing, poor output growth in Statistical Regions 1, 3, 4, 6 and 7 is due to efficiency losses (in the case of Region 7 disinvestment also contributes), while in Statistical Region 2 positive output growth is due to investment and job creation.
11. Both Industrial Chemicals and Other Chemicals have poor output growth due to disinvestment, and to a lesser extent job losses. TFP gains partially offset the factor de-accumulation.
12. Rubber's poor output growth is due to efficiency losses.

13. Plastics has sound output growth, due to capital accumulation in both Statistical Regions 1 and 2, and also due to job creation in Region 1.
14. Other Non-metallic Mineral Products has both strong positive, and strong negative growth performances across the Western Cape. Strong positive performances are primarily due to capital accumulation in Statistical Region 1, and due to job creation in Statistical Regions 6 and 8. Poor growth is due to disinvestment in Statistical Regions 2 and 5, due to efficiency losses in Region 3, and both disinvestment and efficiency losses in Region 4.
15. The poor growth performance of Iron and Steel Basic Industries is primarily due to job losses.
16. In Fabricated Metal Products, poor output growth is due to disinvestment in Statistical Region 7, due to job losses in Regions 1 and 3, and due to efficiency losses in Regions 1 and 2. Output growth is employment-led in Statistical Region 6.
17. The growth performance of Machinery is variable across the statistical regions of the Western Cape. In Statistical Region 1 (the largest in output terms), output growth is both negative, and negative due to all three growth determinants. However, in Regions 2 and 6 strong positive output growth is due to both capital and labour accumulation.
18. For Electrical Machinery, efficiency losses dictate poor output growth in Statistical Region 1, and disinvestment as well as job losses in Statistical Region 2. The positive output growth of Region 4 is due to both capital and labour accumulation.
19. The Motor sector in the province is well represented across the Statistical Regions. But for the 1980´s output growth over time has been predominantly negative and this due to disinvestments and job and efficiency losses. Only Regions 2 and 3 showed output growth in most recent times. In both regions the growth was both capital and labour absorbing accompanied by efficiency losses.
20. For Transport Equipment, poor growth is due to disinvestment in Statistical Region 1, as well as job and efficiency losses in Region 4. Statistical Region 7 has strong positive output growth due to job creation.
21. Professional, Scientific and Photographic Equipment's poor growth performance is due to both job and efficiency losses.
22. Growth performance under Other Manufacturing Industry, across virtually all statistical regions, raises the concerns already noted above about new manufacturing sector activity classification in successive censuses.

Table 22: General Growth Structure By Decade: Western Cape A and B results

	1970's		1980's		1990's	
	>0	<0	>0	<0	>0	<0
Capital	Food Beverage Textiles Clothing Footwear Furniture Paper B Industrial Chemicals B Oth Chem Prods Rubber B Plastics B ISBI B NFMBI Machinery Electrical B Motor B Transport B PSPE A	Leather A Wood Printing ONMMP FMP Motor A OMI	Food Beverage Clothing Footwear Furniture Paper A Paper B Printing Rubber A Plastics A Plastics B Machinery Electrical A Motor A Transport A PSPE A OMI	Textiles Leather A Leather B Wood Industrial Chemicals A Industrial Chemicals B Oth Chem Prods Rubber B ONMMP ISBI A ISBI B NFMBI FMP Electrical B Motor B Transport B	Food Beverage Clothing Wood Furniture Plastics A Plastics B ONMMP FMP PSPE A OMI	Textiles Leather A Leather B Footwear Paper A Paper B Printing Industrial Chemicals A Industrial Chemicals B Oth Chem Prods Rubber A Rubber B ISBI A ISBI B Machinery Electrical A Electrical B Motor A Motor B Transport A Transport B
Labour	Food Beverages† Textiles Clothing Footwear Wood Paper B Industrial Chemicals B Rubber B Plastics B ISBI B NFMBI FMP Electrical B Motor B Transport B PSPE A OMI	Leather B Furniture Printing Oth Chem Prods ONMMP Machinery Motor A	Food Clothing Leather A Furniture Paper A Paper B Printing Industrial Chemicals B Oth Chem Prods Rubber A Rubber B Plastics A Plastics B ONMMP ISBI B FMP Machinery Electrical A Electrical B Motor A Motor B Transport A Transport B PSPE A	Beverage† Textiles Leather B Footwear Wood Industrial Chemicals A ISBI A NFMBI OMI	Food Beverage Wood Printing Plastics A Plastics B ONMMP OMI	Textiles Clothing Leather A Leather B Footwear Furniture Paper A Paper B Industrial Chemicals A Industrial Chemicals B Oth Chem Prods Rubber A Rubber B ISBI A ISBI B FMP Machinery Electrical A Electrical B Motor A Motor B Transport A Transport B PSPE A
TFP	Food Textiles Clothing Leather B Footwear Wood Furniture Printing Industrial Chemicals B Rubber B ONMMP ISBI B FMP Machinery Electrical B Motor A Motor B Transport B PSPE A OMI	Beverages Paper B Oth Chem Prods Plastics B NFMBI	Food Beverages Clothing Leather B Industrial Chemicals A Industrial Chemicals B Oth Chem Prods Rubber A Rubber B Plastics A Plastics B Motor A PSPE A	Textiles Leather A Footwear Wood Furniture Paper A Paper B Printing ONMMP ISBI A ISBI B NFMBI FMP Machinery Electrical A Electrical B Motor B Transport A Transport B OMI	Industrial Chemicals A Industrial Chemicals B Oth Chem Prods ISBI A ISBI B Transport A Transport B	Food Beverage Textiles Clothing Leather A Leather B Footwear Wood Furniture Paper A Paper B Printing Rubber A Rubber B Plastics A Plastics B ONMMP FMP Machinery Electrical A Electrical B Motor A Motor B PSPE A OMI

† Denotes tends to 0

A, B denotes the relevant treatment of apparent industry start-up as specified in Appendix N.

Table 23: Structural Changes to Variables: Western Cape A and B results

	Increasing Trend	Decreasing Trend	U-shaped trend	Inverted-U-shaped trend
Capital	Plastics A* ONMMP ISBI A OMI	Food Textiles Leather A Paper A Industrial Chemicals A Oth Chem Prods Rubber A Rubber B Plastics B NFMBI Machinery A Machinery B Electrical A Electrical B Motor B Transport A Transport B	Beverages Clothing Wood ISBI B FMP	Leather B Footwear Furniture Paper B Printing Industrial Chemicals B Motor A PSPE
Labour	Printing ONMMP	Textiles Leather A Footwear Paper A Paper B Industrial Chemicals A Industrial Chemicals B Rubber A Plastics A ISBI A ISBI B NFMBI FMP Electrical A Electrical B Motor B Transport A Transport B PSPE	Beverages Wood Oth Chem Prods Machinery A Machinery B OMI	Food Clothing Leather B Furniture Rubber B Plastics B Motor A
TFP	ISBI A NFMBI ‡ Electrical A ‡ Transport A	Food Textiles Clothing Leather A Leather B Footwear Wood Furniture Paper A Printing Industrial Chemicals A Rubber A Plastics A ONMMP FMP Machinery A Machinery B Electrical B OMI	Industrial Chemicals B ISBI B Motor B	Beverages Paper B Oth Chem Prods Rubber B Plastics B Motor A Transport B PSPE

* Denotes that the trend is effectively zero
‡ Denotes an increasing trend in negative territory

In broad terms this evidence has significant commonalities with the national evidence reported in Fedderke (2002), though some differences also emerge. The increasing reliance on capital accumulation particularly in the 1990's for output growth in manufacturing noted by Fedderke (2002), and evident in the magisterial district data, is less evident in the data across all manufacturing sectors. Rather, strong investment activity has been restricted to specific manufacturing sectors. The declining contribution of labour to output growth is also present for the national evidence, though in the Western Cape the negative contribution of labour is perhaps somewhat more muted. While the magisterial district data had difficulty finding evidence of the national trend of positive contributions of technological progress in the 1970's and the 1980's, the manufacturing sector data for the Western Cape provides similar evidence to the national data. Moreover, the declining trend in the contribution of technological progress to output growth in the national data is evident in the Western Cape also.

6.5 The Relative Importance of the Contributions of Capital, Labour and Technological Progress to Manufacturing Sector Growth by Three Digit Manufacturing Sector in the Western Cape

As a final step in the analysis of the growth by manufacturing sector in the Western Cape, we consider the relative contribution of the two factor inputs, and technological progress to total manufacturing growth in the province. Thus far the analysis has pointed out the relative contributions of capital, labour and technological progress in each manufacturing sector. The analysis has not been able to assess the relative importance of the growth that has occurred in each manufacturing sector due to the three contributing factors to output growth, for the manufacturing sector growth in aggregate in the Western Cape.

The point here is that while the relative contribution of any one of the three building blocks to growth in any one manufacturing sector may have been either small or large in any given period, this in and of itself tells us very little about the contribution of the growth to Western Cape performance as a whole. A small manufacturing sector, that is receiving a strong growth impetus from capital accumulation, may be contributing very little to manufacturing growth as a whole. Similarly, a large sector that is growing relatively slowly due to additional employment, may nevertheless be contributing a relatively large amount to manufacturing growth in the Western Cape as a whole.

The analysis of the present section allows us to weight the output growth contribution by factor input or technological progress by the value added contribution of the manufacturing sector.

Figures 14, 15 and 16 present the evidence for capital, labour and total factor productivity respectively, breaking the evidence down by decade. Appendix O provides the same evidence, in larger format for ease of reference.

The evidence presented excludes the Other Manufacturing Industries sector because the 1980's and 1990's distort the findings substantially, due to very strong capital and

TFP growth. The likely reason for these findings are the classificatory problems related to the OMI sector that have already been noted a number of times in the preceding discussion. The strength of the effect in the current context is such that to all intents and purposes only the OMI sector comes to contribute to the growth of manufacturing value added in the Western Cape in these two categories. Once again, we caution that significant classificatory problems brought about by the inclusion of new manufacturing activity in the Western Cape over this period in OMI even where inappropriate, will have skewed the data and our results. Finally, we note that the strength of the effect also points to the likely candidacy of the Mossgas projects as driving the strength of the OMI capital and TFP growth. For readers who are interested in the data including OMI, we report the full results in Appendix P.

The results from the real cost reduction computations, which weight the contributions to output growth provided by capital, labour and technological progress by the total value added of the sector, provide an indication of the relative contribution of the three growth drivers to value added growth in the Western Cape across the distinct manufacturing sectors. We present evidence for the three decades included in the sample of the present study. A number of distinct patterns emerge from the evidence.

First, in terms of the contribution of the capital factor of production, the pattern remains constant across the three time periods considered. For the 1970’s, 1980’s and 1990’s the pattern is consistently that the strongest value added output growth attaches to the manufacturing sectors that contribute the largest proportion of total manufacturing value added in the Western Cape. Simultaneously, it is sectors in the mid-range size distribution in terms of their relative contribution to value added, that are engaged in disinvestment, and therefore contribute negatively to total value added growth in manufacturing.

It is noticeable that the largest sector in terms of cumulative relative value added in the Western Cape, Food, has consistently contributed positively to total value added growth through the expansion of its capital stock. We also note that the Clothing sector has consistently experienced positive contributions to value added growth from capital accumulation, while Textiles engaged in disinvestment from the 1980’s continuing into the 1990’s.

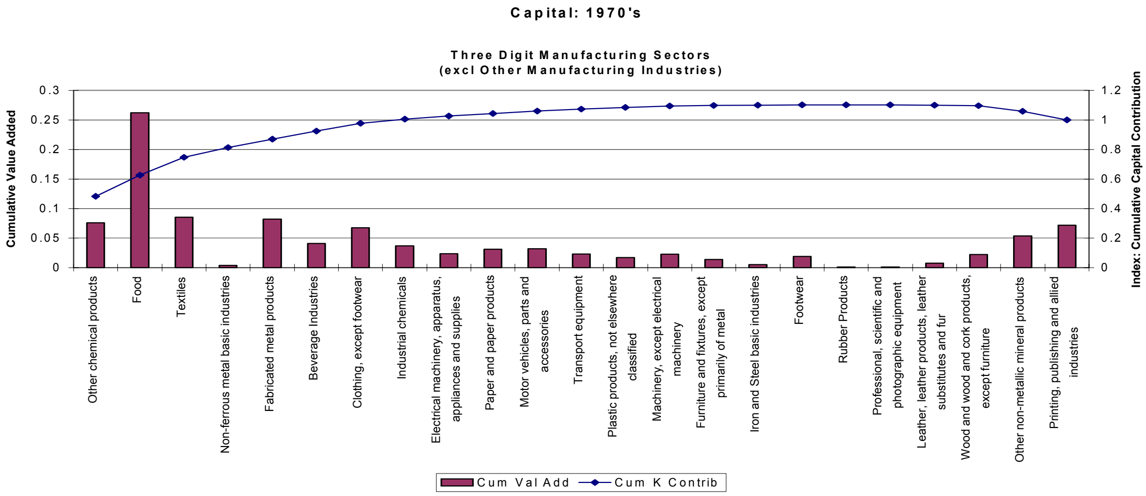
Second, in terms of the contribution of labour to value added output growth, while the 1970’s see little distinct patterns in terms of the growth contributions of manufacturing sectors by size distribution, there is a contrast between the experience of the 1980’s and 1990’s. While during the 1980’s the positive growth contributions through job-creation were located in sectors with a large relative contribution to cumulative value added in manufacturing, in the 1990’s the positive contributions through job-creation came from mid-sized sectors, while large sectors came to contribute negatively to output growth through job-losses.

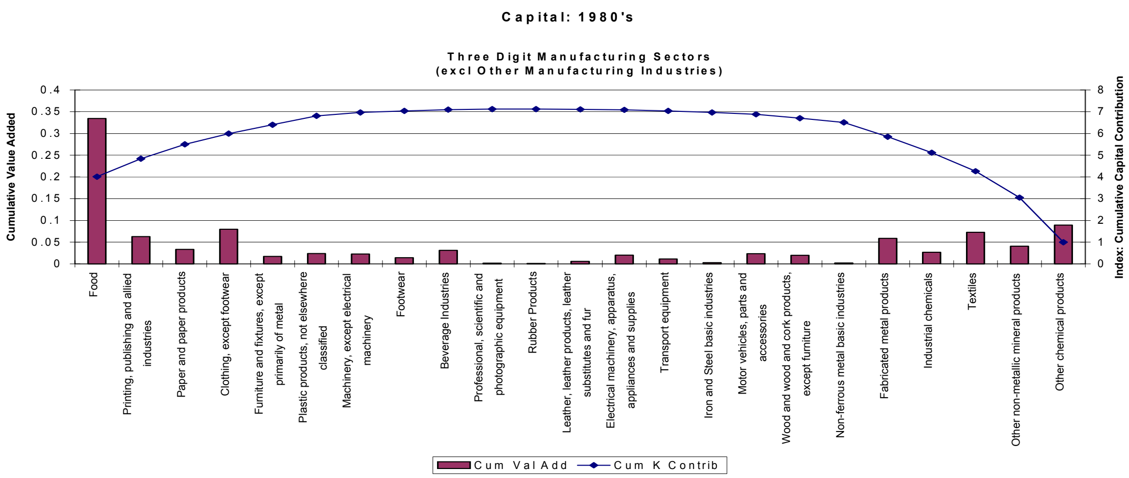
Again, it is useful to note the performance of the largest manufacturing sector in the Western Cape in terms of cumulative value added. The Food sector contributed positively to output growth through job creation during the 1970's and 1980's, though job losses during the 1990's led to a negative contribution to output growth from labour in the Food sector. Clothing again proves to consistently contribute positively to output growth through job creation, over all three sub-periods of the sample. By contrast, the Textiles sector has positive contributions to output growth from labour inputs during the 1970's and 1990's, but a negative contribution during the 1980's.

These sector-specific findings obtained for Clothing and Textiles are mirrored in the evidence for TFP-led growth. The TFP contribution is consistently positive for the Clothing sector, while that for Textiles is positive in the 1970's and 1990's, and negative during the 1980's. For the Food sector efficiency gains are consistently such as to lead to positive output growth over the whole sample period.

Finally, the findings on the growth contribution obtained from efficiency gains in production are dominated by the manufacturing sectors with large contributions to total value added in the manufacturing sector of the Western Cape. Most dramatically, we find that for the 1970's and 1990's the large manufacturing sectors all have positive growth contributions emerging from efficiency gains. The 1980's are similar, though some of the larger sectors were subject to efficiency losses. In particular, this is true for Textiles, Fabricated Metal Products and Printing.

Figure 14: Capital Contribution to Value Added Growth





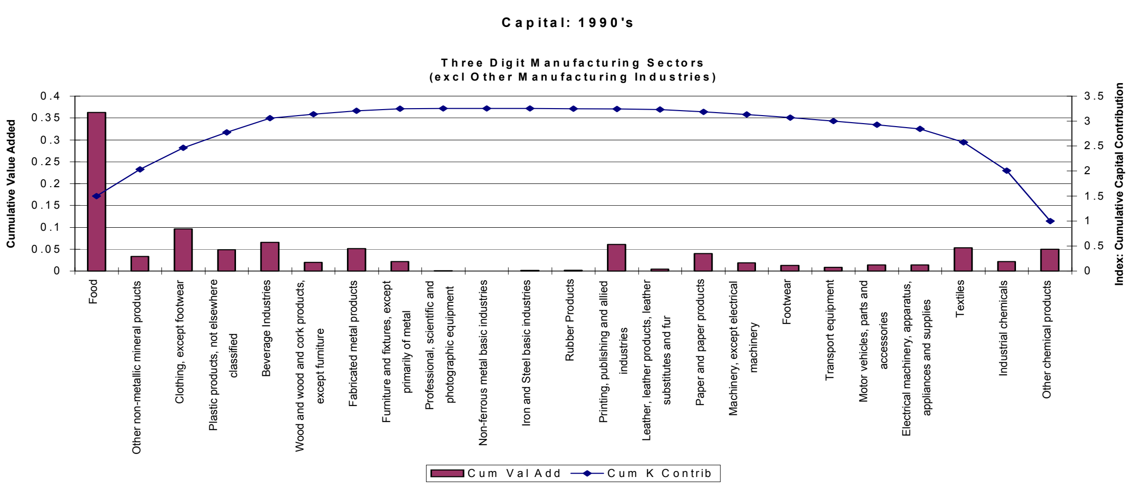
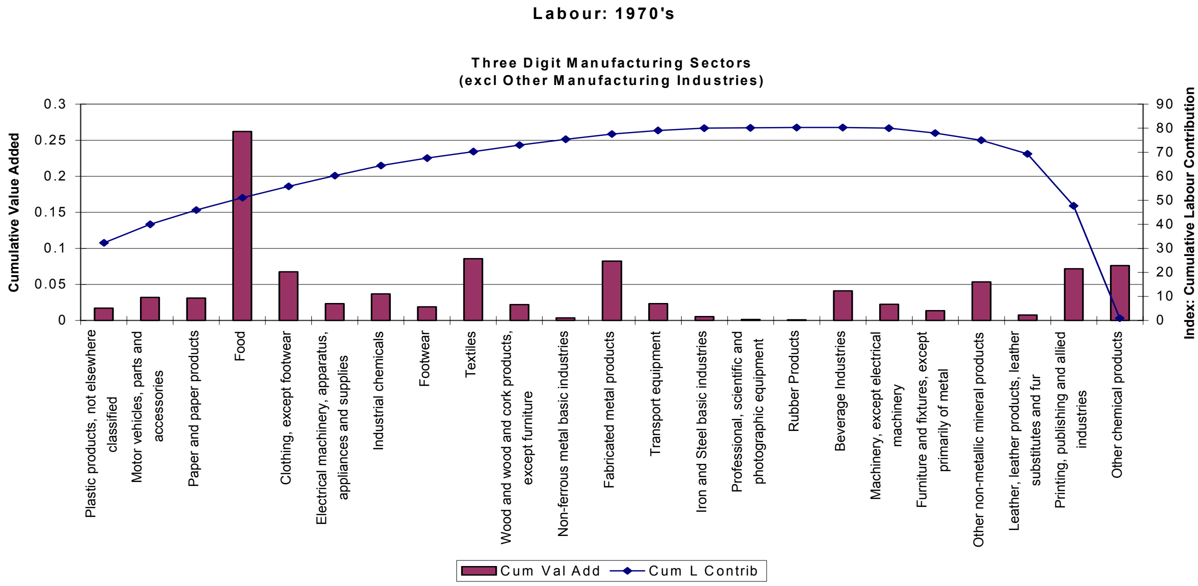
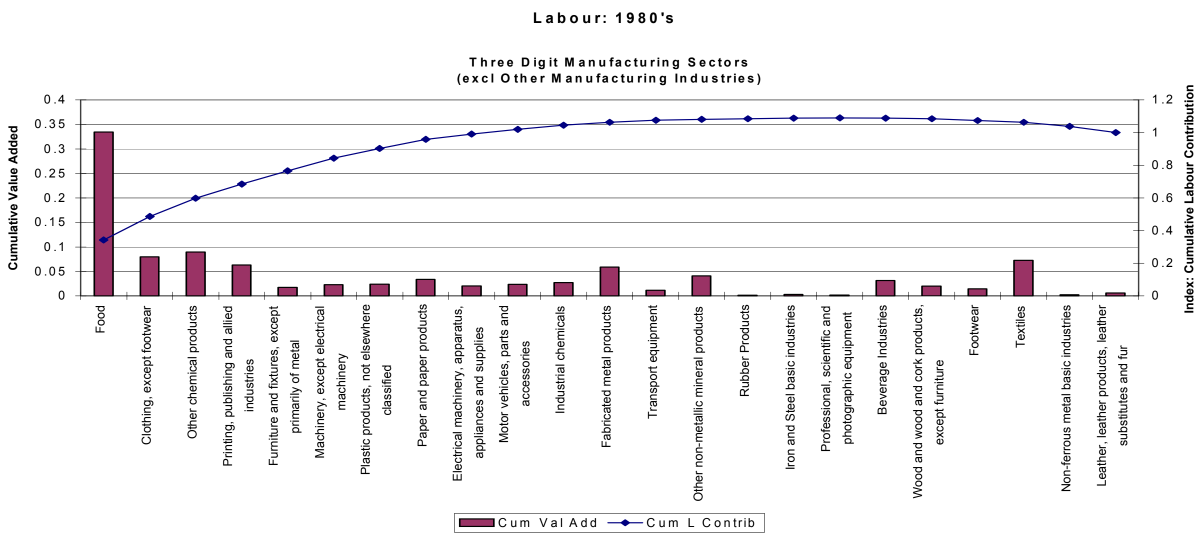


Figure 15: Labour Contribution to Value Added Growth





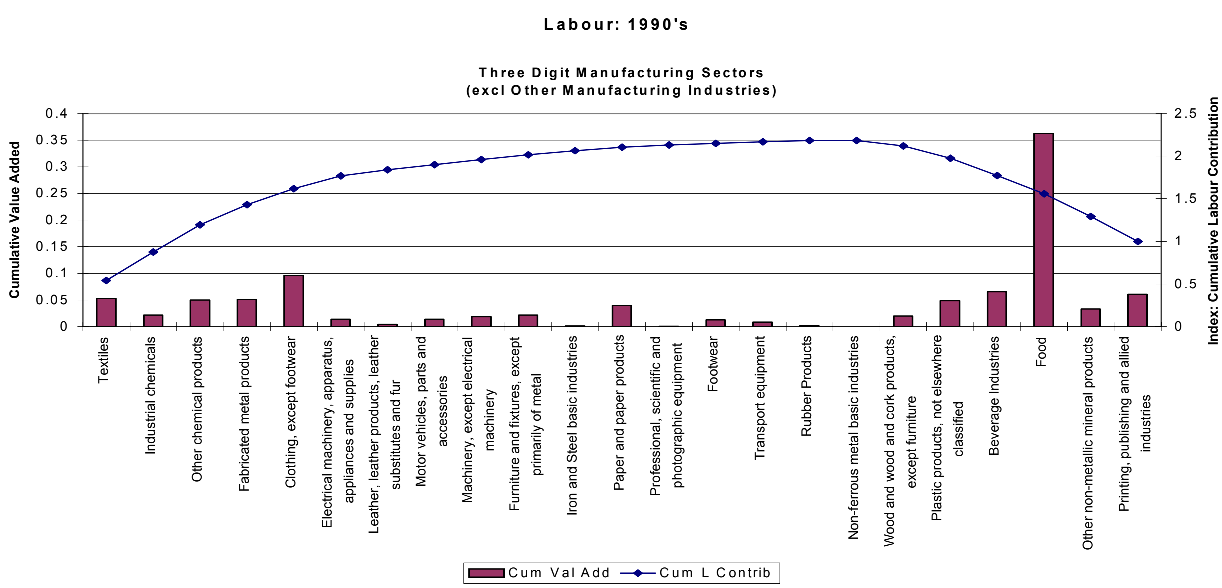
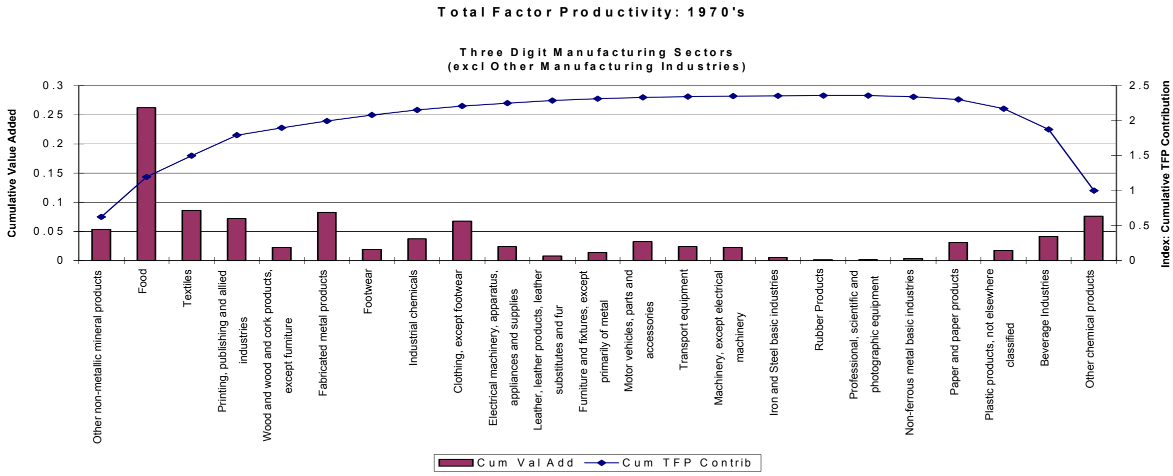
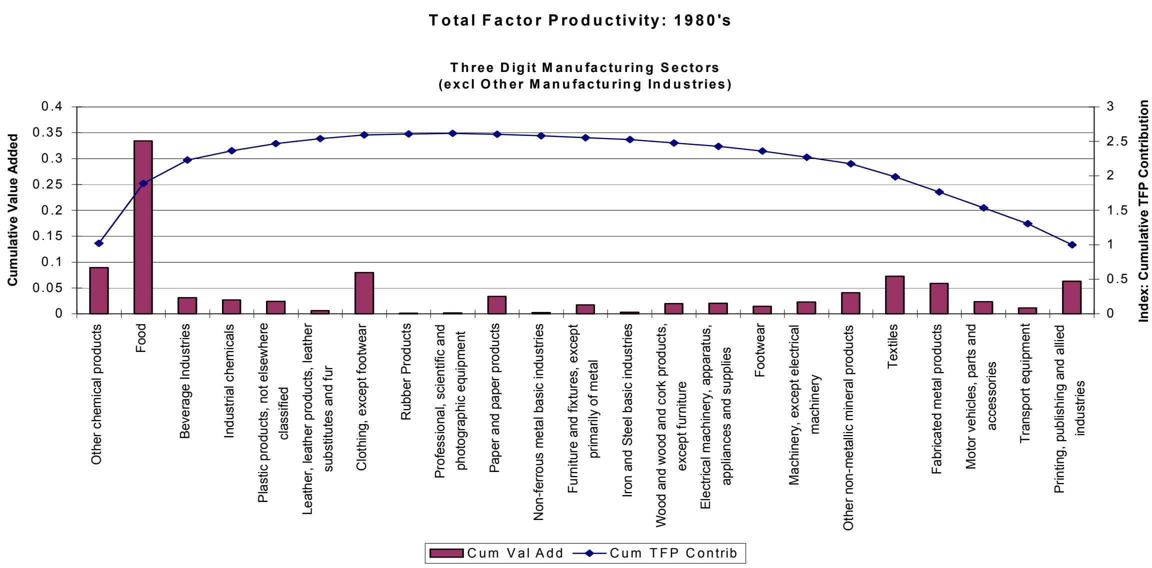
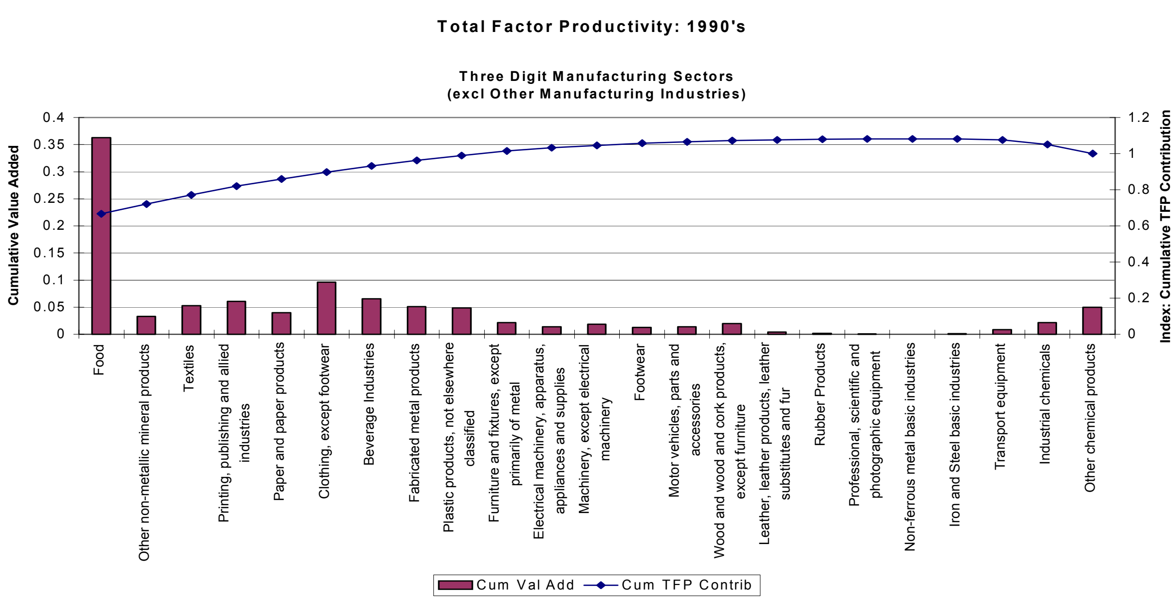


Figure 16: TFP Contribution to Value Added Growth







7.0 Conclusions

This report details the findings of research into the nature and extent of growth in the Western Cape manufacturing sector for the period 1970 to 1996, using official Regional Censuses of Manufacturing data.

The study examines evidence both for the magisterial district level of geographical disaggregation (for the 33 magisterial districts of the Western Cape) for manufacturing sector output as a whole, and for three digit manufacturing sectors at the statistical region level of geographical disaggregation (24 sectors for nine statistical regions).

The sample period covered by the study is 1970 – 1996, the period over which the manufacturing censuses were available for the Western Cape.

In terms of general conclusions, the study finds that:

1. The manufacturing sector during the 1990's experienced significant contraction.
2. For magisterial districts, districts contributing large proportions of total Western Cape manufacturing output, have steadily moved to an increased reliance on capital accumulation as a source of growth, shed labour (though mid-sized magisterial districts have expanded employment), and experienced efficiency losses.
3. Symmetrically, the manufacturing sectors that contribute a large proportion of total manufacturing output of the Western Cape, have consistently relied on capital accumulation as a growth driver, have increasingly shed labour (particularly during the 1990's), and have realized efficiency gains in production throughout the sample period.
4. The manufacturing sector in the Western Cape is predominantly located in statistical region 1, and is dominated by the Food three digit sector.

In real terms, the fastest growing magisterial districts have experienced a deceleration from 15.3, to 12.8 to 5.1 per cent in real output growth, while the slowest growing districts have contracted at an accelerating rate over the three decades.

The central implication of the evidence is that growth in the manufacturing sector in the Western Cape has historically been driven by factor accumulation. This is particularly true of the 1970's and the 1980's, but for the entire sample period also. For the Western Cape, output growth has relied both on capital and labour accumulation, though in the case of labour the 1990's has seen a declining contribution to output growth. Increasing reliance on capital accumulation particularly in the 1990's for output growth in manufacturing has also been noted at the national level. While the declining contribution of labour to output growth is also present for the national evidence, in the Western Cape the negative contribution of labour is perhaps somewhat more muted.

What differs between the Western Cape and the national evidence is that the strong positive contributions of technological progress in the 1970's and the 1980's, that is evident in the national data, is difficult to find in the Western Cape.

The evidence on the growth experience by manufacturing sector carries a number of additional implications.

The value of manufacturing output in the Western Cape is dominated by the Food sector. In the 1970's the food sector accounted for 28% of value added in the province. The Textiles, Fabricated Metal Products and Other Manufacturing Industries sectors were the next largest contributing sectors in the 1970's. The Printing and Other Chemical Products sectors followed closely.

In the 1980's the contribution of the Food sector had increased and Other Chemical Products held onto its proportion. The Textile sector's proportional contribution to manufacturing output dropped while that of the Clothing sector increased. The decline in importance of the Fabricated Metal Products and Printing sectors commenced in the 1980's and deepened in the 1990´s.

The 1990's saw the Food sector's importance shrink slightly. The Other Manufacturing Industries sector saw remarkable increase. The study remarks repeatedly on the likelihood that this is a reflection of problems of data classification. Readers should note that sectoral evidence of manufacturing activity therefore may reflect measurement error, due to classification problems in the Manufacturing Census.

The Textile sector's proportional contribution to manufacturing output continued to fall in the 1990's while that of the Clothing sector held steady. The most dramatic falloff was seen in the Other Chemical Products sector.

In terms of the contribution of the capital factor of production, for the 1970's, 1980's and 1990's the pattern is consistently that the strongest value added output growth attaches to the manufacturing sectors that contribute the largest proportion of total manufacturing value added in the Western Cape. Simultaneously, it is sectors in the mid-range size distribution in terms of their relative contribution to value added, that are engaged in disinvestment, and therefore contribute negatively to total value added growth in manufacturing.

The Food and Clothing sectors have consistently contributed positively to total value added growth through the expansion of their capital stock, while the Textiles sector engaged in disinvestment from the 1980's continuing into the 1990's.

Labour's contribution to value added output growth shows little distinct pattern in the 1970´s in terms of the growth contributions of manufacturing sectors by size distribution. The experience of the 1980's and 1990's sees some contrast. While during the 1980's the positive growth contributions through job-creation were located in sectors with a large relative contribution to cumulative value added in manufacturing, in the 1990's the positive contributions through job-creation came from mid-sized sectors, while large sectors came to contribute negatively to output growth through job-losses.

The Food sector contributed positively to output growth through job creation during the 1970's and 1980's, though job losses during the 1990's led to a negative contribution to output growth from this sector. Clothing again proves to consistently contribute positively to output growth through job creation. By contrast, the Textiles sector has positive contributions to output growth from labour inputs during the 1970's and 1990's, but a negative contribution during the 1980's. These sector-specific findings obtained for Clothing and Textiles are mirrored in the evidence for TFP-led growth.

In the 1970's and 1990's the large manufacturing sectors all had positive growth contributions emerging from efficiency gains. The 1980's results are similar, though some of the larger sectors were subject to efficiency losses. In particular, this is true for Textiles, Fabricated Metal Products and Printing.

Bibliography

Abramovitz, M., 1956, Resource and Output Trends in the United States since 1870, *American Economic Review*, 46 (2), 5-23.

Aghion, P. and Howitt, P., 1992, A Model of Growth through Creative Destruction, *Econometrica*, 60(2), 323-351.

Anderton, B., 1999, Innovation, product quality, variety, and trade performance: an empirical analysis of Germany and the UK, *Oxford Economic Papers*, 51, 152-67.

Ando, A., and Modigliani, F., 1963, The Life Cycle Hypothesis of Saving: Aggregate Implications and Tests, *American Economic Review*, 53, March, 55-84.

Arrow, K.J., 1962, The Economic implications of Learning by Doing, *Review of Economic Studies*, 29, 155-73.

Barro, R.J., 1998, Notes on Growth Accounting, *National Bureau of Economic Research Working Paper No. 6654*.

Barro, R.J., and Sala-i-Martin, X., 1995, *Economic Growth*, New York: McGraw-Hill.

Basu, S., 1995, Intermediate Goods and Business Cycles: Implications for Productivity and Welfare, *American Economic Review*, 85, 512-31.

Burnside, C., Eichenbaum, M., and Rebelo, S., 1993, Labor Hoarding and the Business Cycle, *Journal of Political Economy,* 101, 245-73.

Caballero, R.J., and Lyons, R.K., 1992, External Effects in U.S. Procyclical Productivity, *Journal of Monetary Economics*, 29, 209-25.

Caves, D.W., Christensen, L.R., and Diewert, W.E., 1982, The Economic Theory of Index Numbers and the Measurement of Input, Output and Productivity, *Econometrica*, 50, 1393-1414.

Charnes, A., Cooper, W.W., and Rhodes, E., 1978, Measuring the Efficiency of Decision Making Units, *European Journal of Operations Research*, 2, 429-44.

Christensen, L.R., Cummings, D., and Jorgenson, D.W., 1980, Economic Growth, 1947-1973, An International Comparison, in J.W. Kendrick and B. Vaccara (eds.), New Developments in Productivity Measurement and Analysis, NBER Conference Report, Chicago: University Press.

Dasgupta, P., and Stiglitz, J., 1988, Learning-by-Doing, Market Structure and Industrial and Trade Policies, *Oxford Economic Papers*, 40, 246-68.

De Long, J.B., and Summers, L.H., 1991, Equipment Investment and Economic Growth, *Quarterly Journal of Economics*, 446-502.

De Long, J.B., and Summers, L.H., 1993, How strongly do developing countries benefit from equipment investment?, *Journal of Monetary Economics*, 32, 395-415.

Denison, E.F., 1962, Sources of Growth in the United States and the Alternatives Before Us, Supplement Paper 13, New York, Committee for Economic Development.

Diewert, E.W., 1976, Exact and Superlative Index Numbers, *Journal of Econometrics*, (2), 115-46.

Domar, E.D., 1946, Capital Expansion, Rate of Growth, and Employment, *Econometrica*, 14, 137-41.

Domar, E.D., 1961, On the Measurement of Technical Change*, Economic Journal,* 71(284), 709-29.

Durlauf, S., and Quah, D., 1998, *The New Empirics of Economic Growth*, Centre for Economic Performance, Discussion Paper 384.

Easterly, W., 2001, *The Elusive Quest for Growth: Economists' Adventures and Misadventures in the Tropics,* Cambridge, Mass: MIT Press.

Elias, V.J., 1990, *Sources of Growth: A Study of Seven Latin American Economies*, San Francisco: ICS Press.

Fagerberg, J., 1994, Technology and International Differences in Growth Rates, *Journal of Economic Literature*, 32(3), 1147-75.

Fedderke, J.W., 2000, Investment on Fixed Capital Stock: the South African Manufacturing Industry 1970-97, Econometric Research Southern Africa Working Paper No. 16, University of the Witwatersrand.

Fedderke, J.W., 2001, Technology, Human Capital and Growth: evidence from a middle income country case study applying dynamic heterogeneous panel analysis, Econometric Research Southern Africa Working Paper No. 23, University of the Witwatersrand.

Fedderke, J.W., 2002, The Structure of Growth in the South African Economy: Factor Accumulation and Total Factor Productivity Growth 1970-97, *South African Journal of Economics*, 70(4), 611-46.

Fedderke, J.W., Henderson, S., Kayemba, J., Mariotti, M., and Vaze, P., 2001, Changing Factor Market Conditions in South Africa: The Capital Market – a sectoral description of the period 1970-1997, *Development Southern Africa*, 18(4), 493-512.

Fedderke, Kularatne, C., and Mariotti, M., 2002, Mark-up Princing in South African Industry, Econometric Research Southern Africa Working Paper No. 26.

Fedderke, J.W., and Mariotti, M., 2002, Changing Labour Market Conditions in South Africa: A Sectoral Analysis of the Period 1970-97, *South African Journal of Economics*, 70(5), 830-64.

Fried, H.O., Lovell, C.A.K., and Schmidt, S.S., (eds.), 1993, *The Measurement of Productive Efficiency: Techniques and Applications*, New York: Oxford University Press.

Griliches, Z., 1979, Issues in Assessing the Contribution of Research and Development to Productivity Growth, *Bell Journal of Economics*, 10(1), 92-116.

Grossman, G.M., and Helpman, E., 1991, *Innovation and Growth in the Global Economy*, Cambridge M.A.: MIT Press.

Hall, R.E., 1988, The Relation between Price and Marginal Cost in U.S. Industry, *Journal of Political Economy*, 96, 921-47.

Hall, R.E., 1990, Invariance Properties of Solow's Productivity Residual, in P. Diamond (ed.) *Growth/Productivity/Unemployment: Essays to Celebrate Bob Solow's Birthday*, Cambridge Mass.: MIT Press.

Harberger, A.C., 1998, A Vision of the Growth Process, *American Economic Review*, 88(1), 1-32.

Harrod, R.F., 1939, An Essay in Dynamic Theory, *Economic Journal*, 49, 14-33.

Hulten, C.R., 1986, Productivity Change, Capacity Utilization, and the Sources of Efficiency Growth, *Journal of Econometrics*, 33, 31-50.

Hulten, C.R., 1992, Growth Accounting when Technical Change is Embodied in Capital, *American Economic Review*, 82(4), 964-80.

Jorgenson, D.W., 1988, Productivity and Post-war U.S. Economic Growth, *Journal of Economic Perspectives*, 2(4), 23-41.

Jorgenson, D.W., and Griliches, Z., 1967, The Explanation of Productivity Change, *Review of Economic Studies*, 34, 249-80.

Jorgenson, D.W., Gollop, F.M., and Fraumeni, B.M., 1987, *Productivity and U.S. Economic Growth*, Cambridge M.A.: Harvard University Press.

Kaldor. N., 1963, Capital Accumulation and Economic Growth, in F.A.Lutz, and D.C.Hague, (eds.), *Proceedings of a Conference Held by the International Economics Association*, London: Macmillan.

Kendrick, J.W., 1961, *Productivity Trends in the United States*, Princeton NJ: University Press.

Landes, D.S., 2000, *Revolution in Time: Clocks and the Making of the Modern World*, revised edition of the 1983 monograph, London: Viking.

Lee Kyu Sik Location of Jobs in Developing Cities *Finance and Development* December 1989.

Lee Kyu Sik Spatial Policy and Infrastructure Constraints on Industrial Growth in Thailand *Review of Urban and Regional Development Studies* 4 (1992) The World Bank.

Lee Kyu Sik Cholla Region Catches Up With Korea: The Role of Local Governments Operations Evaluation Department The World Bank 25 September 1996.

Lee Kyu Sik and Sang-Chuel Choe Changing Location Patterns of Industries and Urban Decentralisation Policies in Korea in *Korean Economic Development* edited by Jene K Kwon Greenwood Press Connecticut 1990.

Leontieff, W.W., 1953, *Studies in the Structure of the American Economy: Theoretical and Empirical Explorations in Input-Output Analysis*, New York: Oxford University Press.

Lim, D., 1994, Explaining the Growth Performances of Asian Developing Economies, *Economic Development and Cultural Change*, Vol 42(4), 829-44.

Lucas, R.E., 1988, On the Mechanics of Development Planning, *Journal of Monetary Economics*, 22(1), 3-42.

Maddison, A., 1987, Growth and Slowdown in Advanced Capitalist Economies: Techniques of Quantitative Assessment, *Journal of Economic Literature*, 25, 649-698.

Mankiw, N. Gregory, Romer, D., and Weil, D.N., 1992, A Contribution to the Empirics of Economic Growth, *Quarterly Journal of Economics*, 107(2), 407-37.

Nelson, R.R., 1964, Aggregate Production Functions and Medium-Range Growth Projections, *American Economic Review*, 54(5), 575-606.

Oliveira Martins, J., and Scarpetta, S., 1999, The Levels and Cyclical Behaviour of Mark-ups Across Countries and Market Structures, Organization for Economic Co-operation and Development, Economics Department Working Paper No. 213.

Roeger, W., 1995, Can Imperfect Competition explain the Difference between Primal and Dual Productivity Measures? Estimates for US Manufacturing, *Journal of Political Economy*, 103, 316-30.

Romer, P.M., 1986, Increasing Returns and Long-Run Growth, Journal of Political Economy, 94(5), 1002-37.

Romer, P.M., 1990, Endogenous Technological Change, *Journal of Political Economy*, 98(5), S71-S102.

Romer, P.M., 1994, The Origins of Endogenous Growth, *Journal of Economic Perspectives*, 8(1), 3-22.

Schumpeter, J.A., 1912, *Theorie der Wirtschaftlichen Entwicklung*, Leipzig: Dunker & Humboldt, translated by Redvers Opie.

Schumpeter, J.A., 1943, *Capitalism, Socialism & Democracy*, London: Routledge.

Seiford, L.M., and Thrall, R., 1990, Recent Developments in DEA: The Mathematical Programming Approach to Frontier Analysis, *Journal of Econometrics*, 46, 7-38.

Shell, K., 1966, Towards a Theory of Inventive Activity and Capital Accumulation, *American Economic Review*, May, 62-8.

Solow, R.M., 1956, A Contribution to the Theory of Economic Growth, *Quarterly Journal of Economic Growth*, 70(1), 65-94.

Solow, R.M., 1957, Technical Change and the Aggregate Production Function, *Review of Economics and Statistics*, 39, 312-20.

Solow, R.M., 1959, Investment and Technical Progress, in K. Arrow, S. Karlin, and P. Suppes (eds), *Mathematical Methods in the Social Sciences*, Stanford University Press, 89-104.

Solow, R.M., 1997, *Learning from 'Learning by Doing'*, Stanford: Stanford University Press.

Swan, T.W., 1956, Economic Growth and Capital Accumulation, *Economic Record*, 32, 334-61.

Ten Raa, T., and Mohnen, P., 2000, Neoclassical Growth Accounting and Frontier Analysis: A Synthesis, Manuscript, Tilburg University.

Thirtle, C., Van Zyl, J., and Vink, N., 2000, *South African Agriculture at Crossroads: An Empirical Analysis of Efficiency, Technology and Productivity*, Basingstoke: Macmillan.

Thörnqvist, L., 1936, The Bank of Finland's Consumption Price Index, *Bank of Finland Monthly Review*, 10, 1-8.

Van Der Merwe, C., 2000, Trends in South African Remuneration by Skill Level, Report prepared for the South African National Treasury.

Young, A., 1993, Invention and Bounded Learning by Doing, *Journal of Political Economy*, 101,443-72.

Young, A., 1995, The Tyranny of Numbers: Confronting the Statistical Realities of the East Asian Growth Experience, *Quarterly Journal of Economics*, 110(3), 641-80.